Methodology of Educational Research And Statistics
DEDU404

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METHODOLOGY OF EDUCATIONAL RESEARCH AND STATISTICS

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SYLLABUS

Methodology of Educational Research and Statistics

Objectives

- To understand the basic concepts of research, research processes and designs.
- To understand the techniques of selecting different types of research problems.
- To acquire the skills of preparing the research proposal.

Sr. No.	Content
1	Educational Research – concept, need and scope, Approaches to research- Qualitative vs. Quantitative, Types of research – basic, applied research and action research.
2	Selection and identification of research problem, sources of research problem, Review of related literature, need and sources.
3	Methods of research: descriptive method, Survey method, Correlation Studies, Developmental Studies, Experimental research, Ex post-facto research, Experimental Designs, Historical research.
4	Tools and techniques of data collection; Observation and observation schedule, Questionnaire, Rating scale, Case study, Interview and Interview Schedule.
5	Population, sample and sampling design, Probability and non-probability sampling techniques,
6	Hypothesis – concept, characteristics, sources, Formulation of hypotheses, testing of hypotheses, Quantitative data – collection, scoring, analysis and interpretation, Qualitative data – collection, scoring, analysis and interpretation, Preparation of research report and dissemination of findings.
7	Statistical methods: frequency distribution and graphical representation, Measurement of central tendency- Mean, Median, Mode, Measures of variability- SD, MD, QD.
8	Probability: Normal Probability Curve and its Uses.
9	Correlation- rank difference, product moment method
10	Chi-square test, T-test, F-test.

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Unit 1: Educational Research

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Objectives

Introduction

Objectives

After studying this unit, students will be able to:

- Understand of educational research
- Understand of need of educational research
- Understand of priority of educational research.

Introduction

Educational research means that research which is done in the field of education. The purpose of educational research is to determine various aspects dimensions, processes, concerning the creation of new knowledge to test the accuracy of current knowledge, the direction of development and future plans. **Travers** considers the educational research as an activity, which aims to discover the education related topics and develop and organise the knowledge. Students, especially those whose practices be developed to collect knowledge about education has deemed religion of education is considered extremely important in research. According to **Travers,** organized scientific knowledge about various aspects of education is essential to develop mass, on the same determine what kind of desirable behaviours in students to develop teaching and learning will be necessary to create conditions.

1.1 Meaning and Definition of Educational Research

Education sector and many related topics such as-History of education, Sociology of education, Psychology of education, educational methods, educational-techniques, teacher and student, valuation, route philosophy, basic economy of education, education-collection and the conceptual problem of education etc. In all these areas according to changes in environment and converted conditions the

continuous need of verification and validity test of current knowledge .This work is finished by the educational research. In this type, education research is the area of education prevent and precondition knowledge of test and verification and the only method, process of develop of new knowledge. In every field of education there are different types of problem time to time in front. Their search of solution is also necessary. This action is also possible by the education research. From this approach education research is one of the specific to get solution of problem of education. Education related different unsolved question to get answer of medium is also education research. There are so many specialist the definitions of education research.

Bhitni's (1954), the educational research tries to find solutions to the problems of education and the work to meet the scientific, philosophical, and critical thinking methods are used to visualize the principle. Thus scientific research and procedure of education systems which is to apply academic research to solve the problems of the region is called educational research.

Kaurnell's believe the school children, schools, social structure and the interaction between learners about the symptoms and the systematic collection of information form education research.

According to a publication of **UNESCO**, education research refers to all efforts by the state or by person or entities are and whose aim is to improve educational methods and educational activities.

1.2 Need of Educational Research

Education is a social process. Its fundamental objective is to change things like that in person, to progressive social development and individual approach to life are essential. The purpose is mainly dependent on the process of education. If the process of education is forceful and effective than person in the learning process, it is desirable to change the above simple and would be possible otherwise will be not. Therefore, the process of education is the key problem of how to strengthen the effective and powerful for solution of this problem research is necessary.

Did You Know?   Research by those methods, practices, exploring the possible circumstances which may contribute to strengthen the process of education. This approach has much more value in the field of education research.

Education process is a multi-elemental process. There are many basic elements. Social and cultural circumstances, home surroundings, school environment and its so many qualities, educational methods, study-material, helping material of education, teachers and their so many qualities, learning process etc, are many variables, which are affected the process of education many of these features may be, about which there is as yet no information. Their discovery is possible only through research which have been discovered around the same time, to them it is necessary to know and to decide strengthening of the education process and the importance of each type should be included in the process, how to use it can be made more effective. From the prospective of educational research of particular importance because it is the only possible solution to the above problems.

Socio-economic conditions of education, and qualities, its consequences affect the learning process, many of the effects of such characteristics have been studied, but the results are not unambiguous and get one. Some characteristics of the study are either non-existent. Therefore, requires a lot of research in this area. Many of these studies need to be performed by a well-organized and legitimate method.

In some past years there are so many new discoveries of educational research are to be done .Their usefulness and effectiveness to be need of more intensively studies. And also should be researches some specific methods. In this field research play may be most important role. In past years so many

discovery of models to teaching have been done, but not sufficient observation to its. To be need of the observation by the educational research. In this type programmed learning, micro-teaching, symulatic teaching of usefulness of studied are also necessary.

Example   The teacher himself is an important component of the process of education.

Personal characteristic of teachers, its knowledge, its behaviours deeply affect on students development, but which are those characteristics, how they affect, which types of affect exerts etc. are the questions, which theses are getting unsolved. By the educational research a need their answers to be get. By this approach research in education is required much.

Every person is affected by setting of environment. Students always vary between home-settings and school settings. Which conditions and characteristics of home surroundings and school surroundings are affected there learning and development is very important to determine by education research. In this field education research much needed.

Removing from circle of education process in other contest also education research also seems much needed. Education system is not self-restraint and independent, on his management and activity several systems of society affect them. Political, social system, economy, technological development, religion, caste etc, a number of factors affects education. Education and among all these continuous interaction is going on. Therefore, it is also to know essential that all these affects education too affects these systems. Therefore, it is important to know also that how far and which type the education affects its. Education research is needed in this field also. From this approach education research has special importance also. From historical point of view study of education is important. It is a subject of human curiosity and interest. What has been the format of education in different period, in which conditions, it is given this format, what is his relevance in present condition etc. are important in themself. The answer of these questions can entended the limit of knowledge regarding education material available, and satisfied human curiosity. Hence, in this field too education research is needed. Education research has significance from this approach also.

Education research has great importance from education planning point of view also. For satisfactory education planning and determination of his basic concept research is necessary.

Caution   Full knowledge of resources and liability is necessary for the success of educational planning.

Together with people of society their culture, their mutual similarity-dissimilarity—all are required to know. It is also necessary of organisation of society, their effective control, their necessity, limitations, and well knowledge of problems. This information can be getting to the medium of educational research .Hence, most importance from its approach. Without its information educational planning are not related to worthful and enactness. Most of the times without knowledge of basic concept to make the educational planning and done without discussion will be implemented and after we know that they are not according to necessity of society reason is that not the favour of people and or society could not accepted. Then expanses of money and labours on its are unused. To save of unused of money and labours, if the basic concept of information get by the educational research and make its planning to on the basis.

For the successive action of educational planning to be need of representation, which is effective Representation may be effective, when this is known about which types of improvement to be needed, which types of problem from people of educational field to be fight, whose element are break, in development of education, what are the events in its angle of educational field, different organization of education field are going on in which direction etc. Educational research collects this all types of information and may make strong and effective representate and drawback of educational field to enerts capacity may be given.

Although, all society hypocrasy, baseless, conception, different types of prejudice and conservative thought, superstition and meaningless thinking are affected. Country and society thriving of these are breakage. Educational research those highlighted in effort and search these chains to be present in front of society, which are related to superstitions. To the medium of education research how far to remove, these advice are also by the available of research. How improve of society consciousness, people came in brightness to darkness and well understanding development of social life, different parts of society developed between uniformity and chain-thinking, in all target to be rich, methods and planning to be shows only educational research.

Notes   Education research is the development of different subjective phenomena of education in organized scientifically knowledge.

In this field of education pioneer the research of the year in 1950, as its assumptions. In the field of education first Ph.D. degree was given by Mumbai University in 1943.After its field of research to be expanded. The development which took place between 1943-88, expanded description included four surveys of research in education, which respectively: 1974, 1979, 1987 and 1991 could be in published. First survey is published in 1974, in their description of studies, which completed till 1972. Second survey (1979) in which description of studies, whose completed between 1972 from 1978. In this third survey (1987) its description of studies which done between 1978 to 1983. In fourth survey, (1991) till finished in 1988, and alone discuss of learning. In first surveys 462 Ph.D. and 269 project level of discussion is learning. In second surveys is discussed research of 839, which had done education in 17 fields. These fields are: comparisonal education, syllabus educational process, study material, educational process, study material, component of educational availability, educational technique, educational administration, educational economy , educational psychology, Educational-philosophy, education sociology, route- philosophy and remembrance, educational valuation, measurement and tests, teachers training, history of teaching and educational their problems. In the third survey (1987) between 1940 to 1983 research of decade status to be represent learning of Ph. D level of status is as following-

Table 1.1: Study of Ph.D. decade	
Years	**Numbers**
1941–1950	10
1951–1960	63
1961–1970	234
1971–1980	850
1981–1983	266
Total	1423

As this type except Ph.D. the research which done in this decade their status are as follows:

Table 1.2: Other study of decade	
Years	**Numbers**
1941–1950	5
1951–1960	56
1961–1970	250
1971–1980	556
1981–1983	150
Total	1017

In fourth surveys (1991) to total 4703 researches to be discussed which are divided into 29 fields. From its 3289 level of Ph.D. and 1414 are other project level of study. Its 2272 Ph.D. researches from 3289 in department of education and 1017 other department such as psychology, sociology, philosophy, economics etc. department is done.

It is clear from these explanation that in different fields the research achieved important place. It can be said also that in numerical approach in the field of education development of research is very highly. Some accepts educationist its explosive growth. Their think such a way is that in field of education in this mass production of Ph.D. In fourth survey in its increment of trend to be represented that in types: In decade of 1940 every year one, in decade 1950 in every 73 days on one, in 1960 century every in 16 day one, in decate of 1970 in every 4½ day one, 1980 in every 3 days on one Ph.D. degree to be given. If accept Ph.D. level included other research then according to fourth survey every 36 hours each one research report to get. Before it is said to be, if its same speed is maintain then in future every day one research will be finished.

Task   Clear your point of view on priority of research in the field of education.

Self Assessment

Fill in the blanks:

1.   Educational research is the search in the field of ………………….. .
2.   Important component of the …………………...is the teacher.
3.   First Ph.D. degree in 1943, was given by …………………..University.

1.3   Scope of Educational Research

In the field of education which types of research given to priority, this questions are araise from two decades time to time on its relation to conclusion also have to done, but researchers could not take it seriously. Its one reason is what should be base of priority. In this relation no any definite conclusion. In the last chapter of research survey (1987) **Dr. Shiv K.Mittra** given to suggestion their problems should be priority of research, which is national educational- rule in raise of problems of solutions available for urgent needed. Prior to it, in 1975 the following problems on scope of education were highlighted in an N.C.E.R.T book named "Educational research and innovation." in the following problems to be put on the table was education research-

1. To solve the problem of imparting education to the poor students.

2. Interdisciplinary research.

3. Hunt of talent and problem related to their development.

4. Compulsory and free education upto 14 year-children whose provision in Indian constitution section 45, study related to that problem.

5. Education related problem's study of schedule caste and schedule tribes' children's.

Some educationists have been expressed their views regarding this. Keep all those in minds in the following fields of education besides aforesaid; on the basis of priority research is to be needed.

1. Nurture and education of small children

2. Unformal education

3. Commercialisation of education

4. Revision in text

5. Education of moral value

6. Regional imbalance in education

7. Education and social changing

8. Education administration

9. Leadership in education

10. Study of education institutions' programme and effectiveness

11. Pre-primary education texts and teaching methods

12. Study of education institutions' environment

13. Teacher training

14. Comparative education

15. Moral education

16. Educational economics

17. Education and law

18. Education and politics

Above field is wide and extensive. In each field several problems available for studies. In these fields study has been done very less. It has been shown from this point of view. It is not possible to give list of specific problems.

Self Assessment

State whether the following statement are True or False:

4. The purpose of education research, having research of education related subjects, to improve of knowledge.

5. Education is an economic process.

6. In the field of education, research had introduced in 1950.

7. Men are not affected by their ecological settings.

1.4 Distinctive Future Need of Educational Research

There is an intimate relation between education and social changing. Human life and their settings related each perspective touch education somewhere. Hence study of this field related is necessary.

Most of these have been studied in foreign on the basis of these studies great many theories illustrates facts, events, problems and disorders not withstanding there theories practical utility is not much more. Its one reason is in education science, subject matter to be subjective. Hence in which research has done, their result as consequently theories generality's level have rised up, means on that basis a large as groups of events or much educational.

Conditions can not be explained. Hence, in future such a research is needed which is more extensive and on that basis more and more prespectives and problem understanding is possible.

Regarding this perspectives which educational theories are available, they developed mostly in the research in foreign. But each society has their own social reality. Therefore, it is not essential that the theories which were developed in other countries should be similar to our country's social reality.

1.5   Summary

- Education research is a process in the field of education present and past knowledge testing and verification and types of development of new knowledge.

- A UNESCO's publication according education research means all that efforts that are done by state, or persons or institutions and whose purpose is to improvement in education methods and academic activities.

- Education is a social process. Its basic purpose is to bring such a change which is compulsory of point of view of social development and to make men's life advanced.

- Dr. Shiv.K.Mitra suggested in third research survey that those problems should be given priority to research whose is immediately needed to rise in national education policy for solution of problems availability.

1.6   Keywords

1.   **Educational Research** — Its purpose is, to research on education related subjects, to develop and organise the knowledge.

2.   **Educational Planning** — It signifies imparting education, and making proper plans for and its implementation.

1.7   Review Questions

1.   What do you mean by educational research?

2.   Illustrate necessity of educational research in education field.

3.   Describe the area of educational research.

4.   Write notes on "future needs of research."

Answers: Self Assessment

1. Education	2. Process	3. Bombay	4. True
5. False	6. True	7. False	

1.8 Further Readings

Books
1. Educational Research methods- Sharin and Shasikala, Vinod Pustak Mandir.
2. Educational Techniques and Appraisal – Dr. Ranpal Singh, Bhatt Brothers.
3. Educational Techniques – S. S. Mathur, A. Bhatta Brothers.
4. Educational Technique Management and Appraisal – J. C. Aggrawal, Bhatt. Brothers.

Unit 2: Types of Research: Basic, Applied and Action Research

CONTENTS

Objectives

Introduction

Objectives

After studying this unit, students will be able to:

- Know the types of Educational Research
- Know the concept of development and work of educational Research
- Know the utility and process of Action Research.

Introduction

In the field of education, Educational research plays an important role. The main problem of education is how to make process strong, effective, and powerful. For the solution of this problem there is a need of research. We develop sphere of knowledge the implementation of new theories and laws through research. Takes place from experimental research work. The birth of concept of applied research took place in the mind of **Stephen M. Core** in that time school had many problems and their solutions were not available that time a book of **Stephen M. Core** Action Research to Improve School Practice" give solution to these problems. These suggestions later called applied research. Applied research is such a process through which volunteers of a particular area after studying problems scientifically assess the problem. .

2.1   Classification of Educational Research

It is clear from the educational research that classification of educational researchers can be done through different types. Main classifications are as follows—

Contribution Point of View: Educational researches can be divided into two categories from contribution point of view.

1. Basic or Fundamental Research: New concept is developed by these research work. Implementation of new theories, research of new facts, and establishment of new facts takes place Knowledge field is developed through fundamental research, from the point of view of objective they can be divided into three groups.

(a)   The implementation of new theories and laws is done through experimental research work. Same is done rough survey –research.

(b)   New facts are discovered through historical research. In which past is studied and basis on that we try to understand the present.

(c)   The establishment of new facts and values through philosophical research theory of education. Principle of education is developed through philosophical researches.

2. Action Research – From these types of research local works problems are studied through which improvement and development in the process of education is done Improvement of knowledge is not done through this. They are also called experimental approach research.

Research Approaches: Two types of approaches are used in research works for the study of facts— Longitudinal approach and Cross–sectional approach.

1. Longitudinal Approach: This word has been taken from botany. When a plant is studied from semination till it generates fruits, then it is called longitudinal approach. This is also called dimension, because in study the time is the main component this approach is used in historical, unit and genetic related research methods.

2. Cross-Rational Approach: This word is also taken from botany when study of a stem, leaves or root or any other form of part of a plant is to be alone the part of the plant is studied after cross- sectional approach that past, then it is called cross-rationing, there is no importance of time. This approach is used in experimental and survey methods.

Example   The study of "Teacher-Education emergence reasons" will be done from cross- sectional approach. Study of new concepts in faculty education will done by cross-sectional approach.

Precision in Research Findings

In point of correctness results of research are divided into two categories :

1.   Experimental Research

2.   Non-experimental Research.

Experimental researches are accurate because qualities of control, accuracy and observations are kept in mind. The results Non-experimental researches are less accurate, because measures are not accurate and control of observation is also not possible.

2.2   Functions of Education Research

Following are the main functions of educational research;

1.   The main function of educational research is to improve educational process and to develop it. This work is done through educational process.

2.   For the development of educational process, internal endeavour is to develop new knowledge and to improve the present knowledge.

Why and how an research is done, there are differences at this point of view. Neither the objectives of all researches are same nor their process. A classification of different types of researches is given in further chapters. There is an explanation of a different type of research which is called action research.

2.3 Development of Concept of Action Research

The birth of concept of action research took place in the mind of **Stephen M. Core** (1953). Many writers tried to link this concept with **Levin**. A writer wrote that its development took Place in 1926. also the origin of this concept is ' Modern human arrangement' theory. Those concept are illusions the concept of action research is only belongs to '**Core**' and its origin was written in 1953, his book "Action Research to improve school." Before this no one has used this keyword. This is other matter that the thinking of other writers matches with the concept of **core**. According to '**Mauli**' for the development of this concept credit goes to '**Core**'. **Mauli** states that when this book was published in 1953 teachers' welcomed this book as they were struggling with those sorts of problems they had no any solution to solve their problems and directions to solve these types of problems was suggested in that book. This suggestion was action research.

Did You Know?   The concept of action research birth took place in the mind of **Stephen M. Core.**

The concept of action research took place in **Core's** mind. There was an experienced background behind this. The research that were happening in the field of education in 1950 America Core was not happy because of this they were of very limit to be used. There was no only required influence on the school education. There were lots of problems concern with school but educational research were not satisfying the teacher whom they were passing through the problems and were struggling. The main objective of most of the researchers is to take sample and after collecting information to implement the theories and rules. The results of these researches were limited to theories only. They were not helpful in making more strong of educational process, to resolve the everyday problems of school, to improve the skills of the teachers, for the improvement of educational skill of students. Thus the practical utility of these researches was none the less. So, **Core** decided to think differently after being unhappy from the fundamental research's failure. According to him unless a teacher engages with the research works the results of research to improve the schools position can't be implemented. **Core** wrote (1953) in his book I trusted the researchers specialist of education world and often said to them that they analyze the schools and told what should they do, but now my believe has broken. But to implement the concept in the behaviours' of the volunteers of education world is a big problem and until now we have no any solution.

Caution   Only those should do research who want to change in their process of work on the basis of the results of study.

So, he emphasis, for the solution of problems of schools, school level research should be done and these researches should be done by teachers so that the results can be used to make education process

stronger **Core** developed his concept in 'Action Research'. When **Core** was consultant in 1962 in NCERT his thoughts and concept of 'Action research' were propagated. Those were happily accepted by our educationists. NCERT published a book written on educational research by **Core** (1962). He explained the concept on his book.

2.4 Meaning of Action Research

According to **Mauli** action research is an on the spot study whose aim is to find the solution of present problem, means this research is done where problem accured and still continue. If students of a school are so undisciplined that they disturb the educational works, then the study done to find out the solution to the problem of the school by the teachers would be called action research. According to **Core** (1962), action research is such study in which a person do his work more efficiently means — a teacher to make his education work more effective and to make an administration more strong by an administrator. In other words action research is a process through which volunteers of an area study his problems scientifically so that the decision that they take and the work they do can find correct way, they can be improved and evaluated.

Notes   Action research a well managed and analytical process whose objective is to study the present endeavors and to bring created change by the person related to improvement and change.

The main characteristics of action research are mentioned below. The meaning will be more clear by these.

2.5 Main Features of Action Research

Main features of Action Research are—

1. Different from Fundamental Research

The main characteristic of action research is that it is different from fundamental research in many ways. The objective of fundamental research is to find out the generalization and laws so that on the basis of the explanation of same types of incidents can be done. Therefore, by selecting from a large population a main sample is made the base of study.So, this type of study takes to much time. Its study method, tools and analysis methods all are difficult. On the contrary in action research objection is very limited. In general, to find out rules and implementation of theories that are the chief aim of the fundamental study are different from action research and not the objectives of action research. The objective of the action research is very practical. Improve the present work- system, to find out the solution of problems , to find out the reason of failure any low or method and its influence are the main objectives of this. According to '**Mauli**' action research is done to know what steps should be taken to solve a particular problem.

Second difference is from the point of view of place of study and number of units. The base of fundamental research is large population and prime sample selected from them whose units are selected from a large area. The selection process is also specific. There is no any question arise of population and sample in action research. This research is done only in those school or organization where the

problem is under study. Some or all units are selected for the study purpose from these. There is no necessary that number of units should be in large number. Suppose, students of class 8th are weak in Mathematics. To find the solution to this problem, first of all we need to find the weakness and reasons of the students, for this we need research this. Work will be done by the teacher of that class. The source of getting relevant information would be the students of that class only the need not to go outside of the class to collect the material for study. Study will be limited to that class only. So, action research is limited and local, while fundamental and pure research is a wide, extended and far going.

Third difference is from the point of view of usefulness of results. The result that are fazed from fundamental researches that are applicable to improve the knowledge only. They are less useful in the circumstances in where people work. They are stoped only to this level for knowledge on the contrary to this the implementation of results of action research is the main objective in research action. And on the basis of that result to find the only solution of problem is the main objective of them. Their main objection is to find the reasons of weakness of Mathematics students by research and try to solve them effectively. Therefore action researcher is a practical research and fundamental research is a theoretical research. Action researcher is a very practical person. He likes to give up complexity of scientific research to get the useful solution of present problem on local level. Only present problem is the main fur of his attention because he thinks the problem that present today will remain in future also and its result of research will be useful as they are based on the factual units.

Task   Fundamental research is different from action research. Explain.

There is one more difference between fundamental and action research is that a teacher, principal and a volunteer of educational field who is related to the problem can do active research for that one need. There is not need of a specialist like fundamental research because its over all process is simple. The process of fundamental research is difficult, according to that we need specific knowledge and ability to do work. In fundamental research enough control is kept on the condition of research. Because its objective is to generalise action and to implement the laws, but in case of action research control, foundation of thoughts, analysis of basic material etc. is not very difficult. Research process is completed in the conditions in which they are occurs.

From another point of view action research is also different from applied research. The objectives of both researches are similar but they are different from the point of view of different researchers. According to **Lehman** and **Mehsen** action research is a form of applied research both are similar. But both are different from the point of view that the of the result and implement them. So, one specciality of action. Research is that the same person is a researcher and consumer of the results of the research.

2. A Scientific and Well Established Working Process Method

The second speciality of action research is that it is a method of regular working process. Persons are to face problems daily in an organisation and they have to take decision to solve their problems and have to implement also. Generally, the decisions do not have any solid scientific base they take decision on the basis of their knowledge, experience, and intelligency that proves to be irrelevant after implementation .Action research provides objective scientific and solid ground to take such type of decisions. This is a general complaint of teachers that do not appear in the class. Principal of that school calls meeting of teachers and takes decision that the student who do not appear in the class will be fined. This is not a solid ground of the decision. So, there will be no any improvement after its

implementation. And the second method is that the reason should be find out of why the student are not coming to classes. A short action research would be enough for this. Suppose on the basis of this result it was found that teachers are not coming to the classes. Now the decision would be of another type that the teachers should attend the classes and should teach well. Therefore, action research is a technique to make daily working process regular and more effecting and to give scientific base to the decisions. From this angle that should be considered an important part of organised programmers. A researched —based form is a technique to get the solutions of daily problems, difficulties, and hindrances.

3.   Specific Technique to Improve the Conclusions of Schools

The main speciality of action research is that it is a technique to improve the condition of schools. The center point of **Core's** idea was to improve schools . So, under this, it is emphasized that research should be done on school related short problems and the results of that should be more objective and credible and after their implementation can get help to change school educational method, school administration, student behaviour , teachers behaviour in the desired from and to collect educational material for school and can take help in its planning.

4.   An Important Part of a Complete Educational Process

Core's action research concept is an important part of a complete educational process. That can't be considered a separate part from educational process for example teacher's daily responsibility is to teach and develop the students in same way to do action research is also a responsibility. This is evolved in his work, for example, a teacher's duty is to use the most effective method of educational method likewise to make his behaviour, educational technique and his knowledge effective and strong by action research is also the duty of a teacher. Which attitude or behaviour desirable produce effect on student and which behavior of a teacher produced undesirable effect on the students, by which technique students learn more, and in which age group the learning desire or curiosity of a student became stronger are some of the things that can be found from short objective studies and this information canon it be very helpful to perform the on to duty of a teacher well. This is also true for principal. He can perform his duty well and the get desirable information to perform his well and duty effectively through action research. That provides objective and solid ground to his decisions, planning and actions.

5.   Difference between Applied and Action Research

Generally, there is a confusion between applied and action research, because the objective of both is to establish the result of those that are used to solve the problem and to make the work process developed and progressive, but both have difference. Behavior research is based on the large population and its result are more vast. And it also bound to some other formalities. Action research is limited to class and school and it is not bound to very strong formalities.

Self Assessment

Fill in the blanks:

1.   In action research .... problems are studied.
2.   To discover the generalization and .... is the main objective of fundamental research.
3.   The central point of Core's concept was ....

2.6 Process of Action Research

There is no any fundamental difference between the action research and any other type of research. The steps of process is the same in action research that are followed in the process of other research. The only difference is that the work done on every level whether limited, flexible or solid is free from formatives it has been already discussed about and described about all step processes. Here, action research will be discussed and mentioned in short. Following steps are followed to give scientific form to this research process.

1. Selection, Statement and Definition of a Problem

This is very essential for any research, but there is no need to find the problems in action research. That are already present in daily experiences of teacher and principals. The problems of that they face daily are the problem of action research. Sometimes it happens that a solid technique of a work process strikes the minds of a teacher or administrator then to test that technique can be a problem of action research. This is not necessary to study the related literature to find the problem or to thing that the problem is a fundamental or not. But to state the problem exactly and to define accordingly is very necessary as is done in other researchs.

2. Statement and Determining of Objection

This is the second step of action research process. The determination of objectives are done in the same way as it is done in other research. Its significance, and need are the same as it remains in other researches. In action researches they are few and simple.

3. Construction and Statement of Concepts

Objectives are changed to concepts. So, the concepts of action researches are not very difficult. For example, to be more undisciplined of some students among the students of a class, to be legging behind in a particular subject, to be present irregularly in the class will be more suitable for the construction of concepts related to every thing and to find the reason. It is the process of scientific method.

4. Test of Concepts or Study Method

Many things come under this step process as definition of population, selection of sample, definition of variable, their measurement, collection of information and their analysis. But the question of definition of population and selection of sample does not arise in the action research because their objective is not to do generalisation of the importance of large population. Therefore, their research method is not based on the complex research design in which control of studying variable is done. Neithers the use of specific stastical method for the analysis of information material is done. Despite this, there are some important work that are to be done on this levels are as follows.

(i)   **To get the information from conceptual variables:** To get these information a researcher can take help of interview, exercises, data, and observations. Standardised examinations can also be used.

(ii) **Analysis of received information**: Received information can be of quantitative or qualitative type or both. They generally are not very extensive. Their analysis is done according to those rules that have been mentioned in chapters 7. To prepare simple statistical methods and frequency table, to present the material by line drawing, to evaluate median and mean

and calculation of scale deviation, to find conditional multiple etc. can be used. Researcher can also use t-test.

(iii) **Conclusion establishment**: On the basis of above mentioned conclusion a researcher establishes the conclusion that are considered to be implemented on problems, class and schools.

5.   Implimentation of Result

This is the last step of action research process that is generally not found in other research process. This is not necessary for a researcher to implement the established results by him in fundamental and in behavioural researches, but in action research it is necessary to implement the result that come out for the solution. So, based on the results he takes decisions and work accordingly. If he succeeds then good otherwise he has to take way for another research. The process is continues until and he gets proper solution of his problem.

Some authors have considered experimental projects of N.C.E.R.T. as action researches. This is not correct. It creates confusion in relation to action researches.

2.7   Utility of Action Research

There is no any doubt the objective for which the concept of action research was drafted is very useful in that regard. Some facts that are in favour of action research are as follows.

1.   Connects Research to Practical Utility

Action research is a research which connects research facts and utility, covers the rift that was made between the fundamental research and the persons employed in the organisation. There was an alligations of fundamental and applied researchers the persons engaged in practical conditions, e.g., teachers and administrators do not use the result of the researches done laboursly by them in their working field. And they also complained that teachers and administrators do not pay any attention to their problem and their research process and results are so complex to understand and their researches are in the form of theories and generalisation. They are not practical so both were separate on the basis of research and in regard to the practical conditions. Therefore, to make education process stronger researches was not playing any role although that was its main role. **Core** said that the researches proud to be a scientist and do not think that to links with the practical behaviour conditions are important. Action research frees the research from this allegation and connects to behaviour and utility because these researches are done by the persons who work in the schools and are done to find the solutions of those problems that they have been struggling. It is natural the results that they would get through research would be used in working process. So, action research has become a part of daily working process of teachers and administrators that provides base to educational decisions and scientific base to educational process, experience and reasoning and cooperate in making complete education process effective. In this point of view action research is to be considered productive and important in the field of education.

2.   Change in the Thought and in Mental Point of View of Teachers

When teachers and administrators do research to bring desirable change in their working area then the experience that they get doing work that bring some psychological change, their interests change, due to this internal change their behaviour is also changed. Finally they get connected internally with

the process of education. This is considered very important benefit of action research. That is not possible by mearly studying scripts, briefs of fundamental and other types of researches. When they do research themself then they consider their research important. So by considering the results an important achievement by this research he takes interest to use the results of in practical situations in his working process and to test the credibility and effectiveness of the research by heart. They developed the interest to bring regular multiple changes in their duty programmes and they also disprove their knowledge because they have to study about research and the problems related to research, as a result the teacher or an administrator who is engaged with the research work of action research change completely becomes a high profile and influential teachers.

This is not necessary that a teacher or only an administrator do work on a problem. Many teachers and administrator can do work jointly in this situation. There well be same changes in the behaviour of teachers and administrator trace have been mentioned above. So, awareness can be brought in the whole organization can be improved by movement. From this point of view action research is considered very useful.

3. The possibility of Qualitative Changes in Education Process

To bring multiple changes in education through action research becomes stronger. The meaning of qualitative progress in education is to bring development with desired knowledge in students and to develop the personality of students for this, it is necessary to understand the problem and to solve them that hinders the way. The role of action research to understand the problems scientifically and objectively is considered very important. When a student do not study by heart, be irregular in class, becomes behind in a particular subject, becomes indiscipline, do not cooperates with other students have antisocial behaviours, to be possessine with the problems of home social health, education etc., are the bottlenecks hinders in the way of progress. All these are those conditions that are necessary to bring qualitative changes in education by solving them, but there is also need of some imperative attempt in the direction where it is useful to students e.g., to inspire them to acquire knowledge, to develop their interest in study and to get knowledge, to adopt good behaviour and manners etc. To find the methods of such types by which all this is possible depends on the fact to which extend teachers and administrators considers the problem of students, to understand them and to develop those methods effectively action research helps teachers and administrators.

4. Medium of Examining the Fundamental Research Theories

Another benefit of action research is that the test of fundamental researches results and theories can also be done. To what extend in any practical condition these theories present a solution of a problem this can also be tested. According to **B.F. Skinner** book 'Operant conditioning theory of learning'. there is a generalization that a person learns only the behaviour that is rewarded any body can check its credibility and fact on the basis of action research if it is proved to be true in the test and conditions then a teacher will definitely like to change the behaviour of students by eliminating the undesired behaviour and by developing the desired behaviour in the student from this point of view also action research is profitable and important.

Self Assessment

Multiple Choice Questions:

4. The founder of_____ of action research is Stephen M.Kore.

   (a) Management   (b) Concept   (c) Surrey   (d) Objective

5.   Action research connects research with_____.

   (a) Fundamentalism   (b) Sociology   (c) Utility   (d) Behaviour

6.   During 1962 Kore was a/an _____ in N. C. E. R. T.

   (a) Adviser   (b) Debater   (c) Teacher   (d) Editor

2.8 Limitations of Action Research

It is said in the above lines that action research is very useful but it does not mean that it will be useful in every condition. There is no any doubt that if conditions remain favourable then it will be proved to be very useful. So, the utility of action research depends on some situations. The favourable condition are generally not present in the schools. Only these are the hindrances in the process of action research. They are mentioned below.

1.   Absence of Technical Knowledge and Skills in Researchers

When we adopt action research then we also considers that a researcher have desired knowledge and skill but generally it does not happen. The teachers do not have that knowledge or skill that is required for the research work. Most of the teachers are B.Ed. and they are not taught at the B.Ed. level about research so they do not have any desire and does not to put the feet in this direction.

2.   Excessive Work Load on Teachers

Second problem that appear in the way that the teacher are already over burdened with the work of education. It is almost impossible for them to find time for research work. This condition is found in all the countries except some. Society is not able to reduce the burden on the teachers. Same situation is with the principal also. So to hope that teachers and administrators is not possible also.

3.   Absence of Quality of Desired Level

One problem of action research is that the credibility and validity of the results is very low level. There are so many reasons of this. As they are bit able to defuse the problem construction of concept properly, analysis of research material and explanation as a result of research they get are less credible and valid. For example if some students of a class are legging behind in particular subject there may be different reasons behind this and as researcher should have all knowledge about that only then they can form a proper conception and can be tested by research for the conception also it is necessary to control study variables otherwise result can't be correct but how it is done, a researcher does not have that knowledge. So the results that emerges from the research are not valid and credible it is clear the decision taken on that and implementation in behaviour do not present proper solution of a problem.

4. Limited Results

The base of action research is class or school of a teacher so, the results apply to that school only. On the basis of this result the explanation of another schools boys and behaviour of another students cannot be done. So, if that teacher transfers to another school then the research of that teacher would be go in vain and varied the utility of this action research is very limited.

Self Assessment

State whether the following statements are True or False.

7.   The development of action research concept done by Mauli.

8.   The main objective of education research is to develop and improve the educational process.

9.   N. C. E. R. T. also published a book of Kore on educational research.

10. Through the medium of action research the possibility of to bring qualitative changes in education becomes stronger.

5.   The Environment of School not to be Favourable.

It is necessary for the success of the action research that researcher get necessary convenience their works rewarded in our country is not as such. But to this our country has a negative surrounding and environment that hinders the way of the teachers of research.

On the basis of above mentioned problems to consider that it is useless will not be correct, should take them as a challenge and try to eliminate then would be a positive and creative angle. All the problems have their solution. This is not possible to less on the work load of a teacher. It is another matter that it is only possible on state level. This can be possible by increasing the numbers of teachers by the state. Likewise the development of skills and research relayed knowledge in teachers can be done in many ways. The arrangement of short-term course for them can be done by N. C. E. R. T. In all the school of city there may be arrangement of a research specialist as a guide for the teachers who will advice the teachers. This will also be responsibility of the state. To reward and to inspire the teachers in this direction will also be the responsibility of principal. So this work can be done like this.

From the behaviour point of view be there lots of problems in the way of action research. It has to be admitted from theoretical point of view that action research is an effective technique to lift the level of education. It is profitable to join with the education from every angle. 'Researched Base Education' should be future slogan of the education world and state should do its best to make it success.

2.9   Summary

- It is clear from the objective of the education research the classification of educational research can be through various types. The standard of main classification are from the angle of participation, from the angle of accuracy of research result.

- The main work of education research is to improve and develop the process of educational research. This work is done to prevail the knowledge.

- The concept of action research belongs to Core only its origin lies in the book 'Action Research to Improve School Practice' that was written in 1953.

- In Moil's word action research is on the spot study whose aim is to find the solution of present problem it means this is a research that can be done only at the place where problem has occurred.

2.10   Keywords

1.   **Research—** A discovery of a particular subject or problem.

2.   **Action Research—** Such process of research in which study of problems done scientifically so that it can be given correct direction by bringing improvement in the results.

2.11   Review Questions

1.   Explain education research by classifying it.

2.   What do you understand by action research and its conception?

3.   Explain the importance of action research?

4.   What do you understand by the utility of the action research?

5.   Describe the limitations of action research.

Answers: Self Assessment

1. Local	2. Laws	3. School improvement
4. (b) Concept	5. (c) Utility	6. (a) Advisor 7. False
8. True	9. True	10. True

2.12   Further Readings

Books

1.   Educational Research methods- Sharin and Shasikala, Vinod Pustak Mandir.

2.   Educational Techniques and Appraisal – Dr. Ranpal Singh, Bhatt Brothers.

3.   Educational Techniques – S. S. Mathur, A. Bhatta Brothers.

4.   Educational Technique Management and Appraisal – J. C. Aggrawal, Bhatt. Brothers.

Unit 3: Selection, Statement and Source of Research Problem

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Objectives

After studying this unit, students will be able to:

- Know selection, statement and definition of problem
- Understand the evaluation of selected problem
- Understand the source of problem.

Introduction

Research did in whatever fields, their process almost same. Whole work's systemization in all fields of researches are alike. Behavioral science as a psychology, sociology and in education field it is generally cent-percent apply. In this part of book that process specific steps of research has been mentioned, which is followed in all behavior sciences. Generally, in these fields of researches following steps are

1. Selection, statement and definition of problem.
2. For selection of problem survey of related literature.
3. Formulation of hypothesis.
4. Collection of research informations and datas.
5. Analysis of data.
6. Generalization and establishment of conclusion.

3.1 Selection, Statement and Definition of Problem

Selection of a suitable problem is a hard work for all researchers. In the beginning for the selection of problem researcher's has to wonder, hither and thither. Generally he hopes that his research guides will give him research problems from his own ends. This type of thinking is not right, because it is not an easy task for research guide also. He has not also come selected problems. For the selection of appropriate selection of problems he does as much labour as researcher also. Without labour and intensive study selected research problems in such that on which already much research work has been done, which is worthless, regarding this much informations is already available and whose result is not valid. Hence, for researcher it is quite essential to know how researcher problem's selection should be done which types of problems will be suitable for research and which will be the sources of that. All these have been mentioned ahead.

Mediums of Problems

Notes   Problems of research are available from many mediums. In this researcher's personal experiences, contexts, intensive study of literature, survey of previously done researches , in country happening social, technical, and educational changing etc. are main.

(a) Personal Experience

Researcher on the basis of his personal experience can try to know that in which field of education psychology or sociology, which types of problems, exists, whose solution is necessary, how many and which types of such question whose answer is not available anywhere, how many context and subjects are whose full information is not available to anybody. If he works in there fields or student of this discipline then he has so many experiences which is related to such types of question and required informations. If in his experience any problem comes and his experience guides to any solution then taking them research can be done.

Example   If he feels that due to parents' misbehavior in boys aggression and short-tempered comes then it can be made problem of research.

A teacher working in school, with students, colleagues, principals etc. continuously interactions result which experience gets in those problems of research can be available. Researchers has experienced regarding human behavior, regarding experience research problem can available. Wherever experienced based circumstances, conditions, behavior seems to be facts of problems and whose solution is not available that can be selected as research problems.

(b) Study of Reference Material

Researcher's study is the second source of research problem. In every field on every subjects a great much literature is available. After the study of reference material it come to know that where available knowledge can be applied, on that basis of which events can be explained, where is incompleteness

in them etc. a number of questions prevails in mind while reading, whose answer can be important. In every field a number of theories, statements and suggestions can be determined. Theories of intelligence, theory of knowledge, personal theory etc. many theories have been postulated in education and psychology. On there basis, various types of behaviors, conditions, and problems analysis can possible. These possibilities can be taken form of research problems. By research there theories validity can be tested.

(c) Survey of the Completed Research

In every field already have done many researches. Studying of these researches comes to mind this matter something such left which study is necessary. That research has completed, it can be go ahead, in them adding some important variables, again on that problem work can be done, some study can be done on other perspective etc. also. Studying of these researches it is also to know that in that field. What is future possibility of research because every researcher gives such types of suggestion in the end of his thesis. On the basis of these suggestions, selection of new problem of research can be easy. In every field such a survey is publishing which presented having completed research description in short. It will be mentioned in detail ahead.

(d) Social, Technical and Educational Change

(In every country many types of changing is going on social, technical and educational's.) Education policy is made and in education system can be changed. In country technical changing happen also. Change in society takes place also due to these changes a number of problems occurred.To find solution of these problems from person as well as society point of view can be important. In this background research problems borns. Doing analysis of these changes from critical point of view a number of research problem available. For example, new education policy in 1986, a number of suggestions have been given for the form of education. As a result so many question and problems prevails whose answer and solution which can be discovered only by research. Life values' detreoriatim, increased religion blindness, misuse of given freedom by democracy, spoiled environment of institutions, increasing corruptions in institutions, decreasing importance of academic institutes etc, are such as changes which in our country give born of a number of sociological, psychological and educational problems, on which serious research is needed, there are the some generally accepted sources of research problems but its means is not that besides this. There are not such any medium of selection of problems rather than all accepts that there can be no substitution of researcher's own intensive study and thinkings. For the selection of problems related Knowledge Ocean will have to submerged. In which field research is to be done, regarding this researcher has not ample required informations then a suitable research problem cannot possible.

Holmes views are that following question can helps researcher in the selection of problems.

1. That person is engaged in related field really, before him which types of problem are occurred?

2. In present and in previous some years on which problems research have been done?

3. In related field which research has been done, in that which types of facts, laws, generalization prevails?

4. What can be the practical utility of these facts, laws and generalizations?

5. How far the result can be used in behavior of related fields, researches have done?

6. Which types of new problems have been occurred by these researches and on which research is remain to be done?

7. Which are the main difficulties in the path of related field research is to be done?

8. In the related field of research, which techniques and process have been developed?

9. Which are the concepts which are in use in related field?

10. Having done in related field or doing research, which types of assumptions have been taken help?

Self Assessment

Fill in the blanks:

1. Selection of a suitable problem is a hard work for all………. .

2. In each country social, technical, and of educational types………..are occurred.

3. Taking related problems thesis…………should seriously discussion.

3.2   Process of Problem Selection

In this process of selection of research problem generally following selections are inherited.

1. Generally, first of all determines it that in which field research is done. Each subject's knowledge is divided into many fields. For example, education-subject's particular area, psychology, sociology, education philosophy, education techniques, education management, evaluation and measurement, teacher education, teaching process etc can be. Similarly psychology's this field knowledge motivation, practical psychology, measuring and evaluation, creativity, personal, organizational behavior etc can be. In the field of sociology these social changes, caste relation, separation of family, organisation and their structure social class differentiation, social assumptions and tradition etc can be. On the basis of own study ,knowledge, and interest , determination of field after that from that field a limited and important problem should be research. Field is the extended form of knowledge. Under that many perspectives, theory, dimension, question and problems comes. Hence, it is necessary that after the gifting through knowledge, that problem should be discovered whose definite and unanimous solution is not available so far.

2. In the selection of a definite and clear problem, second step is to survey that having researched in selected field. It in know from that how many and which types of researches have been done on which problems. Consequently it is know also that which question are un- answered or not fully answered. Out of these questions and problems any one can be selected for research.

3. Selection of above question or problems means not that, research problem found. It can be understood. Only possible problem. It would be better that such a many possible problem selected.

4. Taking these possible problem, sitting with research guide seriously discuss should became over that. This is the third stage of selecting of problem processing. To find out the solution of problem is not as tough as selection of problem and to prepare their structure. By various views research guide deliberation and suggestion keeping in minds finally selection of problem can be done at this level.

3.3   Evaluation of Selected Problems

For research problem's giving final from before series thinking on their suitability. This is called evaluation of problem. Under this it is considered that problem will be better for research or not.

When a problem considered better or suitable, it's a criterion, under or under this many points come. By all that point of view if problem is considered suited, then it considered to be better and finally it is selected. According to Fransis Rumel that there is our characteristics or this criterion's point are – *(i)* Researcher's interest to that problem *(ii)* Researcher posses all those qualities which is necessary to research on them *(iii)* Problem should be important and *(iv)* Information regarding problem, data's availability possibility. **Mouli** has described following five points—

1. Problem should be interest of researcher: But it means not at all that according to interest, having problem not that research can not be done. If problem is of interest then it is best, but if problem is important then in lack of interest, it can be selected. Study regarding this, acquiring much information a time after the work is progress, interest became developed.

2. Problem should be Fundamental : It's meaning that problem such a type that on that before same type and research works did not do. That question answers have been got by research , to obtained them again is of no beneficial but if before doing result seems doubtful or their research process finds error or changing of population research is done then it can be keep under fundamentality.

⚠️

Caution　　Repetition of any research in the same form in misuse of time and human power.

3. Problem Should be amenable to research: Its meaning is that problem in such a type that on that research is possible, their variables can be measured, regarding that essential and required information can be acquired, analyzed available data etc. If for any reasons it is not possible that then problem is not considered suitable for research.

4. Problem Should be important: Every research has a purpose increase of knowledge in related field available of un-answered question, pre-established assumption and principle's verification and testing find out solution of problems etc, but by any research does not fulfills any of the purpose then it is not considered an important. Many times research problem is trivial and worthless. **Vollfely** and many other writers have been condemned staunchly taking research of such a problem. N.C.E. R. T. (New Delhi) has also critisized in his third (1986) and fourth (1991) education –research survey such a types. Research's important problems are considered those, by which above purpose fulfills and whose result are helpful in making advancement in related field's present, process, traditions, methods, techniques, procedures of work etc. Which researches' result has no utility that is worthless.

5. Problem should be according to researches' ability and capacity: Any problem can be very important and fundamental, but in researcher does not posses all those ability and capability, which in necessary to complete that research then that problem is not call suitable for that researcher. It is quite essential that researcher, has good knowledge of that problem related facts, concepts and theories etc. consequently. It is also essential that he has reading and understanding ability of related literature, comprehensibility. Report of research, journals etc. At the some time he should have good knowledge of researcher's techniques, formation of psychological test's, their administer times also. He should have good knowledge of data statistical analysis' methods also. If problem is such a type that on that for research these abilities is necessary and researcher has lack of these qualities then that problem is not called suitable for them.

Above points present a suitable and good problem's criterions considered to be evaluating of research problem base. Wan Dalen has kept all these points into headings personal consideration and social consideration.

Did You Know?   Problem's suitability is asses by time, labour and availability of wealth point of view also. If researcher can not manage required time, labour and wealth for research then that problem from his point of view can not be called suitable.

3.4   Statement Problem

The meaning of statement problem is to give title of problem. Title which writes in starting of projected research written format's beginning and after the completion of their or report is written up. Problems should be presented in which type of format means how that would be statesmen, regarding this some rules are. These are following types—

Waan Dalen according presentation of problem should be either in form question or form of direct and simple statement. For example,

Does intelligence affect boys' academic achievement? (Question Format)

Intelligence affect boys' academic achievements. (Statement)

1. Mauli accordingly, presentation of problem should be done as short and precisely. In his statement worthless and unnecessary words should not be used. The use of very tough world is not considered appropriate.

2. The statement of problem should be done in such a way that after reading of that reader should be cleared that which variables are in problems, whose inter-reclaim research in the purpose of experiment. As an "English medium School's teaching". In the type of problem statement nothing is cleared that which matter will be studied. If it can be represented as this type "A comparative study of academic achievements of English medium school's boys and other school's boys" the purpose of research immediately cleared after reading.

3. The statement of problem should be done in such a way that immediately after reading research field's scope is cleared. As a "Studying Boys' intelligence survey". It is not cleared from this statement that which place school's boys, which class or age groups boys' survey will be done. If it wrote as this type. "Meerut town's eighth class boys' intelligence survey" then the scope of research is cleared. In the statement of research work's whole format is inherited. After reading this, it should be cleared that what is the main purpose of research, from where data will be collected, which variable will be measured and what would be the method of analysis of data.

Task   The meaning of problem statement is to give title of problem. Express your view on this.

3.5   Definition and Analysis of Problem

After the selection of problem finally, their statement is done means write it finally and after its statement analysis of problem depthly means definition and describe is done. For various reasons, it is necessary. Problem's analysis and definition clarifies the direction of research and indicate towards

this, that in that research which types of variables used, how they will be measure and what would be the process of experiment. Thus research work's whole map becomes cleared and sured. According to Bhitni meaning of definition of problem is, "problem limit under a circumference and differentiate it from alike questions and separate which finds in related conditions.

To do so researcher has known clearly what is problem actually. In the beginning, such a specification and applicable limitation is very important. Regarding this **Manro** and **Angilhart** statements are of specific importance. His statement is that the meaning of definition of problem is "their detail and rightly specification, clarification of each and every main and secondary question whose answer is desirable and determine the limitations of research. Therefore, according to him, it is essential that research which is already done, review, them so that it can be determine that what is to be done. Sometimes-such a educational approach development of education theory and necessary to build which give a base to proposed (Projected) research. In general, language the meaning of definition of problems is their specification and clarification. Their base is to analyze problems and vivid description. Following works comes under them—

1. To limit the scope of problem based research

Its meaning is that the description of problems such a way that how much work is accessible that work is under the capacity of researcher. In other words to shorten an extensive and intensive problem came under this. For example, if problem is "To study the behavior of problematic boys" then this problem is very vague' extensive and wide. Under this different type of problematic boys, different causes of behavior, different methods of study, various places, and different age groups boys study come under this. Therefore it is necessary to, precise and shorten the problem. Which type of problematic boys, which age group, which is specific causes etc. would be studied. Its determination and clearly mention desireable. This is the meaning of deification. According to **Mauli**, if problem is not clear this cause a number of problems is go ahead and there is no question of relevant and significant conclusion. Therefore, research problem very extensive and vide, (e.g. the study of teacher's teaching effectness) should not be limited some important and specific aspects. At the same time, it should be not too concise and limited that it become a matter of caricature.

2. Problem based different elements' clarification and description

Under this researcher mention the background of problem, describe their theoretical base and describe the assumptions which is vested in problem. At the same time he mention that variables, facts, conditions, persons also/ which can be isolated from problem. Collectively clarification and mentions all these aspects deification of problems come under analysis and description.

3. Terms and concepts used in problems, clarify their meaning and define them.

This also comes under the deification of problem. If its meaning is not clear then it is hard to understand that what is problem. Some terms and concepts are like this whose meaning are different in different contexts or different writers or experts define different way. Intelligence, impulsion, Psychological needs, Personality adjustment, environment etc. are many concepts like this, whose meaning and definition found differently. Therefore researcher's has clearfied in which respect these words and concept have taken to use in problems. To do so, it is easy to measure this. Generally it can be defined as abstract and limited behavior. How it can be defined in literature, mention all this specially it can be showed, in which sense it can be taken in proposed research problem and how it can be measured, which elements, behaviour, conditions, events are indicator them etc. For example, if student's " educations achievement" is a variable, then it should be clear that, that's meaning students appraisal,

grading given by teacher or stendardised postulate examination obtained marks etc are which one of them. **Hillway** has indicated the four following definitions of problems:

1. It can be determines that the scope of problems neither too broad nor too shorten.

2. To express problems in specific questions, whose certain answer is possible.

3. Limitation the problems is such a way that which aspect and elements are not associated with problems they are clearly separated from problems.

4. All these terms which is specific and which is used in problems, define them.

Above mention way's problems, analysis and definition can be done then determination and clarification each and every aspect would be done. Then the statement of problem or it can be said that the title has given to him, what is their meaning in reality, perfectly determine and clearfied. Generally after problem statement it can be explain in detail this is called the definition of problem. It can be called proposed research project, Synopsis or agendum also this can be done before research work start. Its essential components are following:-

1. Problem statement.

2. Theoretical framework of problem.

3. The importance and justification of problem.

4. Definition of technical terms.

5. Basic concepts.

6. Delimitations of scope.

Self Assessment

State whether the following statements are True or False.

4. After the selection of problem finally, its statement can be done.

5. Intelligence could not affect the children's academic attainment.

6. By research any purpose can not fulfils then it can be consider as important.

7. The meaning of definition of problem is to specification and clarification of them.

3.6 Sources of the Problem

J. C. Almack has discussed the four means to find out problem:

1. Which is known by historical scripture, their analysis can be done.

2. That which is lack in explanation, that or find out untouched spot.

3. Irregularities, paradox, opinion different point and find out those places whose conclusion can not be tested methodically.

4. The seminar related to subject, study and thinking should be developed and keep in view that point in which more activities has been done and which is avoided keep in mind the process also. We can solve out the problem by this analysis.

H. H. Abelson has given four suggestions regarding source of problem—

1. Who are going education, study the process of education or do other types of education based, conflict in experience is a main means in them curiosity and conflicts produce problem before them autonomously.

2. Second main sources given in the end of (research dissertations management) suggestion for further study. In the end of all dissertations, given a list of suggestions that what can be done more in this context. By studies of these the problems can be found out.

3. Research work already completed and its gist or its short form by observe it intellectual can find out many problems.

4. Fourth main resources is to find out that area which has been avoided right now and on them there has no work been done so far.

Columbia university teachers college's **W. A. McCall** has suggests five ways for practical problems.

1. The best way to find out practical problems is that as soon as possible, to become a curious student of that special field and do intensive study of that field.

2. Second way is that study the literature by critical approach, hear people's discussion do work through critical approach.

3. Third way to find out the problem every obstacles which is appear in thinking and scope give weight age.

4. Fourth way can be like this that research work, has been started and then curiously observe in born problems.

5. Fifth way is that whatever has been attained in that field, master over all that because then will be get a direction. Its relevance is that which problems and concepts has come, prepared a systematic document of that.

According to **John W. Best**, following are the sources of problems is education field—

1. Class, school or society is a means itself. Every teacher faced different problems continuously whatever we are doing, why so? Which text is teaching why should they taught? Are our teaching method effectful? Are we eligible to necessary change in student? If not, then why? What are the obstacles? He faced a number of problems regularly? If he is curious and interested in research then worked any one them also.

2. Technological changing and social development has also produce new problems continuously and present a wide range of research. The new methods of teaching, teaching machines, television etc. How far can revolutionary change in education, this is the subject of research.

3. By bachelor education experience in researcher should has developed researchful critical approach. This tendency produces critical approach towards present work system and increase the knowledge of problems. Class lectures, debating, seminar reports and can be the knowledge of different problems through discussion between friends and teachers out side the class. Beyond this for curious student study of textbook, special assignments, reports, Encyclopedia of educational research, psychological abstracts, the review of educational research, the journal of experiments education the journal of educational research, postgraduates dissertations and its catalogue etc. various publications are such that through study that problems can be find out.

4. The fourth means of research of problem is that to counsel true scholars, teachers and research director of that field. These peoples assist to a fair degree to researcher of this field make easy to selection of problems.

Good, Bar and Scates statement is that in education field for research find out problems the most important seggestation is that consider in view the following points, intensive study of available literature:--

1. How much research work has done in different field of education;

2. An authentic description of fully research works;

3. Analysis of new tendencies;

4. In any subjected oriented field done critical article, magazines and notes;

5. Education related forecasting;

6. Research, on which the work is going on; and

7. Necessity of invention.

Keep in mind above mentioned points will be helpful to critical study to find out problems.

Good and Scates has mentioned the following sources of problems.

1. Specialization

2. Pursuation of education programme

3. Programme of reading

4. Analysis of any area of knowledge

5. Consideration of existing practices and needs.

6. Repetition of extension of research.

7. Offshoots of studies underway.

3.7   Summary

- Before giving the final touch of problem for research it can be thinking seriously their utility.

- According to Francis Rumel, there are four characteristics of above problems- *(i)* interest of researcher in that problems, *(ii)* researcher has possess all that ability which is essential for researches, *(iii)* Problem should be important, and *(iv)* Problem based knowledge, information's and possibility of availibity of data.

- According to Mouli, problem should be presented in concisely and precisely. In his statement unrelevent and unnecessary words should not be used. Too much hard words use is not appropriate also.

- The analysis and definition of problems clarify the direction of research work and indicates toward this that what types of variables vested in research, how they can be measured, and what would be the process of research.

3.8   Keywords

1. **Examined and valid** – Such material or theory which has been tested and their standarised has been proved.

2. **Research survey** – After restudy of research already done find out their shortcomings and possibilities.

3.9.   Review Questions

1. What do you understand by selection of research problem?

2. Evaluate the selected problems.

3. Write notes on problem statement.

4. What do you mean by problem analysis and their definition?

Answers: Self Assessment

1.Researchers	2 Changing	3. Guidelines	4. True
5. False	6. False	7. True	

3.10 Further Readings

Books   **1.**   Educational Research methods- Sharin and Shasikala, Vinod Pustak Mandir.

2.   Educational Techniques and Appraisal – Dr. Ranpal Singh, Bhatt Brothers.

3.   Educational Techniques – S. S. Mathur, A. Bhatta Brothers.

4.   Educational Technique Management and Appraisal – J. C. Aggrawal, Bhatt. Brothers.

Unit 4: Review of Related Literature : Need and Sources

Objectives

After studying this unit, students will be able to:

- Understand the related literature review and purpose
- Understand the context and established of sources informations
- Know about discussion of research article and related literature management.

Introduction

There are three parts in this unit. In the first part describe the related literatures review and clarify objectives. Second part gives guidelines to researcher's available main and supplementary establishment of information sources in the library, selection and for utilization to gain direction. Third and final part related to that process by which researcher should be followed in the accumulation of organization of related literature.

By continuous human efforts accumulated knowledge of the past is benefited in research. By researcher proposed study, directly or indirectly without adding previous work on related problems, research cannot be done independently. In any research study programme the important steps are to review research journal, books, dissertations, thesis and other information sources carefully. As indicated in the previous unit, before better planned research study it is very important to review the related literature.

4.1 Purpose of the Review

> *Notes* Related literature review introduce the researcher with recognition to current knowledge, in the field he is going on to research.

Related literature review fulfill the following purpose—

1. By review of related literature researcher get helps delimitations of their filed. He gets help in their delimitations of their problems and definition. Regarding conformity, the example given by **Aerry** and other researcher can say –

   "A, B and C has researched so much about my questions; By testing of D so much increase in our knowledge. I want to work further with the work of 'D' in following methods.

   By related literature's knowledge, researcher got full familiar with work done by another persons and can explain their purpose vividely and concisely.

2. By related literature review, researcher can escape from unuseful and unutilisation problems. He can choose such an area in which beneficial research could be done and by their efforts increasing in appropriate knowledge.

3. By related literature's review, he can be saved from repetition of already proved works. If studies validity and stability proved to a fair degree then it is folly to repeat it.

4. By review of related literature, researcher understand the research process, by which it can be knowledgeable how the study can be done. He get knowledge about the used mechanism and tools in the previous study which was successful and useful. He get insight the statistical method by which validity of result can be proved.

5. The final and specific cause of review of related literature is that previous researcher had in his research what recommendation was given for further research.

4.2 Identification of the Related Literature

The first work review of related literature is to recognize which material should be read and evaluated. In library it can be identified available **primary** and **secondary** use of sources.

The main sources of information, author directly work through research article, bookless, the subjected related eassay, dissertation or medium of thesis applied. Such a sources gives much information than any other available informations. By main sources researcher's get a basis of their decision about the study. Although researcher spends a lot of time to get help from these sources, but he get a sound information with the research methods about the subject applied.

In secondary sources researcher do by the work of other persons study result, make precise and then explain. In these author generally discuss about all important study of that field 'education's world dictionary' 'education indicator' Summary, catalogue of books, context and discuss about mentioned statements. It does not take much time to work on secondary sources because material for study is not sufficient. The greatest disadvantage of it is that reader can depends upon the important aspects of study by other persons decision and concepts.

The decision from primary and secondary sources which one can be used, depends upon the nature of study chosen on by researcher. If he research an area in which most research has been done, then the review of primary sources at first step will be logical. In second type, his study is such an area in

which research has done very poor or almost negligible then the review of secondary sources will be more logical. The two sources of information either primary or secondary can only find in library. Researcher should get proficiency without losing time or energy the essential sources. Researcher's collections of resources, selection and help in use their applicability in education research, study gives guidelines.

Self Assessment

Fill in the blanks:

1. By related literature ……………..... researcher, understand research process.
2. Both the sources of informations, primary or secondary found in ……………… .
3. For photocopy of desirable source the Researcher can request it from ……………… .

4.3 Locating Sources of Information Through Library

Researcher should have full knowledge of available facility and services in the library. He should have familiar with the use of material and rule and regulation of application. Mostly library has available printed instructions from which beneficiary informations gets. In which a map, books, collections place, Periodicals department, reference department, study room, special collections of books, Micro card tools, handwritten books, small magazine position showed. In instruction such regular periodicals catalogue which can be taken in library or special index, summaries and others references materials name is listed. Collected places and rule of use of reserved books, process by which getting the rule of materials from library method of borrowed from other library also given in index.

Researcher or other readers generally given a library card by which he can go to appropriate places. He can does it by library staff or self. He can find out the desirable books or other reference material. It is desirable to have the book on bench after use so that there's staff keep it on their fix place.

Sometimes some references cannot available in library. In that condition reader should see 'union' catalogue in which available materials in other library list is given. Such a references from other library can be demanded by following methods

1. **By Inter-library loan System**: By the request of reader the librarian can barrow the books from the library where it is available.
2. **By requesting a photo-static copy**: In this reader can ask photo-static copy of that Page or demand from desirable sources he may request to librarian.
3. **By requesting an abstract or translation of the portion of a desired reference**: In some libraries summer or translation taken facility is available, in which essential Part's summary or translation can be taken by deposit fix fee.
4. **By requesting microfilm or microfiche**: Reader can purchase a microfilm and see on library tools. Microfiche is a sheet of film on which study material has written or micro image of books are Printed. By development of these library and service information get a great contribution through this long scholarlistic speech. It can stored in cheap and confineable way.

International organization of standardization microfiche size is 105 mm × 148 mm in which 98 images (14 micro images in of lines) and 24 times less capacity. It is approved by American National Micrographic, Society whereas Britain's microfiche less in size in which 60 images (BS 4187: 1973) can be.

Recently National Cash Register's P.C.M.I methods developed *Superfiche* has 75x subtraction ratio and in which 4″ × 6″ transparent card stored 1000 page material.

Planetary camera is a 35 mm or 16 mm stationery camera which can be tied on perpendicular base and can up and down to adjust the subtraction ratio from 10x to 50x. 100 feet roll film can be loaded at a time. It is not much costly.

Step and rapid camera has more costly. It can autonomously printed one by one micro image on microfiche.

Rotary camera: Like planetary camera it printed micro image on roll film or subtraction ratio can be adjusted according to need.

Flow camera, half of the price in compare to planetary camera. Its subtraction ratio is fixed.

In all these cameras for printing micro image, silver, Diyaso or vaccicular film is use.

Generally six types of reader can be used for reading of microfilm or microfiche.

(i)   *Cudly or (coil) microfiche* reader can be portable and it can be used to carry on lap. It is very cheap and can be given to library's member for use of residence.

(ii) Microfilm or Microfiche Reader

(iii) Universal Machine

(iv) *Reader / printer* press button set machine which is not only helpful is reading microfilm or microfiche but also printed on paper in full size made on screen.

(v)   *Production printer / Enlarge printer*: It is a autonomous machine which can printed photo copy of microfilm or its any part in required number. It can be used in full size of photocopied of microfilm in large scale.

(vi) *Zerox copy flow Machine:* It is costly machine and therefore beyond the capacity of general library. It can print readable size of microfilm. By which any desirable manuscript's one copy get in less time and expenditure.

The Card Catalogue in the Library

👀? *Did You Know?*	The card catalogue is an index of all collections. Systemically except published periodicals all catalogue of published material in this.

Generally in the card systematic description of author, title subjective card is alphabetical order about any book's much information get in this card. Beyond books title and author's name, author's date of birth, edition, publication, date, number of pages and get the address and name of publisher. In the card other information like related / reference books name, map, sketch, directed image (pictogram), tables, series in which book published, short description of books. In translated book and translator's name etc. also mentioned.

Library Classification Systems

In classification method make the systems of keeping book systemically and find out them. All methods based upon which is logical and give minutely description.

🖅 *Example*   In America two main methods of classification used in library—'Devey Decimal' Systems and "Congress Library" System.

"Devey Decimal" method is decimal system in which Numbers from 001 to 999.99. Secondly "Congress library" System mostly use in big library. In this, "Devey Decimal" Systems' in place of 10 squares 20 main squares. In this for main squares use letters and for sub-squares use number.

In library author, subject or title card's ahead in left corner back side of book for all books one to one call number or in letters. The use of this call number or letters, wardrobe library, books keep systematically and in a square books placed authors first letter of last name according to alphabetically.

Library Searching Guidelines

For research related with problems recognition of available superior source and to find out necessary information is a very important work. For this he should have developed research technique in the library so that he could save time and efforts. **Waan Dalen** has suggested the following valuable guidelines for researcher:

1. Before the use of library, one should familiar with different parts of that, facilities and services of rule and regulations.
2. Microform Reader, Photocopy machine and learn the use of others mechanical tools.
3. Collection chamber of books, periodicals, reference books and reserved books and scarce books, rumens, confirm whose books to be needed where it has been kept.
4. Determine the library time period so that not much stress on their resources and services.
5. In one day programme which books to be needed make their demand schedule in the beginning.
6. For your each reference management give the full information copy to librarian and index of periodicals or check card catalogue before closing. If any incomplete will be remain, correct it.
7. To finish a specific subject how much time is necessary complete it one sitting.
8. If the available time is not sufficient, then take such a question who can be answered quickly by the help at available referenced books.
9. Before discovery the material in library write down all those questions which fulfill all desirable informations listed the questions according to the location of rooms of library from where you can get answer.
10. Make such a list in which periodicals, institutions, government agencies, research agencies, statistics collector, libraries, special collected materials museum and authority of their field's present and past name mention.
11. The best references books of their specific area, order list, handwritten books, historical studies and prepared a list of legal reference.
12. Keep a file at your list at best books at your subject and copies at important research studies.
13. Findout which periodicals regularly or often printed the best books at subjects, literatures review or other material or published in which issue at it.

Task Give your suggestion to get information regarding problem in search of available best source.

Self Assessment

Multiple Choice Questions:

4. Rotary Camera print micro image on roll film like _____ camera.

    (a) Flow   (b) Planetary

    (c) Step or repeat   (d) Universal Machine

5. Production Printer/Enlarge Printer is a _____ machine.

    (a) Hand operated   (b) Feet operated

    (c) Autonomous   (d) Electricity operated

6. 'Devey Decimal' System is a _____ system.

    (a) Zero   (b) Decimal

    (c) Letter   (d) Word

7. Catalogue card is all collections of library's _____ .

    (a) Measurement   (b) Reviewer

    (c) Director   (d) Index

4.4 Reference Manual

There are many references in education field which are useful to researcher. To discover such a material researcher should have read following books carefully-

Coustens M. Vinchel— *A guide to references books* – Eighth Edition Chicago: — American library association 1967. This extensive book printed supplementary once after two years in which up-to-date information about many languages. In this 7500 contexts description and appraisal and in this one Part related to education.

Albert J. Wellford— *Guide to Reference Material:* This is divided into two volumes-(1) Science and technology (1960) and (2) Philosophy and Psychology, religion, social science, geography and history (1968).

Mary and Burton and Mario V. Bell (1962) — *Reference books: A Brief guide for students and other users of the Library:* This guide is beneficial but very short.

International Guide to Educational Documentation (1955-60) UNESCO to 1963— This is educational booklets, Periodicals, Sudden eassy, film and voice recorder on which a sectional international guide.

Arvind Berk and marry Berk — *Documentation is education* — This guide introduce a wonderful to literature of education world.

The Standard periodicals Directory New York — Oxbridge publication Company 1964. There are more than 30,000 entries so far as yet. Except local news, it includes all the periodical. It publish every year and in this in 200 groups, subject wise description. The catalogue is in alphabetical order.

Kristin L. Winer — *Guide to Reference Books for school Media Centers Littleton, colo—* Libraries unlimited 1973. In this guide 2575 entries included about references books and selective tools assessment included note sheet which can be used in education field. In their index author, subject and is title.

Encyclopedias — This is storehouse of informations in which good discussion prepared by experts and given the selected list of books. This subject set according to alphabetically. It presents a critical appraisal of each and every work done in research area. At the same time it marked necessary invention in the field also and given a reflective list of books also.

For researcher in education area useful encyclopedias Sample list are following—

A Cyclopedia of Education: Encyclopedias of education, Paul Monaro, 5 volumes (New York- MacMillan 1911-13) it is edited by Paul Manaro in which divisional editor and more than 1000 writers have been contributed. In that masterpiece books list is and the best of historical and biographical related purposes.

The Encyclopedia of Education: Encyclopedia of education editor **L.C. Detton** (New York: The Macmillan Co. and free press, 1971). There are more than one thousand essays in this. From that institutions and persons, methods and product that is found in education system, being knowledgeable. In essays history, theoretical invention philosophy and form of education or subject of configuration included.

Encyclopedia of Modern Education- **Henry D. Khilin and H. Shooler** (New York: Philosophical Library, 1943): Henry D. Khilin and H. Shooler has complied almost 200 extensive work of authorities. In this, the stress has been given on now-a-days problems, tendencies, methods and principles. Including essays precise book list and method of mutual reference.

Encyclopedia of Educational Research: Encyclopedia of education invention: **Walter Scott Monro** revises edition (New York: Macmillan, 1950): This encyclopedia has been prepared under the supervision of American education invention association. Its aim is to critical appraisal, collection, and explanation of the education field studies. All essays are set according to alphabetical order and catalogue of books also.

Encyclopedia of Educational Research: **Chester Haris** third edition (New York: Macmillan, 1960): This encyclopedia is prepared under the supervision of American education invention association also. This edition is not only the revised edition of previous edition but also written by new approach in which new interpretation of subject.

Encyclopedia of Educational Research: **Robert L. Abbel** fourth edition (New York: Macmillan 1969): In this Encyclopedia, research's short description is given and for future research works many references has been given. In essay current education problems and discussion about defaults in systematic education.

Encyclopedia of Educational Research : **Harald E. Mijel** fifth edition (New York: The free press : Macmillan co. of a part -1982) In this Encyclopedia subjects has been classified into 18 groups according alphabetical order which is spread up to education related agency and institutions, advice, health, Psychological service, text area etc., or teacher and teaching. New ideas or subjects as a computer based education, education of use of alcoholic 'equality in education' ethnography, neurology, has been included in this book. This publication is there flections of modern events and progress of the world in which education should be given.

The International Encyclopedia of Education: **Tarnstan, Hussen and T. Nevil Poslethwet** (New York: overseas press, 1985): The problems related to world, exercises in the direction of institution's present modern scene. This publication is the first effort. It answered three fundamental questions available information in this. What is the position of art in different section of education? Which is necessity invention of different aspects of education?

The Encyclopedia of Comparative Education and National System of Education: **T. Nevil Postlethwet** (New York: Oxford press, 1988: This encyclopedia is divided into two parts. In the first part presents the series of essays on comparative education; in the second part the description of various countries of 159 different education system has been given.

International Encyclopedia of Social Sciences: (New York: Macmillan Co. 1968) It is prepared under the guidance of ten learned persons committee. In this reference book discussion about all social science subjects.

Encyclopedia of Childcare and Guidance: (Garden city, New York: Double day and co. 1968— In this complete discussion about child period's problems nature. In this the solution and elimination methods of these problems mentioned.

Encyclopedia of Social Work: (New York: The national Assembly of Social workers, 1965)— In this book all aspects of social work detailed essays has been given.

Encyclopedia of Philosophy: (New York: Macgraw – Hill book co., 1971) – In this Encyclopedia more than 2000 author's, more than 7000 essays on science and mechanics complied all those subjects.

Encyclopedia of Philosophy: (New York: Macgraw – Free Press, 1967) – This is an authorized and detailed reference book in which both, orient and western ideas – ancient, medieval and modern inclusion.

Dictionary- This is always do a guidelines to researcher. Some of the familiar dictionaries list given below:

Dictionary of Education : (New York: Macgraw- Hill book Co., 1973)- In this 3300 technical and commercial words has been given. En education different countries familiar words has been given.

Comprehensive Dictionary of Psychological and Psycho-analytical terms (New York: David Macey Co.) : Inthio 13000 words has been given. Words has been defined in technical words.

Roget's International Thesaurs of Words and Phrases : (New York: Crowell, Kali and Macmillan)-Thesoras is the antonym of dictionary. If anyone knows the meaning of words but do not appropriate words for use then can be helped from. In thesoras synonyms and antonyms of words are given. Researcher should have read with the help of a good thesoras and a good dictionary so that correct sense can be demonstrated.

Yearbooks, Almanacs and Handbooks: Education problems thoughts and patterns based most contemporary informative annual books, colander and small books get in. In some annual books publish subject of new taste every year and in some others general review of current topics. In some annual books, calendars and booklet list are following-

The Handbook of Research on Teaching. **N. L. Gage** (Chicago: Rand Macnalee and Co., 1963) This book represents an intensive research information on education and a great catalogue books also.

The Rand Mc Nally Handbook of Education: **Arthour W. Phoshe** (Chicago: Rand Mcnally and Co., 1963): This is a convincible source collection of education related mostly important facts. By this book represents a comparison of England, France, and Russia Education in a rapid context.

Education Yearbook (New York: Macmillan Co. 1972- to till now): This is an annual publication. In this prime education problems and revolutions, statistical data has been given and at the some time a wide book list and reference guidelines also.

Mental Measurement Yearbook (Hyland park, New Jersy: Grephan Press 1938- to till now) **Askar K. Boorose** has compiled this. In this psychological measurement and standardized test and summary of tables has been given. It publish after four years and in this measurements important books review and pubnlished books review in commercial journal mentioned parts has been given.

Indian Mental Measurement Handbook: Intelligence and aptitude test (New Delhi: National Council of Education Research Training) 1991 (NCERT).

This handbook national library education and psychological test a great effort for researcher in which standard test review, especially in 'skill' and 'aptitude' has been done. It presents systematic information about developed test in India and foreign test adopted according to Indian circumstances. In this not only commercial test counted whose demanded by researcher or which is available for a finite use, but also that test is included whose only model. Sample is available. In this book review of test has been given, by which reader can did a more critical appraisal of test.

The Student Psychological Handbook: A guidelines of sources (Cambridge, Mass: Shank man publishing co., 1969) Psychology main subjects description is in this book in which sources of information, methods of data collection and has been given concept about use of reference material.

Data Processing Yearbook: (Detroit: Franc H. Gille, 1952— to till now): This yearbook publication is irregular. In this data processing's equipment, technique and composition essay contain. In this, such an institution is being named. Which gives data processing and computer texts.

United Nations Statistical Yearbook: (New York: United Nations 1949 to till now): This is an annual publication. It presents the data related to population, trade, finances telecommunication, health, and education.

World Almanac- Book of Facts: (New York: Newspaper reference, 1968 to till now): This is an annual publication. In this, Presents the social, educational, political, religious, geographical, commercial, financial and new statistical data on condition in economical area.

The Standard Education Almanac: This is the document almost all aspect of education's facts and statistics.

Directories and Bibliographies: When researcher need collection of information about financial assistance or research material then he is to use the index for persons, periodicals, publishers and organization name and address. By the help of index, researcher can find those persons or institutions whose commercial interest are same or who can help them in eliminating problem or can answered their questions.

America and Britain some important indications are following:

Guide to American Educational Directories: In their one book, more than 12000 a list of indices related to education. This indices organize under the title of subjects according alphabetical order.

Education Directory (Washington: American education office; Supretendent writing, 1912-to till now): This index publishes every year in five volume. It has contain name, education agencies, officer, institutions and other informations.

N.E.A. Handbook of local, state and National Associations (Washington D. C.: National educational Association, 1945 to till now): This is a annual publication. It is a list and extensive report related in there associations and departments of state and national authorities.

Educators World (Englewood, kolo: Fisher publishing Co.; 1972 to till now)- This is an annual guidelines of more than 1600 education associations, publishers research centres and offices.

National Faculty Directory (Detroit: Galle research Co.; 1964 to till now)- In this annual publication more than 30,000 employed American colleges and universities fully or part time in alphabetical order, departmental members employed in administrative universities, full or part time name and address is given.

Encyclopedia of Association (Detroit: Galle Research Co.; 1964-till now): In this index America's more than 14,000 ordered list of national assemble according to alphabetical order. In this their executive secretary's membership notification, address name, and their purpose are given.

Directory of Exceptional Children (Boston: Porter sergeant publishing co.; 1962 to till now): In this America's schools, camps, houses, dispensaries, and hospitals description, and socially avoided, Mental underdeveloped, or Physically henodicaped persons services description are give.

Mental Health Directory (Washington, D. C: National Health-Mental health, Government printing office, 1964- to till now) In this annual publication is America's national, state, and local mental health agencies list are given,

American Library Directory (New York: R.R. Baukar Co.; 1923-to till now): This index twice in a year, in America and Canada guides private, public, municipality, institutional and college library. In this special collection, number of holdings, Employee wages, budget and their relevancy informations are included.

Kelly, Thomas, select bibliographies of adult education in Great Britain (London: National education institution, 1952): Block well A. M. in Britain and Ireland for university higher degree in education psychology from 1918 list of researches (London: Newans publishing Co. 1950)

In India at national level for education invention assistance too much prologue has been published. Reentry India's by inter university council, by Indian universities 1946-48 and 1948-50 approved decorate thesises in science and arts' bibliographies has been published. It is under the different universities, in the subtitles of subject in which education is include also, are registered.

The index –Periodical index do some work as bibliographies order or library card file. This book or eassay's source alphabetical order of titles marks under author.

Some education based index list are following:

Education Index (New York: H. W. Willson Co. 1929 to till now): Education index prepared for teacher important and work saving guidelines. This is a monthly publication (Sept-June) which can be annual commutative and after three year same. Process is followed in this list more than 200 periodical magazine related to education, a number of annual books, bulletins and monograph which has published in America, Canada and Britain in this index adult educations commercial education, texts, education management education Psychology, education research, extra ordinary child, higher education, guidelines, health and physical education, international education, religious teachings, secondary education and training of teachers etc. Subjects are included.

Canadian Education Index: (Otava, Ontario: The education research council 1965- to till now) – This index is publish after three month and in this index the list of periodical, books, booklets, and reports published in Canada.

Current Index to Journals in Education (New York: Macmillan information 1969 — to till now). This index publishes monthly and accumulated 06 months or one year. In this more than 700 from education and related journals almost 20,000, essay, writer, and subjects' title are listed.

Aric Education Documents Index (Washington, D.C.: National institute of Education, State Publication office, 1966- to till now) – This index publish annually. This is the guidelines of all research essays, education resources information centre.

Index of Doctoral Disrational international (N. Arbur, Mich: Zerox university microfilms, 1956 to till now) This publish as 13th issue of disration abstracts international each year in which America, Canada and approved by some Europien universities, all dissertations publish in one academic session and which is available in one microfilms, a list of all their inclusion.

International Guide to Educational Documentation: (Paris: Uneso) this guidelines publish every after five years. This prepared books with their meaning in which main publication, book list and national indices which are written in English, French and Spanish are included.

British Education Index Volume I - Aug. 1954 to Nov. 1958: This index is collected by librarians of educations institutions. Essay of education interest context is given. In this, list more than 50 periodicals.

Index to Selected British Education Periodicals (Leads: Librarians of institutes of Education, 1945 – Till now): This index publish thrice is a year and in this 41 education related periodicals are included but primary adult education has been left.

Research Periodicals

New ideas and developments' information comes generally in magazine before books. Education and related fields many periodicals which are best sources of newly research and studies reports. In such magazines general question of education related find out better and up-to-date solutions with respect to books. It publishes temporary, local or essay of finite interest as not in the books. Any contemporary ideas or position – present or past fixed date magazines is the best source.

This is an approxmination that education related almost 2100 magazines. In all this journals Psychology, Philosophy, Sociology and interested in other subject can find out materials.

Caution   Persons employed in education research should have gain some knowledge of education related periodicals and learn the use of index also.

The guess about magazine utility, knowledge regarding to editor, author's name and publisher can be find out knowing the name of assembly or institutions name.

Ulrix Periodical Directory: A Classified Guide to a selected list of current Periodicals-foreign or domestic, 12th edition (New York: Baukar, 1967) has been given a detailed list of education related periodicals. In this directory, magazines are classified according to subjects, arranged in alphabetical order. In every entries title, subtitle first edition date, frequency of publication, annual index, commutative index, and are given the specility of each magazine.

In India by some committees and institutions publisher a number at periodicals. This is for publicity of education research and interested researcher at this field or other profession teachers, scholars etc act as a medium at their give and take experiences.

Abstracts

In this the short synopsis at research study or main the me at on essay. It works as most useful context guidelines for researcher and fully familiar with worked going on their field.

In America regarding this most useful are following—

Example   'The review of educational research' gives best observations which have been done in this field and make familiar with new events.

Between 1931 to 1969 this Publication after every three years reviewed following eleven main education field: *(i)* Administration *(ii)* Syllabus *(iii)* Teaching measurement *(iv)* Education Psychology *(v)* Education Sociology *(vi)* Guidelines and advice *(vii)* Literature art, minutely art, Natural Science or mathematics *(viii)* Research methods *(ix)* Special Programme *(x)* Mental and Physical development and *(xi)* Teaching staff.

Since June 1970 education research review followed the policy that topic at research, according to author's interest and reviewed should be published arbitrary.

Research in Education— (R.I.E) Today this is the Vital Publication at research material at education field. R.I.E Publication from 1966 is monthly and it got published by education resources information centre and made annual index. Every month Publication divided into three Parts.

(i) Drafting department *(ii)* Planning department *(iii)* Approach department

Psychological Abstracts — This useful reference by America Psychological committee has been publishing form 1927. This is for nightly publication and in this more than 530 summary publish in journals in which mostly is periodicals at education. In half-yearly issue (Jan- June, July- Dec) both author and subject's index are given.

Education Summary— This is an UNESCO Publication which start from 1949 and except July and August it Publish monthly. Every introductory essay dedicated to special aspect at education in the and on that Subject different countries' selected books and essays' short form.

Except above—mentioned Periodicals, researcher can take advice from following Publications.

1. The Annual review at Child Psychology (1950 to till now)

2. Child Development Precise and Bibliographies (1927 to till now)

3. Psychological Bulletin (1904 to till now)

4. Social Precise (1962 to till now)

5. Education Administration Precise (1966 to till now)

6. Education Social Precise (1964 to till now)

7. Mental Obstacles Precise (1964 to till now)

8. International Discussion Precise (1952 to till now).

In India governments education and social welfare ministry (now Human resources development ministry) New Delhi for 1955 had been Publishing quarterly consciously. In this India on education, Publish in Hindi or English Presents the Summary at books and Periodicals. In different issues given almost all journal list summary are under following subject titles: Philosophy at education, teaching Psychology Measurement and testing, examinations, students and the student association, teaching and commercial guidelines, teacher education and training couse, basic education, health and Physical education, Primary, Secondary, higher, commercial, technological, and social education.

In India and abroad many publishers publishes many commercial periodicals and yearly books any one or all issue in their series on education and technological discussion review some of such publication list is following:

America: Journal of education research, N.E.A. Research Bulletin, Educational and Psychological measurement, Journal of experimental education, research quarterly, Journal of research in music education, American educational research journal, reading research quarterly, Journal of educational Psychology, Journal of applied Psychology, Journal of Social Psychology, Sociology of education, American journal of sociology, American Sociological review, Sociology and Social research, how and educational review, journal of teacher education elementary school journal, History of education quarterly and education Forum.

Britain: British Journal of Educational Psychology.

India: Indian Education Review. Psychological Research Journal, Journal of Indian psychological Behaviour, Indian journal of Psychological action, Journal of Psychology and Education, Quarterly Education, Administration and Planning journal, University News, Higher Education Journal.

4.5   Thesis and Dissertations

University given the degree of doctorate and Postgraduates to authors generally keeps their thesis and dissertations safely to own hands. Sometimes this study fully or Partially are Published in different educational magazines and journals. Since may research study never be published by different agencies, Publish thesises and dissertations, test the annual list research/invention literature getting the position to all become necessary.

In America including doctorate degree of education in all areas research references getting by collection of different agencies sources. Library of congress from the period of 1912-38 American doctorates' had been Published annual list of dissertations of studies. The association of libraries from 1933-34 to 1954-55, approved by American universities Published list of doctorate discussion. This service American doctorate dissertations 1956-63 continued as index and that American doctoral dissertations from 1963-64 to till known. In this by education intuitions American and Canada approved list of doctoral discussion.

Dissertations Abstracts International May 1970: In this human beings, social science, physics and engineering subjects precise form at inventions/ thesis are given. This is a monthly publication. Each essay have 600 words summary which gives ample information to fulfill the needs at research. If anyone

can read the research's thesis publish internationally then he can buy Zerox copy or microfilm from university. For buying give order reference number and their value given in summary.

In India some of the universities publish thesis completed in their premises.

Kurukshetra University (Haryana) has Published its M.E.D. research essay summary Part I, 1966; M.E.D research essay Part II 1967, Part III 1968, Part IV, 1969, Part V, 1979, M.E.D research essay and Ph. D research essay Part VI, 1973.

M.B Bush (editor) in India education research survey, education advance study centre Baroda, M.S university 1973. In this in India universities till 1972 has been presented all educational research study. In this division like this-462 Ph.D study and 269- Planning invention. All studies have been divided into 17 meaningful at education. That is –*(i)* Philosophy in education *(ii)* History at educations *(iii)* Sociology in education *(iv)* Economics in education *(v)* Comparative education *(vi)* Personality Studies and impueses *(vii)* Guidelines and advices *(viii)* Measurement and testing *(ix)* Tests, methods and textbook *(x)* Education technicians *(xi)* Inter-relation at achievements *(xii)* Appraisal at education and examination *(xiii)* Teaching and teaching behavior *(xiv)* Teacher education *(xv)* Education administration *(xvi)* Higher education and *(xvii)* Informal education.

M.B. Bush, education research second survey (1972-78) Baroda: Education invention and development committee (1979)- In this Publication, 1972-78 period completes 839 research study included and education research survey like 1973 has managed 17 research areas. In the first chapter has presented extensive sample for the development at education, place and work of inversions at the some time has given the history of education research in India. After that in every chapter summary report of research studies of specialized area, nature of research and their short coming has given and mention that according to author what would be the priorities in research summary for each area arranged according to alphabetical order and whole book has been given an order number. In every summary title of studies their aim or hypothesis which is tested, testing method sample, tools of research, statistics techniques which has been experiments and result has been given. The characterization of this Publication is beyond education problems, university education department, Social Science and mankind departments' completes many studies has placed also. Progress report 1972-78 completed studies are not based upon but based upon all research work done between time period 1940-78.

M. B. Bush: Education research third survey 1978-1983 New Delhi: N.C.E.R.T. 1987

There are 20 chapter in this publication, whose begning in India's based upon Quantitative and Qualitative analysis of education has been done from general tendencies at education research. Trends at areas report has been prepared by famous educationist between 1943 to 1983 four decades done studies based upon. Total 1481 research summary has classified into 17 fields. In each summary, problems in brief, Purpose of studies, followed research techniques, and its result and conclusion has been given. In this book's specialty "Research on Indian education in foreign' title's chapter in which two decades in America and British university being given 192 Doctorate review of thesis. Its second specialty is chapter is "Priorities in education research. In this book till 1983 in India done all list of education research work has given in one place.

M.B. Bush: Inverting in education: fourth Survey (1983-1988) New Delhi N.C.E.R.T, 1991.

Published in two volumes in this edition in 31 chapters till 1988 did begning from review of general tendencies in education research, famous educationist have prepared report in four decades (1943-1988) on the basis in different education field tendencies. Total 1652 research summary divided into 29 field have been given. In the book in India from 1943 done total 4703 had been given the full list of education research. Fourth supervision has given a new dimension. In one chapter in Indian universities have been given review done at M. Phil level research.

Newspapers and Pamphlets

Researcher's interests' many essay can be find out in newspaper and Pamphlets. In modern newspaper speeches, seminars, meeting, new tendencies and on different subjects up-to-date informations is available. In old newspaper previous events, movements and ideas, specially for historical informations, written preserved some library keeps list of pamphlets and newspaper in their references department.

Government Documents

Governments documents are the rich sources of informations. In that statistical datas, research study, Government report rules, etc., such as material which is not available always on other places. This material is available in nation, regional, state, or local level's governments offices.

Monographs

Monographs is a main sources of going on research's informations. In America, university and teachers' college education field many research studies Published in a booklet form. Some of its examples—Supplementary educational monographs, Educational research monographs, and Lincon school monographs. In England many education intuitions Publishes monograph time-to-time also. In India only some universities and research institutes publishes very selected monographs.

Computer-generated Reference Material

School Research Informations Service (SRIS), Direct Excess to Reference Information (DATRIX) and Psychological Abstract Search and Retrival Service (PASAR), in America computer-generated gives a number at reference source by which researcher can save their time and efforts. SRIS which is by **phi delta Kappa** (Buminigton Indiayana) governs, gives computer print of summaries by expenses a little. By university microfilms manufactures DATRIX (N. Arbar, Michigen) from 1928 to till gives Service, Summaries of thesises hunt by computer. Researcher if want-paying money, full copy of desired thesis, by university microfilms do on microphice or zero graphic. PASAR service also summary of essays' of Psychological journal, monographs, reports and copies of parts of book gives on very general rate.

4.6   Organizing the Related Literature

After detailed supervision of related literature, the next step of researcher is to collect appropriate informations systematically. According to Arrey and others, this can be done in such a way that looks vividely from studies that what is know to that subject already and what is to be research.

A hypothesis gives a base to related literature's management. A person as on researcher before set out his journey plotted known area in the map he can do have the path of unknown to which he want to research. If the many aspects of studies more than are hypothesis to be tested then followed some process for each. Researcher should have give up that greed that he can did presents whole literature into a series of summary. Rather than he presents in such a way that make a systematic base for study.

Under the management of related literature, Recording of essential reference material and according to the guidelines of projected study is to be managed.

Recording Reference Information

After marked of above informations, researcher should have printed index card of 3 × 5 inch, some essential informations should be marked on Index Card to find out the position of material, which can

be done as *Bibliographies Card.* To make the final report easy, it would be appropriate that mentioned informations in the book, text matter and writing style as per as in final report.

In references card which original information should have contain that is – author's name – final name first, title of essay or book, name of publication (for essay) name of publisher, publication date, volume, number, number of pages and call number of library (for books). If some informations regarding this is not available then necessary place should be left blank so that after getting reference that informations filled immediately.

Recording of Content of References

After filling the necessary information in references catalogue card, it is desirable to manage the card in library according to available place. For example – in pamphlets departments all cards of available materials should be listed in one place. Like that is reserved department make a separates also. After that researcher should have reviewed methodically keep material in one department and after reviewed each references catalogue some process will be done on other catalogue.

In final report probable informations to be included should have printed on 4″ × 6″ card. This card will be known as *material card*. Printed material on material card depends upon that source from which it has gotten. If this is taken from main sources then the brief list of book in that in which author's final name; short title of report number of that page on which material is available, Preamble of problem in one sentence, brief description of study, preamble or result of research or both, the code number of card so that aspect of indicated of research should have close connected with material.

If the sources is secondary then the printed informations will be differ from main sources. **Tarani and Robb** for the printed of secondary information following suggestion has been given:

1. Give information brief bibliographies (according to main sources).
2. In one card printed that informations, which is related to one title (if all information does contain in one card then use second card and stich it with former).
3. Most relevant thoughts in full preamble, written your own words. Give the direct quotation of author only then if it brief and forceful and meaning cab be changed when express in own words.
4. After every separate preamble give rage and Paragraphs number so that its position can be found out in reference and it can be done if need to re-review.
5. On card (right corner in the above) according to subject insert code number which is closely connected.

Preparation of the Related Literature Report

In preparing the report of related literature, researcher should have arranged book list card and material card according to guidelines of problems. It can be done with the help of code number of card.

The inception of related literature should be with introducational paragraph in which management of report should describe. After introduction researcher's should have presented the systematic study of every points of projected guidelines of problems. Such studies whose result are similar or contradict should have presented together without giving much space.

4.7 Summary

- By continuous efforts of human beings collected knowledge in the post benefited in research. In any research studies planning one of the best is— research journals, books, dissertations, thesis and other information sources carefully.

- By review of related literature, researcher understand research process through which he come to know how the study is to be done.

- In the main sources of informations, author directs his work, by thesis, books, one subject essay, dissertations or by medium of thesis applies. Such a sources gives more informations than available sources of informations.

- After the detailed survey of related literature, the next step of researcher is to collect appropriate informations systematically.

4.8 Keywords

1. **Review** – To discuss or criticize of any literature or subject.

2. **Researcher** – Who discover any subject or problem in any field.

3. **Museum** – Museum, where ancient, Historicaled collection of unique objects are keep.

4. **Directory** – Index book in which printed index or material are inserted.

4.9 Review Questions

1. What do you mean by review related literature and hypothesis? Explain.

2. Describe useful reference material in research for researcher (collected book).

3. Explain research thesis.

4. Describe briefly the management of related literature.

Answers: Self Assessment

1. Review	2. Library	3. Librarian	4. (b) Planetery
5. (c) Autonomous	6. (b) Decimal	7. (d) Indexer	

4.10 Further Readings

Books

1. Education Techniques—*R. A. Sharma, Bhatt Brothers.*

2. Work Procedure of Education Research—*L. Kaul, Vikas Publishing.*

3. Education Techniques and Appraisal—*Dr Rampal Singh, Bhatt Brothers.*

4. Education Technique—*S.S. Mathur, Bhatt Brother.*

Unit 5: Method of Research: Descriptive Method

CONTENTS

Objectives

Introduction

5.1   Descriptive Research

5.2   Types of Descriptive Research

5.3   Summary

5.4   Keywords

5.5   Review Questions

5.6   Further Readings

Objectives

After studying this unit, students will be able to:

- Describe method of descriptive research
- Discuss its meaning and nature
- Explain the types of descriptive research

Introduction

Research is basic to every field of knowledge. It is a tool of tremendous importance for verifying, testing and validating current and old knowledge and also a potent means of creating new knowledge. It has, during the past two-three decades, moved to the centre of the behavioural sciences. Most of the textbooks in behavioural sciences may, now, be found to be research-based. Apart from the quantity, its quality, particularly its methodology, has registered a great improvement. Now, we find more genuine problems being identified for research in every field, more relevant and meaningful structural plans being used, more sophisticated statistical techniques of analysing data being applied. The investigators are seen equipped with much better research skills all over the world. Yet, side by side, there seems to be a still greater scope for improvement of methodology of research in behavioural sciences. A major approach to research in behavioural sciences discussed in this unit is descriptive research.

5.1   Descriptive Research

This is the most popular type of research in the field of behavioural sciences. Every third study may, perhaps, be classified under this category. The salient features of this type of research are discussed as follows

Meaning and Nature

Literally, descriptive research means an investigation, which focuses on just describing the phenomenon telling, as an outcome of research, what it is. In the past the tradition of this type of research was making reliable and valid assessment of existing conditions, determining the nature of dynamic processes, describing the systems, groups and people. But recently descriptive research has brought within its purview even the investigations of relationships among variables and various kinds of phenomena.

Like other types of research, descriptive research also follows such steps as (1) identifying and defining the problem, (2) stating objectives and hypotheses, (3) collecting relevant data, both qualitative and quantitative, (4) analysing data and (5) drawing inferences and conclusions. In order to delimit the scope, it also defines population and specifies the way the sample has to be selected. It uses all those methods of sampling, which are used in case of other types of research.

5.2   Types of Descriptive Research

Van Dalen has included three types of studies under descriptive research. These three types of studies are:

    (a)   Survey type of research

    (b)   Inter-relationship studies

    (c)   Developmental studies

We will learn about these types of research in further units.

Self Assessment

Fill in the blanks:

1. Research is basic to every field of ……………

2. Descriptive research means an …………………., which focuses on just describing the phenomenon telling, as an outcome of research.

3. Survey type of research is a kind of …………………..

5.3   Summary

- Research is basic to every field of knowledge. It is a tool of tremendous importance for verifying, testing and validating current and old knowledge and also a potent means of creating new knowledge.

- Descriptive research means an investigation, which focuses on just describing the phenomenon telling, as an outcome of research,

- Like other types of research, descriptive research also follows such steps as (1) identifying and defining the problem, (2) stating objectives and hypotheses, (3) collecting relevant data, both qualitative and quantitative, (4) analysing data and (5) drawing inferences and conclusions.

5.4   Keywords

- Research—A detailed study of a subject especially in order to discover (new) information.

- Methodology—A system of ways of doing, teaching or studying somethings.

5.5 Review Questions

1. What do you mean by descriptive research?
2. Describe the types of descriptive research.

Answers: Self Assessment

    1. knowledge   2. investigation   3. descriptive research

5.6 Further Readings

Books
1. Education Techniques—*R. A. Sharma, Bhatt Brothers.*
2. Work Procedure of Education Research—*L. Kaul, Vikas Publishing.*
3. Education Techniques and Appraisal—*Dr Rampal Singh, Bhatt Brothers.*
4. Education Technique—*S.S. Mathur, Bhatt Brother.*

Unit 6: Survey Method

CONTENTS

Objectives

Introduction

6.1   Meaning and Nature of Survey Research

6.2   Types of Survey Research

6.3   Methodology of Survey Research

6.4   Steps of Survey Research

6.5   Summary

6.6   Keywords

6.7   Review Questions

6.8   Further Readings

Objectives

After studying this unit, students will be able to:

- Define Survey Research and its nature
- Describe different types of Survey Research
- Describe the methodology and steps of Survey Research

Introduction

The survey is a non-experimental, descriptive research method. Surveys can be useful when a researcher wants to collect data on phenomena that cannot be directly observed.

6.1   Meaning and Nature of Survey Research

The purpose of survey type research, according to Kerlinger is to discover the relative incidence, distribution, and inter-relations of sociological and psychological variables. Survey type studies, by and large, describe the **current status** of a phenomenon, some group of people, an institution, some existing practice, policy or event. Sometimes, they **compare** the status with some available standards and make suggestions for **improving** the status. Survey research as being used in social sciences is, however, different from the status survey and is considered enough scientific if looked from methodology point of view.

> *Notes*   In most researches of survey type small samples are studied and on the basis of that, inferences are drawn about the whole or at least larger populations. They emphasise that if this is the purpose, the sample should be drawn randomly. These are generally, called sample surveys.

6.2 Types of Survey Research

A lot of things have been studied through survey research. It is very difficult to classify them into clear-cut types. However, they can be categorised as (1) institutional surveys, (2) job surveys, (3) population surveys, (4) documentary surveys, (5) public opinion surveys, (6) community surveys, (7) sociological and psychological surveys.

> *Notes*   Documentary surveys are also known as "content analysis", or "activity analysis" or "informational analysis" which are quite akin to historical research.

Sociological surveys focus on sociological facts, opinions, attitudes, social habits, social customs, etc. Psychological surveys describe the status and distribution of psychological variables like intelligence in the group or larger population.

6.3 Methodology of Survey Research

The methodology of survey research emphasises using rigorous sampling methods and sampling designs, design of the study including specification of objectives, hypotheses and plan of collecting information.

The methodology of this type of research uses various kinds of tools such as questionnaires, interviews, personal visits, inspection of records, use of standardised psychological tests. The methodology very specifically stresses the preparation of some sort of flow chart which tells the researcher (1) what objectives are, (2) to achieve them what kind of information is needed to be collected, (3) from whom or where this information has to be collected, (4) how this information or data has to be tabulated and analysed.

> *Did You Know?*   In no way survey type of research should be considered inferior to any other research.

6.4 Steps of Survey Research

The researcher to begin with must decide and describe.

1. What is the purpose of the study ? Descriptive ? Explanatory ?

2. Is a survey appropriate for this question ?

3. What is the question or hypothesis to be tested ?

4. What is the population of interest ?

5. What method of data collection is appropriate given the purpose question, and population?

6. What method of data analysis is intended and is appropriate, given the purpose, population, question, and data ?

Sampling phase

The researcher must decide and describe.

1. What is the intended size of sample ?

2. What is the type of sample ? Cross-sectional or Longitudinal ?

3. What is the intended universe, that is, what does the sample purport to represent ?

4. What types of sampling procedure is appropriate, given the sample size, type, and intended representativeness?

Data Collection

The researcher must decide and describe.

1. What is the basic mode of data collection? Interview (personal, telephone) or Questionnaire (individual, group)?

2. Can flow questions be asked or concepts of interest be accurately measured, given this mode of data collection and this population?

3. How long is the interview, questionnaire, or phone call ?

4. Will flow scales be constructed ?

5. What checks are there on the validity and reliability of the data collected?

Data Analysis

The researcher must decide and describe.

1. Will flow data be made ready for computer processing, Transcriptive data entry and Automatic data entry ?

2. How will data be edited and cleaned ?

3. How will it be possible to show that a given explanation is tenable ? Are there ways to test competing alternative hypotheses ?

4. What data analysis procedures will be used ? Are they consistent with the purpose of survey and the quality of the data ?

5. What procedures will be used for documenting data files and data procedures?

Survey Designs

Surveys are primarily conducted to answer "what" of the research question. When a researcher is interested to know what has happened, he uses the survey research design. For example, you may be

interested to know how many children are enrolled in a primary school at the block/district level, what is the dropout rate, what is student/teacher ratio in a district, what is the level of achievement of students of a specific grade in a specific subject, what is the impact of a training programme, what is the level of participation of students in school activities, and so on. Thus, survey method is used to obtain descriptive and evaluative information in education. Using this method almost every area of education can be surveyed.

In survey design, information is collected through various techniques. While use of questionnaire and its derivatives (such as questionnaire, checklist, rating scales, tests, etc.) are more commonly used, the information is also collected through structured interviews, and observation schedules. It is perfectly possible to collect qualitative data within a survey. Even physiological measures (heart beat, blood pressure, breathing rate, cholesterol level, etc.) can be collected using survey approaches, of course with different instruments.

Surveys are of different types such as cross-sectional and longitudinal surveys. These types have been discussed in greater detail under developmental studies.

Self Assessment

Fill in the blanks:

1. Psychological surveys describe the status and distribution of ………………like intelligence in the group or larger population.

2. The methodology of this type of research uses various kinds of tools such as questionnaires, interviews, personal visits, inspection of records, and use of standardised ……………...

3. Surveys are of different types such as…………………..

6.5 Summary

- The purpose of survey type research, according to Kerlinger is to discover the relative incidence, distribution, and inter-relations of sociological and psychological variables.

- The methodology of survey research emphasises using rigorous sampling methods and sampling designs, design of the study including specification of objectives, hypotheses and plan of collecting information.

- Surveys are primarily conducted to answer "what" of the research question. When a researcher is interested to know what has happened, he uses the survey research design.

6.6 Keywords

1. **Randomly** — Happening, done or chosen by chance rather than according to plan.

2. **Inferior** — Not good as someone or somethings else.

6.7 Review Questions

1. What do you mean by survey research?
2. Write down different types of survey research.
3. Describe the methodology of survey research
4. Write down the different steps taken in survey research.

Answers: Self Assessment

1. psychological variables
2. psychological tests
3. cross-sectional and longitudinal surveys.

6.8 Further Readings

Books
1. Education Techniques—*R. A. Sharma, Bhatt Brothers.*
2. Work Procedure of Education Research—*L. Kaul, Vikas Publishing.*
3. Education Techniques and Appraisal—*Dr Rampal Singh, Bhatt Brothers.*
4. Education Technique—*S.S. Mathur, Bhatt Brother.*

Unit 7: Correlational Method

CONTENTS

Objectives

Introduction

Objectives

After studying this unit students will be able to:

- Explain meaning and purpose of correlational studies
- Use of correlational studies.

Introduction

Research in education and psychology can be roughly divided into quantitative research, qualitative research, and historical research. Quantitative research methods can be categorised as descriptive research, correlational research, and experimental research.

As with any survey, other descriptive methods are often used in education in the study of correlation. This study has examined the relationship of two or more variables, namely the extent to which variation in one variable is associated with variations in other variables. The degree of relationship variables declared in a single index is called correlation coefficient. The correlation coefficient can be used to test hypotheses about the relationship between variables or to declare a large-small relationship between two variables.

Correlational research determines the relations between two or more variables. Data are gathered from multiple variables and correlational statistical techniques are then applied to the data. Thus correlational research is a bit more complicated than descriptive research; after the important variables are identified, the relations among those variables are investigated. Correlational research investigates a range of factors, including the nature of the relationship between two or more variables and the theoretical model that might be developed and tested to explain these resultant correlations. Correlation does not imply causation. Thus correlational research can only enable the researcher to make weak causal inferences at the best.

7.1 Purpose of Correlational Studies

The purpose of these studies also, like the casual-comparative studies, is to find out relationship between variables. But, while the other methods tell only about the fact of relationship, the relationship exists or not, correlational studies go a step further and tells how much the relationship is.

7.2 Issues of Correlational Studies

Strength of the relationship between variables is indicated by a score correlation coefficient varying between -1 and +1. The correlation coefficient is a quantity that is obtained through a statistical calculation based on the collection of measurement data from each variable. A positive correlation coefficient indicates a directly proportional relationship or alignment, a negative correlation coefficient indicates that berbading inverse relationship or non-sejajaran. Score 0 for the correlation coefficient showed no relationship between variables. The bigger the correlation coefficient in either positive or negative direction is, the greater is the strength of the relationship between variables.

For example, there is a positive correlation between IQ variables and academic achievement. It implies that a high IQ will be followed by a high learning achievement; in other words there are parallels between IQ and academic achievement. Conversely, a negative correlation indicates that a high value of one variable will be followed by a low value of other variables. For example, there is a negative correlation between absenteeism and academic achievement; it implies that high attendance will be followed by a low learning achievement; in other words there are inequalities between attendance and academic achievement.

Correlation studies use statistical methods of finding out coefficients of correlation. These are used for studying more complex relationships such as studies of predictive nature and multivariate analysis.

One great disadvantage of correlational studies is that they do not tell the cause and the effect. In the kind of relationship that is discovered between the variables, causal relationship cannot be established on their basis. This makes correlational studies different from experimental studies.

7.3 Design of Correlational Research

According to Mc Milan and Achumaker (2003) the stages cover problem determination, problem review or literary study, hypothesis, research design and research methodology, data collecting, data analysing and conclusion.

1. Problem Determination

In correlational research, the chosen problem must have a valuable point in complex phenomenon attitude that needs an understanding. Despite it, the variable involved in the research must consider certain things like theoretically, logically, and that the variable has certain relation. This may be obtained by the previous research.

2. Problem Review

After determining the problem, the important thing to do in research is problem review. The researcher may obtain the problem review from various sources like journal, reports, result of a research, science magazine, newspaper, relevant books, articles, the conclusion of seminars or another sources.

3. Research Design

The researcher determines the subject of the research and determines how to calculate the data. The subject involved in the research must be measured in variables that become the research focus. The

subject should be homogeneous in external factors of variable that is investigated that may influence dependent variable.

4. Data collecting

Various instruments are used to measure and collect data in each variable, in example questionnaire, test, interview guidance, and observation guidance as they're needed. The data collected by those instruments must be in numbers. In correlational research, variable measuring is doing in the same time whereas in predictive research, predictor variable has to be measured a while before the criteria variable emerges to produce a meaningful criteria prediction.

5. Data Analysis

Basically, the analysis in correlational research is done by correlating the result of one variable measurement with another result of variable measurement. In correlational research, bivariate correlation technique based on its data is used to calculate the level of relation among variables. Whereas in predictive, the technique used is regression analysis to determine the level of predictive ability of predictor variable to criteria variable. If there are only two variables a regular correlation analysis is used, if there are more than two variables multiple regressions or canonical analysis is used. The result of the analysis is usually reported in coefficient correlation value or regression coefficient as well for the significance level and the variant proportion of independent variable to dependent variable.

The data interpretation in correlational research is when two variables are correlated and resulted coefficient correlation with the (r) symbol. That variable relation valued in -1 until +1. The value of (-) shows a negative correlation in variables that is contradictory with each other and the value of (+) show a positive correlation in variables that is approaching the same direction .

6. Conclusion

The conclusion defines about the result of descriptive analysis and discusses about the matter researched in plain and brief sentence so that it can be easily understood by the reader.

7.4   Characteristic of Correlational Research

1.   The research is suitable if the variables are complicated or cannot be researched by experimental method or cannot be manipulated.
2.   The research enables to measure some variables and the relations in advances for its real condition.
3.   The output of the research is a level or the high and low of relation and not the presence or absence of that relation.
4.   The research may predict certain variables based on independent variable.

Self Assessment

Fill in the blanks:

1.   The degree of relationship variables declared in a single index is called…………………..
2.   Correlation coefficient varies between ……….. and ……….
3.   A negative correlation indicates that………….. value of one variable will be followed by ……………… value of the other variables.

4. Score 0 for the correlation coefficient shows……………….. between variables.

5. ……………….. is an instrument used to measure and collect data in each variable.

7.5 Summary

*   Research in education and psychology can be roughly divided into quantitative research, qualitative research, and historical research.

*   Correlational research determines the relations between two or more variables.

*   Correlation does not imply causation. Thus correlational research can only enable the researcher to make weak causal inferences at the best.

*   Strength of the relationship between variables is indicated by a score correlation coefficient varying between -1 and +1.

*   Correlation studies use statistical methods of finding out coefficients of correlation. These are used for studying more complex relationships such as studies of predictive nature and multivariate analysis.

7.6 Keywords

*   Variables—A number, amount or situation which can change.

*   Hypothesis—An idea or explanation for something that is based on known facts but has not yet been proved.

7.7 Review Questions

1. What is the basic purpose of correlational studies? How does correlational research determine the relations between two or more variables?

2. What is correlational coefficient? What does the bigger value it shows?

3. Briefly explain the various quantitative research methods.

4. What does the basic purpose of statistical methods in correlation studies ?

5. What do the positive, negative and 0 value of correlation coefficient indicate?

Answers: Self Assessment

1. Correlation coefficient	2. +1, -1	3. High, low
4. No relation	5. Questionnaire	

7.8 Further Readings

Books
1. Education Techniques—*R. A. Sharma, Bhatt Brothers.*
2. Work Procedure of Education Research—*L. Kaul, Vikas Publishing.*
3. Education Techniques and Appraisal—*Dr Rampal Singh, Bhatt Brothers.*
4. Education Technique—*S.S. Mathur, Bhatt Brother.*

Unit 8: Developmental Studies

CONTENTS

Objectives

Introduction

8.1   Growth Studies

8.2   Trend Studies

8.3   Summary

8.4   Keywords

8.5   Review Questions

8.6   Further Readings

Objectives

After studying this unit, students will be able to:

- Discuss growth studies and trend studies.

Introduction

This is another type of descriptive study. This type of study aims at describing the change that takes place in the growth and development of an organism or an institution or some social process over a determined period of time. It also describes what factors and conditions in what manner brought about the change. Van Dalen discusses two types of this kind of research-***Growth Studies and Trend Studies.***

8.1   Growth Studies

Growth studies can be made in any field. But, most common are the studies of human growth and development. They describe how the human organism develops, what characteristics develop at what stage of life, which forces and factors are responsible for these developments. These studies are of two types- **longitudinal and cross-sectional.**

In case of longitudinal studies the same child or the same group of children is measured on several variables at different age levels with the result that the study stretches over a number of years bringing most critical changes taking place at critical age levels. For example, a group of child is measured on intelligence, social habits, emotional stability, self concepts, interests and other personality characteristics at the age-level 5, 6, 7, 8, 9, 10 and 11 years. By comparing these measures, the researcher is in a position to describe the developmental change-taking place.

The cross-sectional research measures several different groups of children of different ages simultaneously on certain variables of interest and compares the groups among themselves to find out how they differ and what dominant characteristics are shown at different age-levels. Such studies

are completed within a short duration of time. For example, simultaneously at one point of time, a researcher administers his tools for measuring a few variables mean on five, six, seven, eight and nine-year old children and compares them. On the scores of each variable for all the age-groups based on this comparison, he describes which traits are dominant at which age level, or which dominant characteristics define a particular age-group.

It is difficult to say whether longitudinal or cross-sectional approach is better. Both have their advantages and disadvantages. Longitudinal method is considered more appropriate a technique of studying human development. It has several advantages. But, at the same time it has certain weaknesses also. It gives, no doubt, more accurate assessment of the developmental change. But that may not be true about all individuals as the group of children that is studied. may not be representative of any larger population. Another weakness is that it is difficult to keep all the subjects within the study over a low-pod of time. Several of them may be lost to the investigation for several reasons. Also, it is very time consuming. It is difficult to wait for the results for such a long time.

Notes The cross-sectional study on the other hand is considered to be handy and adequately manageable. Hence, they are more popular.

Cross-sectional method has the advantage of being completed within a short duration. They reveal the status of the children of different age groups on several variables simultaneously. Yet, they, too, have several weaknesses. One of these is that the groups that are compared are not, many a time, comparable.

Both the types of studies are, however, considered quite useful if the purpose is to understand growth and development.

Children grow very fast. They also learn very quickly. If one observes a child admitted in grade I for some time, one finds many changes in the child's behaviour. The researchers who want to know change in behaviour over time can apply cross-sectional or longitudinal designs for their study.

Suppose, a researcher is interested to know the change in height and weight of the child after every six months for a period of three years. Another researcher may be interested to know how many words children can recognise when they are 4 years old, $4\frac{1}{2}$ year old, 5 years old, and 6 years old.

In these types of studies one can either employ a cross-sectional design or a longitudinal design.

A cross-sectional design is relatively simple. It involves collection of information from different groups of pupils (varying in age) at a single time. For example, you want to know the number of words children can recognise. You select four groups of children: 4 years old, $4\frac{1}{2}$ years old, 5 years old and 6 years old. In other words, in this design, the researcher attempts to study the impact of age on behaviour or learning. The design is simple and consumes less time, money, etc. But it fails to explain the processes involved in learning. Also persons born at different time periods cannot be considered equal in terms of their cultural and historical experiences.

Longitudinal design, in contrast, involves study of same group of children over a number of times. For example, in the above example, children, who are 4 years old will be tested on the first occasion. Thereafter, the researcher will wait for 6 months and only after the children attain the age of $4\frac{1}{2}$ years they will be subjected to testing. The same group of children will be tested when

they are 5 and 6 years old. It is evident that this method is more time-consuming and costly. It is also characterised by the problem of attrition. Considering the current high dropout rate, by the time you go for second testing many children might have dropped out. So you get lesser number of pupils. The same group of children is tested on several occasions, which enhances the possibility of carryover of learnt material from one occasion to another. The advantage is that it helps in understanding the processes involved in learning.

8.2   Trend Studies

Trend studies also constitute a sort of developmental type of research as they also observe and assess what characteristics prominently and consistently emerge at different times. But, they do not stop only at this point describing only these consistently dominating characteristics. They are future-oriented also in the sense that on the basis of these consistently dominant characteristics or trends they also predict what the future status of these trends will be, how they will affect the institution, the people, the environment, the output and other various aspects. For example, the study of the rates of enrolment at primary level of education for the past ten years may enable the researcher to predict what will be the situation in the next nine or ten years, how many schools will have to be opened, how much financial allocation will be required per year, and so on.

This kind of research uses methods and techniques of various other research strategies such as historical research, survey techniques and content analysis, etc. Studies of school enrolment, population changes, employment opportunities, specific social changes, etc. may be considered belonging to this category research. For certain purposes, they may be considered very useful.

Self Assessment

Fill in the blanks:

1. Developmental type of study aims at describing the change that takes place in the…………. and …………. of an organism or an institution or some social process over a determined period of time.

2. Growth studies can be made in any field. But, most common are the studies of …………………………..

3. The longitudinal method is considered more appropriate a technique of studying…………..

4. The researchers who want to know change in behaviour over a time can apply ……………… for their study.

8.3   Summary

- This type of study aims at describing the change that takes place in the growth and development of an organism or an institution or some social process over a determined period of time.

- In case of longitudinal studies the same child or the same group of children is measured on several variables at different age levels with the result that the study stretches over a number of years bringing most critical changes taking place at critical age levels.

- Children grow very fast. They also learn very quickly. If one observes a child admitted in grade I for some time, one finds many changes in the child's behaviour.

- A cross-sectional design is relatively simple. It involves collection of information from different groups of pupils (varying in age) at a single time. For example, you want to know the number of words children can recognise.

8.4 Keywords

- **Dominant**—More important, strong or noticeable than anything else of the same type.
- **Strategies**—Detailed plans for achieving goals.

8.5 Review Questions

1. What do you mean by developmental studies?
2. Discuss in detail about the growth studies.
3. Evaluate the trend studies.

Answers: Self Assessment

1. growth, development
2. human growth and development.
3. human development
4. cross-sectional or longitudinal designs

8.6 Further Readings

Books
1. Education Techniques—*R. A. Sharma, Bhatt Brothers.*
2. Work Procedure of Education Research—*L. Kaul, Vikas Publishing.*
3. Education Techniques and Appraisal—*Dr Rampal Singh, Bhatt Brothers.*
4. Education Technique—*S.S. Mathur, Bhatt Brother.*

Unit 9: Experimental Research

CONTENTS

Objectives

Introduction

9.1   Experiment: Meaning and Structure

9.2   True Experiment

9.3   Field Experiment

9.4   Field Studies

9.5   Experimental Simulation

9.6   Summary

9.7   Keywords

9.8   Review Questions

9.9   Further Readings

Objectives

After studying this unit, students will be able to:

- Understand the meaning and form of experimental research
- Understand true experiment and field experiment
- Understand field studies experimental simulation.

Introduction

In experimental research opposite to descriptive and historical research, researcher any condition of studies whom he consider appropriate manipulates abundantly. According to **Heman**, he himself produce any condition or incidence to a reasonable degree and studies about their effect. To clarify the form of experimental research it is very essential to explain that which one called experiment.

9.1   Experiment: Meaning and Structure

True experiment only can be done in laboratory because to follow their standard procedure only possible in laboratory. In the field of education, psychology and sociology it is not possible to follow completely this standard procedure because in these field taken mostly studies can be done are most complicated and it cannot be studied in laboratory.

The main purpose of experiment is under complete controlled condition of two variables, to find out the functional relation between one independent and other dependent or it can be said that which conditions doing as factor in happings of any events to invent them is the purpose of experiment.

Is condition 'A' is the cause of condition 'B'? Is variable 'A' is linked with variables 'B'? To find out the answers of such questions, taking the help of experiment. For a rough example "Are the boys' intelligence level is cause of their educational achievement"? "Do morning tea give freshness?"

Example   "Does parents quarreling produce behavioural problems in their children?"

Such problems whose solution are only possible through medium of experimental research. Therefore practical is such a procedure under which one variables' (independent) second variables (dependent) studies the effect of that, can be done by controlling of some main variables (controlled variables). Whereas this control is very tight and researcher has full freedom of ample use of dependent variables (as in the laboratory) that is called true or true experiment. As this control and freedom become least, studies goes beyond real studies' condition. Such experiments are called in perfect or quasi experiment. According to **Snodgrass– Berger Hoyden** by these approaches fulfilled experiment is found too much difference on the one end true or laboratory experiments, then on the other end much-uncontrolled correlational and observational experiments. According to these writers experiments bi-elemental criterion has been mentioned. These two element are—

(i)   At least two conditions or having comparable groups and

(ii)   Independent variables on that basis comparable groups makes, their ample use and freedom of transference. The meaning of independent variables ample use is that researcher any unit of true studies based on independent variables can kept under any group, treatment also. In the condition of not such possibility researcher accepts group of units as they are in which form they are stationery in environment. For example, if it has to study that what is the effect of coffee on main activity of a person then we make three groups on coffee (independent variable). First, those persons who are given too much coffee, second that is given less and third that is given too less. Then measure their functionality and then on the basis of that compares those three groups. If functionality is in the same order as a the most coffee users group functionality is found to be least then it can be said that Coffee increases functionality as a coffee effects on functionality. Here matter is to pay attention is that researcher to full freedom to keep any person in any group. He randomly can keeps a person under any group or treatment. In other words any treatment or independent variables position who he formulation himself, can be thrust upon on any true studies unit (persons). These activities is called manipulation of independent variable. But if we studies person's impulsive intensity on their functionality then this manipulation is not possible be cause person's impulsive intensify cannot be changed. Therefore it can be kept as status quo in any group. In which impulsive intensity is too much they are only Place in high impulsive group, not in less or least intensity group. This is the great characteristics of true experiment that in which manipulation of independent variables is not possible by which control increase in experiment and fault is least.

Due to above characteristics of true experiment their result's internal validity or precision increase as it is more rightly to say that studies or dependent variables happens due to independent variables whose impact is to be studying.

But in all these conditions this manipulation is not possible. In any condition it may be impractical or immoral. Then before researcher no option remains but naturally occurring groups, but in this condition done experiments not consider as true experiment they can be kept under the category of quasi-true or correlational or observational studies. Only in them establishes relation, but cause-effect does not establish. In fact lams of cause of invention's use is the great characteristics that based upon **Mill's** law of single variable, whose meaning is that control all the variables which effects on dependent variables only one variable should be effective or activated. It is true that such a control

in the field of education, Psychology and sociology's is not possible in experiments, but at the some time it is also true that the effect of related elements and variables adverse effect on the precision of result and increase fault in experiment.

Types of Experimental Research

Notes   It is experiment which is basic of experimental research.

From the point of view of above characteristics and laws, experimental research has been divided in the following divisions—

1. True experiment
2. Field experiment
3. Field studies
4. Expost-facto studies
5. Experimental simulation

Aforesaid all types of studies comes under experimental invention because in all that the purpose is to establish relation cause–effect between variables. But where and how studies are to be done, by this approach they have difference to one another. Each one is explained in detail in the following sections.

Self Assessment

Fill in the blanks:

1. True and real experiment only can be done in ………... .
2. The main purpose of experiment is between two variables under controlled condition to find out the……….. relation.
3. The rule of cause-effect is based on ………..law of single of variable.

9.2   True Experiment

Which invention can be done by the medium of experiment has been done in laboratory they can be accepted as true experimental studies because the condition of studies is fully controlled. With respect to other experiment, the experiment has been done in laboratory differ from many ways-

Caution   Experimental studies only can be done in laboratory.

Secondly in this independent variables manipulate, by randomization units' division in groups and get full freedom to thrust upon units of treatments.

In other words affecting elements of independent and dependent variables' relation almost full control

are possible. As a reset of this available results' explanation's is uniform that 'A' is cause of 'B'. Beyond this if any more exploration is possible that the result is not called valid up to that limit as if result is such that 'B' any more cause is possible then it be under stood reliable and valid. This is an optimum condition. Reality is that it is very difficult getting cent-percent valid of experimental studies. In every experiment must lies some mistakes, but experiment done in laboratory differ from other experimental studies that is their contrived settings. According to **Kalinger** true experiment has three main objectives—

(i) To get functional relation between events in pure and faultless condition.

(ii) On the basis of studies and theories testing of projected future.

(iii) To give definition of theories and hypotheses, formulation of new hypotheses and formulation of theoretical system.

Experimental invention basically related to evaluation of theory. It is a very useful and powerful medium of formulation of new reliable and valid knowledge, but it can be only true when experiment is done fully controlled methods, which is not possible in every condition. Therefore some experimental studies are more reliable and valid and some are less.

9.3 Field Experiment

Did You Know? When any experiment is done in laboratory, then it is called laboratory experiment or true experiment. When experiment is done outside laboratory in an open field, then it is called field experiment.

Field is much differ from laboratory and this difference affects the format field experiment. In laboratory for researcher it is possible to control each and every condition. When he wants management of studies can do desirable change. Just its opposite field is too much extensive and in that various elements, conditions, variables are activates and it is not possible for researcher to control them. Too many field forces are affecting one another simultaneously. It is beyond control rather than it is not easy to know that in any studies condition which elements are functioning and affects the result. Therefore out side laboratory done experiment are differ from that which is done in laboratory. These experiments are called field experiment.

Meaning and Form

The logical base of these experiment are some as which are true experiment. In these one or two independent variables manipulation can be done. In these researcher makes different levels of independent variables true experiment subjects, keeps in groups based on them, take measure of dependent variables and get conclusion by comparing of result. Like true experiment comparable groups are made on the basis of, at different levels of independent variables. Mostly these groups are readymade and fixed as which units, will in which group, it is fixed. Researcher only selects them. After making the two groups of more intelligent and less intelligent, more intelligent boys will be in more intelligent group. Researcher has some of them for studies only select. But in some conditions by randomization, according to desire, distribution of units in any group is possible. By this approach field experiment is same as true experiment, but they are differ from this approach that their management, techniques field's in natural environment is completed on the basis of natural behaviors of units. Therefore in the environment of field presents cannot be controlled a number of condition, so that their effects of family environment studies then on the basis of family environment (independent

variables) living in favourable and adverse environment, boys' two groups can be made. Here it is not possible that boys by randomly can be kept in this or that group who belongs to that group will be in that. This is the natural group of boys which are already presents. Yes! It is possible that on two or three other correlated variables being established relation between in the both groups of boys but from own desire formulation of groups is not possible.

The quality of differential experiment is that, in experiment research the researcher begins from independent variables and goes towards dependent variables it means firstly he selects the different levels of independent variables on that basis formulated the under process experiment groups. After that those groups' measurements the dependent variables based behaviour. By this approach field experiment and experiment done in laboratory are differ from each other. In field experiment by randomly on dependent variables making groups of units, as a independent variables manipulation possibility is less. At the some time related variables possibility of controlling in that is less also. Therefore with compare to true experiment field experiments' results precision and validity is less. Due to the effects uncontrolled variables result are more faultless. This difference due to this field-experiment is done. Outside the laboratory whose many factors are beyond the control of researcher.

Appraisal

Although the validity and reliability of field experiment is less than with compare to true experiment and it has its own limitations. Nonetheless their utility in the field of education, Psychology and sociology is much more. Whatever studies has been done in this field mostly will found field-experiment. In these areas mostly research condition is that in which true experiment cannot be done. Only field-experiment is possible. Therefore it has special importance in these fields. If carefully intervening and correlated variables try to control then their default will be less to a great extent and can be ranked with true experiment.

Field experiment from this point of view is more useful that due to the natural behavior of true studies units in that, result's external validity (generalization's extensiveness) is increased which is due to too much controlling and by researcher's produced as a result always be less due to unnatural behavior of units.

Second benefit of field experiment is that small groups dynamicity and natural Social Process' can be studied more emphatically which is neither possible nor relevant in laboratory's experiment.

Third benefits of its is that it is more suitable to find out the solution of applied problems and verification of theories. At the some time due to its process is more flexible a number of conditions' use is possible.

These experiments have only two demerits-firstly in this manipulation of independent variables is less and secondly in that by randomization distribution in groups is not possible also.

Self Assessment

Multiple Choice Questions:

4. Experimental invention is basically related to evaluation of _____ .

    (a) Management   (b) Theory   (c) Experiment   (d) Field

5. When an experiment is done in laboratory then it is called _____ experiment.

    (a) Field   (b) Studies   (c) True   (d) Observation

6. True experiment's compression field-experiments' precision and validity is _____ .

    (a) Much   (b) Less   (c) Not at all   (d) none of these

7. Applied problems' sort out and _____ for verification field experiment is more suitable

   (a) Theories   (b) Studies   (c) Observation   (d) Management

9.4 Field Studies

Field studies come in experimental invention category also be course in that try to establish cause-effect relation but these are also different from true experiment and field-experiment.

Meaning and Form

According to **Karligar,** field studies is also export facto studies whose purpose is to establish a relation among social order activating sociological, educational and psychological variables and explore their inter activities. The field studies is (i) expost facto studies and (ii) in harsh conditions of life as a behaviour's real setting as a school, family, community, etc. in that it is done. There is no changing in behavioural setting and true studies whose observation and measurement is to be done are actual and natural. They are not derived by researcher in any medium of process. According to **Barker** (1965), in these studies researcher is an only transducer. The most important characteristics of these studies is that in this behaviour is studies as they happened. In **Karligar's** words researcher does not manipulate any independent variables.

Both in field studies and field experiment and difference between field studies and true experiment is that in field studies formulation of comparable groups is are done on the basis of dependent variables. Where as in other twos their formulation is done on the basis of dependent variables. As if between intelligence and educational achievement, studies is of cause-effect relation then in field studies less or more achiever make groups of studies and will be compared on the basis of intelligence of both the groups. In the experiments of other two types less and much intelligence, two groups will be made on the basis of intelligence and then will be compared on achievement basis.

Kaz has explained two methods of these studies:

   1. Exploratory and
   2. Hypothesis testing

In exploratory studies each term has been explained whereas in hypothesis testing studies, we try to establish mutual relation between variables. Student's educational achievements invention, invention of factor affecting institutional environment, etc. can be the example of hypothesis testing studies.

Assessment

Karligar's opinion is that in field studies "precisioness, importance, conformity of variables, theory orientation and questionable characteristics is much". As these studies are done in the real condition of life, therefore its result assumes on other conditions. By this approach they assume much closer to reality. Field studies are assumed important because they provide many information which can be helpful later in different controlled experiments. The meaning of conformity of variables is that due to in natural environment real behaviours' studies, expression of variables in behaviour is more clearly. In laboratory, these behaviour are suppresses. In these full amplification of variables cannot be done. For example, if we students' achievement's initiative measurement did in school than it will appear more vividly. Their expression in laboratory will not be so good. In these studies not only collection of facts but also possibility of theory propagation is much more. The meaning of questionable is that the result of these studies formulated a number of questions, to get the answer of these questions

much studies is needed again. If result of any studies says that self-concept of children is affected by their family background, then a number of questions arise from this: Does it happen due to parents relation? Does it due to family's children mutual relation? Does it due to family's socio-economic conditions, etc.

Task   Evaluate-field studies.

Including these charities, these studies have also some demerits. All those demerits whose mention is done about expost facto research, in field studies also. In comparison of true laboratory experiment and field experiment, Field experiment result are less reliable and valid. Its reason is that in these neither manipulation of independent variables nor formulation by randomization. Lack of control is the cause of these defaults.

Self Assessment

State whether the following statements are True or False:

8.   The purpose of experiment is to investigate the cause of events.

9.   True experiment has been done in open field.

10.   According to Karligar, field study is same as expost facto studies.

11.   The use of experimental simulation in applied science began a few years before.

9.5   Experimental Simulation

This is also a method of experimental research. In some field, it has been using since long time, but in the field of applied science its use has been started a few years before.

Meaning and Form

These studies are true study behaviour in which true study variables are expressed, formulation of unnatural environments of theirs, which are much alike as actual settings. To know whether any teaching techniques to teach class ix — teacher does not use is how much effective. This technique in real class but he teaches his friends by this method for few days and after that all of them evaluate this method this is known as experimental simulation. In this it is important that unnatural condition is almost same as real condition.

Like true laboratory experiment in simulated experiment inclusion of controlling of variables, manipulation of independent variables and randomization. In management science field a number of games have been invented which management-science's formulae, laws etc. their implementation and to show their success is a powerful medium.

Appraisal

Simulated research is not much in use in the field of applied science. Perhaps its cause is that there is less possibility of theses types of studies in the field of applied science and their results are doing transfers into real condition their utility proves to be less.

Final conclusion

In this chapter six methods of research has been discussed. Each of them has its own merits and demerits. This is not right to think that this method is the best and that method is not suitable. Which of them is the best method it depends upon the purposes and conditions of studies. The reality applied science related researches is that researcher's always in them is to compromise between precision and realism, between external and internal validity and between controlled and natural system. Field experiment a bit far away from that moves in the direction of controlling of variables and manipulation.

Every researcher should remember one thing that "realism", "precision" and "generalization" in each studies have most desirable, but incensement in all of them at the some time is not possible. In laboratory experiment **precision, control and manipulation** are much more but respectively simulated experiment and in field-experiment these three characteristics becomes least and just its opposite in some order realism and natural behaviour order increases. These three characteristics precision, controlling and manipulation are most important but all of three only in one studies desirable equal incensement cannot be possible. Come to this point researcher involves in a great adverse condition. If he tries to increase first characteristics then secondly decrease autonomously. Therefore which is right method, not involves in them he should follow that method which is more suitable purpose and condition of studies context. Selection of that, decrease their faults as far as possible and makes their properties strong, he should try to make it more and more useful. It seems that in the selection of research method this is the best and positive approach.

9.6 Summary

- The main purpose of experiment is under complete controlled condition to find out the functional relation between two variables, first independent and second dependent.

- Any treatment or position of independent variables that it formulated itself, can applies on any true studies unit (person). This is the process which is called manipulation.

- Field experiments' reliability and validity are less in comparison to true laboratory experiment and it has its own limitations nonetheless in the field of education, psychology and sociology their utility is too much

- According to **Karligar,** field studies are, expost facto studies whose purpose is to find out the relation among in actual social order functional sociological, educational and psychological variables and their inter-activities.

9.7 Keywords

1. **Manipulation**—use according to desire (independent variables).
2. **Simulated experiment** —In true studies behaviour like natural settings formulation of unnatural settings.
3. **Natural**—Real, actual

9.8 Review Questions

1. What do you mean by experimental research and how many types? Explain.
2. What do you mean by field experiment? Explain.

3. Throw light on field studies.

4. Writes notes on experimental simulation.

Answers: Self Assessment

1. Laboratory	2. Functional	3. Mill	4. (b) Theory
5. (c) True	6. (b) Less	7. (a) Theories	8. True
9. False	10. True	11. True	

9.9 Further Readings

Books

1. Education Techniques—*R.A. Sharma, Bhatt Brothers.*

2. Education Researches' Procedure—*L. Kaul, Vikas Publishing.*

3. Educational Technique, Management and Appraisat—*J.C. Agrawal, Bhatt Brothers.*

4. Educational Techniques—*S.S. Mathur, Bhatt Brothers.*

Unit 10: Ex-Post Facto Research

Objectives

After studying this unit, students will be able to:

- Ex-post Facto research understanding
- Understand about difference and evaluation of laboratory cost's experiment

Introduction

The purpose of this research is to identify functional relationship among phenomena by relating their occurrence to hypothesized factors or conditions. Ex-post-facto research also aims at finding out most answers to problems, Efforts are made, in this, on establishing of some consequence. In this sense it is an experimental research'.

10.1   Ex-Post Facto Research

These studies are the relation between events and function has been established also and try to know the causes of events.

Meaning and Form

Ex-post facto research is such a study in which the relation between independent and dependent variables couse effect is established.

Therefore, it is placed in the category of experimental research also, but it can not categorized as true experiment because in experiments independent variables transference and desirable manipulation's, research's go freedom which is not in ex-post facto research. In experiment, making different levels of independent variables units can be distributed in some number of group by probity methods.

In this comparable groups can be made on the basis of independent variables, but in ex-post facto research these groups can be made on the basis of dependent variables as a experiment process stars with dependent variables. Therefore, **Mauli** has said ex-post facto research's "experiment in reverse" because in this the order of independent and dependent variables just opposite to under experimental order. In experiment first think about independent variables and on the basis of that comparable group makes, whereas in ex-post facto studies dependent variables comes first as a first on the basis of that comparable groups makes. In experiment comparable groups' compares on the basis of dependent variables. Just its opposite in ex-post facto studies comparable groups compares on the basis of independent variables.

Ex-post-factoresearch's make group on dependent variables are not made really but they are ready-made available in community which are differ from each other as –Boys-girls, rular-urbane, rich-poor, low-attainder or high-attainder, more-intelligent, less-intelligent, etc. Due to inter-variances of these to sought after that compares on independent variables. For example if we have to find the cause of student's low level educational achievement-impulse then we select the groups of low level impulsion and high level impulsion then we will compared it vice-imaginer variables (as a intelligence, or students family background).

The meaning of term ex-post facts is after phenomena (dependent variables) as a dependent variables are available in their natural form. After that their causes (relation with independent relation) to be find out. As in above example initiative of events' low level or high level is available already in community. Such a student is present in school already. In causal-comparative studies is done alike, but in them method of discovery of cause is differ from these studies methods.

Self Assessment

Multiple Choice Questions:

1. In ex-post facto research among events _____ to determine relation.

    (a) non-functional
    (b) functional
    (c) alternatives
    (d) multiplier

2. Mauli ex-post facto's has said _____.

    (a) changing experiment
    (b) non-changing experiment
    (c) positive experiment
    (d) negative experiment

3. The meaning of term ex-post facto is _____.

    (a) on the time of event
    (b) before event
    (c) after event
    (d) all of these

4. Psychology and _____ has great importance in the field of Education of occurred events.

    (a) Economics
    (b) Social Science
    (c) Accounting
    (d) Political Theory

10.2 Difference between True Experiment and Ex-Post Facto

The experiment is done in laboratory in that ex-post facts studies are differ from following point of view:

1. In laboratory oriented experiment desirable manipulation of independent variables is possible and done measurement and study of their effects on dependent variables. In ex-post facto

research studies makes groups of dependent variables at different levels and them it compares on independent variables.

2. In laboratory oriented extraneous studies element's effect's by randomization and matching etc., try to control as far as possible by this result different treatments' occurred by independent variables can be possible to accept. In ex-post facto researches this control is quite impossible. Therefore its result are not more reliable. Both two methods of above mentioned of control is not possible in ex-post facts studies.

3. In both studies it is possible to choose the method for origin of groups from the unit of population but in sequenced study distribution with this method is impossible however it is possible in experiments in laboratory. In sequenced studies units are itself dissolved in groups. In studies dependent variables themselves divide in different groups. According to **Karligar**, In these studies "units" and treatments already divided in groups.

Task   Make difference clearly between laboratory oriented experiment and ex-post facto studies.

10.3 Evaluation

Three main shortcomings of these studies-

1. Lack of possibility of desirable manipulation of independent variables.
2. By randomization of units lack of possibility of distribution.
3. Study of external variables, problems of control.

Due of these short comings these studies internal validity is very less. Therefore **Mauli** has said that these studies in one time supports many hypothesis and sometimes Paradoxical hypothesis also because its research materials collects under very uncontrolled conations. Due to this reason so many alternative hypothesis are extracted from that.

Caution   **Mauli** has also said that these studies should be kept under survey research that utility only understood from that point of view that they produces hypothesis-that hypothesis can be verified after by experiments.

All authors and scholar accept that in post-events studies whatever information available between independent and dependent variables they are less faithful then experiment. But at the some time he also add that although result of experiment is more reliable but their external validity possibility is very less.

After all these demerits study of post-events' education psychology and in Sociology's field has much importance's because in there field mostly research condition is such that in that experiments cannot be managed. For example in this field such a variables whose manipulation cannot be done. Intelligible worry, impulsion, many characteristics of personality etc., are such a variables. Likewise, social pressure and tension, social tendencies, socio-economic status, caste, religion etc., are such a variables which cannot be manipulated. Environment of school, characteristics of teachers etc., also such a variables.

In short too less condition in this field are such that in which experiment can be possible. Therefore mostly condition is such as are that in which only post-events studies are possible.

10.4 Summary

- Ex-post facto research is a such a study in which establishes the relation of course-effect between independent and dependent variables. Therefore it has been also kept under the category of experimental research.

10.5 Keywords

1. **Post events**-After events, to determine the functional relation among events.

2. **Entries**-Admission in a school or an institution.

10.6 Review Questions

1. What do you mean by Ex-post Facto research?

2. Evaluate the Ex-post Facto research method.

Answers: Self Assessment

1. (b) Functional	2. (a) changed experiment
3. (c) After event	4. (b) Sociology

10.7 Further Readings

Books
1. Education Researched work procedure—*L. Kaul, Vikas Publishing.*
2. Educational Techniques management and assessment—*J.C. Agrawal, Bhatt Brothers.*
3. Education Techniques—*R.A. Sharma, Bhatt Brothers.*
4. Educational Research Methods—*Sharin & Shashikala, Vinod Pustak Mandir.*

Unit 11: Experimental Design

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Objectives

After studying this unit, students will be able to:

- Understand the true and quasi experimental design

- Understand the individual studies' and evaluation.

Introduction

It is considered to be necessary to prepare a detailed structure and form before research work. The purpose is to mention clearly in hypothesizes, method of sampling, means of collection of data, methods of analyzing of data etc. This detailed form is called design of research. Every type of research has a detailed form and a design. In experimental research, design has a special significance, and in the books their description is under the title of experimental designs. In book this description found in two different fields—

1. The lay-out of the experimental research, and

2. The statistical designs of the experimental research.

Under lay-out it is explained how the research has been done, how many groups of them, how they will be managed in research, whether the research will be done with only one group or with that controlled groups etc. The discussion includes their merits and demerits also. While analyzing experimental data under Statistical design, a number of statistical methods are mentioned. In present studies design's classification and types have been described by the lay-out point of view.

It will be clear from previous chapter's explanation at experimental research how much complicated the procedure of experimental research is and how much matter is to be considered in that. Therefore

not any design, not any strategy can be possible in which all the rules have been implemented, which is the best in all circumstances. Every situation of research is specific. Therefore according to that design selection can be done. Different types of design have been mentioned in the books, they all have their own benefits and faults.

11.1 Classification of Experimental Design

The classification of experimental design can be done by various approaches. Following classification seems to be more appropriate—

1. Experimental and non-experimental design
2. One three-dimension classification
3. Before and after test design
4. Randomization and Correlated group design
5. Fixed and movable group design.

Every type has been described in detail below—

1. Experimental and Non-experimental Design

Did You Know?	Experimental and non-experimental designs are called true and quasi-experimental design.

True design is that condition of research in which for a researcher, it is possible to do research selection randomly. It can be distributed under research groups. **Karligar's** statement is that if in any research situation researcher has not got above freedom or right then it can be a research experiment but not a true experiment. There are two pre-conditions of true experimental design—

(i) Randomization and

(ii) Manipulation.

According to **Karligar,** in a true experimental design at least one independent variable manipulation is necessary. **Karl Smith, Elsrth** and **Aaroson** state that experimental studies are different from other types of studies because in that circumstances of studies is formulated by researcher himself whereas in other studies depends upon circumstances naturally available in settings. In experimental studies researcher's get full freedom of changing of conditions of studies. The most important characteristics of true experiment is that in those research conditions of studies and on post-studies variables are ample controll is possible. Like these—

(i) Manipulation of independent variables.

(ii) Selection of units and randomization in their distribution in groups.

(iii) Controlling of post–studies variables.

These three types of orders recognition of true experimental design, these are ideal and basic. Due to these three characteristics, it is possible to say that on dependent variables which difference is come to be they are produced by independent variables or independent variables is the cause of dependent variables. Like these on the basis of these designs independent and dependent variables in

cause- effect related matter more reliable and valid statement can be done. In other words, the available results through these designs are more specific, precise and relevant. In brief, true experimental designs are following characteristics-

1.   Researcher-based studies setting, as a natural order rather than contrived order.

2.   Controlling of post-studies variables.

3.   Manipulation of independent variables.

4.   By method their distribution in groups and by some method imposition on groups.

5.   Establishment of cause–effect relation.

Due to above mentioned characteristics following are the benefits of these designs—

1.   Results are more precise and reliable because results of error deviation is being least.

2.   Based on true experimental designs' interval validity is much more.

3.   On the basis of these results establishment of cause of dependent variables is undoubtful.

But where as true experimental designs above benefits, at the same time they have also some fault. The greatest fault is that its use cannot be done in such a conditions of research in which independent variables manipulation is not possible. In the field of psychology, sociology and education a number of such a variables whose manipulation is not possible as a sex, socio-economic level, cultural back group whole characteristics of personality, achievements of students etc, but their affects are vital and their study is also necessary. Before applied–scientists and researcher questions related to these variables are then to find out the answer of these he will have to help the non-experimental designs. Love, detest, jealous, psycho disease, effectiveness of psychological treatments, behavioral-problems' reasons cause learning and perception, development of languages in children etc. such a various variables and circumstances that cannot be derived in laboratory and therefore theirs by true experimental designs' medium cannot studies. Their studies can be done only in natural surroundings. In these conditions only non – experimental research design can be proved more useful. By this approach non–experimental research designs' importance is not become less. This is true that based on these designs results are not reliable as true experimental designs, rather than in applied-science's field for research mostly these designs are used.

In non–experimental designs too much variance is found. Some of them are very simple in which no need of any type of control but in some designs much controls and they are kept a slight difference from true experimental research. In fact differentiate in design and non-experimental research or quasi-true designs are done on the basis of controlling.

Example   In non-experimental design controlled groups are natural and pre-positioned whereas true experimental designs are made by researchers on the basis of manipulation.

It is clear that in any research design as much as control on independent and post-studied variables and methods and conditions of measuring of dependent variables will as much as standardized so as it will be closer to experimental design.

Karligar has named non-experimental designs' quasi-experimental design faulty design and inadequate, but only quasi-experimental design title is used in books mostly. Post happened incidence researches' **Karligar** has also categorized in imperfect research designs. They also called them faulty design.

By this approach experimental researches' designs can be divided in following two categories—

1.   True experimental research design and

2. Quasi–true experimental research design.

e.g. as **Van Dalen** has said, those designs in which controlling is tough and those in which controlling is insufficient.

2. Three Dimensional Classification

Levy-Vergar- Hoyden has classified experimental designs on three basis—

1. Number of independent variables,
2. Levels of independent variables and
3. Units distribution randomly or repeated measures.

Independent variables' numbers' approach are (i) Single variable (ii) Bi-variables and (iii) Multi variables designs. By independent variables' level's approach designs' level × treatment design or called as factorial design. Units have been distributed in groups randomization then those designs are called randomized groups design. If units one groups can be used for various treatments then it is called repeated measures. Having matched the units, done their distribution in groups that design are called matched group design. If matched the units on variables and distribution on them by randomization then it is called mixed design. Above type classified on farmer three dimension a number of combination is made and for each type of data analysis different types of statistical methods is used. This will be cleared from following example—

(a)   One Independent Variables

(i)   One independent variables + random group + two levels of independent variables-T-test in these (independent group) methods will be used.

(ii) One independent variables + matched or repeated measures + two levels – In T-test in these (but correlated group) methods will also be used.

(iii) One independent variables + random group + more than two level – In this condition single direction deviation – analyzing method (ANOVA) = one way method will be used.

(iv) One independent variables + matched or repeated measures + more than two levels of independent variables – In this condition single deviation analysis but correlated groups or repeated measures methods will be used.

(b)   Two Independent Variables

(i)   Two variables + random groups or between subjects on both variables + Two level in this condition completely randomized (ANOVA) will be used.

(ii) Two variables + repeated measures e.g. within subject but randomized groups e.g. between subjects on others.

(iii) Two variables + randomized group on single variable, but repeated measures groups on others. In this situation mixed ANOVA will be used.

(iv) Two variables + repeated measures groups on both.

In this situation applicable on repeated measures groups mixed ANOVA will be used.

In this way it is essential to know before selection of statistical analyzing method that design is of which types above mentioned.

3.   Pre-test, Post-test Design

This is the third type of classification. This classification depends upon this matter that when the dependent variables are measured. If groups or on the groups, firstly measured on dependent variables after that treatment is done and time limit of treatment is over again measured on their dependent variables and on the basis of difference of first and final measurements analyzed then it is called pre-test-post-test types of design.

Notes   After the treatment only one time measurement is done and on that basis analysis is being done then it is called Post-test only.

These designs are also called 'before-after' and 'after' only.

4. Randomized and Co-related Group Design

If the distribution of units in comparable groups is done by randomization and all group units are separate then that design is called randomized groups design or between groups design. Just its opposite if all that units continues in all groups or after matched the units distributes in groups then that design is called within groups, correlated groups or repeated measure design. In this category mixed design comes also in which groups on a variables is randomized and on the other correlated.

5. Static and Rotational Group Design

In static design group, units are separate. In this way making groups of units, it can be making treatment and after treatment they are measured on dependent variables on that basis they are compared mutually. Two groups of such a type of one example may be that one group is given treatment and others not or one is given one type of treatment and second of second type. After that it is compared. Just its reverse rotational group design groups are rotated in such a way that every group can get every treatment. For example first a group (a) by method-1 and group (b) by method-2 taught, after one month group (b) by method-1 and group a by method-2 taught. In this way each groups are taught by both methods, taken examination compare the measurement of method-1 and method-2.

Although experimental methods may have many combination, but **Mauli** statement is that basic design is of four types—

1. One variable design
2. Parallel groups design
3. Rotational group design and
4. Factorial design.

In this ways by different approach designs can be classified, but it mean not that one type of design cannot be of other type. All these types are not exclusive one design may have many characteristics. For example, one design one variable quasi-true experimental, pre-testing, post-testing or controlled groups pre or post testing etc. may have of any types. Like this it randomly controlled groups may be also of pre-and post-testing. On the basis of this type of combination it can be named, but since there number may be huge therefore any type of classification is convincible. Most popular classification is—(i) True experimental design and (ii) Quasi-experimental design. Further some such a types specific design has been described which are comes under in two categories.

Self Assessment

Fill in the blanks:

1. Before starting research work detailed structure is prepared that is called ------------ .

2. Experimental researches' design is of two types– true experimental research design and ----------design.

3. Matched the units, their distribution in groups that is called ----------------design.

11.2   True Experimental Design

These are that design in which controlling of variables is very rigid. **Kristensen** assumes these designs to be most appropriate. **Karligar** assumes these basic and their variants. **Mauli** has kept some of these in "basic designs" category. **Kristensen** explanation is quite extensive and generalized. Therefore in this chapter true experimental design's description done according to **Kristensen's** classification. Those designs' whose description have been done under this class, those are—

1. After only Post-testing Design

According to the structure of this design, units are distributed in experimental and controlled group by randomization, after that experimental groups is given treatment but controlled group is left as it is. It is given no treatment. After the expiry of treatment both groups have measures on dependent variables. To find out the relevancy of difference getting between difference of measurements conclusion is drawn. Remember that in all true experimental design must exist similar controlled groups. This design is like Static design only difference is that in this is both groups distribution of units is randomization, whereas in static group in design both the groups' equality is not necessary.

In the field of applied-science for research this design is much in use. Its popularity's causes are—

(i)   A number of variants of these can be whose use can be done in different conditions.

(ii)   Its main-characteristics is distribution of units in groups by randomization with less error variance.

(iii)   To be provision of controlled groups get difference's appraisal is possible.

(iv)   Matched the units distribution of them in groups by randomization, increase the precision of result.

(v)   Its external validity is satisfactory. Which from vast human-community selection of units can become more extensive.

(vi)   Its internal validity is also more to fair degree.

2. Pre-test or Post-test Design

In this design units are distributed among two or more than two groups by randomization on dependent variables their taken measure. Again experimental groups are given treatment but controlled groups are not given any treatment. After the completion of treatment both the groups' are measured again at that variables. Both groups' pre-test and post-test's measures comparing is done on the basis of progress. From experimental group's progress (G_E) and controlled group's progress (G_C) calculation, get the difference between G_E–G_C. If experimental group's progress is more then it assumes the effect of indepent variables. It is considered a superior and more suitable design because in these a number of post-studied variables as a—history, maternity, measurement error, regression, selection related

error etc. can be controlled, but it has a fault also in this independent variables' effect's assessment (G_E–G_C) is not much correct. **Crownback and Fabri** (1970) statement is that these change scores' use is not appropriate. He recommends use of regression gain scores and regression analysis and analysis of covariance methods, but their uses are more complicated. The second fault of this design is that due to pre-test its groups external validity becomes doubtful.

3. Pre-test, Post-test Fourth Groups Design

Solomon (1949) had propagated this design. **Campbell (1957)** had recommended its use emphatically and said that "for society-scientists prevails a new form of modal", in this design there are four groups– one experimental and three controlled (C-1, C-2, C-3) Its structure has been shown below—

a……………………..b…………..experimental group

Treatment (co=controll)

a……………………b……………..C-1

Without treatment

………………………..b……………………C-2

Treatment

…………………..b……………………..C-3

Without treatment

In the above 'a' is the median of pre-test and 'b' is the median of post-test.

In the above graphic it seems obviously that this design past both designs combination experimental groups and first controlled groups' saw collectively them pre-test becomes post-test. If c.2 and c3 are combined then only becomes post-test design. Therefore in this design previous both designs' benefit are accumulated. According to **Karligar** among the four causes it becomes a forceful design. These four courses are—

(i) On the basis of first two lines and last two lines demand of comparision among groups fulfils fairly.

(ii) Due to the distribution of units by randomization similarity of groups is possible.

(iii) By first two lines history and maturity is controlled.

(iv) By first two three lines pre-test's effect is controlled.

(v) Between 'a' and 'b' fluctuatable and contemporary effect being added in fourth lines is also controlled.

Karligar's statement is that experimental groups 'b' if co. -1's more than 'b' and co.-2's 'b' group co-3'of 'b' is more to a fair degree and these results meet consistently then it is considered to be a forceful proof of experimental hypothesis truthfullness. **Soloman** and **Lessok** (1949) assumes that in the studies of developmental procedures, the use of this design may be more suitable because in this effect of pre-test and effects of experimental treatment, both assessments are possible.

Nonetheless its design's use still some difficulties exists also. Firstly for formulation of four groups a number of units are needed and completion of experiments take much time. If it not called as demerits as such a types of difficulties is second difficulties is that six obtained measurements taken together not any statistical method is available for their analysis. **Soloman** (1949) has also accepted these difficulties also. **Kampwell** and **Stainley** (1963) has given the solution of this problem. His statement is that two way analysis of variance can be used in which four groups' four post-test-measurements are taken, median of columns and median of rows comparison can be done. Columns' median's

comparison effects of treatment's get come to the light and rows' median's comparison will show the effect of pre-test. **Soloman** (1949) four 'b' taken modulas 2x2 factorial deviation analysis statistical methods use has been suggested. Being all those **Karligar's** opinion is that this design "Best example of experimental thinking, best combination of design and analysis."

4. Tri-groups, Pre-post-test Design

Karligar has mentioned this design. **Soloman's** quarter groups design's by first three lines, this design can be shown. In this design pre-test's interaction's result's produced effect can be removed by second controlled groups (third lines). If the median of experimental groups from the median of first controlled groups (Second line) fairly much more than it can be assumed undoubtfully result of treatment because it can be occurred due to the effect of cause of pre-test, buy the median of second controlled groups (third line) is fairly high from the median of first group (second lines) then it is sure that the effect of pre-test is zero and effects of treatment is more than effects of pre-test.

5. General Random Group Design

This is only a type of post-test in which more than one level of independent variables are there. Sometimes condition of experiment is such that independent variables' divided at different levels there on dependent variables separately effects comparative study is to be done as a different types of level worrying, low-level worry and rewards' (fixed amount, applause, books etc) what is their effect on boys' educational achievement, their studies. Like that teachings' three and four types specific methods' studies of effectiveness on boys educational achievement. In all this did distribution of units by randomization, every groups is given desirable treatment. After some time all those group (including controlled groups) measurement on dependent variables, measurement is compared. For comparision deviation-analysis method's can be used. Whole structure can be shown as by following types—

Groups	Treatment	Marks obtained on dependent variables
1. Controlled groups	Not.........	D.-1
2. Experimental group-1	Ans.-1..........	D.3, all
3. Experimental group-2	Ans.-2	D. comparision
4. Experimental group-3	Ans-3	D.4

In this design, one controlled group must exist. In this one independent variable is there, but their levels are infinite. The use of deviation-analysis method can be done for analysis.

6. Factorial Design

This design from one point of view can be understood as on extension of only post-test design, but in these more than one dependent variables' separately effects on dependent variables and doing their interaction with each other studies of effects can be done. In **Karligar** words, these design "such a thesis in which two or more than two independent variables their separately and interactive effect's studies. Suppose that boys personal adjustment's guardian-boys relation, boys perception and with context to their mental ability studies. In this problem there are three independent factors. Dependent factor is personally adjustment. Now suppose every independent variable has taken two levels (higher and lower). This design's $2 \times 2 \times 2$ like this will be expressed. Clearly that 3 independent variables and each have two levels like this $3 \times 2 \times 3$ designs meaning will be independent variables, first's three level, second's two and third has three. Like this $3 \times 3 \times 3$, $2 \times 3 \times 3 \times 3$, $3 \times 2 \times 3 \times 2$ etc. various types these design can be, which number of independent variables and in form of their levels can be written as above mention way.

One 2 × 2 × 2 makes six cells design. The distribution of units in groups done by randomization. More relevant, consistent and useful are in different context more and more element's mutual inter-action effects to know. This is possible in the experimental research's factorial designs. Therefore they are attached with realism and consider to be more particle. Their measures on dependent variables and measurement arranged in a table by statistical method their analysis is done. On the basis of this analysis on dependent effects, 3 first order or two factor inter-functional's effects and one second order or three factor inter functional effect studies. The description of analyzing method has done second part (volume) of books. It is rather a little tough to understand the concept of inter functional effect. Their exploration has been done also the second part of book.

These design's important desirable characteristics is that it is very close to the reality of life. Reality is that in any circumstance of life human behavior is not only enter mines by any one element, one circumstances or one variables, but also any behavior how simple it may be, a number of elements work together then as a result of its derives. Behavior is the result of a number of element's mutual interaction. Therefore factor elements of behavior should be studies this context. Different factor elements when works together with one another then their effects necessarily not as so as it separately in their original form.

Caution   Any elements original effects to know at the some time it is quite essential to know which element with which element what types of interaction does.

Therefore, some elements controlled studies of effects of other elements on dependent variables are unnatural and beyond realism. It is more meaningful, corresponding and useful to know the mutual interactive effects. It is possible in factorial designs of experimental research. Therefore, these are considered to be more practical and connected with reality.

One difficulties which comes to use in these design is that to use of it a number of sample and a number of units is needed but here it cannot be said the default of designs. Second difficulties aries then occurred when the number of independent variables is much more and each have more than two levels. At that condition second –order interaction effects is increased and their explanation is being tough. Third difficulties comes in the third order interactions effect's explanation. To make it relevant and conceivable is very tough.

Including these difficulties factorial design is very popular and it is used in a number of experiments. The reason of this are their some characteristics. Besides above one benefit of its is that in this many independent variables studies simultaneously and a number of hypothesis can be tested together. Second benefit is that in this confounded factors controlling can be managed. Third benefit is that its result is more precise than single-repeated design. Fourth benefit is that in form of interactional effects related factors of dependent variables, notification is gets in this. It is also know that one independent variables at different levels, how effects dependent variables which is not possible in single variable design.

Did You Know?   Before start experiment activates their detail design is prepared, that is called research design.

7. Correlated Group Design

It is also called within subject design. Its structure is such a way that between, on dependent variables measurement of groups, correlation is occurred. It is only happen when such a variables which keeps correlation with dependent variables among the units of groups' obtain correlation is when single units is kept in different groups or matched the units distributed in groups then it correlation is occurred and then these groups are called correlated groups. In which design such a groups is used, that is called correlated group design. This design is alike pre-post-test design. This is also called repeated measure design. In this one units of groups is used for different treatment. Therefore **Kristenson** statement is that which demerits is of single group, pre-post-test design, they are found in this also but in this post studies one or two variables controlling is possible so that effects of treatment becomes more vivid its structure design some following types—

Table 11.1			
Subject	**T-1**	**T-2**	**T-3**
1	Y-1	Z-1	X-1
2	Y-2	Z-2	X-2
3	Y-3	Z-3	X-3
:	:	:	:
N	Y-n	Z-n	X-n
Sums	Y	Z	X

Above table's matter is correlated groups ANOVA methods analyze.

8. Mixed Group Design

When in bi-variables design formulation of groups on an independent variables by randomization and on others by correlated methods then it is called mixed groups or correlated- randomized groups design. It is also called factorial correlated groups design. Some is the benefit of that whose have been mentioned under factorial design. At the some time which benefit of correlated group design also their inclusion in this. In this way its result's prevision is increased.

11.3   Quasi True Experimental Design

The designs included in these groups have been given different name by different writers. **Karligar** called it "faulty design". **Waan Dalen** had called it "design with minimal control". **Kristenson Campbell** and **Stainley** (1966) and some others called it "quasi true design". **Karls-Smith-Elsworth-Aaronson** are keeps under "non-experimental design".

According to **Campbell** when in experimental research controlling requirements do not fulfill then it is called quasi-true design. In the field of applied sciences, a number of circumstances of research is such that in which the tight law of control and standard process of experimental process following is not possible. For example as **Kristenson** statement is also, where naturally settings a number of unplanned and units distributes is groups by randomization and neither it is possible that post–studied variables effect's can be controlled by other techniques. Under these circumstances researcher by the medium of some less standard research structures is subjected to know the defect of treatment whom they named as 'quasi-true designs'. Casual conclusion can be drawn on the basis of these designs or research structures, although they are not as precise and valid as obtained by the true experimental

design medium from this approach all these ex-post-facto research comes in the category of quasi-true designs. **Karligar** has explained in details difference between ex-post-fact studies and true experimental research and said that in ex-post-fact studies units and treatments cannot be distributed randomization because independent variables have been already occurred. Some specific quasi-true design description has been done ahead.

Self Assessment

Multiple choice questions:

4. True experimental design's Mauli has kept in the category of _____.

    (a) Basic design   (b) Test design

    (c) Extensive design   (d) Group design

5. _____ is assumed to be superior and appropriate design.

    (a) Pre-test design   (b) Post-test design

    (c) Pre-post-test design   (d) None of these

6. _____ design is considered to be extension of post-test design.

    (a) Group   (b) Factorial

    (c) Controlled   (d) Pre-test

1. One-way Design

Campbell and **Stanely** has called it one-shot case study in which in one time only one group is studied. **Karlssmith-Ellsworth- Aronson** has said its criticized that "Such a type of study is as make castle in the air'. Under this any one group, person, and about any incidence collects a number of information. It is arranged in a table and their analysis presented very smoothly so that reader believed on their result. Reader forges during their studying that any other comparable person or groups had not been studied. Reader does not think over that which result presents they will or not true as other units also in such a type of studies among variables cause-effect relation cannot be established, none the less these design are not consider to be futile at all. In some circumstances, something more is not possible as it is, that is consider to be better. In any circumstances by them collected much information proves useful too.

2. One-way Pre-post Test Design

Campbell and **Stanley** has kept these experimental designs in category of half–truth experimental category. As **Karligar** assumes in this design one group is compare with some group. The structure of this design is such as- one selected groups units' firstly measures on any dependent variables (Pre-test). After that groups is given a fixed treatment. After finished the treatment same dependent variables measures again on units of groups (post-test). The difference of pre-test and post-test measurement's statistical exactness is tested. If post-test measurement is found reasonably high then that treatment is suppose to be cause of that difference (of dependent variables).

There are a number of shortcomings of these design. Therefore the precision and validity of these result is fount always low level. That difference which get from between pre-test and post-test measurement. That is suppose to be derived by treatment variables is not right. Which changes in the pre-test's measurement they can be occurred due to some other causes also. **Campbell** has explained in detail of these causes, history, maturity and measurement three types of elements affects pre-test

measurements and decreased result's interval validity. Like this regression-effect also makes doubtful post-test measurement. The lower measurement of pre-test towards higher in post-test and higher measurement of post-test goes to lower where as infect there is no difference derived in measurement. Therefore due to derived fault from there elements establishment of valid conclusion cannot be done by the medium of this medium. As though it will not be appropriate to say these design are completely in vain.

It may be in any circumstances besides that there is no possibility of use of other design. Then only these will be used.

3. Two–way Groups–Control–Excluding Design

Kristenson has called this design non-equivalent pre-post test design. In these two groups already in which one can be used like controlled groups, but in fact that is not controlled groups. Only one comparable group exists. Both groups are done pre-test on dependent variables and after giving the treatment of one group, both groups is again tested on that dependent groups. Is again tested on that dependent groups. Both groups' pre-post-test measurement's is taken difference separately and observes that which groups difference is more, e.g. which has been more improved.

This design is alike pre-mentioned pre-post –test design, but cannot be kept under the category of true experimental design because in the beginning both groups do not make some by randomization or matching method. Therefore these types of designs have been kept in the category of quasi-true experimental design, the inequality of these groups only its weakness. Due to this having controlled groups, there is no controlling in this. In **Karligar** words, in these design "generally a huge gate is always open through which many uncontrolled variables can enter".

4. Simulated Before-after-test Only

Under this design, selection of two groups from a mass population of units by randomization one is called controlled groups and other are called experimental group because both the groups is selected from only one population by randomization, hence it is assumes equal. Controlled groups' is measure on dependent variables after that experimental groups is given treatment and after treatment that groups is measured on that dependent group on which controlled group had been done. After that controlled groups, on dependent variables available pre-test measurement and post-test measures of experimental group having taken their difference tested their relevancy. It can be shown by following graphic.

Exp. Groups	Pre-test not	Treatment	Dependent variables (b-2)
Controlled groups	dependent variables	no treatment	at post-test
	pre-test on b-1		No post-test

In the above b_2–b_1's difference relevancie's is tested: having controlled group in this design, control does not have undutifully also, because there is no guarantee of matching of both groups. Hence it can not be consider as forceful design, although this one group consider better than pre-post test designs because in this statistical regression effect and units' selection related bias controlling is possible, but in this history factor cannot be controlled in this also.

5. Time Series Designs

According to **Goatman–Macfall–Barnet**, in these types of designs not used controlling groups uses a number of supplementary strategies of controlling. Two types of such a designs has been mentioned---

(a) Internal Time Series Design

According to **Kristenson** in this researcher before treatment and after treatment groups' on dependent variables a number of times measure. It can be express in this way.

Pre-treatment measures	Treatment	Post-treatment measure
a-1, a-2, a-3, a-4	m	a-5, a-6, a-7, a-8

It can be observed clearly from above diagram this design is much alike one group pre-post test designs. Such a difference is that in time series design on dependent variables, before treatment and after treatment many measure of group is taken after a short interval of time, but in that one group is also compared with some group. According to **Karligar**, it is possible in these designs that as a result of measurement process error-deviation occurred it can be removed from due to treatment from whole effectiveness. In this way effect of treatment available in more precise form. The effect of measurement anti-action is expressed a-1 after a-2. The effect of treatment can be seen in a-5, if it more than a-4 too. If measurement is constant from a-2 up to a-4, not much changes, then it can said more firmly that in a-5 seems effect due to treatment. It can be shown fairly this effect-tendencies by graph. Due to multiple testing this design more useful than one group pre-post test design.

If it is up to first a-4 no difference in measurement than a-5 and a-4 difference maturity, testing and regression' cause does not assumes. If all those unit measurement is taken again and again and unit is not left then related to selection and due to unavailability of units occurred errors can be also controlled. Like this as said by **Waan Dalen**, in comparision of one group of pre-post test, in this design experimental researches interval validity adverse effects of more elements controlling is possible. But **Campbell** and **Stanley** (1963)statement is that history does not control in this and in this design this one problem is continuing. Second problem is statistical assessment of result for the explanation of result measurement's trend's only objective observation is base which cannot consider more reliable. Some specific statistical methods are available which can be used, as single mood test and double mood test. Like that walker leave test-1 and walker leave tests-3 is also which use is more useful.

(b) Control Group Time Series Design

According to **Kristenson**, it is called multiple time-series design. **Kristenson** assumes it the extended form of previously interval time series design, but **Waan Dalen** has said it controlled group time series design. This design is understood more useful than interval time series because in this controlling of history also. In this one controlled group is uses. Below its structure has been shown by graph.

Experimental group	a-1, a-2, a-3, a-4	Treatment	a-5, a-6, a-7, a-8
Controlled group	b-1, b-2, b-3, b-4		b-5, b-6, b-7,b-8

If controlled groups' measurement from b-4 to b-5 not any increment but in experimental group after treatment increment with comparison to a-5 to a-4 then it can be admitted that contemporary history's by treatment in occurred effect has not any contribution because in this interval experiences of both groups will be some. This design consider better than simulated pre-post test design because possibility of error that is controlled. The best example of its use is the study of **Campbell** and **Ross** (1968) in which America's Connecticut states' in experimental groups form and other states had been used as in the form of controlled groups transport death rate's from 1951 to till, 1959 show by graph and proved on the basis of their comparison that governor **Ribocoff's** of Connecticut's in 1955, traffic related law's avoider caught by flying checker had been surely effected and in Connecticut state traffic death rate has been less to a fair degree because in these states one states' controlled group also. Therefore it cannot be said that decrease in death rate history (as in winter motor driving is less fearful) etc. will be factors. These circumstances were same in both the groups.

Above studies' data's when **Campbell-Ross** analyzed on the basis of mood T-test then it was not found any relevant difference between both the groups. When **Glass** (1968) Box and ao-tests (1965) use then difference was found relevant in some degree. The verification of relevancy as has been said before is the actual problem of these studies. Rather than **Kristenson** statement is that **Goatman Makfall- Barnett's** (1965) statistical methods whose description **Glass-Willson** and **Gotman** (1975) has done, proves to be beneficial in this context.

6. Cross-lagged Panel Design

The use of this design is more useful at that condition in which between two variables cause-effect relation establishment is purpose, but not knowing previously that which can be cause of which.

Example   Failure is the cause of worrying or worrying is the cause of failure.

Angry parents make their child offensive or offensiveness of a child makes parents furious, internal inspiration intensity is the cause of better educational achievement of or better educational achievement of students due to their interval initiative intensity etc. Psychology, education, and Sociology's field a number of such situations of research in which whose, cause this is the purpose of studies.

In the use of this design it is essential to keep in mind two facts-

(i)   Firstly cause – effect-relation are present and

(ii)   Secondly this relation process is occurred in course of time.

In short this design is use there where question is such a type is ----'a' is the cause of 'b' or 'b' is the cause of 'a'.

In this design two 'variables are 'a' and 'b' whose measurement only taken one units of groups two different times in 'c' and 'd' has been done. In this way four measurement are taken—

(i)   a of c on time taken measure,

(ii)   a of d on time taken measure,

(iii)   b of c on time taken measure and

(iv)   b of d on time taken measure.

On the basis of there measurement following six co-relation can be found out—

> (i) ^{r}a, c. a, d.   (ii) ^{r}a, c. b, c,   (iii) ^{r}b, c. b, d,
>
> (iv) ^{r}b, c. a, d,   (v) ^{r}a, c. b, d   (vi) ^{r}a, d. b, d

On the basis of above by following types cross-lagged panel is prepared—
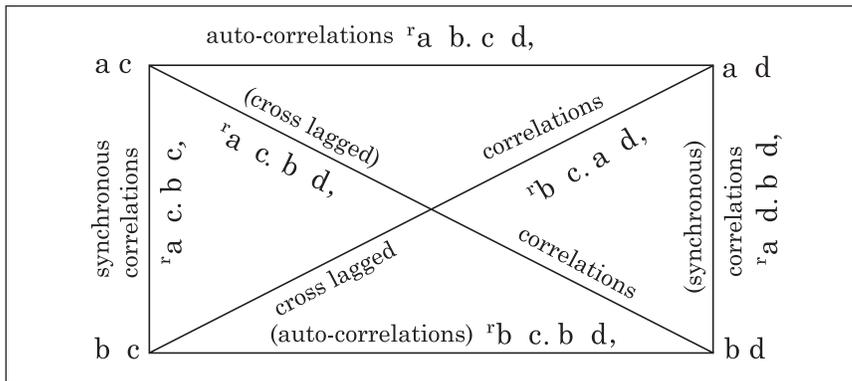
Fig.11.1

In these six correlations two are called Synchronous correlations whose meaning is that correlation between that variables which is measured only for one time, as a –τ a c b c and τ a d b d. Like that two correlation (τ ac. τ ad .bd) are called due to – correlation whose meaning is that a and b both variables between that measurement correlation which are each's first on 'c' time and after that on 'd' time taken measures available. Two correlation are called cross lagged correlation whose meaning is that correlation between that measurement which one variables (a)'of first time taken measures at 'c' and second variables (b)'ef on second time at "d" and Vic versa are available taken measures. There correlation are – *(i)* τ ac. bd and *(ii)* τ bc. ad.

In all correlation of above two cross lagged correlation is of much importance because basis an these it determines that 'a' and 'b' variables which is preponderant. If τ a c. bd is more than τ bc . ad then on 'c' time measurement 'a' will be cause of 'b'. Like that 'b' is the cause of 'a' then bc . ad will be much more all form τ ac . bd **Pelz** and **Andus** (1964) has explained aforsaid agreement and in favour of that witness has been presented. In one studies **Eron – Huesman Lefkowiz – Walder** (1972) try to know that watching (a) violence on TV is the cause of aggressiveness (b) or boys' natural aggression is the cause of interest watching violence scene on TV. This studies had been done by cross–lagged panel design method. When children studied in class three then their on TV violence Scene watching tendency (a,c) and when he entered in class thirteenth then their aggression (bd) is measured. Like that in third class their aggression (bc) and in thirteenth class on TV violence's tendency (ad) is measured. It is found that τ ac. bd (.31) was much more from τ bc to ad (.01).

Therefore conclusion is drawn from it that watching tendency violence scene on TV increases aggression correlation reaming four is also explained. For detailed information of it, students should read **Pelz** and **Andus** (1964) book.

Like that one more design is " Path analysis" whose description **Land** (1964) and **Hees** (1970) has done and he explains one more detailed research design.

7. One-unit Research Design

So far as many as quasi-true experimental designs have been described in all those more than one units' groups are, but such a design is developed also in which only one unit is there. These designs are called single-subject designs. In this only one person is to be studied but it should not consider as illusion that this is a type of unit case study only. It is much differ to single case study because under this get information from subject, that is done under much controlled circumstances. On independent variables subject's action is done through much controlled observation and measurement and all activates are done with some sentiments which is found generally in experimental methods. Rather

than it is not called true experimental research because in this there is no room for randomization, transfers and repetition of units and neither any comparable groups in this. Although through this it is possible to draw conclusion that as a result independent variable's (treatment) that in behavior required changed or not.

In this design before and after treatment a number of times behavior is measured. By this approach its structure is much alike to time series design and pre-post test design. If before and after treatment behavior's measure only once then its structure is alike to one group pre-post test design. Therefore it is not to say inappropriate that it is combined extended form of one group pre-post test and time series designs. **Kristenson** has called it descriptive experimentation.

These types of studies have got a number of forms and names. Here only two types will be described because there two are more familiar. These are-

    (i)   Reversal design and

    (ii)   Multiple baseline designs.

(a) Reversal Design: There are a number of names of these designs, e.g. 'a a b a b' design, reversal technique that has been mentioned by **Bare-Wolf** and **Rizley** (1968), equivalent time samples design that has been mentioned by **Campbell Stainley** (1963), inter-subject replication which has been used by **Sidman** (1960) and intensive design whose has been described by **Chassan** (1967) but these are more familiar by two names reversal design and 'a b a b.' In the treatment of behaviour these studies have much importance. Its structure is of following types-

a	b	a	b
↓	↓	↓	↓
Baseline measurement	Treatment	Baseline measurement	Treatment

This design have above four steps or conditions. Step 'a' which is called baseline measurement is the symbol of dependent variables or aim-behavior in which aim is to change by treatment. Before treatment this behavior come to existence that is why it is called base line measurement. This is the starting stage of dependent variables. It is compared with that changing by treatment. Therefore, baseline stage or behaviour is a types of criterion or conclusion, on the basis of that assessment of effect of treatment is done.

Step 'b' is treatment or experimental stage by which try to change in behaviour or position 'a'. As much time spend to prepare study of baseline behaviour or their record some amount of time is also given to treatment. After treatment when required changes occurred then again stage 'a' becomes and continues as much time as treatment had been going on. This is the third step of experiment. In this period, no treatment is given and subject use get freedom to live in that condition and to do behaviour which is present under the stage 'a'. It is called reversal position and whose meaning is that to remove treatment and get back to stage 'a'. To prove that change is being activated due to treatment, this phase is most important. After that in fourth stage again treatment (circumstances 'b') is given for some period. This is the reason that this design is called 'a b ab' design. One real study which had done by **Tait** and **Barof** (1966) its process will be cleared.

Task   Express your opinion on one-unit-research design.

One a saam's name nine year old boy that was indulged in undesirable and self hurted behavior like hit his heads with walls and stones, beat his face by hands and beat himself etc. At the some time

wrapped with others, to sit in his laps wrapped his arms around him etc. habits had been indulged in him. Perhaps he had a desire to others physical contact. Researcher saam's these undesirables behaviors (dependent variables) treatment for physical contact's (independent variables) withdrawal's followed as treatment. There were four stage of experiment a b a b and every stage had been given five day's time. Researcher having caught hands of saam and talking to his in the campus daily (till total five days) have had for walk. This is base line stage 'a'. In the meantime saam used to do any undesirable behavior he had not pay attention to that. After five days stage 'b' was being started in which saam was given treatment under this if saam used to do any unbearable behavior then he have had at once give up his hands from them (withdrawal of physical contact). This treatment (stage 'b') continues for five days. After that third stage start again in which saam's again back to stage 'a' i.e. base line stage. During the five days of this stage, there was no interference in saam's behavior. After five days again till next five days treatment is given. In every step for every day's frequencies of undesirable behaviors record is used to prepare. These records is shown by a graph, date wise, stepwise. It is clearly known by this graphic that at every treatment stage's every day saam's undesirable behaviors is become less. Therefore, the conclusion is drawn that, that treatment was the forceful medium of achievements of purpose. In this design controlling of history is possible.

(b) Multiple base line design: In this design base lines' data is collect from a number of sources. These sources are—

(i) Person's a number of different behaviour

(ii) Different persons same behaviour

(iii) Person's behaviour in different conditions happened.

After that every aim to change in behavior treatment is given. After the treatment if aim behaviour is changed, but rest behaviour is alike (i.e. base line situated) before than that treatment is considered to be effective. Its structure is of following types.

Behaviour	Treatment-1	Treatment-2	Treatment-3	Tratment-4	Treatment-5
Persons	a-base line	Treatment			
Or	b-base line	Baseline	Treatment		
Circumstances	c-base line	Base line	Base line	Treatment	Treatment
	d-base line	Base line		Base line	

This design's actual use's example and detail description by **Marks** and **Geldor** (1967) prepared studies available.

Self Assessment

State whether the following statements are True or False.

7. One–group designs' **Campbell and Stanley** has said one–shot case study.

8. **Mauli** said 'these types of study is to make castle in the air'.

9. In time series design supplementary strategies are used.

10. Internal inspiration is the cause of educational achievement.

11.4 Individual Study: Some Challenges

These designs have some special challenges whose explanation seems to be essential. Among them one is concept of "base line", second is available data's statistical analysis and third is rival hypotheses. Its detail explanation is as follows—

(a) Baseline: Under this concept characteristics of dependent variables or those aim behavior comes which exists before treatment. In the study of one person it has much importance. This is the only context, behavior's guidelines which is accepted as effect of treatments. To test the exactness criterion or as a base but a number of difficulties related this, that is essential to under stand firstly the problem aries how a fixed and stable base line attain. Neither any criterion of it may be nor a universally accepted definition. When and how it can be said that base line is fixed and stable. Not any solution of its available. Specially with context human behaviour it becomes too tough also because human behavior is very changeable. Therefore Kristenson statement that this concept is "an ideal, not a practicable thought".

(b) Problems of statistical analysis: Second problem is of statistical analysis. After treatment whatever changing in dependent variables occurred that is presented by only graphs and visible mediums. This is not a reliable method of drawing conclusion because on the basis of that it cannot be said that changes occurred in behaviour is such that it can be considered as relevant, not any such criterion. **Goatman** (1973) himself found it that on the basis of graph which behaviour-changing was assumed as relevant, on the basis of statistical analysis that is not found relevant. A number of writers statement is that in the analysis of datas' of this designs statistical methods cannot be used but some of them assumes that not such. This is true also that a number of authors have been described such a statistical methods which can be used in analyzing of data of these designs.

(c) Paradoxical hypotheses: The meaning of its is in these types of studies after treatment which effects occurred is assumed, that is also happen due to a number of other causes. Therefore dependent variables oriented effects' factor hypothesis besides treatment a number of may be. For example if in different stages order, direction observation conditions, behavior and nature of organization is changing then due to that factor this change can be occurred. Then it cannot be said that true studies treatment is cause of changing came in behavior.

11.5 Individual Research Design: Final Evaluation

Although in the field of applied science mostly studies have been done on the groups of many units, they are much popular now-a-days nonetheless single person studies have its own importance. Sometimes they have been used. After the publication of **Sidman's** (1960) book about that knowledge is increased and their use (specially in the field of pshyco treatment) has been used to start. **Sidman** is staunch supporter of it. Some other writers has accepted its utility also and said that single person study is an important strategy of research because one man's behaviour can be controlled fairly good through which it is possible to obtain the effects of treatment. It is possible to obtain the effects of treatment in precise forms but they assumes also that generalization of these results for other units cannot be possible.

Thinking that any research design in all circumstances bad or good is not appropriate. Each has their own merits and demerits. Like that single-person study design has his own merits and demerits. Where in any conditions it cannot be used,rather than in any conditions their utility is too much. For example-guide and advice, treatment of pshyco disease, behavior changing etc. in the field of that its use is most important.

11.6 Summary

- It is considered to be essential to prepare a detailed structure before starting research work. This detailed Form are called design of research.
- From the number of independent variables point of view, *(i)* Single variable *(ii)* bi-variable *(iii)* multi variable being are. From the level of independent variables design's levels × treatment is called design or factorial design.

- In comparable groups distribution of units is done by randomization and units of all groups remain separately then that design is called random group design.

- When in experimental research requirements of controlling is not fulfilled then it is called quasi-true design.

11.7 Keywords

1. **Design —** A detailed form of any research.

2. **Reversal —** Adverseness, oppositeness.

3. **Bias —** inclination, inclination towards inside.

11.8 Review Questions

1. What do you mean by experimental design? Classify it.

2. Having classified true experimental design describe it.

3. What do you mean by time series design? Describe.

4. What is quasi-true design? What are the main types of it?

5. Explain factorial design.

Answers: Self Assessment

1. Experimental design.	2. Quasi-true experimental	3. Matched group
4. (a) Basic design	5. (c) Pre-and post-test	6. (b) Factorial design
7. True	8. False	9. True
10. True		

11.9 Further Readings

Books
1. Educational Research's Methods- *Sharin* and *Shashi Kala, Vinod Pustak Mandir.*

2. Educational Techniques and Assessment – *Dr. Rampal Singh, Bhatt Brothers.*

3. Educational Technique – *R. A. Sharma, Bhatt Brothers.*

4. Educational Techniques Management and Assessment – *J. C. Agrawal, Bhatt Brothers.*

Unit 12: Historical Research

CONTENTS

Objectives

Introduction

Objectives

After studying this unit, students will be able to:

- Understand the meaning and structure of historical research
- Understand the process of historical research and its data
- Understand criticism and evaluation of historical research.

Introduction

Whatever exists in the universe, they all have its past, present and future. Any incidence, institution, ideas, concepts, socio-economic characteristics, theory or tradition are not such as that has no past or history, at the same time nothing is as such whose history is not linked with its present and future. Therefore, any incidence, process and tradition to understand thoroughly, it is necessary to look into its past. Secondly, it is very natural curiosity of human beings that whatever comes within the range of their experience he tries to knows its past. On this background in the various fields of knowledge, historical research's is formulated and developed. All these research are considered important in the field of education, psychology and sociology. Today in this area, there are many such studies available which come under this category.

12.1 Meaning and Structure of Historical Research

Which is gone, has become past its description, writing and studies are known as history. In the field of education and sociology, a number of things are there whose root spread up to the events of past. Therefore to understand its present thoroughly, it is necessary to know its past. If it is not so, then

also the history of educational and sociological process and traditions are important and interesting to know. They produce human curiosity in itself. Many times the study of past indicates towards the desirable changes of future. Therefore definition of historical research is the "A research about those events, process and traditions has been studied which are happened in the past". According to **Smith and Smith,** the purpose of historical research describes the past correctly. Past truth's Scholarship research as a that form of curiosity in which researcher want to know that "its form in past how its condition was, why and how such happened". According to **Mauli**, the purpose of historical research is to give more clear perspective of present's events.

Notes   According to **Borg,** historical research "Regarding the events of past get conclusion available and fore the verification of facts historical witness' research objectively and methodically, their appraisal and synthesis".

In the field of education, any of its current aspects can be studied. There are many problems in Vedic era such as the relationship between teacher and pupil, some characteristics of Mughal period, education policy in first five year plan, the purpose of education in Vedic period, purpose of education in medieval period, role of Madarsa in social development in Muslim period etc. Which can be studied regarding Past. All these studies come under the category of historical research.

All historical studies are of two types—descriptive and analytical. In those event's past information giving, essays, documents, memorials, books, inscriptions historical remaings, etc. studies on that basis a number of facts and figures has been collected and draw conclusion by their analysis.

Planning of Historical Studies

As it happens to other types of studies, before starting of these historical studies a complete and properly planning is done.

Caution   It is quite necessary to take final decision before the selection of subject that whether ample material, source of material are available or not.

If it will not so, then study is quite impossible. At the same time, it is also necessary to study and review the researches that have been done so far including available literature related to problems. On their basis to fulfil the purpose of studies, creation of hypothesis can be possible. According to **Heman**, at this level creation of hypothesis vividly and Shoul have tried to theoretical development. **Heman** has also accepted the importance of hypothesis in these studies clearly.

12.2 Process of Historical Research

These types of studies have almost same steps of process which are followed in the descriptive method.

Waan Dalen has mentioned the following five steps—

 (i) To determine the problems, their definition and detailed explanation.

(ii) To collect source material on which basis research related thesis can be collected, problem based information is to be got.

(iii) Critical evaluation of source material

(iv) Formulation of hypotheses on that basis facts and figures is to be explained.

(v) Analysis of material, drawing conclusion and prepared document.

In other words, **Mauli** has also mentioned these terms. **Hocket** has described a three step process. These three steps are—

(i) Collection of Data

(ii) Evaluation of data

(iii) Prepared written document

12.3 Data of Historical Research

The data of historical research is historical components and events. Originally, in other researches the sources of this material are psychological examinations, questionnaires, interviews, etc., but in historical research it is in the form of historical facts, events and informations which can be collected from different sources.

Example   On the basis of historical understanding answer related to questions and for the test of further hypotheses, facts are presented.

Mauli has divided the sources of historical understandings and facts into two categories—

(i) Historical documents

(ii) Historical remains

By an another approach, **Waan Dalen** has divided medium historical data into Primary and secondary— in the two categories. According to **Waan Dalen,** primary source is "The basic material of historical research". Basic material or secondary becomes a source. In that presentioner inclusion his own approach and concepts. At that condition it is consider to be less reliable nonetheless its importance is not less.

Under documental source includes a number of types of documents, as a—

(i) Governmental document

(ii) Personal document

(iii) Different types of images, maps, drawing, photos, etc.

(iv) Published material

(v) Mechanical tools such as-tape, video cassette, etc.

Under relics comes a lot of things, such as –

(i) **Massive objects**—buildings, furniture, different types of equipment, dress, tools, remains of dead bodies, etc.

(ii) **Published material**

(iii) **Handwritten material etc.**

Answer of the problematic questions can be obtained on the basis of all the above sources, information, and data and hypothesis can be tested, but to get valid and reliable conclusion, it is necessary that base of these facts must be reliable. In another types of research like this is essential that psychological

test, questionnaire etc. are reliable and valid like that historical studies aforesaid facts and sources consider to be essential that it is reliable and valid also and it is consider to important prior to analysis of data their reliability and validity determines. Its main method is criticism.

Task   Write a note on historical research data.

Self Assessment

Fill in the blanks:

1.   Whatever is exist in the universe, it has its past, present and …………also.

2.   Whatever has become past their description, writing and studying are called……….. .

3.   All historical studies are of descriptive and …………..types.

4.   In historical studies, the importance of ………….has been accepted clearly.

12.4   Criticism

In historical research whatever documents and remains are available that is not consider rightly as per their autoerotic. Therefore researcher determines their authencity very minutely. He determines that document or remains are fundamental, undoubtful and real or not. Its determination on the basis of two types of criticism—

1.   External criticism

2.   Internal criticism

1.   **External Criticism:** Under the external form of criticism document or validity of remains, truthfulness, or tested their precision. By two researchers gets the answer of this question that "Does it some which appears or as has occurred originally" rather it is not that looks any deceive under this mainly original writer of document or remains or determination of sources. At what era or when it wrote or prepared, who prepared, at what condition it can be made, is this its original form etc. collected facts on that aspect then it is determines that is fundamental and authentic. Specially, investigates about the author.

Did You Know?   Document or their manuscript's languages' types, printing, etc. Publication date of that document or very helpful in the determination of time.

    In the determination of authenticity of documents and remains history, phonetics, chemistry, dance book, archaeology science, literature, art, architecture, etc. many fields. Sound knowledge of is to be needed. A matter of attention in this is that it only determines or verifies that document or remain original, real and authentic or not. The assessment of its content is not comes under those.

2.   **Internal Criticism**: Under internal criticism the content of document or remain. Whatever has been said in that or which types of information it gives that is evaluated. That information which is find out in their contents how far it is relevant, correct and reliable its determination is the purpose of

internal criticism. Whatever writer has said how far it is valid, how much truthfulness in that, how far it is objective how far writer explained facts correctly etc. some of such as problems on which researcher thinks seriously and determines that how far the contents of document is valid and reliable. This is very much author's own reputation, position and basis of levels writers writting attitude, conditions in which it written etc. determines on the basis of that. If other writers also, have written about that then it can also be taken as a base.

Formulation of Hypotheses

By the medium of documents and remains which information is available by analysis of that problem oriented questions answers or solution is to be discovered, but before this it is essential of all collected facts classification and reorganization. For this direction-denoted indicator is necessary. That collected historical facts and whole information read carefully research formulate some hypotheses which included in special classes of all collected material and on the basis of their analysis in formulation of conclusions helps the researcher In historical studies hypotheses has its own importance also, although their being is not inevitable. **Waan Dalen** throw light clearly on their importance. **Mauli** has accepted its importance in Secondary form. In the process of historical research's discussion on step in step four his statement is that "which any hypotheses or theory's data approves in that respect their analysis should be done". It is inevitable to accept the importance of hypotheses but it should not be think that in historical research happenings of hypotheses in every condition in not compulsory. Without hypotheses these research can be possible also one more matter is to keep in consideration. If hypotheses have been formulated then its testing methods is differ from experimental research methods. In these methods use of statistics cannot be done only do reflective analysis of material, information and facts which approves hypotheses or deny it on that basis conclusion are drawn.

Self Assessment

State whether the following statements are True or False:

5. The data of historical research is historical components and events.
6. In the field of education its past study cannot be done.
7. Criticism is not the method of research.
8. Under external criticism, validity and truthfulness of remain are tested.

12.5 Evaluation of Historical Research

Generally, this question is raised that is historical research a scientific research. Some people assume that scientific, some do not, but all accept it as a partially scientific. According to Hocket, scientific research has three characteristics:

(i) Observation

(ii) Hypotheses

(iii) Testing

These are also available with a few modifications. Some scholar thinks that in historical research cause-effect relation cannot be determined. Therefore it cannot be kept in the category of scientific research, but a number of historians' statement is that in these researches course of events can be determined. Like that some statement is that in historical studies predication is not possible but some historians admits that in some special conditions pre-narration or prediction is possible.

Mauli statement is that "It is not a matter of intelligence to neglect historical research due to its unscientific". He also added that to find out the solution of important problems of education, historical

research can give a perspective, a background. Some scholar's statement is also that on the basis of historical research to fir degree generalization and derivation of lams is possible. Like **Thyusididars** his statement is also that "according to human nature whatever happened will be happened".

Nonetheless due to various reasons historical research's cannot be ranked specially experimental research because their result's reliability and validity cannot be undutiful. Studies have many difficulties is own and to remove it is not on easy task. Therefore it will be reasonable to accept the limitations of studies.

12.6 Summary

- Whatever is exist in the universe they all have their past, present and also future. To understand any incidence, process or tradition fairly, many a times a glanced in their past necessary. In this perspective in different fields of knowledge historical research was formulated and developed.

- In the field of education and sociology such as many a things whose root have been spread up to the events of past. Therefore, to understand their present form completely, it is also necessary to know their past.

- All historical studies is of two types — descriptive and analytical. In those giving information of Past's document, monuments, books, inscriptions, historical remain, etc. studies is to be done.

12.7 Keywords

1. **Secondary**—Secondary source of historical data.
2. **Recent happenings**—That events happened in the Past.

12.8 Review Questions

1. Clarify the meaning and form of historical research describe their process.
2. Describe main method of historical research—"criticism".
3. Evaluate historical research.

Answers: Self Assessment

1. Future	2. History	3. Analytical	4. Hypothesis
5. True	6. False	7. False	8. True.

12.9 Further Readings

Books
1. Educational Techniques and Assessment—Dr Ram Pal Singh, Bhatt Brothers.
2. Educational Techniques—S.S. Mathur, Bhatt Brothers.
3. Education Techniques Management and Appraisal—J.C. Agrawal, Bhatt Brothers.
4. Educational Research's Work Procedure—L. Kaul , Vikas Publishing.

Unit 13: Tools and Techniques of Data Collection

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Objectives

After studying this unit, students will be able to:

- Understand meaning of data, nature and need
- Understand variable and non-variable contents
- Understand collection and types of data
- Understand source and various ways of analysis of data, data arrangement and classification.

Introduction

The administration of research tools for data collection is done by subject sample. Mostly, data collection in educational researches is either done by proved experiments or by self-established research tools. By this method we get objective data, and with the help of these date we reach on connect result in study. The collection of data is done by various methods like questionnaire, observation, interview, etc. It is fourth step of research.

It is important for a researcher to know how much, which type, where and when data collection could be done. It is also important for a researcher to know the collection of which type of data is an objective to prove the hypothetical research.

13.1 Meaning and Need of Data

The meaning of data is to observe. We need data in scientific and educational researches. Data are collected by proved data research tools or by self-manufactured tools. Data are of two types: Quantitative and qualitative.

Obtained marks describe a person's numerically obtained marks has its two importance measuring process helps uni-variable to measure quantitatively. Data are collected in the form of figures/diagram and marks obtained, it is dependent on the types of instrument by which date are being collected. Mostly, these data are collected through observation, they are in the form of marks obtained, and the marks got from data are in the form of figures. Data helps us to understand that the results of research are valid and believable. Their authenticity can be checked.

Need of data collection

Data collection is done to fulfillment of following objectives in educational researches:

1. Data collection provides solid base for research works in educational researches.
2. As we require raw material for a product, in the same way we also need data for research. If data is collected multiplicatively, the result of research will be multiplicate.
3. A suitable answer of a research can be given for a suitable question on the basis of data. Data are very important for scientific research works.
4. Data plays an important role in the confirmation of results of research.
5. Data are collected for the confirmation of hypothesis in the research works.
6. Statistical data is used for mainly two problems—
   (a) To get an idea of standards of population which helps in rendering of simplification.
   (b) Hypothesis of researches is examined to get answer of research related problems or to get answer of a particular question.
7. Facts are discovered on the basis of qualititative data and on the bases of quantitative data new principles are rendered.
8. The evaluation of effectiveness of new methods is done on the basis of data.
9. Scientific solution of problems is found on the basis of data.
10. The accuracy of Simplifications of research depends on the credibility and validity of data.

Difference between facts and data

The following are the differences between facts and data—

1. Facts are organized in materialistic world while data are organized in orderly form.
2. Fact is not achieved by following any pattern on the other hand data contain an orderly pattern, for example, a body has a orderly pattern.
3. It is difficult to explain facts and explanation of facts is generally personal. This is based on hypothesis of a research while explanation of data is qualitative and objective.
4. Facts are confidential in nature white data are not confidential in nature. They can be examined.
5. Facts are descriptive in nature white data are explanatory in nature.

6. Facts are not responsible for objective statistical behaviour on the other hand data are responsible for objective statistical behaviour. Statistics is used in data.

7. Facts are not related to any research-related discoveries and results, while data are directly related to research-related discoveries and results.

8. Facts are very vast in nature and they are not used for their objectives while data are always collected for a specific purpose.

9. The collection of facts is done by historical, philosophical and survey research while data are collected for scientific and for experimental research only.

13.2 Measurement Methods and Nature of Data

Educational researches are related to qualities of groups. Qualities are changed to quantities with the help of measuring tools. But all qualities cannot be changed into quantity. So, data can be divided into two categories—

1. Qualitative data
2. Quantitative data

(1) Qualitative Data—All qualities can't be changed to quantity by using measurement method, it means some of the qualities are not given digital values. We change them to relative value for example-self confidence, Honesty, motivation, and beauty etc.

(2) Quantitative Data—The qualities that are given digital values are called variables e.g. value, interest, personality ability, intelligences, accomplishment, etc.

With the process of measurement, qualities are changed to quantities by several methods and many tools are used in process of measurement. Measuring process is based on type and nature of quality.

Measuring process plays an important role in research works because development of accurate and high level research happened through measurement tools. Findings are formulated on the basis quantitative data. The study of nature of quality is done accurately and explanation of findings can be done objectively.

Methods of measurement

With the help of measuring process digital value is given to qualities of a person measurement is done of requisite variables of application for which methods are used that are mentioned below—

(a) **Use of observation method** is done in measuring qualities of children and animals. For internal process of class observation method is used. In the field of education this method is used extensively and this method is developed more.

(b) With the help of **psychological and educational observations measurement** of many variables is done accurately. The data received by these observations are more reliable and credible.

(c) **From questionnaire** and interview, required information and data is collected.

(d) By **character scale inventory** interest, personality and feeling are measured.

(e) Data are collected from the analysis of primary and secondary sources **in historical research**.

In this manner, several measuring tools are used on research works, and different types of data are collected. The main measuring tools have been described in previous chapters.

Self Assessment

Fill in the blanks:

1. Meaning of data is……………….

2. The collection of data in research work is done for the confirmation of ……………..

3. Facts are descriptive in nature while data is ……………in nature.

13.3 Variable and Non-variable Quantities

The virtue that remains constant in all circumstances at the time of research is called non-variable. There is equality in context of quality among the members of sample. The virtue that keeps on changing in all circumstances at the time of research is called variable. There is inequality in the context of quality among the member of samplers several virtues are included in circumstances of researches but it all depends on the conception of research to decide which virtue is variable and which is non-variable.

Variable and non-variables can be understood from an example.

A conclusion can be drawn in respect of effectiveness on the basis of observation by teaching students with two different methods using the same study material.

Example   In this study teacher, study material class environment, level of students are considered non–variable and educational methods and students skill are variable.

Teacher teaches with equal skills in both methods, that is a main non-variable.

Variable

The quality that can be changed to quality is called variable and every member of sample remains different in that context. The calculation of unevenness of groups is based on digital values.

Notes   Educational or psychological qualities connected to quantity through B calling method than it is called variable.

Variables are divided into two forms:

1. Continuous variable

2. Discrete variable

(1) Continuous Variable: When decimal values included in scaling, they are called continuous variables. For example in educational feeling scaling 24.50 and 64.75 marks are given and in students weight measurement it is 62.60 kg and 74.25 kg. It is dependent on the accuracy of tool of scale. There is continuous trend in variable scaling.

(2) Discrete variable: When scaling is done in complete units and fractional values are not given called discrete variables e.g. 30 male and female students, 64 pass and 36 fail, 15 Indian and 20 American etc. There is a discrete trend in discrete variable.

Variate

Generally scaling of variable is done with the help of tools. When a variable is converted to quantity then it is called variate. When member of sample is tested through I.Q. then it is entilted as variable. Like wise if skill test is done in figures then it is called variate. In statistical analysis uni-variate, bi-variate and multi-variate analysis methods are used. It is clear in, the process of data variables are changed in multi-variate. Conclusions are drawn from statistical analysis of data through which generalization is done. Variates are used in research works, variables and in statistical analysis.

🦉?

Did You Know?   By scaling digital process value is given to person's qualities.

Quantification of variable

In the process of quantification digital value is given for level of variable. Scale processing is used in quantification through which data or digit is received.

Generally hypothesis is confirmed in the process of educational research works with the help of data and find results. Multiplicative data is converted to quality and investigation of their authentication done by statistical analysis.

Characteristics of quantitative data

Data collection is done with the help of research scale tools. They have following characteristics—

1. Data collection is done with the help of proved tests. Step analysis is also done.

2. Quantitative data is collected from credible and valid tools hence generalizations are more reliable.

3. The explanations of results received by quantitative data can be done easily. The level of significance is also determined.

4. The digitisation process of quantitative data is objective. There is no influence of personal views.

5. The collection of quantitative data is done for the objectives of research and configuration of assumptions of research is done.

6. Conclusions are drawn with the help of statistical analysis of quantitative data and we get more accurate generalization.

7. Accurate and correct results are received with the help of quantisation of data in educational research works.

13.4 Types of Data

Scaling process contains four steps that has four types of data. They can be divided into—

1. Nominal data or scale.

2. Ordinal data or scale.

3. Equal interval data or scale

4. Ratio data or scale.

(1) Nominal Data— Generally data are of four types but they are considered lowest accuracy levels data. In this, a group or facts is divided into two or more divisions. They are completed in frequencies, e.g. pass or fail, male and female students, Hindu-Muslim etc. These results are unknown. In this way survey and questionnaire method is used for data. These types of data are collected in the form of frequencies for analysis of these types of data percentage multiplicative value, chi-square test and for correlation Contingency method is used generating descriptive structural methods are used. These types of data are used in class teaching arrangements.

(2) Ordinal Data—Compared to name related data this form of data is more accurate. Students of each group are arranged in orderly manner. Member of each group is given a scale. Position survey method and position –scale is used for this types of data on the basis of ability of a student, they are levelled and positions are given. The level of a member is known but accurate distance remains unclear. In this positions are given on the bases of ability by dividing the groups of members for example students of a class is divided into boys and girls and each student places in order according to their ability.

Frequencies are placed in order in this method. In statistical methods, by medium quarter values chi-square test and spearmen position correlation method this types of data got analysed. Teacher, in his class teaching gives level to students on the basis of inspection. Positions are assigned on the basis of student's behaviour.

(3) Equal Interval Data— These types of data have all features that both of above mentioned data have but the quality of these types of data is that the distance between the member appears taken in these types of data is zero. More accurate data in educational scaling are found in these types of data. Educational and psychological value is accurate so zero is considered. Numbers are given in scaling of quality to the member of the group for these types of data for example for educational achievement subject marks given, mark also given for intelligence scale.

This is accurate data for education and psychology. The conclusion drawn by such types of data are credible and accurate.

Generally, all three data are used in practical scientific education, psychology and sociology. All these data are represented in the table below.

Students	TABLE 13.1 Type of Data		
	Name Related	**Order Related**	**Equal interval**
	Sex	**Skill level**	**Skill marks**
A	Boy 1	Second	68
B	Girl 1	First	76
C	Girl 1	Third	60
D	Girl 1	Fifth	28
E	Girl 1	Fourth	48
	Boy=2, Girl=3		

It is clear from the table that the difference of position in first and second is one and a difference of 8 numbers. Third and fourth also has a difference of one position but number difference is 20. So, interval data are more accurate but there data because the skill or ability of a student can't be zero bell confers zero if does not perform in examination.

(4) Ratio Data— This type of data has all qualities of interval data and inspite of that it has two extra qualities.

(a)   The referral value of this types of data is zero while the values of above mentioned data are not zero but groups reference. Zero value represents the position of that variables these types of data are collected in physics. In physics all scales represent zero.

(b)   The numbers in ratio–data are real numbers they can be added or subtracted but it is not possible in interval data. 15 g is three times multiple of 5 g but such relation can be established to education scaling.

The classification of four types of data mentioned above is based on four stages of scaling. The nature of data is cleared from the stage of its scale. A researcher can only understand the nature of a data when he knows very well about the levels of all scales. Its explanation is given in the table mentioned.

From this table, stages/levels of scale and the types of nature of data assumptions and specialty can be understood widely. The first three data are used in educational and psychological research works white fourth type of data is used is physics only.

Self Assessment

Multiple choice Questions:

4.   Data are divided into two parts _____ and qualitative data.

(a) Quantitative   (b) evaluative   (c) measurable   (d) All the three

5.   _____ data is used for measuring qualities in children and animals.

(a) Inspection   (b) Psychology   (c) Questionnaire   (d) Interview

6.   _____ process plays on important rote in scientific research.

(a) Social   (b) Measuring   (c) Religion   (d) Cultural

7.   In _____ researches data are received from primary and secondary resources.

(a) Physics   (b) Chemistry   (c) Historical   (d) Social

13.5   Data Collection

The data collection for research work in behavioural psychology is done after the administration of research tools on members of samples. Different types of methods of measures are used for measurement of variables in research. With the help of research tool different types of data are collected for4 this, It is Important for a researcher to understand the nature of variables and collects data by selecting appropriate measuring method. The nature of data is dependent on the nature of variable and tools of measurement. This fact is shown in tables.

The levels of measurement plays an important role in determine natural of data characteristics use of scales and techniques of statistics. Nature of data determines the techniques of analyses. Validity of conclusion depend upon data.

Table 13.2: Classification of Scales of Measurement				
Scale	Characteristics	Assumptions	Tools	Statistical Technique
1. Nominal Scale	Classification, equality, inequality	All members are given one number but one or two groups are not given one number.	Inspection technique questionaire interview	Percentage mode number value, correlation technique, chi-square technique

2 Ordinal scale	Classification order equality / inequality	All members on the basis of belaviour or variable arranged in an order	Observation method positional techniques educational and psychological inspection	Mode values, medium values, position correlation technique, hundredth place value, chi-square technique
3 Equal Interval / tract	All digits / number can be added subtracted and multiply	On above all stages eligibility of members represents distance.	Educational and psychological insertion	All the above and median, high inspection and Pearson correlation technique
4 Ratio scale	All that mentioned above and zero is also in existence multiplication, addition and subtraction can be done	Zero is natural in all the stages.	Data are collected on the basis a physical measuring techniques e.g. length, time, speed, etc.	All the mentions above and asthmatics is also used.

TABLE 13.3 : Data based on the Nature of Variable		
Variable	**Tools**	**Nature of scale**
1. Skill	Educational examination	Equal Interval level
2. Intelligence	Psychological examination	Equal Interval level
3. Ability	Psychological examination	Equal interval level
4. Attitude	Position Scale	Order level
5. Aptitude	List	Interval level
6. Setting	List	Interval level
7. Personality	List	Interval level
8. Sensation or feeling	Interview questionnaire	Nominal level

In addition to this many types of educational tools are used. Most useful technique is examination technique. By this technique data are received from nominal scale to equal internal scales. Relation of educational measuring tools rotated to nature of data and statistical techniques.

TABLE 13.4 : Classification of data tools and statistical techniques		
Scale	**Tools**	**Statistical**
1 Nominal	Questionnaire deter view inspection technique	Interval percentage chi- squares and correlation
2 Ordinals	Positional list inspection technique level-list	Medium value, spearman chi-square inspection and co-correlation technique

3	Equal interval scale	Psychological and educational inspection technique positional scale	All the above and medium value, deviation value pearson correlation technique t-Test /High correlation technique
4	Ratio scale	Physical measuring technique	Analysis can be done from arithmetic techniques, Median and co-relation techniques

From the above table it is clear that statistical techniques are based on research tools and nature of data. Entire selection of statistical technique is done on the bases of data. So, on researcher most aware of the nature of data.

Ethical consideration in data collection

In sampling of educational research works human members are selected. So, it is important to follow the following ethical consideration in data collection.

1. A researcher should respect and pay sympathy to a sampler
2. Should care the members of sampler.
3. Should keep data confidential received from sample.
4. A researcher should not disobey the confidentiality of data.
5. A researcher should take care of the level of research.
6. A supervisor should take care completely the work of research.

Every researchers should obey the rules of above mentioned ethical considerations. Should not mention the names of any member of sample. The name of that organization can be given from where the reelection of member of sample can be done. Code language is used for this, and it is a better way. Individual onuses of sample of research work should be regarded and they should be contacted first.

Precautions in data collection

Following precaution must be taken while collecting data in research—

1. Data should be legible for research problem.
2. Data collection should be done on the basis of specific tools.
3. Data should be like that their analysis can be done through statistical technique.
4. In collection of data there should be less errors in measuring.
5. There should be less sample error in collection of data.
6. The forms of data should be in such a form idea of population standard can be got easily.
7. Data should be complete and broad.
8. Data collection should be done objectively.
9. Data should be correct and accurate.

Caution   Data should be reliable and valid.

10. The form of data should be in such a form that its presentation and explanation can be done easily.

11. Numerical technique should be easy and objective for data collection

13.6 Arrangement and Classification of Data

After collection of data, their classification and arrangement is done so that their appropriate analysis can be done and conclusion can be drawn.

Data collection is done with the help of Incredible and valid tools. They are like raw materials. They do not have any meaning. To make data relevant statistical techniques are used. Therefore, there is a need of classification and arrangement of data.

The meaning of classification is to divide received informations into different groups to analyze for required results.

Classification of Research Data

In Initial stage the received data are in unclear extended mangled forms. Statistical technique can't be used in data without its classification and basis on this no any result or conclusion can be drawn. So, it is important for the usefulness of received data to collect and to arrange them in appropriate form. So, classification is a process to arrangement and to shorten the data, according to which depending on equal and unequal, data are divided is such a way that data of equal quartets can come in one group and data of unequal qualities can come to another group. By doing so, there is clearly in data work.

As per **Alhans**. "The process of arrangement in groups according to similarity and uniformity of data is called classification in terms of definition.

Characteristics of classification of Data

There is following qualities of good classification—

1. Clarity: Clarity is important in the classification. Data should be differentiated in such a simple classes so that there should not be any confusion.

2. Stability: Classification should have stability. If there is no stability, then there will be difference in revision, it will be impossible to compare.

3. Flexibility: There is importance of flexibility in different situations.

Basis of Classification of Data

On the basis of following the classification of data of research can be done.

1. **Qualitative basis**—To divide data on the basis of their symptoms and qualities from Qualititative base for example interest, nature, etc.

2. **Quantitative basis**—We adopt quantitative basis where classification of data can't be done on the basis of qualitative bases for example age, height, length, number, etc.

3. **Situational basis**— The classification of data in situational basis is done according to nature of specific time or according to situation.

4. **Geographical basis**—The classification of data can be done according to geographical areas.

Types of classification of data

(1) Uni-or-Bi-Variate classification—According to this system, data are divided into two group on the bases of a particular quality, so that data of a particular quality can come in a first part. The react of the data will come under the part that do not have that quality.

Example   Interesting/non-interesting, with artistic or without artistic capability.

(2) Multivariate Classification—On the bases of different qualities data are divided in many group. It makes more than two groups for example. If classification of any population be happen on the basis of sex literacy and intelligence then it can be done like this-

Population—$2 \times 2 \times 3 = 12$ (Three Variables taken)

(a) According to sex—

	(1)	(2)
	Male	Female

(b) According to literacy

	(1)	(2)
	Literate	Illiterate

(c) According to intelligence

	(1)	(2)	(3)
	High	Average	Low

(3) Quantitative classification—Quantitative classifications are need for those data that are Quantitative in nature e.g., height weight, age, solid-economic intelligence etc. These data are arranged on the basis of frequency distribution and classification on true calculation.

(4) Chronological classification—According to age, under the classification data are classified according to age-group. The time is divided into different groups, data that are related to time arranged in different groups of time.

Example   Child age, teenage infant age or data related to specific time.

(5) Situational Classification—Data are classified according to place in situation classification. For example, Villager, citizen, Indian, foreigner, etc.

Utility of classification of data in research

These are the following utilities of classification in the process of research.

(1) Summarization—Data are extended and unorganized in their original form. From classification data are divided and there is appearance of clarity, summarization and man agent which helps in evalysation.

(2) Classification of material—By classification the data that shows similar characteristic are placed in one group while the data that show dissimilar characteristic placed is anther group and study becomes easy.

(3) Clarity—From classification the form of data becomes clear which helps in selection of compete statistical technique.

(4) **Simplification for the following processes of researches**—From proper classification analysis, statistics use generalization and helps in finding conclusion.

(5) **Comparative basis**—Data are divided into quality symptoms, Newness through classification by which it becomes easy to do comparative study of data

(6) **Inclusion of new data**—This is one more advantage of classification of data that the data that are received at the end can be arranged in their related group on the basis of then quality and feature and could be used them in data analysis.

(7) **Arrangement of data**—It is important to use data after their classification and collection of research data through which a researcher can to a conclusion and this use is called arrangement.

Self Assessment

State whether the following statements are True or False:

8. Variable is that particular virtue that can be changed into quality.

9. The nature of data decides the analytical techniques.

10. Numerical technique for data should be tough.

11. Data can't be divided on the basis of geographical area.

13.7 Source of Arrangement of Data

Following are the sources of data arrangement-

1. To arrange in Table (Tabulation)

2. To use statistical technique.

3. Data Analysis

4. Presentation and Interpretations of results

(1) Tabulation

To make data clear and knowledgeable their tabulation is important. Through tabulation data becomes simple and clear and descriptive facts after becoming more arrangeable to display. Under them data are represented in different rows and columns and it is easy and convenient to infested the table. Generally the arrangement of table into different rows and columns to called tabulation.

Types of Tables—Mainly these are the types of data but depending on the nature, more types of data is possible.

1. **Uni-variate**—Under this, you can see one variate and single quality in arranged form.

2. **Bi-variate**—This table give information of feature of two correlated variable.

3. **Multi-Variate**—Provides Information of two correlated features of a variable or incident.

Significance of Table in Research—From the angle to give collected data a simple and short form in research they are very important in the following form—

(1) **Logical arrangement –** All data are arranged in an Important way in relation to any variable or incident though tabulation which is very important for research. A particular order is followed in tabulation.

(2) **Summarization of data —** After tabulation the form of data becomes easy and clear.

(3) Easy to analyses data— Through appropriate tabulation it is possible to find out conclusion and analysis of research.

(4) Save of time energy and money— On the basis of received data after tabulation, time and energy is saved in finding conclusion and work is done more effectively. Tabulation is considered a less expensive process in research.

(5) Easy is comparative study— After tabulation when research data are divided into different colors then the similar features of data become clear. It is easy to do comparative study on that base.

Use of statistical techniques—The second important step of data arrangement is the use of statical techniques on them.

Analysis and interpretation of data— In this process received data are arranged in such a way that in relation to problems they can produce required results.

Notes   As per **W. Cook**, "Scientific analysis discovers facts of study, relations of scientific knowledge and conclusions.

Data analysis reaches us on a scientific conclusion and helpful in observation of assumptions.

13.8 Various Ways of Data Analysis

The main objective of data analysis to get new facts from collected data. In the process of finding a conclusion many sub-processes are in valued that, in their complete form are called Analysis. Following sub processes are Involved in Analytical process.

(1) Editing of material— The prime function of editing is to improve weak and satisfactory parts and make them appropriate for use under received data.

(2) Classification of data— Under classification, dispersed data are arranged so that conclusion can be drawn easily.

Classification Fulfils following objectives

   (a)   It separates different qualities of data from each other

   (b)   Data become shorter after classification.

   (c)   Data become clear and simple after classification.

(3) Code of material— After classification each group is given specific name, sign or symbol or code. This is called code and analysis becomes easy.

(4) Tabulation of data— Data have to represent in different Titles columns and rows, from which data form becomes limited and it can be understood easily.

(5) Interpretation of data— Interpretation means to find the conclusion on the basis of practical study of complete data. These conclusion are based on the arranged data.

(6) Generalization— Received conclusion is generalized on the basis of interpretation if classified data.

Uses of data in Research

The use of data in research is useful in the following way-

   1.   Data Collection in any educational –research is useful to give solid base to research.

2. In research the data collection is like a raw material that is used for the production of data.
3. Data are very useful to give appropriate direction and solution of a problem for research problems.
4. Data are very important for scientific research.
5. Data are used for the investigation of research hypothesis.
6. On the basis of data the explanation of research conclusions can be done objectively.
7. The result of research are more valid and reliable.

13.9 Classification and Arrangement of Data for Computer

Data collection in research works is done with the help of proved tests. Generally, in these tests multiple choice items are involved. For more accurate results large sample is used and it is harder to calculate the answer sheets of larger sample. Therefore, machine and computers are used. For the calculation by machine I.B.M instrument is used that has space for six options and 150 steps to mention the answers. The received marks are not got by machines. However, answers are mentioned on paper. A particular person has mentioned which different choices of question. All these paper are handed ones to computer center. For the analysis of data a draft is developed. Computer on the basis of analysis classifies and arranged data. All information are mentioned on a paper.

Task What is the usefulness of data in research work?

Researcher also do calculation answer paper of the members of sample of and for the formation of analysis researchers has to do classification and arrangement of data on his own. Then they are sent to computer center for analysis. Sentences data are sent to computer centre in rough form and their classification and arrangement are done on the computer center.

Researchers themselves also do analysis of data with the help of machines. But in this situation a researcher has to do classification and arrangement after calculation then he analyse the data on computer. They should be investigated before using machine to check the results that are received by computer are correct or not

A small sample is analyzed by a researcher and it get check on computer or machines. When correct results got then all data should be analyzed on machine or computer. In this way we need internal investigation.

13.10 Summary

- For data collection the administration of research tools is done on objects of sample. The collection of data by questionnaire, inspection, interview, examination. This is the fourth step of research.
- The meaning of data is to examine. Data are needed in scientific educational researches. Data are achieved by proved research tools or by self-built tools, Data are qualitative and quantitative.
- Non-variate is that virtue that remains unchanged at the time of research in all circumstances and variate is that virtue that remains changeable in all conditions of research.
- For different types of measure of variable different types of measuring technique are used in research. Different types of data collection is done with the help of research tools.

- Measuring levels is our important base of data nature, differences, use of scales and in determination of techniques of statistics.
- The main objective of data analysis to get new facts from collected data. Many sub-processes are involved in reaching conclusion in this process, that is called analysis as a whole**.**

13.11   Keywords

1. **Infanthood—** Stage of Infant
2. **Brief—**To present a subject in short.
3. **Under-written—** Written below

13.12   Review Questions

1. Define 'data'. How data differ from facts ? Explain with example.
2. Why there is need of collection of data? Mention nature of data.
3. Differentiate between qualitative and quantitative data.

    (a)   Between variable and non-variable.

    (b)   Between variable and variate.
4. State the type of data, how they are based on the nature of variable and measuring tools. Explain.
5. How statistical techniques are also based on the nature of variable and measuring tools? Explain with example.
6. Mention the code of conduct of research in data collection and why should they be kept in mind.
7. What precautions should be taken for data collections? Describe the limitations of data collection.
8. Tell the meaning of data classification and arrangement. Mention the need of classification and arrangement.
9. Differentiate between data classification and data arrangement. How data are classified in use of computer or machines? Explain.

Answers: Self Assessment

(1) Analysis	2. Assumptions	3. Explanatory	4. (C) Quantitative
5 (A) Inspection	6.(B) Measurement	7.(C) Historical	8. True
9. True	10. False	11. False	

13.13   Further Readings

Books
1. Educational Technique and Evaluation—*Dr Rampal Singh, Bhatt Brothers.*
2. Education Technique—*R.A. Sharma, Bhatt Brother*
3. Working method of Educational Research—*L. Kaul, Vikash Publishing*
4. Educational Technique—*S.S. Mathur, Bhatt Brothers*

Unit 14: Observation and Observation Schedule

CONTENTS

Objectives

Introduction

Objectives

After studying this unit, students will be able to:

- Understand the observation and its type
- Understand the characteristics and limitations of observation.

Introduction

"Avlokan" word is hindi conversion of English word "Observation" which means "to see", "To evaluate" and "to Observe". In other words observation means "To know work cause or mutual relation that happens naturally and to see then consciously is know observation.

According to **Smt. P.V. Yung**—"The study of self-developed incidents at the time of their happening arranged by our eyes is called observation."

According to **Prof. C.A. Mozer**—"In solid meaning there is more use of eyes than voice and ears in observation".

From the above definitions, it is clear that observation is a method in which a primary material, directly or indirectly is collected. In this method an observer sees, watches and understands the incidents and collects the related material.

14.1   Observation

This is a very famous method. In this method human behaviours is observed and data is collected on this base. This is a direct method to measure human behaviors, in different social conditions. This method is mainly applied in the field of education and psychology in controlled experiments. We can't study anything without observation. Personal and mental knowledge is only possible in this method.

Historically the methods used by the troglodytes nothing but observations vagrant of that period. Observers tries to listen to huntering animals , felt the blowing air, the manner in which an astrologer observes stars, a doctor examines a patient by touching diagnose a patient after feeling heart beat of a patient. In the same way in the field of education and Psychology this method is applied to observe the students behaviour in different condition. A man in loneliness, group and in special circumstance do some activities those activities can't be considered meaningless. It is seen that a man while walking or sitting do some unnecessary activities like cracking of fingers, throwing hands, chatting to self, etc. These unnecessary activities play an deport rare in measuring personality. We cannot come to any conclusion without observing a person's behaviour accurate observation one should pay attention to the object and should note down whatever observation he has done, because as time passes the memory becomes weak and an observer should have the capacity to detect any type of impulsion balance. But it is a matter of great concern that teachers observe only educational and do not pay any attention on other situations relating to life how a student behaves in different life conditions. In addition to this teacher should not only observe the children with difficulties but also should observe all the children. It is necessary to mention here a teacher should be confident to his observation. And the behaviour, objects or seen that he wants to observe, he must be impartial to his observations. He should not believe others as the decision is finally taken by the observer. So, to make observation satisfactory he should not be activated by others request, partiality or sentiments.

Notes   To see minutely the incidents that happen naturally to know work-cause relationship is called observation.

Self Assessment

Fill in the blanks:

1. The meaning of observation is……………to the human behaviour.

2. In the field of education and psychology use of ……………… mainly done in controlled experiments.

3. When we question to a particular person, it is called………………….. .

14.2   Types of Observation

Observation is mainly of two types:

1. External Observation

2. Self-observation

Sometimes we face the situation when we ask a particular person that how many times he has done so? Why and when he did so? This is called self-observation.

Example   When a teacher observes child's behaviour, it a called external observation.

We have to depend on other persons in such types of observation. Observer only one side of behaviour as he is not accustomed with that person. This is the main drawback or defect of this method. A person

is asked to give details of himself on the self-observation method but in such types of observation a person hid some of the facts. In the third method the above said methods are incorporated. It is done only in situational tests. In situation tests such types of situation are generated that are similar to situations of human life e.g., Test of Honesty, Test of Cheating, etc. After that human behaviour is tested.

Observation can also be divided into two more types:

(a) Direct Observation

(b) Indirect Observation.

(a) Direct Observation

In direct observation, a person is examined in practical situations. In this method, child's behaviour is directly observed by observer child becomes busy in his daily work and observer notes down all his observations regularly. It's obvious that child's behaviour becomes unnatural in the presence of observer. Consequently our observation can't be said accurate despite of that we get correct behaviour related facts of child through direct observation. In contently innocent child's behavioral evaluation this method spiral because of two reasons.

1. An innocent child does not try to make his behaviour unnatural. So, the presence of someone does not affect his behavioural change for long time.

2. Direct observation looks significant as speech development in a child remains limited.

Did You Know?   'Avlokan' word is hindi conversion of English word 'Observation'.

(b) Indirect Observation

On the basis of collected information's direct observation we try to understand a person. This method is processed or finished form of direct observation. In the field of sociology this method has proved very useful for research. The sociology researches introduced life-style of triberenan through this medium. To make this method more important we should keep in mind the following things:

1. Confirming the behaviour pattern

2. Specification of practical aspects of selected pattern.

3. Arrangement the recording of behaviour observation.

4. Quantification of observation work.

5. Give proper training of indirect observation to the teacher.

14.3   Characteristics of Observation

1. In observation child's practical behaviour is evaluated.

2. This method is equally applied to both on child and on adults to evaluate behaviour.

3. Behaviour is done in general conditions.

4. This method is also applied deaf, dump end disabled persons to evaluate their behaviour.

5. Observation is very important method to study innocent child.

6. Generally in this method there is no need of any special training. This method is used by all persons.

7. It is possible to observe a person or a group simultaneously using this method.

Self Assessment

State whether the following statements are True or False.

4. In direct observation a person is observed in practical conditions.

5. An innocent child tries to make his behaviour unnatural.

6. Indirect observation has been proved very useful in the field of research of sociology.

7. Through this method, observation of a person or a group of person is not possible.

14.4 Limitations of Observation

1. This method is fulfilled through subjectivity and Bias.

2. An observer is influenced by prejudice Psychological call it as Halo-effect.

3. The report/data is not same prepared by different observers.

4. It takes long time while observing.

5. Observations is also influenced by observer's behaviour, his mood, physical and mental state, and his tiredness.

6. An observer influences the natural behaviour of a person so, psychological-environment of a child remains unnatural despite many attempts.

7. A person does not explore his intentions and shows or behaves differently opposite to his intentions. In this situation observation remains unsuccessful.

14.5 Suggestions

Keep in mind following things to make observation more effective.

Caution   Apply observation method only when there is no other method to apply.

1. The aim of an observer should be clear and defined.

2. The record and report of observation incident should be real and accurate.

3. The explanation of observer should be objective.

4. We should already choose/select the instruments related to observation.

5. Behavioural evaluation should be done on the basis of many observations as it improves the confidence of observer.

Notes	Present the suggestions to make observation method more effective.

6. Observer should try to make his observation to be impartial. It is suggested that not to do observation if an observer is not interested in a person to do observation.

14.6 Summary

- The 'Avalokan' word is hindi conversion of English word 'Observation' which means 'to see' 'to evaluate' and 'to observe'.

- According to **Smt P.V. Young**—"The study of self-developed incidents at the time of their happening arranged and knowingly done by eyes is called observation."

- This is a very famous method. Human behaviour is observed in this method and based on that prevalent data is collected. This is a straight method to measure human behaviour in different social conditions.

- Observation is mainly of two types: (1) Direct Observation (2) Indirect Observation.

14.7 Keywords

1. **Purified**—Processed, rectified.
2. **Self-observation**—When we ask questions to a particular person.

14.8 Review Questions

1. What do you understand by observation? Explain.
2. Explain the types of observation.
3. What are the characteristics of observation?

Answers: Self Assessment

1. Observation	2. Observation method	3.Self-observation
4. True	5. False	6. True
7. False		

14.9 Further Readings

Books
1. Procedure of Education Research—*L. Kaul, Vikas Publishing.*
2. Educational Research Procedure—*Shareen and Shashikala, Vinod Pustak Mandir.*
3. Educational Techniques—*S.S. Mathur, Bhatt Brothers.*
4. Education Technology and Assessment—*Dr. Rampal Singh, Bhatt Brothers.*

Unit 15: Questionnaire

CONTENTS

Objectives

Introduction

Objectives

After studying this unit, students will be able to:

- Understand questionnaire and types of questionnaire
- Understand limitations of questionnaire
- Understand precautions of questionnaire.

Introduction

Person determined by medium of different post that how he will behave in the different situations of life. Questionnaire by one means on auto determined measures it. In this method, person is given a questionnaire on which direction is written. According to that directions person has to react. Some answers of questions will be given in Yes or No.

15.1   Questionnaire

For the internal quality of personalise related that particular quality questionnaire is found by selecting question, which can do measure more accurately. In this method questionnaire is given to the persons, on which direction is given. Person has react according to directions. Hence, this is a good technique for measurement of many persons in more less time. These questionnaire either impulsive fluctuation found to person or either found to specific virtue or uses of diagnosis. Questionnaire is a self-rather scale. Persons determined by medium of different post that, how he will behave in the different situations of life. Although this method is seems to be simple internally. But for its formation and by its scientifically collection of data needs a good training. In questionnaire one true answer is found quality of objectivity. Questionnaires are under of self-report techniques. In words of **Lazarus –** "Simply stated

the self-report technique, involve attempting to measure aspects of human personality on the basis of what a person can say or is willing to say about himself. They usually consist of a series of printed objective questions presented to the subject or to a group of subjects. Such inventories of questions can be used to study interests, attitudes and various other facts of personality. They are objective, because the subject must respond usually with a 'Yes' or 'No' or 'I don't know answer of question".

Notes In a short time, questionnaire is a best method to measure personality related internal qualities of persons.

15.2 Types of Questionnaire

There are many types of questionnaire, which are as follows:

1. Closed Questionnaire

In the closed questionnaire answer of the question is given with tick mark on the one of the option Yes or No. The form of questions in questionnaire is as:

(a) Do you always worried? Yes/No

(b) Do you like meet with people? Yes/No

(c) Do you see nightmares? Yes/No

2. Open Questionnaire

In this questionnaire some questions or statements are given about that, person own views are express in detail. The form of question is like this type—

(a) What do you mean by 'Operation Black Board?

(b) What is your opinion regarding success of new education policy?

(c) What is your concept regarding justification of rule of reservation?

3. Pictorial Questionnaire

In this types of questionnaire, some questions are asked with the help of figures, person gives the answer of those questions by tick marking or by underline of the figure.

4. Mixed Questionnaire

As its clear by the name, in these types of questionnaire almost all types of questions are found in combined form.

Self Assessment

Fill in the blanks:

1. The quality of ………………… is found only one correct answer is in questionnaire.
2. ………….. in questionnaire some questions are asked with the help of figure.

3. In which questionnaire all types of questions are combined forms that are called ……………. questionnaire.

15.3 Limitations of Questionnaire

Although questionnaire method is very simple, low cost, and in short time technique to observe the more people and therefore this is very popular also, but also, there are some limitations It is necessary that these should be keep in mind.

1. Sometimes candidates did not want to give answer with honesty of any question. So that, they have to push up own impulsion and can gives wrong information.

2. This is also, more probability of that point, candidates could not understand the question properly so that they may not give conceptual information.

3. Sometimes candidates fill's questionnaire carelessly and its tick mark on 'yes' or 'No' without thinking which, effects goes on the result.

4. Sometimes it may happen that which events at discuss of the form of questions they did not happening in the life of candidate or at that conditions of he had forget, in this stage answer are not realistic but imaginary.

Example   Children are not able to self-assessment. Hence, they could not give the correct answer of their own subject.

5. Some questions, whose answer candidate does not want to give in spite of given consolation to him that the answer will not be explore in front of society.

6. In these questionnaires are of less importance of solution, because questions of credulity and validity in low level.

7. People do not show the interest in fill of questionnaire, because less quantity of questionnaire are return.

8. This is possible that the sample of questionnaire is unfavourable.

Did You Know?   Questionnaire method is very simple and no costly and in short time it is observe the many people.

9. This is not possible that the prepare enact questions will be able to every educational and cultural level of people.

10. In adjustment related question the adjustment can not apply to all people, this is possible that in such condition one person can be adjusted other could not.

11. It has been seen the fixed of scoring rationale on also the given marks by examiners's not in equality.

Self Assessment

State whether the following statements are True or False:

4. Questionnaire has no any constant objectivity.

5. In closed questionnaire the answers of questions are given in yes or no.

6. In open questionnaire the answers of questions are given to the help of figure.

7. Questionnaire method is low costly in comparison of any other method.

15.4 Precautions of Questionnaire

At the time of using questionnaire these some precautions keep in mind according to specialist—

1. Questionnaire may be used when it's possible.

2. An objective of questionnaire must be fixed.

3. The students should have taller in confidence prior to prepare questionnaire show that, they could reliable and realistic answers.

Caution   It has not been used such types of statements, which is related to persons present or past life.

4. Do not ask factual question, such as 'Honesty is the big thing'.

5. Do not ask double meaning question.

6. The focus should be on the attractiveness and exactness of questionnaire.

7. Do not ask such type of question which is applicable for all, such as –'Do you always worried'?

Task   Keep your glance on the precautions related to questionnaire.

8. As far as possible the language of questions are simple and conceptual.

9. It has not been started question with the words like 'Sometimes' 'No one', 'Always' etc.

10. It has been every statement should be given in formation of valuable and functional.

11. Statement should be meaningful and order in proper sequence.

12. Number of question is not much more.

13. Question are agreeable of each other.

14. The language of question should not be disgracful and their objective should not examine.

15.5 Summary

• For the internal properties of personality related that particular quality questionnaire is found by selecting question in which can do measure more accurately.

• These questionnaire either impulsive fluctuation found to person or either found to specific virtue or user of diagnosis.

• In questionnaire only one true answer is found to be properties of objectivity.

15.6 Keywords

1. **Candidates**—Participant in research process, applicant.
2. **Relevance**—Necessity of any law or policy.

15.7 Review Questions

1. What do you mean by questionnaire? Explain its types.
2. Explain the limitations of questionnaire.

Answers: Self Assessment

1 Objectivity	2. Pictorial questionnaire	3. Mixed
4. False	5. True 6. False	7. True.

15.8 Further Readings

Books
1. Educational Technique—*S.S. Mathur, Bhatt Brothers.*
2. Education Technique—R.*A.. Sharma, Bhatt Brothers.*
3. Functionality of Educational Research—*L. Kaul, Vikash Publishing.*

Unit 16: Rating Scale

CONTENTS

Objectives

Introduction

16.1   Rating scale

16.2   Types of Rating Scale

16.3   Forced Choice Rating

16.4   Errors of Rating Scales

16.5   Summary

16.6   Keywords

16.7   Review Questions

16.8   Further Readings

Objectives

After studying this unit, students will be able to:

- Understand the meaning and definition of rating scale
- Understand the types of rating scale
- Understand forced choice rating and errors of rating scale.

Introduction

Rating scale is such a tools by which it knows that any person regarding some specific properties , what impact on coming persons. In rating scale a catalogue of some properties in which before all some digit is written. According to experience of rator tick marked to related persons. In all methods of psychological measures rating scale user much.

16.1   Rating Scale

In all psychological measures method 'Rating scale' is most familiar. It is using successfully in industry, trade, research etc. The credit of its inception goes to **Fechner** in the field of psycho-physics. But first of all **Galton** in 1883 published rating scale which is related to imagery. After that in 1906—1907 **Pearson** for measuring intelligence formulated a rating scale in which was seven categories. In this technology any person's personality measures is done on the basis of such a man's opinion that know former person through and through. In these testimonials, character certificate, confidential reports etc are main, but due to low level of reliability and validity of rating scale it can be user in experiment work rarely.

Notes   According to **Waan Delen,** "A rating scale ascertains the degree, intensity or frequency of a variable."

According to **Rooth strang,** "Guided observation is the only rating."

Rating scale is such a means by which it is known that any person regarding some special traits what impact on coming persons. As a rater anyone can be selected from the following is a teacher, guardian, friend, neighbor, adviser, siblings and employer etc. In rating scale a list is given of some traits, in which before each an adjectives or digits are given. Rater has on his own experience and knowledge tick marked on one of related person. This method's user much in achievement test. This is an subjective method. Now–a-days This method takes help in increment of wages of industrial undertakings or in promotion. This can be used in person's reactions or excitements assessment also.

According to **Good** and **Sket,** "The rating scale typically directs attention to different parts or aspects of the thing to be evaluated, but does not have as many items or categories as the check list or score card."

16.2   Types of Rating Scale

Rating scale is mainly four types. These are:

1.   Numerical scale
2.   Graphic scale
3.   Cumulative points scale
4.   Standard Scale.

1. Numerical Scale

Rater in these types of scale select square, to a limited number and according to their scalve value sympathized. Means in this method digit is related to definite catalyst and man gets score according to their merit. These digits from convenience point of view 3,5,7 or 11 keeps on scale. This type of scale uses only when measured trait increases one side of middle point and decreases on other side. Middle point is the centre of these scales on which both side equal interval other square lies.

Example   **Lewin** used seven point scale for the study of depression impact of on boys' games creativity.

For example, We try to prepare a numerical scale on women's beauty then scale can be of the following form:

1.   Most beautiful
2.   Very beautiful
3.   Beautiful
4.   Average
5.   Ugly

6. Very ugly

7. Ugliest possible

Merits

1. This type of scale's formation and use both are easy.

2. If rator takes his digit seriously then rating is himself represents a high level of scaling.

Limitations

1. In this scaling much possibility of favours.

2. Decision is not some due to done by a great many persons. Sometimes decision of one person is if most beautiful that objects for another person may be only general category.

Suggestions for construction

1. These types of scaling both external ends seems to be futile because, no one rator user there to be futile ends in their rating. This is only an anchors of complete scale.

2. As far as possible a rater should try to least possibility of favour.

Caution Do not use negative marking, because it based upon continuity principle.

2. Graphic scale

This scale is much popular and widely used. In this a line is already made which is divided into many parts. Below in each part something is written and rator has to tick mark any one of them. Firstly this scale was used by **Boyce.**

Example 1. How do you live from social conversation.

1	2	3	4	5
Talkative	Simple speaker	Like to listen	Speak when necessary	Try to avoid speaking
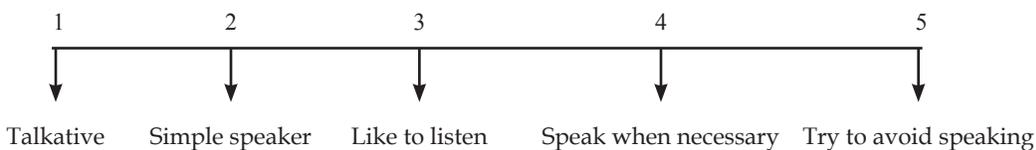
Example 2. How does he think?

1	2	3	4
Very slowly	With normal speed	quickly	very quickly
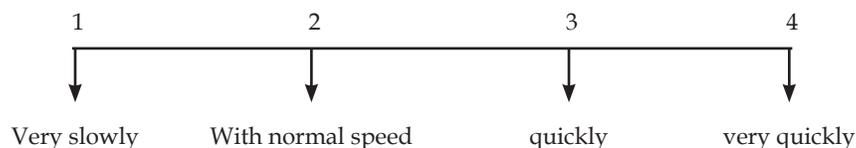
Merits

1. Its structure and administration both are very easy.

2. It can be filled quickly.

3. In this decision maker get a chance to very minutely distinguish.
4. Facility of giving comparative decision.
5. Factorization method when ever can be changed.

Limitations

1. Although in factorization method possibility of changing, rather then calculation of factor is tough, at the same time it needs much labour.
2. In this scaling it is not an easy work that in a person some trait is or not or this is which symbol according.

Did You Know?   Rating scale's inception first credit goes to Fechner.

Suggestions for Construction

Main suggestions are as follows:

1. Line should be adequate length (almost 5 inch).
2. Line should not be broken.
3. Good adjectives should be kept in first end and bad or adverse adjectives on the last end.
4. Three or five adjectives should be use. Among them some high, medium and low category.
5. This is not necessary that distance between symbol will be equal.
6. For each trait should write symbol in separate parts. One trait should not overlapping on another trait.
7. Should not use parabolic statement, as a "I am fully satisfied with my profession".

3. Cumulative Points Scale

In this scale, person's evaluation is done by many characteristics giving marks. Sum of marks or cumulative basis about persons concepts is fixed. From one point of view this scale is like psychological test, difference is only that in this marks have not been given on objective criterion, given only by decision. This type of scales are used to evaluate for persons who are employed in any work check list and guess whose technique comes under this.

(a) **Check list Method—Hartshorne and May** had used this method for children's character related many characteristics as a—Cooperative, kind, cruel, greedy, grateful, etc. Decisioner tests which characteristics of above characteristics is showing children behaviour. After that total score's basis is taken decision about children's quality. For each favourable traits +1 and for unfavorable trait –1 marks is given.

Example:

Cooperative	Kind	Grateful
With zeal	the best	much
With desire	better	more than general

Cooperative	Kind	Grateful
With neutrality	acceptable	normal
With jealous	bad	less than normal
Under subjection	very bad	Less

According to Hartshorne and May, by teacher evaluation of student this method reliability coefficient had found more than 0.6.

(b) Guess- Who Technique—In this method the student is say the nomenclature of their mates which is mentioned by some image medium. This method is used by **Hartshorne and May.** Every Sketch is a short description. In this some directions are given as a—"Here some such a student's sketch are given whom you know. Having read every statement attentively you have to determine that from who makes it is related." Every statement is either favorable or unfavourable.

Some Sketch's examples are as follows:

(a)   "Here is such a boy who do something for the pleasure of others."

(b)   "Here is such a boy who without any movement from his place silently do work."

Every sketch's ahead as much space is left so that description applies for those students their name can be written. Clearly that a popular student's name again and again call with required characteristics where as unpopular student's name call with undesirable characteristics. In this method only a few statement basis decision should not be taken, rather than all statement's basis. In particular group what is the position of any particular student or how much popularity, its knowledge by this method can fairly. In this type of scale 'Ohio' recognition scale is a famous measure.

Merits

1.   This is a new method and gradually it is going on popular.

2.   Its structure and administration is very simple.

3.   For the use of this scale determiner does needs any special type of training.

4.   Its weightage is very simple also, specially at that case where term has given the +1 or 0 marks.

5.   It can be used in complicated condition also.

6.   By this personality's only one quality can be evaluated.

Limitations

1.   Due to each term's only two probable reactions weightage process does not become more scientific.

2.   In check list method determiner is to say test only those terms or statements which is applicable on that. As a result in their evaluation unnecessary inclination or bias occurred.

Suggestions for Construction

1.   In check list method each term's in place of two possible reactions at least three reactions should be used.

2.   Rator have to say only to check term in this bias possibility occurred. Therefore, it is the best that rator should have to say answer each term.

3.   Weightage should be done very carefully and only those qualities of personality should be evaluated in which bias possibility is less.

4. Standard Scale

In this type of scale rator is given some set of standards as a—handwritings equality between men to men, etc. Rator compares these decision worth material to these standards. **Ayres and Thorndyke** have done a lot in this direction. The evolution of scale of man-to-man scale had been done for armies. To prepared this selected five characteristics, as a physical trait, intelligence, leadership, personal quality, and their general importance among armies etc. again each particular quality specialty one officer has to choose five persons, as a in them in maximum quantity this particular traits are, that whose in very low quantity, that who is in middle, that who more than general and a that whose less then general with compares to these persons taken decision about other persons. Under this method a number of person according to their me quality is ordered but here it is not essential for rator that is those persons whom on their any quality basis ordered, complete familiar.

Example:

1. Choudhary   from courageous point of view superior in Batallion.
2. Arora   from courageous point of view super in Batallion.
3. Deshpandey   from courageous point of view general in Batallion.
4. Chattarjee   from courageous point of view a coward in Batallion.
5. Data Ram   from courageous point of view very coward in Batallion.

Merits

1. In this rating is done in place of scores person's merits.
2. In this for comparison a permanent criterion is available.
3. Finding a permanent criterion rator does not change his standard day-to-day.

Limitations

1. Fundamentally to prepare this scale is a tough work.
2. In practice two rator's opinion perhaps at times only be similar.
3. In scale one man and any other man distance generally not equal.
4. Having taken decision about any person overestimation and underestimation is possible.
5. Scale's army format is not practice worth in civic life and industrial institutions.

Some scholar bride above four scale an other scale mentioned also that is called forced choice rating.

Task   Throw light on rating scale standard.

Self Assessment

Fill in the blanks:

1. Rating scale's inceptions credit is goes to…………….. .

2. This method's use ………………….. much more in test.

3. Mainly rating scale ……….. is of types.

16.3 Forced Choice Rating

This method's is also done for assessment of army officer. In this method rator does not need to explain in any person any quality is or not is rather from quality pair he has to explain it that between these both pairs which is correct. Generally, two pairs of statements in which either of them may be favourable or un favourable presented together sometimes in these one neutral statement is included also, for example—serious, enthusiastic, negliant, uncultured. In these first two quality are favourable and last two are unfavourable. Rator's considered this whole pair as a term given his decision and explain which trait is most suitable for that person and which one least. After that on the basis of an weightage key it can be calculated.

Merits

1. In this generosity error is less because in this rator overestimation and underestimation doing general tendency or Halo-effect is sort out.

2. In this scale with respect to check list method get a chance of minute distinguish.

3. Obtained scores distribution is Leptokurtic.

Limitations

1. A general rator cannot say definitely that which pair of term is related to much related to person.

2. This methods nomenclature "forced choice rating" completely unsuitable because no one rator is not likes listen that he is not independent to give freedom.

3. The scruting of pairs guessing possibility in this scale.

4. The construction of this type of scales is very complicated and it needs a lot of time and training.

Self Assessment

State whether the following statements are True or False:

4. Graphic scale is a very popular and widely used.

5. Graphic scale has used first of all by Boyce.

6. Digits are used in estimation method.

7. Fundamentally, preparation of standard scale method is simple.

16.4 Errors of Rating Scales

Rating scales' structure and in its used a number of errors occurred, which are following:

(a) Error of Leniency—This is called due to "error of leniency" because rator evaluated those persons generously whom he knows or that person that is ego-involved. This is a continuous tendency. Thus some rator are 'generous' and some are (hard) as a result positive leniency and negative leniency is bored to less this error unfavorable traits number is kept less than favorable traits.

(b) Error of central tendency—This type of errors cause are that generally rator hesitate to give extreme decision. As a result rating shifted towards centre. Rator thinks so that any person any quality neither completely absent nor present, due to this reason he placed their decision in the middle. This is the cause that decision is not be impartial. To less his error in the statements of extreme ends keeps much differences.

(c) Contrast Error—Murray indicates towards an another types of partiality that to called contrast error. According to this error rator estimates persons estimates opposite with respect to their own quality. For example 'cooperation and cleanness' characteristics evaluator if fulfil with both qualities then he will observed in other non-cooperation and dirtiness because it is human nature as we are ourself some we observes others but when we do not find him according own desire then criticism. Regarding discipline characteristics general it happens.

(d) Halo- Effect—According to this error, rator that prejudice about any particular person assessment that on that basis. Hence our decision is not much valid. Thorndice called it Halo-effect. This is such a type of error which prey generally all rator moral significance's characteristics this occurred much this error can be removed by practice.

According **Rugg,** "We judge our fellow into term of a general mental attitude towards them and there is, dominating this mental attitude toward the personality as a whole alike mental attitude towards qualities."

(e) Logical Error—when rator observe similarity between two student's work then it will be determined alike. According to **NewComb**, "In the brain of rator which traits have logical relation they evaluate them equally. It is called logical error. If objectively observed worthful activities evaluation not that about abstract traits, then escaped form this type of error."

16.5   Summary

- In all psychological measures method 'Rating Scale" is most familiar. It is using successfully in the field industry, trade, research etc. the credit of its inception goes to Fechner in field of meta-physics.
- In this technology any person's personality measures on the basis of such a person opinion which completely familiar with former person.
- According to *Rooth Strong,* "Guided observation is the rating".
- Mainly rating scale is of four types following—1. Numerical Scale 2. Graphic Scale 3. Cumulative points scale 4. Standard scale.

16.6   Keywords

1. **Cumulative—**Totals of score
2. **Systematic—**orderly, coherence

16.7   Review Questions

1. What do you mean by rating scale?
2. Describe different types of rating scale.
3. Explain in detail cumulative point scale.
4. Throw light on the error of rating standard.

Answers: Self Assessment

1. Fechner	2. Achievements	3. Four	4. True
5. True	6. False	7. False	

16.8   Further Readings

1.   Academic Research Methods—*Sharin of Shashikala, Vinod Pustak Mandir.*

2.   Academic Technique and Assessment—*Dr. Ram pal Singh, Bhatt Brothers.*

3.   Education Technique Management and Assessment—*J.C. Agrawal, Bhatt Brothers.*

4.   Education Technique—*R. A. Sharma, Bhatt Brothers.*

Unit 17: Case Study Method

CONTENTS

Objectives

Introduction

Objectives

After studying this unit, students will be able to:

- Understand the meaning, nature, characteristics and kinds of case study

- Know the advantage and disadvantage of case study method

- Understand the distinction among case history and single-subject experiment and case history.

Introduction

The use of case study in psychology, social study and education has been done from the beginning. Consequently in scientific researches it has an important role. First of all, case study method in social research was used by **Fredric Le Play** in 1840 in a study of family budgets.

Notes   Case study method is one of the methods in which any incidence of social unit of life is investigated and analyzed.

17.1   Meaning and Nature of Case Study Method

In the form of social unit a person, a family, an institution, a community, events, policy, an organizations, etc. can be taken or considered. The case which is discussed in the case study method is related to

any process or events that has a boundary context, i.e., the events or social unit included in case has its own boundaries. According to **P.V. Young (1974),** "Case study is a method by which life of social unit can be investigated and analyzed." **Goode** and **Hatt** (1987) also told about case study method that this is a technique with the help of that any social study can be done as a whole. In other words, in this technique any social unit that can be a person and may be any social group, studied by maintain its single unit or unitary character. **Goode** and **Hatt**, (1989) have defined case study method, "case study is technique of collection of social data so that the unitary character can be maintained on which the study is done. In different way, it can be said that, such an approach is which any social unit can be seen as a whole. Nearly, always in this module, unit that can be a person a family or a set of other group processes or relations or it can be a complete culture, can be developed."

Theodorson and Theodorson,(1969) have define case study as – "A case study is a study method of social incident from the medium of deep analysis of a person case. The case can be a person, a group, an incident, a process, a community, a society or a unit of a social life. It genus a chance of deep analysis of many specific statement that are ignored in other methods."

Yin, 1984 stated by defining case study – "This is an experienced investigation that investigates contemporary incidents in real life context when there is unclearity of boundary between incident and contact and all resources of proofs is used."

On analysis of these definitions we come to know about the important facts of the nature of study methods. These are discussed as follows:

(i) In case study method we study developmental events of any social units. In another words, in case study the study of social unit is done its historical background.

(ii) In the form of social unit a particular person is also studied or any other social group for example, family or culture is also studied.

(iii) The important factor of case study method is that unitary character of social unit not allowed to be broken. It means the social unit that is to be studied tried to be studied completely.

Example   If a family is decided to be studied in the form of a social unit, then after collecting a complete, historical chronology data and by not dividing a family into different sub-units, it is tried to do complete study of that family.

(iv) In case study method, the social unit that has been selected for study, what and why? Both conditions are studied. It means that is method a researcher notely explains complex behavioural pattern of social unit but also feeds the reasons through which this behavioural pattern can into existence. In another words, it explains and describes the social unit.

17.2 Important Characteristics of Case Study Method

There are four important characteristics of case study. According to **Punch** (2004), these are as follows:

1. **Case studies are bounded system:** Case study is a bounded system because the case which is to be studied its boundaries. According to **Yin** (1984),the boundary between context and case is not clear but there is a conformity of boundary. A researcher finds the boundary of a case by endeavour and explains the case.

2. **In case study case is a case of something:** In a case study a researcher has to find out that what about this case is, because it helps in determining analysis of unit easily.

3. **There is an obvious attempt to preserve the wholeness, unity and integrity of the case:** A case is studied by sustaining its wholeness, unity and integrity of study of a case. Because researchers know the study of a single thing of a case is not possible therefore they pay attention to some of the particular plan of a case on such a way that integrity of the case do not harm.

4. **In case studies multiple sources of data multiple data collection methods are used:** Particularly, in natural settings is case study multiple source of data and multiple data collection methods are used. In many cases interview reports data are collected by them white questionnaire and numerical data are also collected. It means to consider case study always a qualitative technique is unit appropriate although mostly the case studies are qualitative. It is clear that there is some specific importance of case study that separate it from rest of the methods.

17.3 Kinds of Case Study Method

In case study method, its influence is not studied somehow but it surveys that conditions which bring changes in social unit in previous time by being present and that is to be studied in social unit. Behavioural scientists hold two types of case studied-

(a) Deviant case analysis and

(b) Isolated clinical case analysis

These two types are discussed here:

(a) Deviant case analysis: Researchers took two cases together in which despite of similarity they are different in some forms. For example, of a researcher study two cases in which one is normal and another is stiffer from schizophrenia, then this is a good example of deviant case analysis method. Both the children are them so they are similar by the difference is that one a moral and another is schizophrenic- a mental disorder and a researcher will find out after a comparative study what are the factors that despite of similarity between the two children why are they indifferent in some aspects. The analysis case study of their type is mostly done by **Warwick** and **Osherson** in 1973.

Did You Know?   In case study method the analysis and experiment of life style of social unit has been done.

(b) Isolated clinical case study: In this type of case study a researcher do analysis of individual units in analytical problem historically. In this type a researcher analysis the events of past time and on the basis of that reaches on a find conclusion. This type of method is generally used in psychoanalysis. **Fryad** in his theory of human psychic response has explained on the bases of many isolated chemical case. Lately **Wixen** 1973, through is dated chemical care analysis did a study in which a child named Brewer' who was a son of a rich parents, an analysis done on him. On the basis of that, **Wixen** introduced to rich family person's problem and discovered the possible and appropriate solution to these problems.

Both the types of case study methods are popular. The only difference is that the used of isolated chemical care analysis is done for chemical situation and deviant case study is used in general conditions.

Stake in 1994 on the base of his analysis told the although are studies are of many types so case study can also be of many types. They have described the following three types of case studies:

(a) **Internal case study**: In this types of case study a researcher study a case from the beginning because he wants to know deeply about the case.

(b) **Instrumental case study**: In this type of case study where a researcher study a specific case because of that case he is able to understand the specific problem or it helps to refine a theory.

(c) **Collective case study**: In this type of case study a researcher extends the instrumental case study to study money cases is which he learns as events, general conditions and population.

17.4 Preassumptions of Case Study Method

The following are the important Preassumptions of the case study:

1. One preassumptions of case study is that there is uniformity in human nature on the other it is also true that human behaviour changes according to conditions or situation.

2. Second preassumption is that related unit is based on natural history.

3. In this preassumption the extended study is possible of related unit.

It is clear that case study has its own pre-assumptions.

Self Assessment

Fill in the blanks:

1. The investigation and …………………….. of life events of social unit in this type of case study.

2. Case study method is a ………………………….. method.

3. Case study method is very ………………….method.

17.5 Advantage and Disadvantage of Case Study Method

Case study method has been applied psychology, sociology and in education. There are some advantages and disadvantages in this method. There are some advantages of this methods.

(i) There can be a comparative study of two types of cases.

(ii) By case study method the cases selected for study are studied deeply because the study of social unit or any one case in one time can be possible in this method.

(iii) It helps in forming the hypothesis. **Goode** and **Hatt** in 1987 started the data that are received by study method not generalized with confident by a researcher. But on the bases of this method, he is able to form some hypothesis that can be considered an important project of this method.

(iv) Case study is that method by which on the basis of acquired facts the problem that can occur in the future studies easily be assumed and can find the ways and mends to short out.

(v) Because on this method social unit is studied deeply therefore it helps to understand the behavioral pattern of related unit. On this point **Cooley** in 1992 stated that case study generates deep analysis in related to related unit and forms a clear understand about its life history. In this the study of behaviours of unit done directly.

(vi) This method is used to know natural history of society and related to environmental social element.

(vii) The case study method helps in mailing schedules for the related work on the bases of received information's by the researchers.

(viii) According to the requirement of situation a researcher uses many researchers technique in case study method. In another words it can be said that in this method others methods such as deep interested questionnaire, notice can be used.

(ix) From case study method the experience of a researcher becomes stronger and because of this his ability to understand the case and to analysis a case becomes stronger.

(x) In case study method therapeutic and administrative purpose considers important on the basis of case study it is easy for a diagnostic psychologist to take decisions related to medical and from the administrative and managerial angle case study helps in understand the behavioural problem of unit.

Besides advantages, case study method also has some disadvantages, these are as follows:

(i) In case study method, subjectivity's found more that affects the conclusion of study. In this method the relations between a researcher and a social unit becomes intimate and rapport, consequently a researcher not able to do subjective evaluation correctly.

(ii) In the case study method, researcher grown a false sense of determination a researcher becomes so determined about his conclusion that he becomes completely determined about a specific result by supposing the representative cases in his study method.

(iii) A researcher is also given the responsibility to prepare case history of a social unit or a family. To do so, he has to work harder and collects all information about social unit and analyses them. There is no any method mentioned for the validity of such types of information given by them. There is no any way to be agree with the information he provides. So, critics do not suppose case study method a complete scientific method.

(iv) This is a time censuring method. A researcher has to prepare informations on large scale. A researcher by keeping in mind all aspects has to prepare historical data so this is a time taking process and it is also a costly method because there is only losses in this process.

(v) In the case study method, although a researcher by asking a person about his past experiences and events prepares a history. So there is more chance that a person can tell accurately about the old events or experience in this situation the information's received are not so meaningful.

(vi) In case study method, a researcher wants to reach on a conclusion of the bases of single case and it is seen that the conclusion drawn on the bases of a case does not correct and if it is correct for that case them there is no guarantee that the case would be equally correct on other social units.

(vii) Case studies are based on preassumptions that sometimes prone to be true on practical aspects. Consequently, data received by case study methods: remains in doubt always.

(viii) The use of case study done is limited sphere it can't be use for large group for the study use of social study. In this method use of sampling is not possible.

Caution The data are useless receiving from study method because in this subject he said or write that a researcher wants.

It is clear that case study method has many draw backs. Desperate of this drawbacks the use of case study method is happening in behavioral science in research.

Self Assessment

Multiple choice questions:

4. In case study method by taking two different cases their _____ study is done.

    (a) Social   (b) Comparative   (c) Political   (d) Religious

5. There are some _____ of case study.

    (a) Pre-assumptions   (b) Characteristics   (c) Equality   (d) Needs

6. In cases study _____ study of social unit is done.

    (a) Sample   (b) Deep   (c) Traditional   (d) Old

7. There is more _____ in case study method.

    (a) Subjected   (b) Objectively   (c) Dictionary   (d) All of these

17.6 Distinction among Case Study, Single-Subject Experiment and Case History

In the case study as we already know a case a studied deeply like case study in single subject also only single person is studied. But there is a major difference between them they are following:

(i) In case study is a non-experimental research while a single object is our experimental research.

(ii) In case study manipulation of independent variable can't be done while in single subjects experiments manipulation of independent variable is done.

(iii) By some social psychologists case study and an another research that relentless case study that is called case history has also been differ tailed. In case study scientific adopt perspective and longitudinal angle while is the case of case history a retrospective and archival angle is adopted. In another words it can be send that is case study a researcher reaches on a conclusion after doing deep case study of many cases at different time intervals while case history a researcher reaches on a conclusion by receiving information through written papers, or proves for example school, hospital, government and non-government agencies analyse them and researchers are to recondition.

Self Assessment

State whether the following statements are True or False:

8. Case study method takes less time.
9. A researcher is completely responsible in case study method.
10. Case study method is based on many preassumptions.
11. Case study method is used in various fields.

17.7 Measures of Removing Demerits of Case Study Method

There are many demerits in case study method. Then a question is raised that what can't be removed these demarits. Research scientists tried to give its answer positively. According to scientist, there are some demerits that can be removed completely.

(i) According to **Aronson** (1980), **Goode** and **Hatt** (1987), that a researcher should select a sample while study through this method, and should not a case himself only on the basis of a single study. By doing so many problems of study will automatically be solved. For examples, after selecting an appropriate sample the possibility of reaching to a wrong conclusion will be fresher and the information will also be valid, reliable and there will be lesson is inappropriate recall of previous experiences by a man. By selecting sample and studying a researcher also save same this up to some extent.

(ii) **To make sample representative of population**—A researcher requires when he selects a sample in case study, sample would represent population correctly.

Notes   In a sample when the quality of a sample increases than the credibility and validity received through them is also increase.

(iii) **To code the information objectively**—If a researcher do ending of data recent from study method then the channels of manipulation of information becomes less and its statistical analysis becomes easy.

Task   What are the main preassumptions of method of case study?

(iv) **To provide specific training to the researchers**- The method to make a case study improved is also that researchers who are to study through the method should be given trained. Because if a trained researcher the credibility and validity of data will increase.

It is clear that case study method can be improved accordingly.

17.8   Summary

- Case study method is that technique through which the analysation and investigation of a social unit life is done. So, it can be said that case study is a method of a study of social events through the analysation of a personal case.

- There are four important characteristics of a case study method—Case study is a bonded method, in case study case is a case of some, in case study the limit of case, integrity and completeness is maintained and in case study data collection techniques are used.

- There are many types of case study—in which deviant case analysis and isolated clinical case analysis are main.

- Case study methods are based on preassumptions in which there are three important case study.

- There are some advantages and disadvantages of case study methods.

- There are difference between case studies method and case history. Case study method is different from single subject experience.

17.9   Keywords

1. **Refine**—Improved.
2. **Retrospective**—An Observer.
3. **Archival**—A script written on old role.

17.10   Review Questions

1. Define case study and describe its form.
2. By defining case study describe its importance.
3. Describe the type of case study methods.
4. Describe the advantages and disadvantages that happens from case study.
5. What is case study method? What are the solutions to remove its disadvantage?

Answers: Self Assessment

1. Analysis	2. Bounded	3. Famous	4..(a) Comparative
5. (a) Preassumptions	6. (b) Deep	7. (a) Subjective	8. False
9. True	10. True	11. False.	

17.11   Further Readings

Books
1. Educational Technique and evaluation—*Dr. Rampal Singh, Bhatt Brothers.*
2. Educational Research Technique—S*harin and Shashikala, Vinod Pustak Mandir.*
3. Educational Research Work Technique—*L. Kaul, Vikas Publication.*
4. Educational Technique—*R.A. Sharma, Bhatt Brothers.*

Unit 18: Interview and Interview Schedule

CONTENTS

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Objectives

After studying this unit, students will be able to:

- Understand the meaning and define term of interview
- Understand the purpose and types of interview
- Understand the benefits and precautions of interview.

Introduction

In English '**Sakshatkaar**' is called interview, whose meaning is internal examination or survey, and insight. In both words the fact that are unexplored and can't be inspected outwardly, to know that facts is called interview. Interview is that arranged method in which two or more than two persons keeping in mind the main objective, argues, discuss and cross questions to each other. This is a psychological technique in which Interviewer study the emotions, thoughts, psychology insight and internal or personal life.

18.1   Meaning and Definition of Interview

The meaning of interviews is internal survey or inspection. Interview technique is a simple and convenient method, because it can be apply to any category of the society. Through this technique, the matter that a person tries to hide get explored.

According to **John G. Darley**—"Interview is a purposeful discussion."

> *Notes*   Gud and Hat Writes- "A serious discussion for a particular purpose is called interview."

In such a way, in this technique persons discuss on particular purpose by sitting face to face.

"Interview refers to a verbal face to face interchange is which one person the interviewer attempts to elicit information or expressions of opinion or belief from another person"— **Maccoby and Maccoby**

"The Interview may be regarded as a systematic method by which one person enters more or less imaginatively into the inner life of a comparative stranger.   —**P.V. Young**

In view of evaluation interview is a difficult process, generally this method is used before service

> *Example*   An interview is conducted to roughly calculate the personality of a person.

Interview in another word is a form of questionnaire. The only difference is that questionnaire is in a written form and students write their option/reactions and there is no need of candidate to be present during the administer, but in interview all the work is done verbally and interviewee and interviewer should be present in front of each other. Mostly, in interview the following specific elements are present-

(a)   Face to face interaction

(b)   Means of communication with each other

(c)   Knowledge of the purpose of interview to one of them.

18.2   Purpose of Interview

The following are the objectives of an interview:

1.   For the confirmation of pre received knowledge

2.   To know the person's thought, values and psychology.

3.   To survey the physical of the person.

4.   To find the powers lie within unconscious of a person.

5.   To study the behaviour affected by tension and frustration.

6.   For explanation of inspirational and working powers of a person.

7.   For the use of complementary measurement of a personealise.

8.   To get the knowledge that appears on conscious after many hindrances.

Self Assessment

Fill in the blanks:

1.   Interview is a …………………..for a particular purpose.

2.   The meaning of an interview is ……………………….

3.   Through Interview personality of a person is …………….

18.3   Kinds of Interview

Interviews mostly are of the following three kinds:

1. Directed or structured interview
2. Non-directed Interview
3. Eclectic Interview

1. **Directed or Structured Interview**—It is a kind of closed questionnaire. In this kind of interview method, time and language of the questionnaire is pre decided. All the candidates are asked the questions in a same order. Means that, Interview is done according to decided plan. In this plan the Interviewee lights upon his experiences, emotions and thoughts, and the draft of planning is determined by interviewer, because he is known as more capable of doing so. In this technique it is easy to compare different persons.

There are two types of questionnaire in directed interview. The first type of questionnaire is such that answers are remains controlled and candidate do not get any freedom, to give answers of second type candidate are free and can express his feelings.

Did You Know?   Interview is a psychological technique.

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2. Non-directed or unstructured Interview— This is a kind of open-end-questionnaire. It is also known as depth interview, clinical interview or focussed interview. There are some problems in human life whose study is only possible by non-directed interview. This type of interview is used by psychologist for the study of a person's imperator, psychology, etc. the nature of this interview is soft and the language of questionnaire, method, time, order etc. are not pre-decided. And the candidate is free to give answer of questionnaire. An interviewer Inspires a candidate to be open for his expressions by creating a friendly environment. By this method a candidate gives above natural answers. After open expression he develops internal sense and he feels his own capabilities and weaknesses. In these types of interview impulsive side is preferred to intelligence side. Also, open expression as a limit of this, because by this the received data corrected on this bases we can't comparative study of a person.

3. **Eclectic Interview—** This is a contained form of direct and indirect interview. In this technique the good matter of these two methods involved. Under this a candidate develops different types of sense. At the end of interview, is asked for the conclusion in brief. If candidate is unable to do so then interviewee presents briefly himself. In this interview and interviews neither have non-directional freedom and non have direction interview like freedom. So, this is a valid and best method of interview.

Self Assessment

Multiple Choice Questions:

4. The formulation of questionnaire in direct interview done _____ types.
   (a) One   (b) Three   (c) Two   (d) Five
5. Indirected interview is also known as
   (a) Comparative   (b) Inspirational   (c) Problematic   (d) Criticizable or Focused
6. Eclectic Interview, is a valid method of _____ interview.
   (a) Best   (b) Medium   (c) Low   (d) Ungradable
7. Directed Interview is a kind of close _____ group.
   (a) Answer   (b) Question   (c) Technique   (d) Valid

18.4 Merits of Interview

The following are the merits of interview technique:

1. It is very easy and convenient to use interview technique.
2. The drafting of interview can prepared according to different problems and objectives.
3. Interview can be apply easily on any group of society.
4. There is no any problem is Interview, because a candidate does not need to give anything in writing so he cooperates happily.
5. Interview helps a person to develop insightness.
6. The nature of interview is completely flexible.
7. Fare expression of a candidate explores many hidden facts of a person.
8. Interview is a best technique for the study of impulsive problems.
9. Through interview, an Interviewer can also know the facts of a candidates behaviour which a candidate tries to hide.

Task   Explain the limitations of interview.

18.5 Limitations of Interview

There are the following limitations of interview:

1. This is a double subjective technique, a candidate gives answers to interviewer to make him happy.
2. An Interview is completely effected with personal feelings.
3. Interview can't be considered verily and erodible.
4. Interview is more flexible in nature consequently Interviewer turns interview to his likeness.
5. Because of limitations a candidates does not state everything. Social foundations prohibits him to do so.
6. When a candidate does not want give answers of some of the questions, then he replies in a round way and tries to keep himself site.
7. In an indirected interview as a candidate has enough freedom so the answer are not receive with conceptually.

18.6 Precautions Regarding Interview

An interviewer should keep in his mind the following consulated tips while taking interview-

1. The personality of an interviewer should be effective.

Caution   Interviewer should not use such questions that may hurt the feelings and auctions of interviewee.

2. Pin-pointed questions should be asked and in interviews should create laughter environment. The validity of question should be maintained.

3. Interviews should not have effect of being sex-biased.

4. In keeping mind the tune, in interview should select questions in the manner that complete evaluation of a person can be done.

5. If a candidate is not able to answers of any questions then he should not be insulted but must natures the self confidence of interviews. We want to know through interview what a candidate knows.

6. Interview should be complete.

7. The interview should accomplished. In such an environment that a candidate remain happy at the line of finishing of an interview. This is the largest specialty of Interview. Taking interview is an art that cams from experiences.

18.7 Summary

- The meaning of Interview is Internal survey/Inspiration or Insight.

- Interview is that arranged system in which two or more than two person discuss, argues, eross questions, for a particular purpose.

- As per PV Young, The interview may be regarded as systematic in which one person Euler's more or less Imaginatively into the gives life of a temperate life of a stranger.

18.8 Keywords

1. **Self-subjective**—Self relent, Confidence.

2. **Eclectic**—One that combines, collects.

18.9 Review Questions

1. What do you understand by interview? Explain its objectives.

2. Explain the types of Interview.

3. Explain merits and precaution of Interview.

Answers: Self Assessment

1. Discussion	2. Internal Survey	3. Study	4. (c) Two
5. (d) Criticizable or Focused		6. (a) Best	7. (b) Question

18.10 Further Readings

Books
1. Education Technique—*R A Sharma, Bhatt Brother.*

2. Educational Technique—*S.S. Mathur, Bhatt Brothers.*

3. Educational Research Techniques—*Sarin and Shashikala,Vniod Pustak Mandir.*

4. Educational Technique and Evaluation—*Dr. Rampal Singh, Bhatt Brothers.*

Unit 19: Population, Sample and Sampling Design

Objectives

After studying this unit, students will be able to:

- Understood the concept of population
- Understand sample and sampling techniques
- Understand the process of sampling.

Introduction

In the field behaviour sciences, there are many important researches accomplished that are done on small groups of units, but results based on them are also considered to be applicator to the population. Because of many reasons all two units of population can't be studied. In that situation only one small group of units to be studied. If it is possible to study the whole population, it is not a matter of intelligence because it takes lots of time, money and energy, and profit is very less. With minor error saved result can be accused by taking a small group of a population and money, time and energy wastage can be saved. As consider time to buy a bag of rice how much then will be spend to instigate each and every rice and how much physical energy will be applied to avoid this is customer investigates only a fest of rice and based on line quality of that purchases a bag of rice only on the basis of one fest rice select rice and purchases in our daily life. In many situation we follow this method in researches, in behavioural sciences especially psychology, sociology and in the field of education tenses types of researches are very famous. From the population by taking some small groups a study is done and the conclusion drawn by that considers to be corrected for complete population that is considered as importance of whole population is described on that basis. This small group is called **sample**.

On the basis of study on sample, to get knowledge of importance of population, explanation of populates to study its different forms is a general scientific technique of research but has limited to scientific methods where the selection of sample has been done by scientific method. On the basis of sample, it is possible to find direct results of population. So, in this regard it is necessary to know about

sampling and its methods. But it does not mean that in the absence of representative sample research is not possible. Research is also possible in this condition. But in which conditions this happens, why this happens, and in that conditions how to describe the knowledge and results, all these matter needs to be understand properly.

In this chapter sample, kinds of sampling selection methods and another references are mentioned.

19.1 Concept of Population

Sampling assumption is a statistical assumption and its means a group of many units in which some of the units are selected for study. According to research population, unit has a determined member and we get studied conclusion is this subject. A schedule of list is also available about their knowledge population is also defined in a specific way based on some clear specification. In research contact this population is called target population. Target population are define as "This is a rent group or image nature group of units of persons, events, things and other lands of limits". This can be distributed in large geographical land or in smaller group in a limited land.

Sometimes all the units of target population not available for research impossible to collect research data on that conditions by eliminating those populates, the population that are received for research is called accessible population. In this way, we differentiate target population and accessible population. accessible population is that population whose research material can be collected about all units. In researches these should be described separality. But if it is possible to get knowledge of all the units of target population is a research then it will be a targeted and accessible population this is no any difference between them.

Like this population are two types homogeneous and heterogeneous. When there is enough equality between all limits according to their specialty then it is considered homogenous population but when there is difference in units then it is called heterogeneous population. In this manner, in heterogeneous population there is formation of differentiated groups is different units. There is difference between groups but in many group between limits there a enough similarity, means each group nearly homogeneous.

Did You Know?   Smallest part of population is called unit. Population is a combined form of all there counts.

Self Assessment

Fill in the blanks:

1. The rent of imaginary group of unit of things, events, persons is called ....
2. Smallest part of population is called ....
3. From all population the selected unit for study is called ....

19.2 Sample

Notes   From all the units of population some units have been selected for study from a specific methods is called sample.

On the basis of this sample, studied events happen and on the basis of the population based conclusions generalization is done according to objectives for the population or can say that observation and study of population is done through population. It is supposed that what ever is found about sample or what is correct about it. Sample will be also corrected for population, but these facts do not correct always. But it is proved correct only when the selection of sample is done by representative sample. If sampling has not done with this method, then it has not represent population and the result will emerge situation will not correct about populations. In this condition selected sample is called biased sample.

In biased sample condition the value that received is statistical sampling that is very different that received from the complete population. For example, if the objective of study is to survey the achievement of educations of class 8 students and the definition of class 8th students city of meerut 10 selected schools is to be studied put of 25 schools. If sample is selected that are good schools then selected samples will be called biased sample. In population all kinds of schools are there. In mentioned samples arrange levels and bad schools has not be presented. So that is effected of bias. Biased sample are not representative of population so they contain constant and fixed errors. So it is important that in inferential research it is necessary that populations should be free from bias. In other words that should be representative of population.

Representative sample is that sample which contains all qualities of population or be a form of population or be its replica. If a sample is selected randomly it get the capacity to represent population. Randomly sample has the specialty that on the bases of it the pre assumption of statistical value can be done correctly, there is less possibility of errors, and the error that a left can also be predicted.

Caution   In the field of behavioural sciences at the time of selection of sample for research it is an objective that sample should be random and representative of population.

For selection of this type of sample it is necessary to prepare a sample plan it means a plan on the bases of that selection of equal sized sample go for safely then 90% results of sampling and is two middle of that result that achieved from complete study, the different should not be more than 5%, it means out of 100 to 90 samples should be like then that their results should not differ form 5 more or less form complete population.

If a plan determines, the sample that is selected will represent the population is called representative sampling plan. It is also confirmed from this type of plan that the different types of units that have been selected from sampling same units are included is population and this representative is done properly in sampling.

Sample-Structure

There is a need of sampling structure or framing to prepare sample plan.

Example   Selective to do such arrangement though which a researcher get require number of maximum required units for research.

For this, it is assumed that population is limited and a schedule of all its unit can be prepared. This schedule is called sample frame. On availability of this schedule the selection become easy and possible.

Cluster

Sometimes the definition of population is not be done on the basis of its smallest unit but in the form of clusters. In that situation sample structure is also prepared in the form of cluster. These clusters present in the population For example, classes of students or school, family, caste, city, state, different types of groups, etc. The list is not of each student but list of schools is prepared and from them some school are selected to form a sample. This sample will be based on clusters of units (students) which were available in the form of school. Hence, sample selected in this way is called cluster sampling and the sampling unit is not related to any particular person, object or incident but related to cluster.

Self Assessment

Multiple Choice Questions:

4. Representative sample is a form of _____

   (a) Macro   (b) Micro   (c) Research   (d) Selection

5. To prepare a sample plan a _____is to be prepared.

   (a) Frame   (b) Cluster   (c) Capacity   (d) Study

6. Sample unit is actually a _____

   (a) Work   (b) Cluster   (c) Form   (d) Schedule

7. From random method is simply selection there is no any place of _____

   (a) Bias   (b) Unit   (c) Population   (d) Determination

19.3 Process of Sampling

In selection of sample, a researcher should keep in mind that how much time is required, to complete the whole work, how much money can he spend in research, how many skilled persons can help him in work, etc. On the basis of these he has to decide its sample size. After confirming this, he starts selection process has to The following are steps is the selection process:

1. Target and bias population determination and its explanation.

2. Define sample unit.

3. Sample farm and to prepare its schedule.

4. To determine sample size.

5. To determine sample process method.

6. To select sample units and implementation of plan.

Task   Write an eassy on cluster.

19.4 Sampling Techniques

All the processes and techniques which are used in the process of sampling are divided into two groups. These are:

(a)   Probability Sampling Technique

(b)   Non-probabity Sampling Technique

19.5   Summary

- Some groups of units are scheduled from the population of units and the resent based on that is considered to be correct in respect of whole population and that small group is called sample.

- Population resumption is a lifelong and assumption which means a group of unit select for study.

- Representative sample is that sample contains all the qualities of population or replica.

19.6   Keywords

1.   **Pre-assumption of population** — A group of units in which some are selected for study.

2.   **Replica** — A form of population.

19.7   Review Questions

1.   What do you mean by assumption of population?

2.   What do you understand by sample? Explain.

3.   Explain the process of sampling process and its methods.

Answers : Self Assessment

1. Target	2. Unit	3. Sample	4. (b) Population
5. (a) Frame	6. (b) Cluster	7. (a) Bias	

19.8   Further Readings

Books   1.   Educational Technique and Evaluation — *J.C. Aggarwal, Bhatt Brothers.*

2.   Education Technique — *S.S. Mathur, Bhatt Brothers.*

3.   Educational Technique — *R.A Sharma, Bhatt Brothers.*

4.   Worker person of Educational Research — *L Kaul, Vikas Publication.*

Unit 20: Probability and Non-probability Sampling Techniques

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Objectives

After studying this unit, students will be able to:

- Understand probability sampling techniques and its types
- Understand size of sampling
- Understand Non-probability sampling techniques
- Understand of sampling–errors.

Introduction

At First it is necessary to understand the meaniny of Probability the problem of probability or chance rises where we have not the complete knowledge of the subject and Surely we can not tell anything about it then we can only assume that, there is less probability of it to be true: It is considered with as many error as there is less probability of truth. So, in this situation too it is tried to know that how much error is contained in that assumption and what is the probability of truth. It can not be confirmed that a particular student will qualify, then it is tried to know the percentage of possibility of his qualifying. If he appears five times in a examination and the possibility to qualify is one then it will be said that his possibility to qualify is $\frac{1}{5}$. It can be said as if there is 1 complete probability of qualify than the probability of student to qualify will be $\frac{1}{5}$ or 20 per cent.

20.1 Probability Sampling Techniques

The question arises in the case of surrounding research is that the statical result obtained on the basis of Sample, what is the possibility of appear within a fixed corder lone (0.5 or 0.01 or nearly) of complete nature based result (result obtained in group study) ? It can be said as what is the possibility that group based value will not differ from a sample based value with a fixed volume. Several times it is questioned as what is the possibility of identical representative of Sample group research, up to which limit it represents the group, it is the part of same group or represents the group, it is the part of same group or represents the other different group.

Probability sampling technique's main characteristics are following

1. Each unit of population can be determined in the selection of sample. Generally in sample possibility of selection of each unit is equal. It is not essential that every unit should be included in the sample. It is essential that possibility of every sample should be included definitely.

Notes　　Probability sampling in the only technique which presents the reliable sample based value.

This gives possibility of the statement that sample based result will not different from group based result to a fixed quantity.

2. On the basis of probability sampling techniques it is also possible to assume, how much error inclusion researched test. This errors seems difference of sample based result and group based result. It is also called "margin of error" or "Limit of accuracy". This is that limit which is accepted in researchers activity. According to the probability sampling technique this is possible to assume how much errors will be. Level of significance (.05 or .01 or any other) which is chosen by researcher, fixed the possibility of errors.

20.2　Types of Probability Sampling Techniques

There are two types of probability sampling techniques – (i) Simple random sampling and (ii) Stratified random sampling techniques.

Simple Random Sampling

Among all scientific techniques of sample sampling simple random sampling technique is a excessively basic concept. It is in foremost probability sampling techniques. Any other techniques are variation only. In this basic concept after little-bit changes to their structure. Hence, it is more necessary to understand the concept the simple random sampling technique:

This technique is based on such a process which involve equal possibility of entry to not only each unit in group of sample but also of equal shaped units of every possible groups that can be selected equally. For example, A, B, C, D, Y, Z units can be arranged in two-two units then total 15 groups (AB, AC, AD, AY, AZ, BC, BD, BY, BZ, CD, CY, CZ, DY, DZ, YZ) WILL BE FORMED. It the from of each sample with 'Y' group the possibility will be $\frac{1}{5}$. In the same way if in any situation the group can be formed of 20 then possibility of selection in each sample will be $\frac{1}{20}$ or 5 per cent. In this way the most important characteristic of simple random sampling technique of group with all possible sample have equal probability of selection.

Within this technique, there are three main techniques of selection of sample – (i) Conventional Technique or Drum- Wheel technique or to make cost of page which is to select even without seen etc. (ii) Second method to be to based on random number tables and third method (iii) Systematic sampling.

Within this Lottery technique small slips of page are made on, which serial number of group units are written (which are written on general catalog) and make their roll to be table and put them pot or jug etc. Same serial number is written on each slip. After shaking several times slips are picked one by one and the numbers are written.

Once we get the required units then the process is stopped. This process is stopped in two ways. First process is to keep the picked slip in the same box from it is picked and second process is to keep separate the picked slip. In the first process there is possibility of picking the same withdrawn slip which is kept second times. In Rolling drum process drum is used. Each drum is market with number 0–9. When the needle fixed on drum is rotated then the obtained numbers are noted. When we get the required units then the process is stopped and the noted serial order units are arranged to complete the sample. This method is used in the reliable condition where group is small and little sample is to be selected.

Caution   Random Number Tables Technique is used at such a place where group is expanded large and size of selected sample is also large.

For this a table is used which is generally available in all books of statistics. The numbers which are written in this table is prepared by the technique of random sampling method. They are free from bias. These numbers are written in vertical column, but these can be used in rowwise or columnwise. A little part is mentioned below in table format.

42827	70203	78569	60281
41519	84612	30877	37989
38273	91905	33891	31641
48225	65290	85998	11528
56506	28841	56560	28947
29280	51213	96336	79288
73184	26689	05928	65869
52677	23027	51511	87251

Table is used in this ways. Let us assume that the table number of units in group is 600 which is arranged in series and also arranged in serial order. Suppose we have to select 15 units out of 600. For this any number is picked randomly. Let us consider that this number is present in second column at second place 84612. We will leave it because it is above 600. It should be remembered that we are using last three digits of table because our group number is also of three digits. 612 digit is more than 600 so we leave it. Let us more forward we get 905. It will be left and move ahead then we get 209. It will be noted: in this way all those digits will be noted which is less than 600. It this way we get these 15 numbers 290, 213, 27, 569, 560, 336, 511, 281, 528, 288, 251, 519, 273, 225, 506. We will prepare a sample by seperating serial orders of units.

Third process is series sampling. In this group content any units is selected randomly. After this other units are selected in the serial order of third, fourth, fifth, etc. When desired numbers are collected then this process is stopped. Selection of units third, fourth, fifth, etc. depend upon the total number

of groups and the number of units present in it. Let us suppose we have to take 25 out of 100 then fourth unit will be taken after selection of first. The number will get by dividing 100 with 25. If we take 25 out of 100 then each fifth unit will be taken. In this way sample will be selected. It process too in the updated format of simple random sampling. It is necessary in this unit that content developed of group units is free from bias. This should be prepared by random sampling. Otherwise sample of sample of sampling will not actinium of probability sampling series.

Stratified Random Sampling

This is also second from of simple random sampling. In this complete group is first divided in some typical level off stratum, stratum or in series. This stratification is based on some characteristic or variables in which subject is understand they affected can be result of studied. After this units are selected in the ratios of n/N by random sampling Technique from each stratum. In this N is total number of units of group and n is total number of units of stratum from which units are to be selected.

In this technique it is necessary that stratum or level should be equal and homogeneous but it should be different and homogeneous from referal point of view. It this type result based on selection of sample. Foremost expected of simple probability sampling. Now we arm get same result of expanded after simple random sampling based sample. Now its approach stratified subs. Probability sampling should be most economical.

Stratified sub-probability sampling techniques are two types – (i) proportionate and (ii) disproportionate under there proportionate techniques selection of unit in each ratios of stratum they are present in of whole population.

Example   If in a class total number of students are 60 which are 40 boys and 20 girls (Ratio of 2 : 1), then sample of 15 students upon girls will be 5.

This is called proportioned technique but it is possible when complete knowledge of population units, their equal proportioned of ratio of research. Now it is not possible sometime. If it is possible also the after sometime that knowledge should be wastage, because some characteristic is very quickly to changed, now for example earning 0-12 guardian, growth rate of boys, level of economy. Society of people. But it not understands should be in every instances stratified ratio of research is sub-probability sampling or will be. Now sometimes selection of units the form of disproportionate is very useful. In some instances it is do that. Hence it not knowing that stratified proportionate of sub-probability sampling is only a choice, it's not second way. In the area of research in any instance is not ideal and necessary. According to every instances will be importance and usefulness.

Disproportionate meaning of stratified sub-probability sampling is a process which within every level or stratum should be selected; they are not equal of stratum number or not a proportionate. Selection of each as every stratum should be different when such a stratum is small the necessary to do that then more selection of particular stratum such can be represent ate to let us we know that to make a stratum of school which study of in English medium only two school are present. In that case unite the appropriate both schools because one school can be different of other that he not able to represent ate then some stratum is small of end which is not stag excessive units. In that case necessary of disproportionate technique tired to. In real according to his own number this is essential of number unit should be proportionate, rather than it is necessary to proportionate deviation of that particular variable, which researches. It's type meaning of stratified sampling of disproportionate is that only method should selection be in every stratum of units, which is not related to size of stratum characteristic of this method is very economical. This drawback is this type of selected population units is not represent ate to right way, and that reason appropriate result is not much clear, which

means may not exact guess of value of population. This result comparatively pain of view is not much reliable.

To be used of stratified sub-probability sampling. Keep some points in mind following—

1. In subject of stratum, stratum or strata research or known should complete knowledge.
2. Which according to the basis of stratification that they should be logical that means be related to study of problem.
3. Number units of stratum is more appropriate that means their size is big either possible selection of appropriate units.
4. In stratum internally homogeneity and between each other inequality or heterogeneity.
5. Where it may possible, by the researcher to be make of stratum in place similarity form to be used.

Did You Know?   Stratified sub-probability sampling is also called restrictive random sampling.

In this selection of sample. Researcher under control, or some restriction. It is some profit the some loss also profit is that this population every part of sample should be represent ate, not any part should left blank. In that types of sample is available he must be very right represent ate to population. In simple random sampling is not much that. Hence: According to the base of stratified sub-probability of sampling is most reliable of research. Result is more accurately after small size of sample that this one draw back is after used to population it should be more knowledge require of population. That it is not said to be loss or drawback of this technique. Accepted is a form of discomfort but after such try it may be removed.

Self Assessment

Fill in the blanks:

1. Which types are _____ probability sampling technique.
2. Under the lottery technique small page _____ to construct.
3. _____ in this population of catalogue which unit to put the finger after closed the eye.

20.3 Size of Sampling

Although researcher ask question that how big size of sample should be? Exact answer of this question is impossible because depends on this so many facts. This is the facts of general knowledge will sample of big, result of research is more reliable, but exact clearness, exact reliableness to be appropriate what is the size ? exact answer of that question is not possible in the case of sub. Probability sampling is possible of exactness of size but in any other sampling technique is not possible.

Hence: here discussing of sub probability technique sampling.

This fact should be written previously the size of sampling is more big, result should be more reliable. Hence it is clear the size of sample should be big. But it not one an that its size of unnecessary big. Reality of this which its size is not much more or not much less. He has been optimum. Optimum size

is that which size which is defined of reliability softness and efficiency of research is confirmed, and given to capacity of sample to represent of population. Then must be small should loss of expanses. As it type equal size of sample error to be same to out of eternal limit. And is equal size of less expanses and it is to collect of reliable result.

The affect of so many elements of size of sample. These are some- (i) structure of population (heterogeneity population sample of big size) (ii) Tabular term of numbers (If divide in so many series the needs of big sample) (iii) Research raw-data to called to researcher available such as time money, and people power etc. (iv) Number of psychological test and their expansion (v) Geographical expansion of sample units, (vi) Availability of units that is some units are not available, (vii) Techniques of sample selection (viii) Analysis of statistical data technique (ix) an variable number (if the number is more then its size is big) (x) Wanted result (if result is get more clear and reliable then size of sample is big) etc.

Counting of Sample Size

In that case this necessary to know (i) counting of sample size is possible only the presence of probability sampling, (ii) counting based on the two facts- (k) population variance and (kh) Wanted confidence limit third (iii) This is available of counting formula it is not appropriate to fixed of size rather size should be available in that instance this is known to necessary the size of sample is not most important is that important to be the form of represent.

Sample size is decided on the basic of which technique.

1. Some scientist to be prepared table these by according to the size of population to be decided. Such a table was presented by **Dr. R.P. Singh** in 1973. According to that if the size of sample should be also 10 units. As these type size of population respectively. 15, 30, 50, 100, 200, 400, 600, 800, 1000, 1500, 3000, 5000, 10, 000, 50, 000 and 1, 00, 000 then it is size of sample in the serial will be 14, 28, 44, 80, 132, 196, 217, 234, 260, 278, 306, 341, 357, 370, 381 and 384.

2. As such a different way counting of sample size their two facts is required (i) One is the precision of result and second (ii) estimate population of variance. Means of precision clear is how much acceptable errors in research. One, two, three or four etc. how much error could be accepted, or, should confirm to own. Population variance or such a small initial study to be found or if preciously study is done then which is known about to them. If this is not possible then only to be guess. If such guess should be clarify what is the study of variance of whole population of emanated. Other wise which expansion, what is the minimum limit and higher limit, then difference to keep divide into 6 parts of standard dedication to found.

Clarity of result in other words of research population variation and sample median how much difference. This 2% or 5% some are accepted. That depend on that fact companion of each equal which method should be more affected. Hence medium of error are variation of sample.

In other words meaning of purity of result is that how much difference and in which situation the secret investigation id allowed between entire group and sample coefficient of square. 2% or 5% any thing can be expected, It depends on what is the aim of the researcher, what percentage of correct result he wants. If the medicine of heart disease is on research than the researcher must want that error should be least or minimum means error must be less than 1%. If the two methods of education is compared that which method is more effective than same errors can be accepted. Probability of standard error is a numerical assumption which show's that what is the limit of sample with acceptable error which is already decided earlier. If the belief limit is fixed on the level of 0.05 or 95% than 95 per cent within Sample ± 2 S. E. Standard Error is considered as $\frac{1}{6}$ of range of all samples, but extreme difference or variation is rare. So variation limit of standard Error is considered as $\frac{1}{4}$. In this way if

variation limit is fixed at 0.95 level than we have to select the such sample whose standard Error will be $\frac{1}{2}$ of acceptable error. If belief level is set higher that this limit 0.99 level than standard Error of sample is lesser than standard of acceptable error. On the base of this it is considered that if the result purity of research is to be increased means to reduce the standard error the size of sample would be increased. To double the purity we have to increase the size of sample four times. To triple the purity we have to increase the sample nine times and to increase the purity four times we have to increase the sample size sixteen time.

This means that multiplicant of increment in purity of result is the square root of increase in multiplicant of sample size.

Parton (1965) develop two formulas to know sample size one depends on percentage while another on mean value these are

(a) $$N = \frac{P.C.\ (100 - P.C.)\ Z^2}{T^2}$$

This formula is used when the difference between population value and mean value is in percentage. In this P.C. is the expected percentage of population value, Z is the value of S.E. which is 0.5 or 0.01 which is available in the basis of chart. T Tolerance error may be 5% or 2%. Actually this formula is the converted form of S.E.

(b)   Second formula is

$$N = \left(\frac{\sigma \times S.E.units}{T} \right)^2 or \left(\frac{\sigma Z}{T} \right)^2$$

In this formula σ =   standard deviation of exported population

Z =   value of S.E. units.

T =   Tolerable error (5% or 2%)

Example-Assume that there is a study of effect of medicine and researchers can tolerate expected error of 0.95 but not more than 2% then he wants to know in how many sample of percents medicine should be tested. In this siltation sample size will be

$$N = \left(\frac{\sigma \times S.E.}{T} \right)^2 = \left(\frac{10 \times 1.96}{2} \right)^2 = 96 \text{ approximately}$$

Expectation is 10 in the above.

Actually tolerance error is equal to the product of the unit of standard error (1.96 or 2.5 etc on the basis of probability level) and standard error. To know the sample size of 0.95 level than its formula will be –

Tolerance Error = 1.96 × S.E.

Because formula of S.E. is $\frac{\sigma}{\sqrt{N}}$ (σ =S.D.)

So Tolerance error = 1.96 $\frac{\sigma}{\sqrt{N}}$

If tolerance error is 2 then 2 = 1.96 $\frac{\sigma}{\sqrt{N}}$

If expected S.D. is 10 than 2 = 1.96 $\dfrac{10}{\sqrt{N}}$

After solving this we get N = 96 approximately

In this way after calculating the sample size it cannot be assumed that available result will be in the form of complete accuracy. It is only possible when selection of sample will be idle which generally does not happen, still it is a useful method of deciding sample size.

There is another method of deciding accurate form of sample. It is called stability test of sampling. One after another sample is selected and tested in this method. When approximately same results are derived from two to three testing then it is stopped then that will be the appropriate form of sample. Examples, first of all results of 10 units of small groups are taken then another 15 units of small groups are taken. These are tested and then first and second samples are combined and is seen that how much its accuracy has been increased. Similarly third 20 units of samples are taken again and tested. Then first second and third samples are combined together and its their results are collected. If results of this is same as earlier then it is will be concluded that units of sample 10 + 15 = 25 is enough.

Task   Express your view about calculation of sample size.

20.4   Cluster Sampling

This is not any person, place, object but a cluster or group such as classes of students, school, group etc. in the selection of unit of sampling in this method. Both methods of selection can be used in the selection of forms of problems. It is more comfortable. This is its benefit but it has so many disadvantages. There are more errors in this. There is a need of big sample to get accuracy in the probability of sampling. Probability of selection of each sample of same size of population of sample is not same. There beneficial characteristics which are available in selection of sampling is not found here. So it is less useful in comparison to probability of selection.

Mahalanavis (1944) to change a little in this method and developed a new method which he had named overlapping grid- sampling.

20.5   Multistage Sampling

This method is an extended form of cluster sampling. Order this firstly from population unit's big groups are scrutinized. Their selection is done by randomization also. This is the first stage of sampling. After that within selected group other small groups are selected. This being second stage. Thus from these groups required unit is selected. This become third stage. In each stage process of selection is random. As a- if any town's eighth 150 students sample is to be taken then for this we first scrutinized 10 schools by randomization out of 50 schools' of town (second stage). After that out of 10 schools from each class' eighth one section will be scrutinized by lottery method (second stage). Now from each section by systematic sampling 15, 15 students will be selected (third stage) thus 150 students sample will be available.

By this method selecting of a sample all those defaults presents that is found in by cluster sampling. This method can be used in probable or non probable both types of sampling.

20.6 Non-probability Sampling Techniques

Probability sampling techniques' an important things is that under that each unit of population appears possibility in sample is equal and it is also known also that what is the possibility of inclusion of each units in sample? Consequently it is known also approximately how much error or how accurate the sample based result, but in non probability sampling techniques. In that units of population inclusion in sample possibility is not equal. What will be the possibility of coming in sample, it, can not be known also. Therefore it can not be estimated by these methods selected sample's basis obtained result is what? How much error in that Rather than their utility in research. Generally they are used. In some cases there is no alternative of that. Therefore these methods knowledge is essential. Some important methods has been described ahead.

1. Accidental, Incidental or Opportunity Sampling

Under this method there is no preplanning of sampling. Neither any population context, nor list of units. Whatever got wherever data is obtained from that. What public thinks about any incidence, subject or facts, generally it is surveyed by journalist. Some people opinion which he get by chance, taking it prepared report. Similarly in exhibitions, fairly, school is whatever get wherever that becomes the unit of sampling this is called incidental sampling.

2. Quota Sampling

Under this method firstly population is divided into specific section or classes. These can be called whatever sub-populations, categories, special area, class, section, specific level. After that each section or population of that area means total units is determined and it determined also that, that population's which ratio. After that it determines that from each what fraction means how many units will be included in sampling. It is generally determined in some, ration which exists between sections and populations. From each section or parts how much determined units how will be selected, this depends upon researcher's own insight and decision. Main purpose it is that all types f units of population can be included in sampling.

This method's too much extent alike standardized randomization. Difference is that in this from each clears or section selection of unit is not done by randomization. Selection is depends upon researcher's or interviewer's own wisdom and determination.

In fact in this method it is not compulsory that the number of unit from each section selected in some, ratio in which ratio they exists in population. It is only understood to be essential that from each unit sufficient unit can be selected in sampling. Therefore it cannot be said that units taken from section will be their representative similarly it cannot be said also by this method obtained sample will be representative of population.

Hence in this way selected sampling's basis obtained result vested error cannot be estimated. It is to be supposed that by this method selected sampling's basis obtained result's accuracy is much less from comparative point of view.

3. Purposive Sampling

The purpose behind this type of sampling is that some units had been selected from population which is accordingly that population in which researcher is interested or which is that purposive. Which will be such a types of units and how much will be selected this is depends upon researcher's own decision. The base of decision is their meaning and purpose of research. The concept behind process

is that keep in mind purpose and wring his wisdom, researcher himself is selected such a units which is accordingly that population on which he wants to research. As is assumed that in the decision of unit's selected related that by researcher's which errors happened they cancel each other and in the final that sampling is prevails that is representative of required population. But in reality it does not happen. Such as Mutually assumption are. According to **Mouli** in purposive sampling selection of units is done on that conclusion which acts as a second controller in sampling selection. For example if it to study intelligence but weak in studies then such a boys' sampling selection weak in study not taking all boys taking only those boys that are intelligence. Hence intelligence is such a conclusion which is acting as second controller. The purpose also research is to study a special children groups.

Mauli assumes purposive sampling only a form of standardized sampling. Thus he assumed quota sampling a special form of purposive sampling.

In this method of probability inclusion of units in sample is being equal. Each units possibility is either one or zero. This saves time but result is not much accurate. Rather to use this method population's characteristics sound knowledge is desirable. How much error in the result or what is the accuracy of result it cannot be guessed.

4. Judgment Sampling

When researcher does selection of units one is wisdom and knowledge basis then it is called judgments sampling. As a if it is to know that what is the approach of villager towards population control programmed and researcher selects only three (3) or four (4) villages do his studies and on that basis expressed his view about whole villages then this 3-4 village's sampling comes under judgments sampling. These 3-4 village's selection behind researcher's this wisdom or knowledge that these villages represents whole population of villagers. Really it does not do, it is another matter according to his decision do it in fact.

Thus in judgments sampling are the some defaults which is mentioned under purposive sapling. On the basis of it gets results are not much accurate. Much errors exists in those also, rather than in most studies, particularly in sociology field studies has been done on there types of sampling.

Thus how many non-probability methods are they are not satisfactory. Their accuracy cannot be estimated. How much errors occurred in their results it cannot be calculated. Hence on their sampling based result nothing can be said on the characteristic of populations. The generalization of result is not possible then it cannot be said that all these methods are futile and worthless. Whatever rusts obtained under these they can be produced new concepts, new approaches, may types of extra conceptions, which testing can be done scientifically afterwards. In that case, where more accuracy is not needed as a in preliminary studies, their this method is proved to be useful. Consequently where researcher's has not complete knowledge of population or format of units is neither cleared nor possible or compulsory, in that case this method can be used, but it is absolutely desirable that the explanation of result keeping in mind all these constraints.

Self Assessment

State whether the following statements are True or False:

4. Non-probability sampling technique's under, all units of population appears equally.

5. Incidental sampling method, there is not any pre-planning of sampling.

6. Quota sampling method is alike standardized probability sampling method.

7. Non-proportional standardized probability method is a expensive method.

20.7 Sampling Errors

In sampling techniques context an important concept is sampling error, to understand it through and through very essential. The question of sampling error arise where there basis gets results imposed on population means it can be said that whole population have same. Characteristics which are found in sampling. The result obtained by sampling's basis they are mostly in the form of statistical values or measures, as a sample's mean on any variables relevancy of two mean's difference means T-Value or F-value. After the testing of there value, which conclusion is drawn that becomes the base of population's and said that which is correct about sampling that will be correct about population too. This is called generalization, but this types of generalization is only possible when sample represents population. How much will have capacity he as will be the possibility of generalization. It says so because if sample is much represents population means uniform to population then that value which obtained sampling's basis, that value will be of population also, means if value will be calculated taking whole population some variables then it will be equal or almost equal to sampling's based value. It can be said as this type also that how much population value differ from sampling value (how much difference will be), as much as error in sampling based value. Thus sampling's error means that magnitude of difference of population value and sampling value.

The difference between population value and sampling value exists due to a number of reason, but one factors of these cause is lack of uniformity or not representative of sampling to population. Such a assumes are that, sample has been selected by randomization then it will be representative, but can1-precent similar to population cannot be said. Thus having sampling value is not considered to be errorless and if sampling has not been done by randomization then it will be not represents at population at all. In that case sampling is much more. Thus sampling error's related is connected with sampling selection's method types of sampling.

Types of Sampling-error

Sampling error are of two types-(a) Random error (b) Systematic or constant error.

(a) Random error is related with randomization to techniques. It is assumes that in randomization selection differences between units are eliminated to one another as a result of that which value obtained by sampling value based that is very close to population's value and error becomes less to a fair degree rather than it cannot be assumed that error eliminated completely. Rather some errors are remain. This is called random error. Its characteristics is that it cannot be eliminated completely but (a) do it less (b) as far as, possible it can be estimated. There is a one method to less it is increase the size of sample. How much percentage. Sample occurs how much error or what is the maximum limit of error it can be known. For this firstly standard error (S.E.) is calculated- whose formula is

$$S.E. = \frac{S.D.}{\sqrt{N}}$$

Suppose that S.E. is 2.0 then is 95 percentage sample's this error will be ±1.96 × 2= ±3.92 and in 99 percent sample it will be ± 2.58 × 2= 5.16. If sample's mean is 100 then in 95percent population mean between 96.08–103.92 will be. Similarly in 99 per cent it will be between 94.84–105.16. Thus on error basis population value can be estimated but it only possible when sample is selected by randomization and it represents population. Random error's concept is related to this.

(b) Systematic or constant error, occurred due to sample's biased. In this error between units of sampling which difference occurred they are not eliminated to each as it happen in the case of random sampling rather than this differences presents in all units in uniform format and are directional means effect

full in one direction, either increased or decreased in all units equally. For example, if it is to known that what is average achievement of any town's ninth class' students' in mathematics and to know it we calculate some schools' any class '9' (A) students' scores doing measures calculate average than in this standard error will be included because general in section 'A' keeps most intelligent boys Hence their scores will be found increased equally. All students' marks will be higher. Similarly we will take section 'C' then all students' marks will be appeared as decrease because in section 'C' keeps generally systematic least intelligent student. Thus error activates in one direction equally. Either increase or decrees measures.

There is on one method to eliminate or reduce systematic error is that sample section is free from bias. By randomization doing sample-selection this error is controlled, but generally there are such a type of error that it cannot be seems. In research field it is supposed to be bad error because it cannot be estimated by any means. These are beyond the range of statistics probability theory. Sometimes it is hard to know in which direction they are active. Hence at the time of research must be very caustics about that by any means it may be possible should be try to controlled it completely.

20.8   Summary

- Probability or problems of chance is occurred there we do not have keep complete knowledge of any subject and definitely we cannot something regarding that.

- On the basis of probability sampling that in experiment testing how much error is included. This error is the symbol of sampling based result and population based result. It is called "error limit" or "accuracy limit."

- There are two types of probability sampling techniques-(i) Simple probability sampling method (ii) Standardized probability sampling technique.

20.9   Keywords

1. **Economical method-** Methods which finished in less expenditure.
2. **Standardized sampling –** Such a method in which units are selected from each section, it has no relation with size of section.
3. **Context –** In described matter.

20.10   Review Questions

1. Describe probability sampling techniques.
2. Mention types of probability sampling techniques.
3. Give light on standardized randomization.
4. Explain about size of sampling.
5. Describe non-probability sampling techniques.
6. Give light on sample error.

Answers: Self Assessment

1. Two	2. Chits	3. Systematic	4. False
5. True	6. True	7. False	

Notes

20.11 Further Readings

Books

1. Education Technique and Assessment—*Dr Rampal Singh, Bhatt Brothers.*
2. Educational Research Methods—*Sarin and Shashikala, Vinod Pustak mandir.*
3. Educational Techniques—*S.S. Mathur, Bhatt Brothers.*
4. Educational Technique Management and Assessment—*J. C. Agrawal, Bhatt Brothers.*

Unit 21: Hypothesis: Concepts, Characteristics and Sources

Objectives

After studying this unit, students will be able to:

- Understand the meaning and structure of hypothesis
- Understand types of hypothesis, purpose and importance
- Understand source or element of hypothesis
- Understand evaluation of hypothesis.

Introduction

After the final decision of research problem their solution process begins means data collection is started, but before starting to collection of data it is necessary to definite for in which direction proceed. Formula is vested in that hypothese which is formulated by researcher on the basis of their knowledge by study, imagination and creativity.

In absence of hypothesis he will have to wander hither and thither by that his time and power will be consumed. Hence all researchers admit that as far as possible, the beginning of research should be done from hypothesis because in **Wann Dalen** words "Hypothesis works as a lighthouse in path of research."

21.1   Meaning and Structure of Hypothesis

When before any person any problem arises then he thinks about its solution. As a result, which measures comes in his mind that is probable solution of problems. It is another matter that later

on it proves true or false. For example a student is declared failed again and again in test. What is this reason, to know that for research he is submitted to a psychologist. For the solution of problem psychologists his causes of failure's do hypothesis. It may be he is of lack of intelligence, he is weak in study already, may he become sick in time of test, may be he is not interested in study etc., a number of hypothesis may be possible. Among these which are true and which are false. If solution is present into a question format (as a why student fails again and again) then these hypothesis can be possible answer of that question, but this is a starting point of research process.

Notes   In **Townsands** words "Hypothesis is the projected answer of problem".

"Parikalpna" is Hindi translation of English word hypothesis, which means such a thesis which is hypo. In **Hodnet** words, Hypothesis is the eyes of researcher by which he peeps into unsystematic facts and discovers their solution. **Waan Dalen's** according; hypothesis researcher's solution of problem or about the answer of problematic questions an intelligent guess. He assumes hypothesis such a solution of problem which is only in the form of suggestion. **Karligar** assumes that hypothesis is an imaginary statement about the relation between two or more than two variables. As a "intelligence affects boys" academic achievement". This is a hypothesis. In this between achievement and intelligence, a special type of relation has been imagined.

When any problem occurred before any person and he tries to find out the solution, then first he imagines on the basis of his knowledge, experience, studies etc that what would be the solution of that. Alike as he tries to answer of any question, then first assumes that what would be their possible answer. He presents these probable solution, possible answer in ' format of generalizations and after that it is tested that how for they are time. There generalizations are called hypothesis. Similarly hypothesis in **Best** (1977) Words, "Such an inference which is formulated for the explanation of objectivity, incidences and circumstances are done temporarily, and which helps to further proceed of research work means later on if it is verified then solution of problem is and position is cleared". In our daily life occurred problem's solutions (e.g. formation of hypothesis and later their test) is done similarly.

Lighting bulb in the room all of sudden put out, immediate person asks to himself " what happened" a problem is occurred. The solution of a problem to get the answer of this he formulates one by one hypothesis and tested them. In the final status is cleared first do guess means formulates hypothesis "Probabilly electricity is cut out from sources". Having gone outside watches rest of the houses and finds that all house electric supply is continuing. Then this hypothesis "Fuse of my own house has not gone out of order". Having unplucked cut out he tests it and find that there is no disorder in it. This hypothesis to proves false. Then he do an another third hypothesis "Perhaps bulb had not fused. After the testing of bulb he finds that bulb is fused. This hypothesis proves true that bulb has fused and the whole situation become clear to sort out all the problems. Some process is followed and in that hypothesis (inferences, probable answers and solutions) plays on important role. Hypothesis too is a special and scientific process to sort out of problems. Hence in research two hypothesis has an important role.

Which is known, regarding that 'what is' 'why is' regarding this inferences is the hypothesis.

21.2   Types of Hypothesis

Applied scientist user in his research process a number of types of hypothesis. Various writers have described it by different types. It has been explained in details ahead.

Good and Hatt's classification

Good and **Hatt** (1952) have mentioned three types of hypothesis. He classified it on this basis that in hypothesis expressed, what is the level of obstruction? If the level of research is high then hypothesis' level also will be high. This depends upon that how abstracter extensive the conclusion and generalization of research are. By this approach hypothesis are of three types-

(i)   lowest level

(ii)   Higher level

(iii) Highest level

(i) Lowest level hypothesis: This type of hypothesis is found only in lowest level and they explain only some empirical uniformities. They are in the form of ordinary guess and statement. As an eleven years old boys' are very sensitive, average level of intelligence of students of class eighth between 90-100, India's backward classless socio-economic condition is not satisfactory etc. These are of low level's research hypothesis.

(ii) Higher level of hypothesis: From the aforesaid, higher level hypothesis concepts are based upon mutual relation. In these the matched level. These are vested in matched express any abstract concepts. The purpose of research of these types based hypothesis is extensive study of incidences.

Example   As a due to rapid physical changing an eleven years old boys are most sensitive.

In this hypothesis the purpose of research is not only to know that these boys are sensitive or not, but also further to know that is their sensitivity cause within him rapid physical changing. Hence this hypothesis is no longer of low level become some complicated.

(iii) Highest level of hypothesis: In this level of hypothesis abstract thinking's highest level is vested. Thus this level of hypothesis is the most complicated. First and second level's hypothesis's related from, "what is" where as third (highest) level's hypothesis related with "why is". On the basis of highest level's theories and laws are evaluated. For example to guess that why and how Physical changing become the cause of sensitivity, will give occurrence of highest level of hypothesis physical changing and sensitivity related empirical uniformities mutually connecting will research that link which is of another chain's link. In this case level of thinking will be most abstract. Research complicatedness will be too much. The formulation of this type of hypothesis will be depend upon research's high level creative capacity and imagination power.

How the statement of hypothesis has been done from this point of view they are of two types. These are— (i) Question form and (ii) Declared form

(i) Question form hypothesis is in the format of question, as a – Does home environment effects psychological development of boys'? Some researcher likes hypothesis' question format.

(ii) Declared hypothesis is in the form of assertion. In that one facts guessed declaration. This facts is in the form of any events true position or about variables' mutual relation. This is very simple statement as home environment affects the psychological development of boys. Mostly researcher presents their statement in this format.

There is no differences between these two forms. Only difference is to write and to statement.

From an another approach hypothesis have been divided into two categories- (i) Experimental hypothesis and (ii) Statistical hypothesis

(i) Experimental hypothesis are called substantive hypothesis, scientific hypothesis, research hypothesis, operational hypothesis general hypothesis, empirical or alternative. It can be expressed in two forms- Question form and declared form consequently it can be of any level – low, higher, highest.

(ii) Statistical hypothesis is called null hypothesis, elimination hypotheses or zero hypothesis. The testing of experimental hypothesis could not be done on oneself basis. Therefore it has to change in statistical form do their testing indirectly. Statistical hypothesis is tested by statistical method. In this testing it has rejected experimental hypothesis is accepted. For example "Home environment affects self concept". This experimental hypothesis changing into statistical hypothesis it will be expressed as it " Home environment does not affects on boys' self concept".

From an another approach statistical and experimental hypothesis are of two types—(i) Directional and (ii) Non-directional

Directional hypothesis is called one-tailed hypothesis also. In there comparable groups differences direction is determined means one groups mean second groups mean's up and down taking which side of randomized curve, it is directed. In this only one side of normal probability is used as Boys' academic achievement is better than that of girls' achievement set it first – Two change it is null hypothesis "Boys' academic achievement is not much better than girls' academic achievement." For the testing of this hypothesis girl's academic achievement's mean will be blocked middle of normal probability curve and boys mean's on the right end. Difference will be only one side of curve.

Non-directional hypothesis is called two-tailed hypotheses also. In this group's mean's differences will be taken only one end of curve, such is not mentioned. This differences lies on either side of the curve means direction of differences is not mentioned. As a "There are a differences between boys' and girls' intelligence". (Statistical "there is no differences) In this hypothesis this is not mentioned that any intelligence mean is less or more from another groups' mean only to observe that difference is or not. If boys' intelligence's mean put on the centre of normal probability curve, then girls' mean from curve's centre on either side. If boys' are less than mean then left side and if more than right side. Whiever side will be, differences will be. This is to be testing. Hence this type of hypothesis is called two-tailed or non-directional hypothesis. Only to write the hypothesis' statement that it is directional or non-directional. In non-directional "Difference is" or "difference is not" user these words but in directional "is less", "is much", "is superior", "is good", "is bad" etc. such words are used.

\[\textreferencemark\]?

Did You Know?   Word 'Parikalpana' is Hindi translation of word 'Hypothesis'.

21.3 Importance or Purpose of Hypothesis

In research hypothesis' has important roles, be carve a number of purpose satisfies by the medium of it.

Researcher's view's is that where it is possible there research should be taken assistance of hypothesis, but it means not that without hypothesis research cannot be done. According to **Karligar's** without hypothesis also research is possible. According to him particularly in exploratory research, hypothesis is not inevitable, but in modern science field it is not possible. **Waan Dalen's** view is that in those researches in which relation of cause-effect is aim, hypothesis is particularly required. If the aim is to describe any event's present status then, there is much need of it, although there too researcher's may have for the discovery of suitable research-scope hypothesis may needed. In fact in the initial stage of research whenever problem is not finally at exploratory stage. Hallway's statement is too in such a research whose purpose is to data collection only, being hypothesis is not necessary. Historical research, descriptive research, legal research, documentary research, bibliographical research etc possibility of use of hypothesis is nominal, rather than in some cases these research too such can be, in which use of hypothesis proves useful. These field's studies generally based upon inductive logic

system. Hence in that research does not begins from hypothesis rather finished by hypothesis. **Beacon** had given challenge to compulsion of hypothesis in research whose statement was that hypothesis is produced bias and prejudice in the researcher, by that objectivity of research becomes less, but it seems no justification in it.

In fact hypothesis has great importance in research. There are number of advantage of its.

1. **Mouli**, "According to hypothesis clarify the direction of research. As a result researcher has not wander hither and thither. He can avoid collection of unnecessary facts and information. He does not kill his time in study of fruitless literature because hypothesis determines avoid that which types of facts to be collected and what is to be studied in which book." Thus, according to **Waan Dalen** hypothesis is worked like a pool between research problem and sort out of solution. It clarifies the limitations of problems what is significant and what is not, it can too determines by hypothesis. Consequently which facts and proofs are collected how show they classified, it is clarified also hypothesis wine their composition and analysis is possible to do. Which variables are vested in hypothesis only to know about that. Thus research's saves a lot time money and power.

2. By research hypothesis it can be clarified also that how research methods should be used for research design. Which types of relation assumes in hypothesis for the testing of that accordingly design is selected. A number of design of collection of data, and their analysis as a pre and post testing, controlled groups design are available. Which of them will be more suitable it depends upon that what is hypothesis. Likewise a number of methods data's depends upon selection of hypothesis too. Hypothesis indicates that data will be collected by which persons, which place and which type of Psychological test. From this point of view hypothesis has a great importance in the field of research.

3. Hypothesis presents that framework also, in which as a result of sort out of problems conclusion is established. For example. It is to be studied boys' problematic behavior then selected to hypothesized cause factor, what tested that and at that framework. Problematic behavior will be explained. There is no question arise to go beyond out of that. Hence to explain the problem in objective form, hypothesis is very helpful in the presentation of research's result significantly gets much help from that.

Example　　　When we watch a figure the whole image prevails in the brain in the same way conclusion based on hypothesis exported collectively problems form.

4. There are a number of aspects of problem whose study is essential and important but all of them cannot be studied together. Which aspect is to be studied or going on, it is cleared from hypothesis. Thus hypothesis is a path which indicates that where to arrive. **Karligar** compared research to scientific game and said that like player, research "First set chance and after that throw dice. First throw dice then take change, not such happen. After the collection of data, chance cannot be changed.

5. Hypothesis is not the final point of creation of knowledge. Testing of a new hypothesis gives birth to another, second testing is third. Like the waves of a ocean then push to each other ahead as a result of that knowledge range is extensive. Each research's hypothesis indicates towards next hypothesis.

Self Assessment

Fill in the blanks:

1. According to Waan Dalen, hypothesis in the path of …………… is worked.

2. Research too is special of sort out of problem………… process.

3. Low hypothesis ………… founds in research level.

4. Higher hypothesis ………… based upon mutual relation.

21.4 Sources or Elements of Hypothesis

Hypothesis's formulation is as tough as selection of problem and source of elements of hypothesis is same as selection of problem. There is no fixed method or formula for formulation of hypothesis like selection of problem, but some essential condition, circumstances and base is which is helpful in this work. These are called soure of formulation of hypothesis or elements or helping factor.

1. Researcher's study knowledge and Experience: These three are much helpful in the formation of hypothesis. Not only the study of own subjects, but also other subject's study is much beneficial. From interdisciplinary studies develops new ideas, increased knowledge as a result of that problem based variable's.

New relation seems, which sometimes give birth to a suitable hypothesis on the basis of intensive and extensive study only researcher can find out that how much and what types of study for research determined subject have been done so far, how they have been tested under hypothesis, which types of error are, which are new direction, towards which researcher's attention has not been gone so far. In hypothesis based variables which are theoritical conceptions are, after the study of that their operational definition's knowledge is acquired. On the basis of that variables' related, formulation of hypothesis get help. In the framework of research subject researcher's will as much knowledge of that as much their concepts of that. He will have to able to formulation of hypothesis as logical and important.

Sometimes apart from own subjects, study of other subjects is much beneficial regarding this. In education, Psychology and in Sociology's field a great many concepts are which have been taken from other fields and on that basis in this field completely new type formulation of hypothesis doing they have been tested. For example **Kurt Lewin** for the explanation of human behavior formulation of that hypothesis and testing them that was based upon Physic's concept forced. Like user controlling of behavior **Feed-Back** rule had been taken from engineering thermo state. Thus this type of completely new insight is developed through extensive and intensive study. Thus researcher's background of knowledge is an important source of suitable and superior hypothesis.

Researcher's own experience role is not less important regarding this. Events happening in the community, conditions of life, behavior of a person, works of institutions, purpose, process of work and going on changing is political, social and economical's as extensive experience researcher's will have as able he will have precise, significant and suitable formulation of hypothesis. These experience of their in the clarification of problem based variables many and different types of relation helps reseacher's. Among these new and fundamental hypothesis prevails.

If a researcher's study knowledge and experiences range is very intensive then there is not possible for him to discovery of new relation of problem based variables and formulation of fundamental hypothesis.

2. Mental Caliber of Researcher: These are too a source of formulation of higher level hypothesis. Study, knowledge and experience in itselves do not able to formulation of hypothesis, but at mental level their manipulation or at mental level their explanation, composition rationalisiation, etc., are important. The birth of a for said hypothesis by such mental exercise. Researcher's creative ability a great role in this creative thinking mutual relations of problem based variables presents into a new dimension. Then formulation of higher level hypothesis becomes simple and possible. Researcher's imagination is a powerful chain of process of formulation of hypothesis. Science had done miracle taking the help of imagination of human being. Scientist **Alberrt Einestine** assumes that maris

imagination is much more powerful than his knowledge. A high level imagination researcher's far go beyond to conventional problem-solution, pre answer of questions. Hence research's far does not admit it. He thinks over that seriously "Why' "What", "How" enters tough valleys and is discovered such a new facts, perspectives relevancies, factors which presents, before then problem into a new and wonderful approach and give birth to very new hypothesis. **Thorndyce, Pavloveas'** and **Skinner**, behind the evolution of induction-theory such a types of hypothesis will haves.

3. Reasoning by analogy: alike conditions and event's logical analysis is also helpful in the formulation of hypothesis. Some times are subject or one field events, ideas and theories much alike to other subject, events of region, By comparing of that or doing analysis after matched, sometimes researcher's finds a new ideas which is helpful in the formulation of fundamental hypothesis. It is called reasoning by analogy. For example a research studying effectiveness of academic institutions, reads in the book of sociology that lack of controlling in society give birth to social disorder and corruption. He is compared to that condition of academic institutions condition, analyze that then this idea born that if lack of controlling within academic institution then it can be spoiled the environment of academic – institution and its adverse effective non of institution.

4. Some other suggestions: In the formulation of above hypothesis time has its own importance. On the problem of research upto a long period of time thinking should be done seriously. Thought over that should be a different point of view.

⚠️

Caution   Researcher's should not do hurry in the formulation of hypothesis.

At times for some time problem should be forgotten. To do so in that thinking alesence period research's subconscious mind will have thinking over different aspects of problems, worked a little aloof from conscious mind thinking link. Hence unexpected but very useful hypothesis prevails.

Researcher guide, experts, administrator, officer sitting with colleagues and discussion with him seriously over hypothesis is useful in this context. To give speech on any aspect of under research process problem (if get a chance), write essay on that, presents problem in seminar for discussion etc. are beneficial.

Self Assessment

Multiple Choice Questions:

   5.   Declared hypothesis is _____ in the form of statement.
        (a) Indefinite   (b) Definite   (c) Changing   (d) Neutral
   6.   Question form hypothesis _____ is the form of _____ .
        (a) Question   (b) Answer   (c) Alternative   (d) Incidence
   7.   Directional hypothesis is called _____ hypothesis also.
        (a) Two tailed   (b) One Tailed   (c) Parallel   (d) directed
   8.   In research hypothesis have _____ role.
        (a) Negligible   (b) Worthless   (c) Important   (d) None of these

21.5   Evaluation of Hypothesis

The evaluation of hypothesis means that to which hypothesis is formulated how far they are suitable mean how far those characteristics exists which should be in a good hypothesis. Experts has described

good hypothesis, accepted imagination some merits. There are formulated criterion of required hypothesis. The characteristics of this criterion are following-

1. Hypothesis should be Plausible: Its meaning is that which solution possibility express in those, that seems logical and true. In other words which relation is imagined among variables, from any point of view they are logical. If that relation from any point of view cannot be reliable about their to be true then that hypothesis cannot be understood suitable. This hypothesis is that "available number of bench and desk in school affects students' academic achievement" totally beyond reliability, because between the number of bench and desk and students academic achievement from any point of view seems no relation. Which relation has been imagined that is neither relevant nor logically possible. There is no relation at all between number of benches and desks and students' academic achievement- neither any experience basis nor theory basis or previous experiment basis. Hence this hypothesis is not plausible. It cannot be accepted thus a suitable hypothesis is that presents a logical, reasonable, reliable, facts based possible explanation. Consequently it should not be impossible from implementation point of view. As a "This hypothesis that six hours study in a day in place of it eight hour study doing students' academic level can be gifted. From implication point of view it is impossible. Due to a number of factor increased the study hour could not possible. Beyond this inherited relation in hypothesis or solution not go against ongoing rules and theories "To rise the academic levels of student fear and hard discipline is necessary". In this hypothesis probable solution "fear and hard discipline "is against the theory of Psychology. Therefore this hypothesis is not acceptable.

2. Hypothesis should be testable: Its meaning is that which possible solution or relation is imagined means which explanation of solution presents, that is such a type that it can be tested As a – " intelligent but underachievers is suffered from low feelings both are such a characteristics that their measures means hypothesis testing is possible. Now we can say that "intelligences students' failure cause their pre-birth rites", then this hypothesis cannot be accepted because" "pre-birth rites's measures is not possible. Hence hypothesis cannot be tested. If inherited variables of hypothesis result's practically observations, testing and measures cannot be done, then testing of hypothesis cannot be done also. At that it is considered to be, worthless. Similarly if hypothesis used variables analysis any technique or method is not available then their testing, measuring will not possible. If problematic variables' nature is such that in their measuring will take many years then that hypothesis is not understood as good hypothesis, although that is not a hard and fast rule.

If in hypothesis such variables are included that cannot be defined then their testing cannot be done. As a hypothesis "modern age tendencies has been adverse effect on life style of true religious person" in "modern age" "tendencies" "true religious" "life style" all these words or variables are such that which cannot be defined objectively . Therefore, it cannot be measured also. In this case, hypothesis can not be tested also.

This from any reason or approaches hypothesis used variables and measures cannot be done then it does not consider suitable, because their testing cannot be done.

3. Hypothesis should be extensive: Hypothesis as much as extensive, as much as considers to be beneficial and valuable. Its meaning is that, the hypothesis which "problem related all or much more facts explained, that is considered to be extensive and useful. That hypothesis from this point of view is very limited, that has no utility. Hence to make hypothesis useful, try to make its field more extensive. For example, in education Psychology for the explanation of induction many hypothesis are available but none of one do not explain some, second other facts. Not a single hypothesis field is so much extensive that it had explained all those facts and events whose others do different hypothesis. Suppose that a hypothesis is " achievement motivation the most important". If this hypothesis explains only eighth class' students' academic progress or does not explain any other circumstances, facts or incidence then it will be considered to very intensive and their utility will not be too much . Now if it explains all levels students' academic progress then their extensiveness will increase. Similarly, if achievement motivation's importance besides students, teacher's progress their learning, teaching progress etc., founds, then their extensiveness' field and will be much extensive. Similarly it explains

industrialists, traders, lawyers employers states and nation's progress, then it will be considered to be extensive and useful. Hence, if any one hypothesis's basis if any generalization is available that explains or presents different fields' in different circumstances happened events and problems, then that hypothesis will be considered to be more extensive, useful and beneficial. Theory of gravitation, atomic theory, theory of evolution such a hypothesis's example, whose explanatory power and problem solution are much extensible.

Task   Give your thoughts on hypothesis testing.

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4. Hypothesis should be theory based: Hypothesis in related field should be based upon using theories. In every hypothesis between variables a relation is imagined, but this imagination pro-theory means a solid base should be for such thinking. These bases are pre-researched theories, rule, generalization etc., in the form, available. Those hypothesis not opposite to it rather accordingly theories that is considered to be suitable; As the hypothesis is that "Students' positive self-concept is the factor of their tested higher success' can be considered as theory-based. Success in test is a special type of behavior which a number of other behaviors such as –present in the class regularly, read attentively, practice regularly, try to eliminate difficulties etc., depends on that. Behavior is affected by persons' personality qualities. **Karl Rodger** and by many others Psychologists postulated "Self concept theory" assumption is that positive self-concept give birth to constructive, organized and integrated. For higher level testing Success these types of behavior is desirable. Hence positive self concept should be a factor of tests success. This hypothesis founds to be attached with use theory. Pre determined imagination, ideas, guess relation's imagination theory originated mean theory based is. Accepted theories appose or against that hypothesis is not considered to be suitable. Such hypothesis' that present theories short comings, their errors, to remove their inconsistency formulated can be accepted but they do no match with familiar theories or not supported by any theory then it cannot accepted.

5. Hypothesis should be purposeful: Its meaning is that hypothesis should be related with hypothesis, means be it should present the solution of problem. Any problem from many point of view a number of solution can be. As a result from different approach a number of hypothesis can be, but all those hypothesis should be purposeful necessarily. Rather than differ from each other which is the purpose of problem solution from that point of view hypothesis should be related to that purpose. For example, students' failure in test in cause finding from many point of view hypothesis can be formulated. From Psychological point of view "Lack of motivation and interest in student" from sociological approach it can be hypothesis "Students' economic social environment not be favorable", Similarly educational approach hypothesis can be "Teaching method not be suitable" But all these hypothesis rather to differ each related to problem's solution's acceptable forms, hence all are acceptable. Difference means that oppose to each but rather they should support to one another. Each hypothesis is formulated for a definite purpose. So, to fullfil in that purpose should be supportive, only then it is considered to be suitable and acceptable.

6. Hypothesis should be simple: Its meaning is that , to present the solution of problem or their explanation simply means presented solution is not based upon such a complicated solution is not based upon such a complicated theory, assumption, conception that it is hard to understood. If possible the hypothesis present in simplest form is considered to be more suitable. Thus hypothesis presented in simple precise and in consistent language is required. Use of unnecessary words, use of tough word, impulsive or value based expressions for hypothesis not appropriate. For example this hypothesis that "Students who are at the top of success, who are set forth example stars are rich of intellectual talents." From aforesaid point of view it is not to be said acceptable. Directly it is to say more suitable that "to achieve good success in examination students' are more talented."

21.6 Summary

- Parikalpana is the Hindi translation of English word 'hypothesis' that means such a thesis which is hypo.

- In **Hodnet** words hypothesis are the eyes of researcher's by which he peeps in problematic in consistency (unsystematic facts) and in them sort out of problems.

- Research too is a specific and scientific process of sort out of problem. So, in research also hypothesis has an important role.

- Hypothesis has an important role in research because various purposes fulfils by that medium. Karilar's according without hypothesis research is impossible. According to him particularly in exploratory research hypothesis not inevitable, but in the field of modern science such is not possible.

- **Waan dalen's** view is that those research in which cause-effect relation discovery is aim, hypothesis is required particularly.

21.7 Keywords

1. **Creativity -** Creative or making new things
2. **Null –** Worthless, zero

21.8 Review Questions

1. Give the definition of hypothesis and explain its meaning.
2. Doing classification of hypothesis, mention its type.
3. Clarify the importance and purpose of hypothesis.
4. Mention source or elements of hypothesis.
5. Evaluate hypothesis.

Answers: Self Assessment

1. Light house	2. Scientific	3. General	4. Concepts
5. (b) Definite	6. (a) Question	7. One tailed	8 (c) Important

21.9 Further Readings

Books
1. Educational Techniques—*R. A. Sharma, Bhatt Brothers.*
2. Educational Research's procedure—*L. Kaul,Vikas publishing.*
3. Educational Technique – *S.S. Mathur, Bhatt Brother.*
4. Educational Technique and Assesment—*Dr. Rampal Singh, Bhatt Brother.*

Unit 22: Formulation and Testing of Hypothesis

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Objectives

After studying this unit, students will be able to:

- Know the formulation and fundamental basis of hypothesis
- Know formal conditions for testing hypothesis
- Know testing of hypothesis.

Introduction

There are more than one formulation of hypothesis to solve any problem by statement. When some problem arises in front of a person and he tries to find out the solution, then he imagines what will be the probable solution on the basis of his knowledge and experience. He presents hypothesis of probable solutions and probable answers and then he examines to what extents this hypothesis is correct.

22.1   Formulation of Hypothesis

There are more than one formulation of hypothesis to solve any problem by statement. Here are three formulation of hypothesis of one problem that will decide the solution of problems-

(a)   Prize increases the achievement of study.

(b)   Prize decreases the achievement of study.

(c)   Prize does not affect the achievement of study.

First two hypotheses are directional hypothesis and third hypothesis in non-directional hypothesis. Principle of excession can be used for class excession. Second hypothesis cannot be said as good

hypothesis because it is not right to use it and there is no principle foundation for this hypothesis.

There is no need of any base of principle for **third type** of hypothesis, so this can also be used, but only one hypothesis can be used out of first and third hypothesis. Both hypotheses cannot be used because these are contradictory to each other.

Entry and exit both are used for thought process. Many psychologists and principle of education use both types of processes in which formal behavior is used in the format work.

Notes   For research, entry and exit both are used for thought process in making hypothesis.

Thought process of entry and exit can be used for the research of formulation of hypothesis conclusions derived from the special condition of hypothesis are generalized. Research process used to get conclusions from research the basis of hypothesis.

Hypothesis is a probable assumption on the basis of knowledge and principle. It directs the work of researchers. The most important and difficult work of a researcher is to formulate hypothesis. There are three characteristics of a good hypothesis:-

(a)   Enough data are collected with patience.

(b)   Conclusions can be derived and generalized.

(c)   To get result discussion are made with the quantitative data.

Hypothesis plays an important role in the process central point of research. Hypothesis is the entire research process which helps in the selection of new method, measurement of process formation of research, collection of data and discussion with data.

According to a study, analysis and confirmation of main hypothesis is done but with this analysis secondary hypothesis is also confirmed. When many hypothesis are used then each hypothesis is formulated in a separate form and it is presented on which basic principal of hypothesis is made data are analysed for the confirmation of each hypothesis so that it can be accepted or rejected. According to **H.H. Mackson**, purpose of research is not only formulation of hypothesis and its confirmation but also to discover new facts. Formulation of hypothesis and its confirmation is not made in all research works research is also done without any hypothesis. Hypothesis is meanly used in the research.

Self Assessment

Multiple Choice Questions:

1.   There are _____ formulation of hypothesis for solution of any problem by speech.

     (a) One   (b) Some   (c) More than one   (d) None of these

2.   Both entry and exit are included for _____ process.

     (a) Study   (b) Thought   (c) Attraction   (d) support

3.   Researchers are related to realities at two levels – operational and _____ .

     (a) Unprofessional   (b) conceptual   (c Social   (d) Psychological

4.   Hypothesis is a probable _____ which is based upon knowledge and principle.

     (a) Assumptions   (b) Reflection   (c) Criticism   (d) Study

22.2 Fundamental Basis of Hypothesis

Researches are related to facts at two levels.

(a) Operational and (b) conceptual

> (a) Appropriate words should be used to define the analysis of events and facts at **operational level** so they actual facts can be used in the research.

> (b) At **conceptual level** researchers should define events and facts in cause, affect form to get the knowledge of that events. At this level researchers define events in such a form in which he tries to move from specific event to normal event. It gives the knowledge of relationship between variables and its capacity. Normally there is a movement from operational to conceptual in the formulation of hypothesis. Researcher generalizes from event and provides its benefit universally. It is necessary to define events and facts at both levels for research because at operational level definition confirms hypothesis. At conception level definition shifts research from conceptive to operational.

Did You Know?   Aim of research is not only formulation of hypothesis and its confirmation but also to discover new facts.

Difficulties in the formulation of useful hypothesis: Generally these are the problems in the formulation of hypothesis as mentioned below:-

> 1. Lack of clear theoretical context.
> 2. Lack of capability and ability to use theoretical context.
> 3. Lack of complete knowledge of available experimental equipment and its process.
> 4. Lack of ability to formulate hypothesis in appropriate words.

Task   Express your news about the difficulties in the formulation of hypothesis.

22.3 Formal Conditions for Testing Hypothesis

There are two types of formal hypothesis.

> 1. Research hypothesis and
> 2. Quantitative hypothesis and zero hypotheses.

Researchers formulate their research in two forms-Directional hypothesis and non-directional hypothesis. Available data are analyzed and lasted by statistical processes. Zero hypotheses is used in this technique. Some formal conditions for testing hypothesis are necessary such as:-

> 1. Exit process must be used in the statement of hypothesis so that it can be generalized.

Caution   Hypothesis must be written in formal and clear words.

> 2. The structure of hypothesis must be in such a form which can be accepted or rejected

3. Report of hypothesis must be special and in tested form so that formal side of hypothesis can be examined.

22.4 Testing of Hypothesis

Development of hypothesis is not a solution of problem. Hypothesis is only an expected solution of it. It is a solution of problem which is understood when it is accepted. Acceptance and rejection of hypothesis is made on the basis of external appearance. So, researchers analyse the hypothesis after its development. It has been decided on the basis of analysis. Whether it represents solution of problem or not. Formulation of hypothesis depends on three things- (i) Fixation of results of hypothesis, (ii) To decide whether results are really available or not so that its measurement, analysis, selection and analysis of verification of tests and the method of analysis, (iii) To collect data (related research and its analysis and testing and to conclude whether the hypothesis under consideration is acceptable or not acceptable.

1. Fixation of Formulation of hypothesis

Under this it is decided if hypothesis is true then in which form and where its result will be available. Some hypothesis are in such a form whose results of external events, situation and facts are available directly of appropriate situation, place and form. Example, of hypothesis "Road accidents happen more at night ", then the result of hypothesis is true means number of road accidents at night will be more than day and its number can be worked out. Result of some hypothesis are not available apparently. So, their indirect forms and presentation have to be discovered.

Example   If the hypothesis is "It is difficult to accept mentally-retarded children socially."

If hypothesis is true then its results cannot be seen apparently. Results of expression can be found in apparent form. There results can be fight among mentally retarded children, low in the member of their friends, their more sentimental, to live separately, not liked by their friends. It is not easy to find these types of invisible results. It is very necessary to conclude that selection of results should be compels only related to the hypothesis. It these are not related to hypothesis then their testing is useless. Along this their presentation must be in clear and measurable forms and in the form of situation and events.

2. Selection of methods of testing and development of testing

Development of hypothesis is the probable solution of problem. That probable solution can be true or false. So, the next step of research is to discover methods and medium of testing of hypothesis. To present evidence on the basis of which it is decided whether the hypothesis is true or not. There data are available by physiological medium and testing. There are deduced consequences of movable research data which means these are the information on the basis of which it is tested by hypothesis whether it is true or not. So development and selection of methods must be valid and error-less otherwise in the absence of valid information unavailability of correct evidence it cannot be concluded whether hypothesis is correct or not.

Self Assessment

Fill in the blanks:

5. After development of hypothesis………………. tests the hypothesis.
6. Development of …………… is the probable form of solution of problem.
7. There are mainly three ……. of testing of hypothesis.

3. Hypothesis–Testing: Last chain

On the basis of selected methods and information from the medium of testing, data is collected and tested and its main aim is to select or reject the hypothesis. The first thing to be kept in mind that hypothesis can be selected or rejected. It can not be proved and verified. The words "To prove" and "To Verify" show that these words are "Final truth", "Undoubtely true". It is true which actual situations are different. The truth is that testing of hypothesis is verified in the probable from. So the use of words" Acceptance "or "Rejection" are considered correct and are presented in the probable form of conclusion of acceptance. These things are discussed in details.

22.5 Summary

- Statement of any problem and to solve it more than one hypotheses are formulated.
- Hypothesis is important in research. Hypothesis is centre of research which helps in the selection of new ideology, methods of measurement, form of research, collection of data and analysis of quantitative methods.
- Statement of H.H. Mackson is that aim of research is not only formulation of hypothesis and its confirmation but also to discover new facts.
- Researchers test the hypothesis after its formulation. It is concluded on the basis of testing whether this hypotheses presents solution of problem or not.

22.6 Keywords

1. **Methods**—Defined methods of special activities to work in technical fields.
2. **Exit**—To conclude from less general to more general form for estimation.

22.7 Review Questions

1. What do you mean by formulation of hypothesis?
2. Explain testing of hypothesis.
3. Explain formal conditions for testing of hypothesis.

Answers: Self Assessment

1. (a) More than one
2. (b) Thought
3. (b) conceptual
4. (a) assumptions
5. researchers
6. hypothesis
7. basis

22.8 Further Readings

Books
1. Educational Technique—*S. S. Mathur, Bhatt Brothers.*
2. Methods of Educational Research—*Shareen and Shashikala, Vinod Pustak Mandir.*
3. Management and Valuation of Educational Techinique—*J. C. Agarwal Bhatt Brothers.*
4. Educational Technique and Valuation—*Dr. Rampal Singh, Bhatt Brothers.*

Unit 23: Qualitative and Quantitative Data

Objectives

After studying this unit, students will be able to:

- Understand qualitative analysis
- Understand quantitative analysis
- Understand the concept of generalization and conclusion.

Introduction

Data or documentary evidence whose types and collection methods have been mentioned previously are only a means. They have no importance in themselves. Ends are for fulfillment of research purpose i.e. drawing conclusion related to the problem or to get the answer of true problematic questions. Documentary evidence i.e. data is only means to achieve these objectives on the basis of their analysis for reaching at destination.

For the analysis or treatment or processing of these data a number of methods are used. Some writers distinguish between processing and analysis, for example **Gultong** (1967) under processing only collects data at one place, keeps them in different categories and keeps other types of required arrangement. By analysis he means in the context of hypotheses end true problematic questions on the basis of evidences establishment of conclusion but many other writers do not differentiate between them. They understand all those activates components of data analysis. If it consider as components of analysis or keep it separately, it does not means any difference in fact data's collection or processing, analysis and interpretation three activates are separately in reality.

There is not a single method or techniques of analysis and interpretation of data is much different to one another also. Therefore for each type of analysis of data any one method may be, it is not possible. Which types of data is, they are analyze by that method, which is appropriate for that nonetheless generally analysis of data can be divided in two groups –(1) Qualitative analysis (II) Quantitative analysis

23.1 Qualitative Analysis

Historical studies, some descriptive studies and ethnographical studies' data are quantitative and descriptive. It cannot be expressed in numbers and digits. Therefore its analysis can not be done by numerals method also. Hence, for its analysis, qualitative method is followed.

Under this on equality basis data's can be classified e.g. on the basis of hypotheses (which data is associated with which hypotheses) grouping can be done and on that basis conclusion is established. If hypotheses had not formutated before then on study time which characteristics is to be found on that basis classification can be done. For example if "informal education's status in division (Jan Pad)' has been done and related to that many types data have collected then all that data on equality basis included in some groups, on that basis that education's status' on many aspects throw light can be done. Finally, combines all those aspects collectively it can be stated that what is the status of informal education. Like that in observational studies, which material is available after the observation of behavior, phenomenas and circumstances, that is on equality basis having classification on that group in which seems characteristics, on that basis persons, phenomones etc. can be described. Mostly survey's purpose is only description of institutions, communities, society, caste, professions, processes etc. of present status. These studies' data is mostly descriptive e. g. literal. On that classification basis any conclusion is established.

In this way whatever material is available in ethnographical studies that is synthesised in the context of important questions. On that basis an important sketch is prepared it is presented only in descriptive style. The base of this whole analysis is logical and theoretical. Statistical methods are not used in the analysis of this data.

Contrary to this in the analysis of this data attention is paid that there is a logical and meaningful relation among, purpose of studies, Processes, methods, results etc., by increment of knowledge. The quality of study depends upon this. On the basis of analysis of whole data and facts, having kept it mutually associated and organized, a complete perspective is formulated. Under perspective "why", "what", "how"'s sceneries' are given stress in descriptive and reflective style expression. Conclusions are based upon researcher's own logical decision.

Like this is historical studies whatever evidences are collected, their internal and external criticism is done. After that in descriptive style only conclusion is established. The base of analysis and criticism mainly researcher's logic, analogy, classification of facts vested relation etc are. In historical studies for mutation of hypotheses is done tentatively. Having collected facts related to those, which are in the form of as per word facts on the basis of their logical analysis hypotheses, is tested. This whole analysis is quantitative in which are, researcher's thinking, his insight, his judgment, his imagination, logic and intelligence. Play an important role. The main example of quantitative analysis are **Piyaje's** cognitive development theory, **Friod's** unconscious mind theory, **Arrald Geesal**'s child related **Margret Meed studi**. In the field of Comparative studies, purposes of different counties education, their basic philosophy, texts, developments' comparative study, are the example of qualitative analysis.

In qualitative analysis that mental process help is taken, that are *(i)* inductive - deductive reasoning, *(ii)* reasoning by analogy, *(iii)* thinking and imagination, *(iv)* analysis of similarities, *(v)* analysis of difference, *(vi)* establishment of relation *(viiI)* relation explanation by theories approach *(viii)* finally description of results on the basis of all synthesis.

Self Assessment

Fill in the blanks:

1. Historical, descriptive and ethnographical studies' data ………………. and is descriptive.

2. In historical studies' collected materials' internal and ………………….… is criticized.

3. Numerical analysis is possible where data in ……………….. is available.

23.2 Quantitative Analysis

Notes   Numerical analysis is possible only that condition where data is available in the form of numbers and digits.

In applied science these data are the marks of Psychological examination. Observational data is also available in numerical forms for several times. The analysis of these types of data is done by the basis of statistical methods.

A number of statistical methods of this type has developed. Basically these methods have been divided into two parts- (i) Descriptive statistical methods and (ii) Inferential statistics, descriptive statistical methods has been used there, where collected data's having presented in precise form on that basis any population, any group or any specific class characteristics is to be described. For example, a teacher wants to know what is level of mental ability of his class students. He gives a intelligence test to the pupils on the basis of which their marks are available. Having tabulized them, their mean is calculated on that basis. He can describe the intelligence level of students of class. Besides mean a number of statistical value which is calculated. In different conditions, different statistical value are calculated. Which statistical methods will be used for analysis of data, it is depends upon research's purpose and hypotheses.

Descriptive Methods of Statistical Analysis

Under this heading all those methods come which only describe the characteristics of any group or population or presents data any summarily.

Regarding any speciality, what is the status of any group or population, get the answer of these questions by these methods analysis basis.

1. Mean
2. Median
3. Mode
4. Standard Deviation
5. Correlation
6. Graphical representation of data

Meaning of these methods, use, statistical calculation, etc., has been described is detail in further chapters of this book.

Inferential Methods of Statistical Analysis

Caution   These methods are used, where on the basis of a sample larger population's characteristics are described.,

Under this a number of statistical methods are included, but these methods are based upon only one concept. This concept is of standard error. Aforesaid all statistical values (mean, median, standard

deviation, correlation) having known its measurements error, on that basis it is stated that any conclusion is how far true about whole population. These concepts and all those methods have been mentioned in the second part of book. Main methods which have been mentioned are-

1. S.E.m. e.g. Standard error of mean.

2. S.E.r. e.g. Standard error of correlation.

3. S. E. σ. e.g. Standard error of standard deviation.

Cause- effect Relation's Statistical Analysis' Methods

In applied sciences, a number of circumstances of researches are such that in which phenomenas, behaviours and course of results is determined.

Example   It determines that "Is intelligence course of students' educational achievement?"

"Having combined both intelligence and initiative how it effects educational achievements" etc. These types of studies comes under experimental research and its process a number of times is much complicated. These studies have special strategy that is called experimental design. From more complicated to most complicated designs have been developed by experts on the basis of these designs whatever data is available, their analysis have special statistical methods also. These are called statistical designs. It has been mentioned in details in further chapter. These main methods are-

1. T-test

2. F-test (ANOVA, Analysis of variance)

3. ANCOVA, Analysis of covariance

4. Factorial Design

5. Regression Analysis

Relation's Analysis of Statistical Methods

Any studies's purpose is only to know the relationship between two variables. Who is whose cause, to know it is not purpose. Such studies' data is analyzed by correlation methods, these methods are of many types, for example –

1. Rank order (rho) product moment correlation: When only correlation between two variables is to find out then these methods are used.

2. Biserial *r*, tetrachoric *r*, Phicoefficent of correlation and contingency coefficient of correlation: These are the specific methods to find out relation between two variables also.

3. Partial *r*: where any one variables effect has been cancelled, to find out the relation between two variables then this method is used. For example, if intelligence and inspiration collectively affects educational achievement then to know it having controlled initiative effects, how much relation of intelligence with academic achievement.

4. Multiple correlation: Where it is to know that more than one variables together how much effects a dependent variables, these methods are used.

What is the meaning of these methods how it can be used and in these how statistical values are calculated, all those matter have been mentioned elsewhere.

Statistical Analysis' Non-parametric Test Methods

Further T-Test, F-test, ANOVA, ANCOVA etc., methods have been mentioned. To use these methods some preconditions are there. These conditions have been mentioned in further chapters. If these conditions are not fulfilled then these methods can not be used which are called parametric tests, but in that conditions it cannot be used, in those its non – parametric tests alternatives are used a number of non-parametric tests are among those some mostly in used methods one following-

1. Chi-Square Test
2. Median Test
3. Runs Test
4. Kolmogorov- Smirnov Test (K. M. Test)
5. Mann Whitney 'U' Test
6. The Walsh Test
7. Wilcoxon – Wallis one-way variation analysis (K. W. one way ANOVA)
8. Wilcoxon matched pairs Singed Rank Test.
9. Friendman's two-way ANOVA by Ranks

Self Assessment

State whether the following statements are True or False:

4. The main example of quantitative analysis is Piyaze's mental development theory.
5. In quantitative analysis help of mental processes is taken.
6. Chi-square tests is non–parametric methods of statistical analysis.
7. The special strategies of studies are called statistical design.

23.3 Conclusion

The analysis of data is an important chain related to fulfillment of purpose of research, but on the basis of the result achieved do not become relevant as long as till their explanation is not done in the context of problems. Therefore, it is quite pertinent to add with purpose of problems getting results by analysis. For example, suppose that the "Analysis of academic achievement of mathematics problem was of students of class eighth. Having chosen a sample to sort out the problems, under that comes students' given them a test of mathematics to find out the mean of marks. Suppose it comes 60. This is the result of our analysis, but this result is worthless. Mean 60 is not meaningful. The purpose of problem was not to find out mean. This result was not ends, This is only a mean which we had been selected to sort out the problem. This means under some fix limit number of boys obtain marks or can had been to get percentiles. Like this way if problem is " Boys and girls mathematics' marks obtaining any differences is or not and we having marks obtained by them, taking difference of their mean marks and having their tested, states that " difference is worthful" Which is only a result of analysis of data, then it has no meaning. Our problems were to know that their "difference in achievement or not". It is clear from above result that research datas' analysis got available statistical result, not got avails sort out problems. Sort out of problems these results' in the context of purpose of problems having explanation are available. Like that on the basis of analysis of descriptive studies data which facts, characteristics, cause, relation etc prevails, they are only unreasonable, meaning less, uncoherant and figures. It becomes worthful only when it is added to problems and its statement is taken. In the

form of raw material by the analysis of data gets results with context to problems to explain and to narration them is called establishment of conclusion.

Establishment of conclusion and Process

> **?**
>
> *Did You Know?*   Conclusions of research are the tested solution of problems.

Their propagation is done by analysis of data on result basis. By this approach result of analysis and conclusion establishment are two different stages of research process. For conclusion establishment getting result by data analysis is to add results with problems e.g. in the context of purposes of problems having done their explanation that is restatement. Almost in all research hypotheses is the gateway to purposes. Therefore these hypotheses presents that context under the limit of that establishment of conclusion and do statement is essential. These hypotheses context makes conclusion relevant and conceivable. If we say " Average educational achievement is 60" then it has no meaning. To make it worthful hypotheses " Academic achievement is satisfactory" its explanation will be done in that context and will be made sure that " average achievement 60" is satisfactory or not. For this available measures or available evidences anywhere, preedited research result, having compared with education application recommendation critically result will be established and as such statement factory. In the whole process of it researcher's mental ability, knowledge of subject and imagination power have great importance.

Conclusion establishment is a specific activities. That form depends upon method of research. For example, historical studies' forms of conclusion historical facts, their hypotheses, and depends upon review of historical facts. In experimental review of historical facts. In experimental research this applies characteristics of Psychological test, types of measures and research design is depends upon.

Conclusion's establishment's level researcher having gone in the depth of true results and reviews in the background of that theories and practibility.

In the interval of results vested and invisible relation and indicates towards process. From which point of view gets result and conclusion seems to be true, explains that. By the medium of this explanation importance of conclusion is exposed. For example, result "In unmarried persons suicide tendency is found much more" that this explanation that "between loneliness and suicide may be relation, by this approach may be important that one theory (Durkhim's theory) supports **Durkhim's** theory has got support from this conclusion. In this way explanation of result is increased the importance of conclusion. Explanation of result throws light on that matter that from which point of view result is important. Under the explanation of result researcher considers it that what is his purpose, what is their relevancy, what answer they presents of basic problems etc.'

For the establishment of conclusion on the basis of data analysis obtained result from statistical point of view explanation is needed. Under this relevancy of result is examined. These methods are use only those studies whose data is quantitative and their analysis is done by statistical methods.

The base of result in these studies, selection a sample through a definite process, but conclusion are applicable on whole population. This process is called the process of generalization. On the basis of it wideness of conclusion is to found out, e. g. it is to know that what is possibility of true to be of that conclusion? In simple language, its meaning will be how far that conclusion true about total population. The base of generalization is to be sample's population's representative. If sample is full representative of population, only then this type probability statement, e.g. validity of generalization determination and mention possible. At that condition the use of that methods are possible, on that basis relevancy is tested.

These methods are-

1. Standard error of mean (S.E.m)
2. Standard error of difference of two mean (S. E. D)
3. Standard error of correlation coefficient (S.E.r.)
4. Chi-square
5. F-ratio

23.4   Concept of Generalization

Concept of generalization's use is done in the testing of significance of conclusions. Sample based result population's (whose sample representative) how far indicator of that characteristics, to get the answer of this question available on the basis of process of generalization, but such a statement is possible only then when sample did representative of population and selection has been done randomization, but generally it is not possible that sample did representative of population cent-percent.

Their possibility to be true (e.g. their possibility of some, which in that condition when research is done on whole units of population) is not cont-percent. How much this is possible, to do statement of these is to be the test of conclusion's worthfulness. For this levels of confidence is to be used.

Task   Express your view on generalization rule.

Laws of Generalization

1. Generalization will be as much as useful and valid as sample will be representative of population. If sample is not representative of population then their result cannot be true about population i.e. at that condition generalization is not possible.
2. In which conditions research has been done, those condition will be as far as alike to condition of population, as far as generalization possibility to be true. It is too controlled condition research has been done under laboratory, then its result will be more accurate, but their generalization possibility will be less because outside laboratory such a controlled condition will be not.
3. Having done the experiment on a few sample, possibility of generalization of results is less.
4. Insufficient or incomplete data narrow down the validity of generalization. Therefore conclusion should be based on adequate accurate data.
5. Generalization should not be against predetermined facts, theories and nature's laws.
6. That should be in the form of either in solution of problems or in the form of answer of problem's question.
7. At the time generalization of conclusion, limitation of research design, the inadequateness, demerits etc., should be paid due attention. For example if correlation design has been used then it is keep in mind that generalization can not be done about cause-effect relationship. It is weakness of this design. Like these every research have its own demerits. It should be keep in mind.

23.5 Summary

- There are various methods of research and their data is also different from each other.
- There is not a single method or technique of analysis and interpretation of data.
- Generally analysis of data can be divided in two group-(1) Qualitative analysis and (2) quantitative analysis.
- Historical studies, some descriptive studies and life sketch studies' data are qualitative and descriptive.
- In different conditions different statistical values are calculated. Which statistical method will be used for the analysis of data, it depends upon purpose and hypotheses of research.

23.6 Keywords

1. **Generalization** – Generalization to make general data from research point of view so that sample can be representative of population.
2. **Observational**- Able to observe.

23.7 Review Questions

1. What do you mean by qualitative analysis?
2. What do you mean by quantitative analysis? Describe the methods of quantitative analysis?
3. What do you mean by conclusion establishment? Describe its form and process.

Answers: Self Assessment

1. Qualitative	2. External	3. Numbers	4. False
5. True	6. True	7. False	

23.8 Further Readings

Books
1. Educational Research Methods—*Shareen and Shashi kala, Vinod Pustak mandir*
2. Educational Research's Procedures—*L. Kaul, Vikas publishing*
3. Educational Techniques—*S. S. Mathur, Bhatt Bothers.*
4. Educational Techniques—*R. A. Sharma, Bhatt Brothers.*

Unit 24: Statistical Methods

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24.3   Initial Step in Statistics

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Objectives

After studying this unit, students will be able to:

- Understand the development, meaning and definition of statistics
- Understand statistical terms and initial steps
- Understand frequency – distribution table.

Introduction

Sankhyiki in English is called STATISTICS. It seems that statistics is derived from Latin language's term STATUS or from Italian STATISTA. **Yule and Kendall** has said that origin of this word is STATUS. The meaning of both STATUS and STATISTA had been political STATE in ancient times. Use of these words had been done in the context of political situation. In ancient times king had to keep records of different types of informations regarding his state as his own power, population of state, birth rate, death rate, state's revenue and expenditure etc., this types of State's description called statistics gradually. In this way science of statistics was incepted.

24.1   Development, Meaning and Definition of Statistics

With the induction of statistics word this matter is clear that the use of this science in the beginning numbers of birth-death, income-expenditure numbers, and state's population description's record had been done. But later on as the state's political, social and economic condition become more complicated.

In the course of time statistics not only used as a political subjects but also it spread upto state's economic and social problems and conditions. In this way statistics term modern meaning seems to be

not more than 100 years old. In seventeenth centuries including insurance scheme the use of statistics was increased to a fair degree also and again it will be used in the all fields of knowledge. Now a days statistics is uses in Science, Mathematics, Education Psychology, Economics etc. in all subjects.

Scientist has given definition from a number of types. **W. G. Sutcliffe** in his book, 'Elementary Statistical Methods' had been written the definition-

"Statistics comprises the collection, tabulation, presentation and analysis of an aggregate of facts, Collected in a methodical manner without bias and related to predetermined purpose."

Notes   According to **A. L. Bowley,** "Statistics may be called as the science of counting.

According to Boddington-"Statistics is the science of estimates and probabilities"

According to Lovitt – " Statistics is the science which deals with the collection, classification and tabulation of numerical facts as the insist for explanation, description and comparision of phenomena"

According to **Ferguson** "Statistics deals with collection, Classification description and interpretation of data obtained by the conduct of surveys and experiments.

Self Assessment

Fill in the blanks:

1. According to Boddington, Statistics estimation and probabilities is ....

2. Scattered number or numbers origin is called ....

3. In one class interval insert number of digits class interval is called ....

24.2   Statistical Terms

Some important terms which is used in statistics are following-

Data – Scattered digits or numbers are called basic data. Basic data from a types from statistical point of view are understood as compulsory, but on its basis we can not draw any conclusion when it could not classified or analyzed properly.

Example   Basic data are the numeral form of our Physical or Psychological observations as a intelligence test, examination marks, height, weight etc.

Ungrouped Data – When basic data is obtained on a short sample then at that condition classification can not considered as essential and calculation can do directly, as a 10, 12, 20, 13, 17, 15, 8, 6, 16, 14 (N = 10) This type of arrangement of data are called un-classified data (N = 30).

Grouped Data – When data is obtained on a big sample (N > 30), then is such a condition classification is essential and this type of management of data is called grouped data.

Range – The difference get from the highest number to lowest number, is called range or expansion e.g.,

Range = Maximum score – Minimum Score

Class-Interval – From range, distribution of data's correct information cannot finds.

Therefore this range again divided into sub range and this sub range is called class – interval.

Number of C. I. – Internal can be calculated from following formula

$$\text{No. of C.I.} = \frac{\text{Range}}{\text{Size of C.I.}} + 1$$

Size of C. I. - In a class interval inherited number of digit is called length of class interval of limit of class interval. Actual digits can be calculated by inclusive and exclusive series 'basis'.

Mid-point of C.I. – The mid point of class interval is find out by adding maximum and minimum score and it divided by 2.

Did You Know?

$$\text{Mid Point of C.I.} = \frac{\text{Max. Score + Mini. Score}}{2}$$

Exact Limits of C.I. – Statistical scale is differ from mathematical scale. In mathematical scale absolute zero exists and in mathematics the meaning of 5 is only 5 where as in statistical scale due to absence of absolute zero the meaning of 5 is not only 5 rather. Then it varies from 4.5 to till 5.5 is. In this way in statistics to know the exact limit of any number .5 is deducted from lower limit and .5 added to upper limit. This is the reason that statistical scale is consider less reliable than mathematical scale.

Therefore to find out the exact limit of a class interval, .5 is subtracted to lower limit and in upper limit .5 is added , for example class interval 3-5 exact limit will be 2.5-5.5.

Frequency- Which numbers repeats how many times or any number is repeated how many times, that is called their frequency. For example, 10, 12, 15, 10, 18, 22, 10, 25 in number 10 is repeated thrice, hence frequency of 10 will be called 3. It is expressed by letter *f* or *F*.

Frequency Distribution- On the basis of size and magnitude of numbers, arrangement process is called frequency distribution.

Tallies or Tally Marks – Tally mark infact in an specific class interval lies, shows the actival numbers.

After completion of counting up to 4 to get 5 first four is crossed by a transversal line as ⦙⦙⦙ (show 5 counting)

Series-The systematic form of class interval is called series. There are two types of series – exclusive and inclusive. In exclusive series the upper limit of a class interval is only formality, which we not counted in that, clouted in next class interval. In other words in exclusive series upper limit is exclusive series upper limit excluded where as in inclusive series both limits of class intervals is assumes under that class intervals. For example,

Table 24.1	
Exclusive series	**Inclusive series**
40-50	40-49
30-40	30-39
20-30	20-29
10-20-	10-19
0-10	0-9

As far as the question of arrangement of series is concerned we can write it in two orders ascending and descending. In ascending order we write as 1, 2, 3 5 in descending order we write as 6, 5, 4, 3, 2, 1,

Use of statistics in education— Importance of statistics in education is due to following courses-

1. Exact description
2. Summarization- simple and meaningful
3. To make data simple and conceivable
4. Helpful in drawing simple conclusion
5. Helpful in forecasting
6. To get knowledge about relation
7. Helpful in comparative study
8. To find out course effect
9. Helpful in observation formulation
10. Helpful in sorting the problems.

Task   Explain the importance of statistics is education.

Self Assessment

Multiple Choices Questions:

4. Differencing getting by lowest number from highest number is called _____.

    (a) Range   (b) Expansion   (c) Class   (d) Limit

5. Statistical scale is differ from _____ scale.

    (a) Class interval   (b) Frequency   (c) Mathematical   (d) Fixed

6. The process of systemization of numbers according to their size and nature is called _____ distribution.

    (a) Series   (b) Counting   (c) Recurring   (d) Removal

7. The Systematic form of class interval is called _____.

    (a) Series   (b) Discrete   (c) Marks   (d) Ascending

24.3   Initial Step in Statistics

Preparing a frequency distribution Table—Illustration— Prepare a frequency distribution table from following data. Keep class interval range 5.

90, 93, 95, 98, 96, 95, 97, 101, 100, 99, 104, 102, 103, 102, 104, 103, 105, 107, 106, 105, 106, 107, 105, 107, 106, 110, 109, 108, 110, 102 (N = 30)

24.4   Frequency–distribution Table

Solution–   Minimum marks = 90

             Maximum marks = 120

Range   = 120–90 = 30

$$\text{Number of class interval} = \left(\frac{\text{Range}}{\text{Size}} + 1\right) = \frac{30}{5} + 1 = 6 + 1 = 7$$

Table 24.2			
S. No	*C.I.*	*Tallies*	*Frequencies*
1.	90-94	||	2
2.	95-99	⌊⊬⊤ |	6
3.	100-104	⌊⊬⊤ |||	8
4.	105-109	⌊⊬⊤ ⌊⊬⊤ |	11
5.	110-114	||	2
6.	115-119	0	0
7.	120-124	|	1
	Total		N = 30 (CHECK)

Steps Involved in Preparing Frequency Distribution Table-

To prepare frequency distribution table should be determined following steps-

1. First of all select minimum and maximum marks from given data. Then encircled these marks separately.

2. Get range (by the help of formula) e.g. subtracted minimum marks from maximum marks.

3. If class interval range is not given, then determine arbitrarily. Take care so that rage is such type that taking it number of class interval did not exceed ten (approx view). From convience point of keep class interval between 5-10.

4. Determine number of class.

5. It is desirable to write class in table (exclusive or inclusive) by ascending or descending order. First class will be begun from minimum marks and in that fix limit will be included.

6. Now take one by one marks. Marks belongs to that class before that a vertical pi (tally marks) drawn. After completion of four, for fifth counting drawn cross transversal line over that completed block.

⚠

Caution   Continued tally marks till maximum marks table prepared.

7. In frequency column write tally marks after counting.

8. Make total of all frequencies.

9. Sum total of all frequencies must be equal to number of data. This is test of suitability of table.

24.5 Summary

- In English shankhiki is called statistics. It seems that statistics term derived from STATUS of Latin language or STATISTA from Italian prior this word had been used in political contest.

- Statistics comprises the collection, tabulation, presentation and analysis of an aggregate of facts, collected in a methodical manner without bias and related to predetermined purpose.

- Scattered marks or numbers are called fundamental data. Basic data are considered to be a compulsory material from statistical process point of view.

- In a class interval included number is called range of class interval or limit of class interval.

- Determine actual number of marks on inclusive or exclusive series basis.

24.6 Keywords

1. **Frequency**—In given data the number that comes regularly, which has more frequency.

2. **Exclusive**—To eliminate, remover.

24.7 Review Questions

1. Prepared frequency distribution table from following data. Keep range of class interval 10.
   135, 139, 138, 110, 116, 119, 122, 135, 134, 126, 127, 128, 131, 139, 140, 150, 145, 184, 148, 155, 154, 160, 158, 165, 170, 175, 180, 179, 190, 160, 170, 155, 148, 149, 123, 186, 117, 118, 119, 120 (N=40).

2. Prepared frequency distribution table from following table. Keep class interval range 3.
   18, 24, 10, 12, 20, 28, 20, 14, 18, 114, 18, 14, 18, 20, 24, 14, 18, 20,20, 12 (N = 20).

3. Having taken examination of high school class of 30 students whore marks are following with the help of this prepared distribution frequency of tables keep class 10.
   38, 36, 80, 82, 85, 28, 30, 20, 90, 72, 75, 58, 42, 36, 75, 72, 68, 65, 70, 66, 48, 50, 10, 63, 57, 55, 62, 61, 50, 62. (N=30).

4. With the help of following data prepared distribution frequency table in which keep range 8.
   16, 18, 18, 11, 15, 5, 20, 18, 11, 25, 30, 15, 17, 11, 16, 22, 25, 20, 22, 15, 30, 32, 18, 7, 20, 25, 22, 22, 35, 37, 40, 20, 11, 25, 29, 10, 15, 35, 50, 10. (N=40).

Answers: Self Assessment

1. Science	2. data	3. Limit	4. (a) Range
5. (c) Mathematical	6. (b) Frequency	7. (a) Series	

24.8 Further Readings

Books   1.   Educational Techniques and Evaluation—*Dr Rampal Singh, Bhatt Brothers.*

2.   Education Technique—*R. A. Sharma, Bhatt Brothers.*

3.   Education Technique—*S. S. mathur, Bhatt Brother.*

4.   Educational Research Methods—*Shareen and Shashi kala, Vinod Pustak Mandir.*

Unit 25: Measurement of Central Tendency—M, Md, Mo

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Objectives

After studying this unit, students will be able to:

- Understand the meaning and definition of central tendency
- Understand mean, median and mode
- Understand assumptions underlying of central tendency.

Introduction

Having collected data in process of research from which we can not reach on any conclusion. For that classification tabulation of data is necessary. From the series of facts we have to find out a number which can be done suitable representative of that series. That value which express ability of group precisely is one number, is called measure of central tendency.

25.1　Meaning and Definition of Central Tendency

During studies of data researcher interested in that matter that he has to taken help of only one measure to know the tendency of his group. This type of assumption is known as **central tendency**. To clarify the meaning of central tendency suppose, five students marks are 10, 11, 9, 12 and 13. By observation these marks certainly differ from one another, rather than is this a type of central tendency to be seemed. The meaning to say is that amount five marks one marks is such that around which rest four marks are cantered.
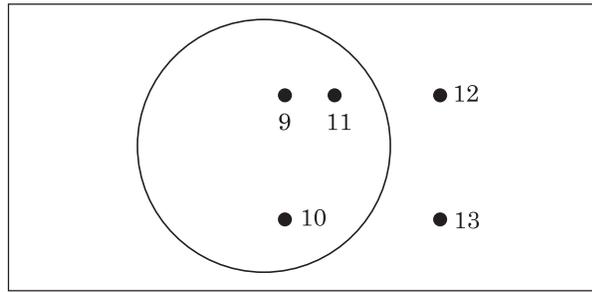
Fig. 25.1

In the above figure if we set marks 11 in the centre of circle and rest four marks around that then it seems that these four marks close to the marks situated in the centre or four marks come towards the marks situated in the centre. In simple language we can say that some marks are less than 11 and some are greater then 11. In statistical language this tendency of data is called central tendency.

Ross has written clearly definition of central tendency

"It is the tendency of the scores to bunch or concentrate somewhere mean the centre. It is that value which typifies or best represents the whole distribution" *– Ross, C.C.*

Measures of Central Tendency—Garrett has written regarding necessity and importance of central tendency measures-

"The value of a measure of central tendency is two fold. Firstly it is a average which represents all of the scores made by the group and as such gives a concise description of the performance of the group as a whole and secondly it enables us to compare two or more groups in terms of typical performance."

—Garrett

There are three measures of central tendency.

1. Mean
2. Median
3. Mode

25.2   Mean: M

Definition- What is called mean in statistics, in normal mathematics it is called average. Symbolically mean is represent by sign, M. The Simplest method to calculate mean is sum of number is divided by their numbers. Some main definitions are as follows:

Notes   Ferguison— "Mean is the sum of a set of measurements divided by the numbers of measurements of the set."

John Griffin - "In statistical usage since average is a single values used to represent all the values of a set of observations, an average may by thought of as a measures of central value".

F. C. Mills - The arithmetic mean is the centre of gravity of a "distribution."

Computation—Related to mean two types of data may be-

1. Ungrouped data
2. Grouped data

Ungrouped Data

Example: Compute mean from following data

7, 10, 8, 13, 11, 14, 9, 9, 13, 15

Solution - In ungrouped data following formula to get mean

$$M = \frac{\sum X}{N}$$

Where   M = Mean

     $\sum X$ = Sum of datas

     N = Number of datas

According to question $\sum X$ = 7 + 10 + 8 + 13 + 11 + 14 + 9 + 9 + 13 + 15 = 109

     N = 10

Hence, $M = \frac{\sum X}{N} = \frac{109}{10}$ = 10.9 **Ans.**

Important Stage

1. Calculate sum of all marks
2. Calculate total number of marks
3. Put the value in formula and calculate answer.

Grouped Data: Questions related to grouped data can be solved by two methods'

1. Long method
2. Short method

(1) Long Method – Under this method following formula is uses:-

$$M = \frac{\sum fx}{N}$$

Where, M = mean

     $\sum fx$ = Product of marks and frequencies.

     N = Sum of Frequencies

Example: By long method calculate mean of following data.

S. No.	C.I.	Mid Point (X)	f	fx
1.	55–59	57	1	57
2.	50–54	52	1	52
3.	45–49	47	3	141
4.	40–44	42	4	168
5.	35–39	37	6	222
6.	30–34	32	7	224
7.	25–29	27	12	324
8.	20–24	22	6	132
9.	15–19	17	8	136
10.	10–14	12	2	24
Total			N=50	$\sum fx$ =1480

Table 25.1

Putting the value in formula,

$$M = \frac{\Sigma f x}{N} = \frac{1480}{5} = 29.60 \text{ Ans.}$$

Important Stage

1. Find the mid value (X) of each class interval.
2. Multiply mid point (X) to frequencies (*f*)
3. In this way find sum of all *fX*.
4. To obtained N sum all frequencies.
5. Putting the obtained value in formula calculate mean.

(2) Short–cut Method or Assumed Mean Method—In this method following formula is used.

$$M = \text{A.M.} + \frac{\Sigma f d}{N} \times \text{C.I.}$$

Where, M = Actual mean

A.M. = Assumed mean

Σ*fd* = Sum of total frequencies

C.I. = Range of class interval

Illustration: Shortcut method to find mean

Table: 25.2

S. No.	C.I.	f	d	fd
1.	90–99	1	+3	3
2.	80–89	4	+ 2	8
3.	70–79	7	+ 1	7
4.	60–69	10	0	0
5.	50–59	9	–1	–9
6.	40–49	9	–2	–18
7.	30–39	4	–3	–12
8.	20–29	3	–4	–12
9.	10–19	3	–5	–15
Total		N=50		Σfd =–48

Putting the value in formula

$$M = \text{A.M.} + \frac{\Sigma f d}{N} \times \text{C.I.}\,.$$

$$= 64.5 + \left(\frac{-48}{50}\right) \times 10$$

$$= 64.5 - \frac{48}{5}$$

= 64.5 – 9.6

= 54.9 **Ans.**

Important Stage

1. Prepared frequency distribution table.
2. Select assumed mean.

Caution   That class interval is selected for assumed mean which lies exactly in the middle or which class interval frequency is most.

(This class interval should be lies in middle also.)

3. Just before the assumed mean group put 0 (Zero) in deviation column and greater than this group is given positive value (+1, +2, +3… and less group is given negative value (-1, -2, -3…) respectively.
4. Find the product of frequencies and deviations.
5. In this way find the sum of all *fd*, pay attention to sign also.
6. Range of class, obtain the value of A.M. and N, putting this value in formula calculate mean.

Self Assessment

Fill in the blanks:

1. Mean is that value which obtained from the sum of numbers .... by numbers.
2. Central tendency have three measures mean, median, and ....
3. .... related can be two data-grouped and ungrouped datas.

25.3   Median: Md

Definition

Prof. Bowley: "The median is the point that divides a ranked distribution of measurements into two equal parts."

Lindquist: "Median is that point on the scale of scores below which one half of the scored (50%) lie above which one half of the scores (50%) lie."

Computation: Median is calculated from two types of datas.

1. Ungrouped Data
2. Grouped Data

Ungrouped datas: Although, to find out the median of an ungrouped data, no need of any formula, though, from convenient point of view $\left(\dfrac{N+1}{2} \right)$ th term can be used.

Case I: When numbers of measures is odd.

Example: Find out the median of following data.

23, 23,22, 20, 19, 17, 16, 15, 15, 25, 28, 13, 19

Solution: Re-arranging the numbers in ascending order again we get

13, 15, 15, 16, 17, 18, 19, 20, 22, 23, 23, 25, 28

By formula, $\quad$ Median $= \left(\dfrac{N+1}{2}\right)$ th term

$$= \left(\dfrac{13+1}{2}\right) \text{th term}$$

$$= \left(\dfrac{14}{2}\right) \text{th term}$$

$$= 7^{\text{th}} \text{ term}$$

$$= 19 \text{ (To get seventh term count from left to right or right to left)}$$

Hence Median = 19 **Ans.**

When numbers of measure are even.

Example : Find out median of following datas.

34, 37, 46, 42, 33, 44, 30, 40, 35, 33

Solution in ascending order of the numbers, we get

30, 33, 33, 34, 35, 37, 40, 42, 44, 46

Now $\quad$ Median $= \left(\dfrac{N+2}{2}\right)$ th term

$$= \left(\dfrac{10+1}{2}\right) \text{th term}$$

$$= \left(\dfrac{11}{2}\right) \text{term}$$

$$= 5.5^{\text{th}} \text{ term}$$

$$= \left(\dfrac{\text{fifth term} + \text{sixth term}}{2}\right)$$

$$= \left(\dfrac{35+37}{2}\right)$$

$$= \left(\dfrac{72}{2}\right)$$

$$= 36$$

Hence $\quad$ Md $\quad = 36$ **Ans.**

Important stages:

1. Arranged the ascending or descending order of given data.
2. Find out the total number (N) of data.
3. Calculate median by applying formula.
4. To find out the median of even numbers taken two successive term and do half the sum of that.

Grouped Data: To find out the median of grouped data related questions following formula is used:-

Did You Know?

$$Md = L + \left(\frac{\frac{N}{2} - f_b}{f} \right) \times C.I.$$

Where   Md   =   Median Value

L   =   Lower limit of that class in which our median value lies.

N/2   =   Half of all frequencies.

f_b =   The sum of all classes frequencies which lies below median group.

f   =   Frequency of median group.

C.I.   =   Limit of class interval

Example: From following table calculate median

Table 25.3				
S. No.	*C.I.*	*f*	*cf*	
1.	90–99	2	60	
2.	80–89	6	58	
3.	70–79	5	52	
4.	60–69	11	47	
5.	50–59	20	36	← **Median group**
6.	40–49	12	16	
7.	30–39	3	4	
8.	20–29	1	1	
Total		N=60		

N/2   =   30

Now,   Md   = $L + \left(\dfrac{\frac{N}{2} - f_b}{f} \right) \times C.I.$

= $49.5 + \left(\dfrac{30 - 16}{20} \right) \times 10$

= $= 49.5 + \left(\dfrac{14}{20} \right) \times 10$

=   49.5+7

=   56.5

Hence,   Md   =   56.5 **Ans.**

Test- Our answer must be lies in median group. Here 56.5 which lies in 50-59 that is median group. Hence, our answer is correct.

Important Stages:

1. Arranged frequency distribution table.

2. Calculate cumulative frequency. There are two methods of H. first methods is that the frequency before lowest class interval that is written in of column as it is adding to its next continuously. Second method is that the frequency of highest group is written in of column as it is deducting continuously. Paid a attention that the sum of all frequencies comes in highest class interval, by whatever methods we calculate *cf*.

3. Do half of frequencies and observed that in column where *cf* comes. This will be your median group and encircled it.

4. Find out actual lower limit of median group interval.

5. Please set systemically. Find out class interval limit.

6. Now, all these values, e.g. f, f_b, $\dfrac{N}{2}$, L and C.I.

7. Check the verification of correctness of answer.

Important Case I: When there are gaps in distribution and N/2 lies in more than one C.I.

At that condition applicable formula is following.

$$\text{Md} = \frac{\text{Md}_1 + \text{Md}_2}{2}$$

Where   Md   = Median value

Md$_1$ =That class interval when for observation of N/2, counting from top to below.

Md$_2$ = *That class* interval when +we to find out N/2 from below to top.

Example: From following table calculate median.

				Table 25.4	
S. No.	*C.I*	*f*	*cf*		
1.	90-99	2	10		
2.	80-89	1	8		
3.	70-79	0	7		
4.	60-69	0	7		
5.	50-59	2	7	$\leftarrow$ Md$_1$	
6.	40-49	0	5		
7.	30-39	0	5		
8.	20-29	3	5	$\leftarrow$ Md$_2$	
9.	10-19	2	2		
Total		N=10			

N/2   = 5

$$\text{Md} = \frac{\text{Md}_1 + \text{Md}_2}{2}$$

Now,　　Md_1　=　50-59

　　　　　Md_2　=　50-29

Now combining these two-class interval one class interval. One class interval will be made which is 29-59 then it changed into actual class interval. Subtract 0.5 from lower limit and add 0.5 in upper limit. In this way our class interval limits will be 19.5-59.5.

Hence,　Median　=　$\dfrac{19.5 + 59.5}{2}$

　　　　　　　　　$= \dfrac{79.0}{2}$

　　　　　　　　　= 39.5 **Ans.**

Important stages

1.　Prepare frequency distribution table.
2.　Complete the commutative frequency column.
3.　Observe that N/2 lies in which class. If it lies more then one class then calculate Md_1 and Md_2.
4.　To get Md_1 in frequency column form top to bottom calculate N/2 and in that class it falls, encircled it.
5.　Similarly find Md_2 counting form bottom to top.
6.　Now, combining these class make one large class and write it in actual limitations.
7.　 Putting these values in formula computed median value.

Important case II: When N/2 lies in one C. I. only, but gaps are still there.

Step: At that condition, having combined class to one another less their number and again basic formula can be used. In the following example rather (N/2) e.g. C. I. lies in 40-44, but some class as a 35-39 and 30-34 before zero frequencies still remain. Hence, here including two class make one class. Clearly to do so frequencies will be added and zero frequencies will be removed.

After following this process, basic formula is used.

Example : Calculate median from following data:

Table 25.5				
S No.	**C.I.**	*f*	*cf*	
1.	45-49	5	16	
2.	40-44	4	11	← Median
3.	35-39	0	7	
4.	30-34	0	7	
5.	25-29	3	7	
6.	20-24	2	4	
7.	15-19	2	2	
Total		N = 16		

In this question, since N/2 lies in one C. I, still before some class zero are remain. Hence to eliminate zero having combined classes and make less their number. In this way the transformed form of table is following.

	Table 25.6					
S.No.	*C.I.*		*f*	*cf*		
1.	45-54		5	16		
2.	35-44	4	10	11		← Median
3.	25-34	3	4	7		
4.	15-24	4	4	4		
	Total		N=16			

$$N/2 \ = \ 8$$

Now, $\quad$ M$d \quad = \quad L + \dfrac{N/2 - f_b}{f} \times C.I.$

$$= \quad 34.5 + \dfrac{8-7}{4} \times 10$$

$$= \quad 34.5 + \dfrac{1}{4} \times 10$$

$$= \quad 34.5 + 2.5$$

$$= \quad 37.0$$

Hence, $\quad$ Md. $\quad = \ 37$ **Ans.**

Self Assessment

State whether the following statements are True or False:

4. Median does not divide distribution in equal parts.

5. Median is written as Md also.

6. C.I. = Range of class interval is their length.

7. Mean is the centre of gravity of any distribution.

25.4 Mode : Mo

According to **Crow** and **Crow**: "The score in a given series of data that appears most frequently is called the mode and is represented by the symbol Mo."

Kenny: "Mode is the most frequently occurring value in the series."

Guilford: - "The mode is strictly defined as the point on the scale of measurement with maximum frequency in a distribution.'

Computation: Mode value can be calculated two types of data also-

1. Ungrouped data

2. Grouped data

Ungrouped Data

Example : Calculate mode from following data.

8, 9, 9, 13, 14, 13, 17, 16, 17, 16, 18, 20, 17

Solution: Here, 17 is evidently the most often recurring measures and is therefore the crude or empirical mode.

Here, 17 is repeated thrice, hence it is the mode value of distribution.

Grouped Data - To find out the mode of classified data following formula is used.

$$Mo \quad = \quad L + \frac{f_a}{f_a + f_b} \times C.I.$$

Where,   Mo   =   Mode value

L   =   Lower limit of highest frequency class

f_a =   Frequency of that class which lies above modal group.

f_b =   Frequency of that class which lies just below the modal group.

C.I.   =   Range of class interval.

Task   Write a short note on mode.

Example: Calculate the mode from the following data.

Table 25.7			
S. No.	*C.I.*	*f*	
1.	123-127	6	
2.	118-122	10	
3.	113-117	20	
4.	108-112	20	
5.	103-107	15	
6.	98-102	30	← Mode Group
7.	93-97	5	
8.	88-92	8	
9.	83-87	6	
10.	78-82	4	
		N=120	

Now, $Mo \quad = \quad L + \dfrac{f_a}{f_a + f_b} \times C.I.$

$= \quad 97.5 + \left[\dfrac{15}{15 + 5}\right] \times 5$

$= \quad 97.5 + 15/20 \times 5$

$= \quad 97.5 + 15/4$

=	97.5 + 3.75
=	101.25

Hence,   Mo   =   101.25 **Ans**.

Note :

1. From one table to find mean, median and mode, to calculate mean and median formula is same (above mentioned formula), but to calculate mode formula differs.

Example   Mode   =   3 Median – 2 Mean

                       (Mo   =   3Md-2M)

2. If any question such a type of two class whose frequency is highest and equal also then (a) If those class are some distant then that question mode value will be and (b) If those class interval are to gather then mode value will be mean of mid point of those class intervals.

25.5   Assumptions Underlying M, Md and Mo

1. Mean (M)

1. When distribution is normal.
2. When each marks of distribution is given weightage.
3. When find out the centre of gravity precisely.
4. When almost reliability is desirable.
5. When to find out true mode.
6. When to calculate standard deviation, correlation, and standard error.

2. Median (Md)

1. When distribution of marks is not general.
2. When central tendency is to find out more accurately.
3. When more accuracy is not needed.
4. When distribution is skewed.
5. When distribution is incomplete e.g. some class have zero frequency.
6. When to find out the exact mid-point of group.
7. When in the end marks tendency is much.

3. Mode (Mo)

1. When to find out guess of central tendency quickly.
2. When distribution of marks is not normal.
3. When distribution is incomplete.
4. When to find out special measures of central tendency.
5. When to calculate central tendency on by observations.
6. When a rough estimate of central value will do.

7. when is to find out need such a special marks of central tendency which frequency is much more. **Garrett** has written correctly " When we describe the style of dress or shoes worn by the ' average woman for instance, the modal or most popular fashion is usually meant. In like manner, in speaking of the average wage in a certain industry, we often mean the modal wage under specified conditions."

25.6 Summary

- Having studied at data reader interested in that matter that he has to take help of only one measure to know the tendency of his group such a type of assumption is know as central tendency.

- Mr. Ross has written to define control tendency clearly. " It is the tendency of the scores to bunch or concentrate some where near the centre … It is that value which type files or best represents the whole distribution."

- There are three measures of central tendency-(1). Mean, (2) Median and (3). Mode.

- According to Prof. Bowley " Mean is that value of a series which divides distribution in two equal parts.

25.7 Keywords

1. **Frequency** – Happening again and again repetition.

2. **Mean** – In general mathematics which is called average in statistics it is called mean.

25.8 Review Questions

1. What do you mean by measures of central tendency? Describe its assumed values.

2. Calculate mean, median, and mode of following data.

Table		
C.I.	*f*	
200-219	6	
180-199	8	
160-179	13	
140-159	10	
120-139	6	
100-119	4	
80-99	8	**Ans**. M-148.12
60-79	2	Md = 155.5
40-59	1	M0=170.26

3. Compute median from following data.

Table		
C. I.	*f*	
0-10	2	
10-20	18	
20-30	30	
30-40	40	
40-50	35	
50-60	20	
60-70	6	
70-80	3	**Ans**. M = 37.15

4. Find Mean from following data.

    10, 16, 17, 22, 26, 24, 26, 11   **Ans**. M = 19

5. Find Median from following data.

    5,7,9,12,10,8,7,15,21   **Ans**. Md = 9

6. Find Median and Mode from following data.

    10, 6,7,10,9,8,7,5,10   **Ans**. Md = 8

                                                       Mo = 10

7. Find Median from following data.

    20,18,16,15,11,29,39,40,15,20   **Ans**. Md = 19

8. Find Mean, Median, and Mode from following data.

    12,16,18,25,35,40,42,12,17,19,12   **Ans**. M = 22.5

                                                       Md = 18

                                                       Mo = 12

9. Find Median, and Mode from following data.

    62,80,72,74,72,78,76,92,88,84,80,72   **Ans**. Md = 77

                                                       Mo = 72

10. Find Median from following data.

Table		
C.I.	*f*	
90–99	2	
80–89	1	
70–79	0	
60–69	0	
50–59	2	
40–49	0	
30–39	0	
20–29	3	
10–19	2	Ans. Md = 39.5

11. Find Median from following data.

Table	
C.I.	*f*
45–49	5
40–44	5
35–39	10
30–34	20
25–29	0
20–24	15
15–19	10
10–14	8
5–9	4
0–4	3 **Ans.** Md = 27.0

12. Find Median from following data.

Table	
C.I.	*f*
20–21	2
18–19	1
16–17	0
14–15	0
12–13	2
10–11	0
8–9	0
6–7	2
4–5	1
2–3	1
0–1	1 **Ans.** Md = 9.5

13. Find Median from following data.

Table	
C.I.	*f*
1–3	6
3–5	53
5–7	85
7–9	56
9–11	21
11–13	16
13–15	4
15–17	4 **Ans.** Md = 65

14. Find Mode from following data.

Table		
C.I.	*f*	
45–49	2	
40–44	3	
35–39	7	
30–34	13	
25–29	8	
20–24	4	
15–19	3	**Ans**. Mo = 31.83

15. Find Mean, Median, and Mode from following data.

Table		
C.I.	*f*	
150–159	2	
140–149	2	
130–139	4	
120–129	1	
110–119	5	
100–109	5	
90–99	12	
80–89	10	
70–79	12	
60–69	10	
50–59	1	**Ans.** M = 92.62
		Md = 88.50
		Mo = 80.26

Answers: Self Assessment

1. Part   2. Mode   3. Mean   4. False

5. True   6. True   7. True

25.9   Further Readings

Books

1. Educational Techniques and Assessment—*Dr Rampal Singh, Bhatt Brothers.*

2. Education Techniques—*R. A. Sharma, Bhatt Brothers.*

3. Educational Research's Procedures—*L. kaul, Vikas Publishing.*

4. Educational Techniques Management and Assessment—*J. C. Agrawal, Bhatt Brothers.*

Unit 26: Probability : Normal Probability Curve and its Uses

Objectives

After studying this unit, students will be able to:

- • Understand the characteristics of normal probability
- • Understand normal probability curve
- • Understand use of normal probability and use of diagram
- • Understand the measuring divergence from normality.

Introduction

When mean of any diagram's both sides data lies in such a way that if we show them by a curve diagram and made following type bell – shape then we call that type of distribution as normal distribution.
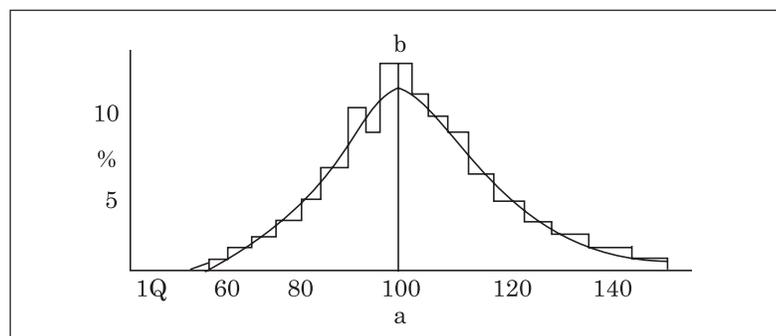
Fig. 26.1

In this type of distribution maximum number of data lies in the mid and as we precede both side from mid point then score of data will become less. In the end of both sides minimal score remain. Second matter is that both side left and right of mid-point in the position of distribution equality.

If we divided in two equal part at point *a* of above figure then *a* will be the mid-point. If we draw perpendicular a b then both side of line a b divided domain will be equal in shape and area. This is the **main** characteristics of normal probability.

Secondly we observe that mostly scores lies closely to mid-point and as remove from beginning both sides, scores is least in equal ratio and in the end of both side minimal scores remain.

In this figure if at point a mean 100 lies then we observe that in both side on equal data are. In one side less than 20 then in second side more than 20. In one side between 80-100, 20 score lies then in second side also between 100-200, 20 score lies. Again in one side between 60-80 below 80 only 20 score are removed. And in second side also as it is. In this way both sides have complete similarity. As either side of a. Both sides of scores has removed equi-distance. In one side as much as less than 100 in other side as much as more than 100. This is the meaning of normal probability.

In statistics normal probability has great importance. In some places use of normal probability is of great worthful. On the basis of normal probability our mean's utility, relevancy and justification is determined. This is clear from ahead instance.

    1.   55, 50, 54, 52, 50, 50, 60, 70, 75, 84 mean = $\dfrac{600}{10}$ =60

    2.   60, 70, 60, 50, 68, 66, 62, 56, 54, 52 mean= $\dfrac{600}{10}$ =60

Both above distribution mean is 60. But is their relevancy a great difference. One is even and other is odd. In the first condition range of data is from 50 to 80; in the second it only in 50 to 70. Both mean is 60. In this way we observes that in the previous example in one side below 60, minimal number is 50 and maximal 84 E. G. in one side range is 10 and in second side 24. In other words above 60 range has been gone upto 24 and in the below has been gone upto only 10. In this way in either side of mean skewedness has been occurred. If we shown it by a graph then this type of shape will be made.
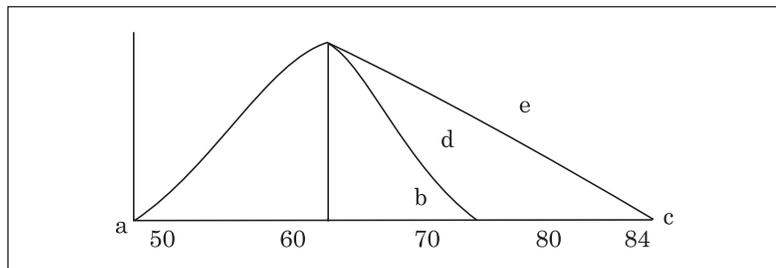
Fig. 26.2

In this figure's in b position neither scores exists around mean 60 nor exists equal-distance. It is clear form that more than 60 is much and less than 60 is least. The meaning of it will be that mean 60 is not proves to be more useful. He has not the capability at scores correctly. By meaning of mean 60 almost whole data should be equal to 60, but we observe in above condition some data is equal to 84 also. A great number is greater than 60. In the other hand minimal scores is equal to 50. Rather it is in some degree around 60. Therefore both sides of mean distribution has no equality. This is called skewed distribution.

In the second condition a mean is only 60 also, but at that condition range of distribution is upto 50 to 70. e.g., in one side less than 60 is 10 and on the second side more than 60, range is upto 10. It is clear that as score less than 60 as much more than 60. Both side distribution is same. Therefore is this distribution mean 60 express data more correctly. This is called normal distribution.

26.1   Characteristics of Normal Probability

Normal distribution have following characteristics:

1. If N is 100 and their distribution is even then in this position up and down of mean, e.g. 50 percent scores will be. If we do not assumes normal distribution range 100, assumes only 1 then up and down of mean range will be .5.

2. In this way both sides of mean upto limit of ±1σ, aggregately 2/3 part covers. If total range area 100 then upto +1.0 σ to -10 σ between approx 2/3 e.g. , 68.26 scores exists. If total range area assumes 1 then between mean +1.0 and (M)-1.0, .6826 part will be covered.

3. In the same way between the limit of M +2.0 σ and (M) -2.O σ approx 95.44 percent part covers e.g. if total range area is of 100 data then approx 95 data between +2.0 σ and (M) –2.0 σ will be lies. If we assumes total range 1 then between M± 2.0 σ scores will be .9544.
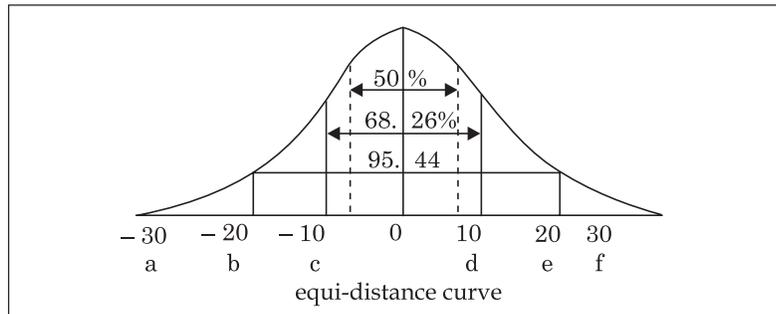
Fig. 26.3

In the someway between the limit of M ± 3 σ 99.74 percent data will be lies.

From the above figure it will be become more clear.

In this figure between point a and b limit explains limit of (M) ±1 σ. Between (M) + 1 σ is 1/3 part and between (M) - 1 σ 1/3 part. Between (M) - 1 σ 1/3 scores is below (M). e.g. lower. In the gone way between (M) + 1 σ one third data is greater than mean. In this way both sides from -1 σ to till + 1 σ total scores are two third.

In the same way between c and d 95.44 percent scores exists point c from mean point Lt. situated at distance -2 σ and d at distance +2 σ between these points 95.44 data are exists.

This means that small data below (M) [between (M) -2 σ] = $\dfrac{95.44}{2}$ =47.72 percent data will be exist and above (M) e.g. between (M) + 2 σ scores will be some.

Some way distance between e and f explains limit of (M) + 3 σ. The total number of scores between these is 99.72.

Example

Suppose 600 student I. Q's is given whose mean is 107.5 and (S.D) 8.6 and score is even.

Then normal probability's according to above characteristics among 600, 68.26% (409.56) student's I. Q's 107.5 + x 8.6(M ± 1 σ) e.g. will be 98.9-116.1%.

Similarly 95.44 percent's 107.5I $\pm$ 2 x 8.6 (M $\pm$ 2 σ) e.g. 107.5 $\pm$ 17.2 =90.3-124.7's will be. In other words in the condition of 95 percent, possibility is that their I. Q's will be between 124.7 and 90.3 only in 5 percent their I. Q's possibility beyond limit. If we taken limit of $\pm$ 3 σ then it can be said that 99.72 percent's I. Q's 107.5 $\pm$ 3 σ e.g. 106.4 $\pm$ 3 x 8.6 = 107.5 $\pm$ 25.8 = 81.7-133.3 (between) will be only 1 percent boy's I. Q's possibility beyond this limit e.g. in normal probability condition among 600 students only 6 students I. Q' will beyond limit of 81.7-133.3 and 594 will be under this limit.

(i) In this way percentage number vested in normal probability and by limit we know total data's status. This is the great characteristics of normal probability and it is their great utility.

(ii) Second characteristics is that in normal probability mean, medium and mode all lies at the mid-point of distribution and their value is equal also.

(iii) Third characteristics is that in normal probability condition inter quartile is of. 6745 stander deviation (S.D.), e.g. more than S.D. is 40% inter quartile (Q) is called Probable Error (P.E.) also. Therefore this relation can be expressed in this way also.

$$P.E. = 0.6745 \text{ σ or σ} = 1.4826 \text{ P.E.}$$

Between Q and M from below e.g., less than that 25 percent data lies. In this way in normal probability Q's range 'middle 50 percent' data are and since in Q and P.E. normal probability is same, hence $\pm$ P.E. e.g. between $\pm$ 0.6745 σ (because P.E. = 0.6754 σ) above and below mean 25% data exists.

In this way to know the situation of data instead of $\pm$ 1 σ, $\pm$ 2 σ, $\pm$ 3 σ we can use $\pm$ PE, $\pm$ 2PE, $\pm$ 3PE.

26.2 Normal Probability Curve

This characteristic of normal probability based upon theory of probability. Theory of probability has great importance not only in statistics but also in all sciences. Therefore it is consider to be complete. If anyone incidence occurrence is of 'a' type and 'b' is such a type is which they can not occurred then probability of that incidence will be a/a +b. Similarly not probability will be b/a + b.

In this way out of 52 cards we draw 1 card and try to know it that what is the possibility of that

card to be a king, then according to theory of probability we can say that its possibility will be $\dfrac{4}{52}$, because in whole cards king of paan is only one.

Since card are 52, therefore drawn cards of kings possibility or not possibility's total probability are 52 out of these four kings, Therefore in these by 4 types that cards possibility can be done and in 48 type its kings not possibility will be.

Therefore types of occurrence = 4, not occurrence types = 48.
Drawn cards kings probability (above according to law of a/a+b) = $\dfrac{4}{4+48}$ = $\dfrac{4}{52}$.

Similarly according to rule of b/a + b not occurrence probability = $\dfrac{48}{4+48}$ = $\dfrac{48}{52}$.

Example One coin on which one side Figure and other side year has printed toss. What would be probability that coins falling on earth Figure will be on up. There are two types of incidence happenings either Figure or year will be

come. Therefore probability of Figure (P) $\dfrac{1}{2}$ will be and not happenings

probability will be $\dfrac{1}{2}$ also.

If we added probability and non-probability, in every condition result will be 1. Now, if we toss same two coins then by following methods fall on earth probability will be:

F-F, F-Y, Y-F, Y-Y

Total 4 probability are, either both coins have Figure or both have year, and in one year and in one Figure or in one Figure or year F–Y or Y-F is something. Hence Y- F probability will be twice e.g. twice such will be happen that on one coin either Figure or year will come. In this way

1. Y- F probability (P) = $\frac{1}{4}$.

2. Y- F probability (P) = $-\frac{2}{4}$ = $\frac{1}{2}$.

3. Y- F probability (P)= $\frac{1}{4}$.

Adding left hand side and right hand side F–F + Y F+YY or $(Y^2+2$ F $Y+Y^2 = (F+Y)^2 =1$

Similarly tossing 3 coins following 8 combination will be get.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
F F F	F F Y	F Y F	Y F F	F Y Y	Y F Y	Y Y F	Y Y Y

But combination (2), (3), (4) are some. Hence, F, F, Y probability three times e.g. $\frac{1}{8}+\frac{1}{8}+\frac{1}{8}=\frac{3}{8}$ will be, since total 8 combination are and each possibility is $\frac{1}{8}$ e.g. $3F^2$ probability will be $\frac{3}{8}$ similarly F Y Y (5), (6), (7) combination's possibility will be 3/8 e.g. $3Y^2$ F probability (P) will be $\frac{3}{8}$ also. In other words on two coins sun and on one coins statue together come, combination is 3—It means it can happen thrice only.

Besides these probability possibility of FFF will be (P) $\frac{3}{8}$ YYY will be $\frac{1}{8}$ also.

Since,

1. FFF's probability (P) = $\frac{1}{8}$

2. $3F^2$, Y Probability (P) = $\frac{3}{8}$

3. $3Y^2$ F Probability (P) = $\frac{3}{8}$

4. YYY's probability (P) = $\frac{1}{8}$

Hence, $F^3+3F^2Y + 3Y^2F + Y^3 = 1$

(Adding probability of left hand side and right hand side)

or $(F + Y)^3 = 1$

Similarly we toss 10 coins then FY's (Figure and Year) Combination and their probability $(F + S)^{10} = 1$'s expansion, means

$F^{10} + 10F9 S + 45 F^8 S^2 + 120 F^7 S^3 + 210 F^6 S^4 + 252 F^5 S^5 + 210 F^4 S^6 + 120 F^3 S^7 + 45 F^2 S^8 + 10 F S^9 + S^{10} = 1$

i.e. total occurrence of incidences will be

$1 + 10 + 45 + 120 + 210 + 252 + 210 + 120 + 45 + 10 + 1 = 1024$, out of these

1. F^{10} probability will be
    (Probability of 10 statue all together)
    $$\frac{1}{1024}$$

2. $F^9 Y$ probability will be
    (Figure on 9 and sun on 1 probability =10)
    $$\frac{10}{1024}$$

3. $F^9 Y^2$ probability will be
    (Figure on 8, sun on 2 = 45)
    $$\frac{45}{1024}$$

4. $F^7 Y^3$ probability will be
    (Figure on 7, sun on 3 = 120)
    $$\frac{120}{1024}$$

5. $F^6 Y^4$ probability will be
    (Figure on 6, sun on 4 = 210)
    $$\frac{210}{1024}$$

6. $F^5 Y^5$ probability will be
    (Similarly)
    $$\frac{252}{1024}$$

7. $F^4 Y^6$ probability will be
    (Similarly)
    $$\frac{210}{1024}$$

8. $F^3 Y^7$ probability will be=
    (similarly)
    $$\frac{120}{1024}$$

9. $F^2 Y^8$ probability will be
    (Similarly)
    $$\frac{45}{1024}$$

10. $F^1 Y^9$ probability will be
    (Similarly)
    $$\frac{10}{1024}$$

11. Y^{10} probability will be
    (Similarly)
    $$\frac{1}{1024}$$

In this way on binomial theorm basis probability of incidences is determined.

Now if we prepared a graph from the combination of probabilities (1, 10, 45, 120, 210, 252, 210, 120, 45, 10,1) then it will be called normal probability histograms. For this we taken on x axis F^{10} Y, F^9 Y ….. etc. combinations and on y-axis their probabilities in this way following histogram will be, prepared:

Notes
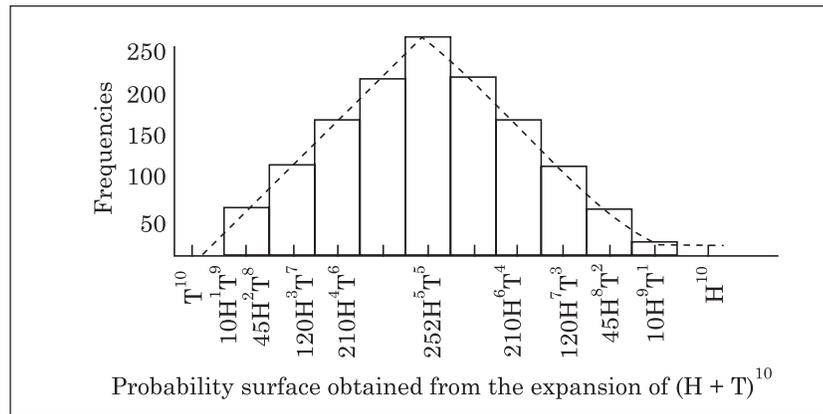
Fig. 26.4

From above histogram one thing is complete clear. Between 252 the greatest probability line on either side of it distribution of data is equal. On one side 210, 120, 45, 10, 1 is and on other side is 210, 120, 45, 10,1 the also. In this way in this histogram on either side of 252 area is equal and figure of both side some also.

In above histogram (F S)^{10} express only the expansion of 10 coins statue and sun addition. Therefore in that 10 angle are seems. If the number of coins (N) upto infinite then in his to gram infinite angle will be made but they will not visible, and joining their points a smooth curve will be made that mid-point's either side of area like histogram will be some and either side of figure's part will be some also therefore this curve is called normal probability curve. This is called probability curve due to it is prepared on the basis of probability combinations. Secondly for this reason it is called that if having taken the mid point of this curve, divided it in two parts then both parts will be equal in area and figure. In the middle probability is most and again both side of its distribution is same, as is clear from above histogram.

On the basis of that normal distribution is explained and it is applicable. All characteristics of normal distribution is taken from this basis.

Self Assessment

Fill in the blanks:

1. In statistics………… has great importance.
2. On the basis of normal distribution………….. determines their utility, relevancy and justification.
3. In normal distribution mean, median and mode value normal distribution's…….. lies on point.

26.3 Uses of Normal Distribution

By the next two to three example equal distribution's use will be cleared.

Example 1.

The mean of an equal distribution data M is = 125 (S.D.) = 11 then (a) between 114 and 136 how many data lies among whole data? (b) how many data will be lies more than 140?

<center>M = 125   S.D. = 11</center>

To be find out number lies between 114–136

(a) M 114 is 11 less than mean 125 or -1 σ below. Similarly, 136 is 11 more than its mean 125 or +1 σ is distant or above. Therefore below 114–136 same number will be which will be from M between ± 1 σ limitations. Since in the condition of normal distribution between M ± 1 σ 68.26 percent data lies, therefore between 114-136 two third (2/3) of whole data or 68.26% data will be.

(b) From mean 125, 140 whole 15 is greater or from 125 to 140 distance is 15 scores. S. D. divided by 11, it will be said that from 125 to 140's number lies a distance of 1.36 σ. Therefore mean +1.36 σ (e.g. above mean one side) 41.31% data will be laid (by table). Hence above 140 whole data 50.0 – 41.31 = 8.69% or 9% will be.

Example 2.

A Normal distribution data's mean is 16 and S.D is σ 4 then between 75% data, in which limit will be lies. Between the half of 75% data will be lies in either side of mean. By observation of table (A) we find out that between M+1.15 σ 37.5% data lies. Likewise other 37.5% will be lies mean and 1.15 σ . Hence total 75% will be laid between . Since σ =4 therefore 75% data will be laid between is therefore. They will be laid between. Hence this limit 20.6–11.4 have. Between 20.6 and 11.4, 75% data will be laid.

26.4   Uses of Normal Probability Distribution Diagram

In any distribution mean and on x-axis between any S.D. how much percent data lies, to know this a table is being used.

Observe table A in the end of book. Above first line of that x/σ 00.02……..09 and up to down in the column σ number has been written. In the first column towards up to down distance of SD(σ) has been given which upto one digit of decimal. If we have to observe the data between mean and 1.2 σ

.00 .02 ...09 then we read first $\dfrac{x}{\sigma}$ in column digit 1.2 and having read above's first line come down in

the same column exact before 1.2 where both between data of mean– +1.2 σ .

In the same way between 1.38 σ will be to observe then first draw a line before 1.3 of first column and again in the first line of above having seen .08 come down to that column. Where before 1.3 line it intersect that is the number of percentage.

Second thing is to remember is that that numbers has been given in the table they are given in 10,000. Hence to see percentage then place decimal after two digit from left.

6. Extra example question

1. M = 14.4

S.D. (σ) = 2.5 then in whole distribution between marks 12-16 per thousands how many student will lies?

Distance between M and marks 12 σ – = $\dfrac{12-14.4}{2.5}$ = $\dfrac{-2.4}{2.5}$ = $\dfrac{2.4}{2.5}$ =–.96 σ

The percentage of number between mean and – 0.96 σ (from table) = 33.15 σ distance between mean

and marks 16 = $\dfrac{16-14.4}{2.5}$ = + 0.64 σ **Ans**

Between mean and +.64 number of percentage of data (from table) =23.89, hence between both marks 12-16 total percentage = 33.15 + 23.89 = 57.04

In 1000 = 57.04 x 10 = 570.4 e.g. 570

2. M = 14.4 σ = 2.5

If frequency distribution is even than what is probability of students' in 1000 to get more than 18 marks?

$$\sigma - \text{Distance, between mean and marks } 18 = \frac{18 - 14.4}{2.5} = \frac{+3.6}{2.5} = +1.44\,\sigma$$

Between mean and 1.44σ number of percentage students (from table)=42.51

Hence, number of percentage more than 18 = 50.0 – 42.51 = 7.49 (Since in normal distribution above mean each half part of below is 50%.

Hence, in 1000, taken more than 18 marks, number of answer getting = 74.9 or 75.

But taken upper limit of marks 18 as 18.5 the difference will be came in answer 25. If asked upper taken integer rather then upper limit and where is asked data below any marks, there marks lower limit is taken. As a –

3. In the above question to find out the number getting marks below 8.

$$\text{Distance between 8 and } \sigma = \frac{7.7 - 14.4}{2.5} = \frac{-6.9}{2.5} = -2.76\,\sigma$$

Percentage student between mean and –2.76 σ = 49.71(table)

Taken 7.5 rather than 8 σ distance = 2.76 and percentage data = 49.71

Therefore, in 1000 respectively = 497

Below 7.5 = 500-497 = 3

4. If normal distribution of marks

Mean (M) =14.4

S.D. σ = 2.5 then what is the probability to get more than 15 marks obtaining student. Mean and 15

marks e.g. $\left(\dfrac{15.5 - 14.4}{2.5} \right)$ -.44 σ between of distance.

Number of data =17.0% (By table (A).

Number of more than 15 marks getting = 15 – 17 = 33%

Hence probability of 1 among 3 that their will be more than 15.

5. How many data will be laid between mean and 1.54 σ

Observe in table (A)'s first column below $\dfrac{\sigma}{x}$ 1.5 and before that draw straight line.

Again in topmost line below column .04 move downwards and just before 1.5 line drawn intersect it at that row which number drawn, observe that. This number is 43.83. e.g. in out of 100, it is 43.83 if whole distribution assumes 10,000 then it will be 4383. If assume 1 then 4383 will be and assumes 10 then 4.383 will be.

6. Similarly between mean and –1.73 σ data will be 45.82%. The meaning of negative (-) sign in its that these data less value than mean e.g., will be laid left side.

7. Similarly if we have to calculate total data between 1.54 σ and – 1.73 then add data between mean and 1.54, between mean and 1.75.

Therefore total data =43.83 +45.82 = 89.65 percent will be. In normal distribution curve that position as follows.
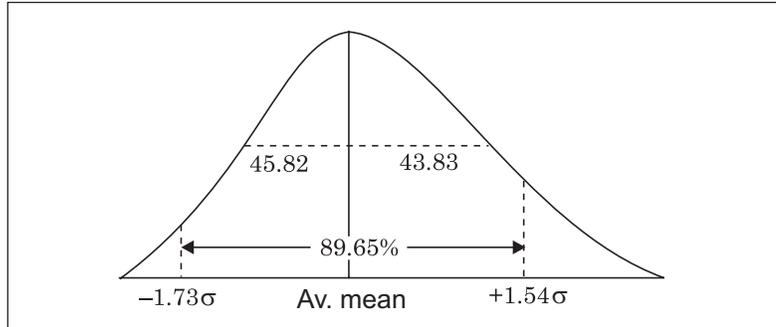
Fig. 26.5

8. Similarly if it is to calculate that more than +1.54σ marks obtaining number how much then to show that position by in this way.
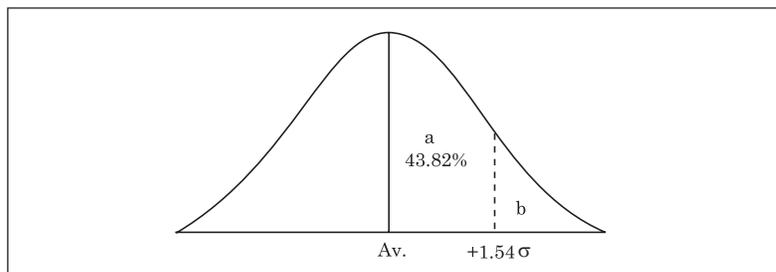
Fig. 26.6

In this figure whole area in the condition of normal distribution consider to be one unit which can be divided by mean into two equal parts. Therefore both a+b will be1/2 of whole. If 100 data lies in whole part then in half e.g. in a+b will be 50.0 + 1.54σ average's right hand that area in which 43.82% data has been covered, therefore in b's part will be 50.0 – 43.82 = 6.18%. If whole part considers to be 1000 then in part a+b 500 data will be, and by table in part a 4382 will be. Hence in part b 61.8 will be.

Similarly (taken as x) left side to x number of data can be seen also.

<div align="center">

PROBABLE ERROR

</div>

Similarly in place of σ P.E. table is used also. By observation that scores can be find out or P.E. can be changed in scores can be find out because P.E. = 0.6745 σ's is. If it is to be calculated how much data will be between mean and -2.7 P.E. then we will converted P.E. into σ.

$$1P.E. \quad = \quad .6745\ \sigma$$

$$-2.7P.E \quad = \quad 2.7 \times 67.45\sigma = -1.82\sigma$$

In table σ mean exists 1.82σ between 46.56. Hence, between mean and -2.7 P.E. 46.56% data had.

9. Now class 8's students' marks in history in mean to 40.0 and mean of marks of mathematics 62.0. Having after some months taken examination mean of history 52, and mathematics 72.0 respectively, then student in which subject progressed and much more progressed to others. S.D. of history (σ) 3.6 and S. D. of math σ =9.60 is.

	At this time	After Some month	Progress
History's mean	40.0	50.0	12.0
Mathematics mean	62.0	72.0	10.8
Progress in distance	(1) In history = 12/3.60 = 3.33σ		
'	(2) In mathematics 10.8/9.6 = 1.12σ		

Having changed σ in distance both subjects progress, they have been mutually comparable. Hence it is clear that in history has been more progressed. 3.36/1.12 = approx. thrice more have been progressed.

10. Four questions a,b,c,d in which a's 50%, b's 60%, c's 70% and d's80%, students do correctly. What is difficulties between a and b compare with the difficulties of c and d. If distribution is normal then difficulties S.D. (σ) will be following types.
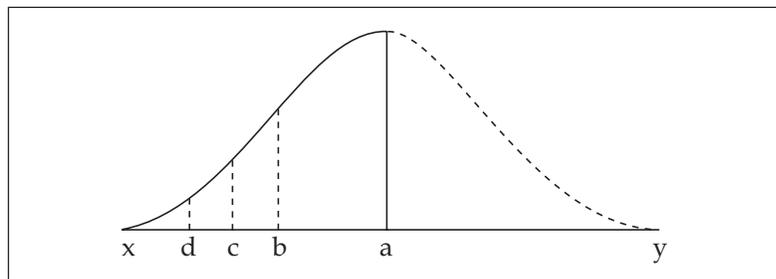
Fig. 26.7

(i) 50% students can do a correctly e.g. a on scale σ₋ (on line x, y) lies on point at a because 50% will be laid on either side. Therefore it lies exactly on that point where mean falls. Therefore distance between mean and that point will be zero.

(ii) 60% does 'b' correctly and 40% can not does e.g. 60% student up and 40% lies below. y upto a becomes 50%. To keep 60% above below a point 10% taken more upto b point. Therefore b's position mean (a point) as distance below σ. as between 10% data observing table (A) it comes - .25σ.

Distance of a = 0.0σ b's distance = – 25σ.

Difference = + .25σ, hence a from b +.25 much more tough.

Similarly point C from mean 70.0 – 50 = 20% at a distance of 20% data comes under .52σ distance. Hence c from a .52σ less difficult.

Similarly 'd' from a (80-50) =30% e.g.-.84σ is less tough.

Difference of difficulties c and d = 0-.84σ -.52σ= -.32σ e.g. C from d -.32σ is more tough.

Hence 'a' difficulties with respect to 'b' that difficulties which is less than c with respect to d is 1.28

times $\left(\dfrac{-.32}{-.25}\right)$ = 1.28.

11. In a class of student has give a+, a, a-j, b+, b, b-j, c +, c, c- and d grade. If related qualification is normal distribution then out of 500 how much students will come in each grade?

In this question whole range of normal distribution has been divided into 10 categories. Whole range of normal distribution both side of mean is upto 3σ. Hence total range=6σ.

The range of 6σ has been divided into 10 category.

Hence each category's range area = $\frac{6}{10}\sigma$ = .60σ will be. In the following figure there position will be as follows.
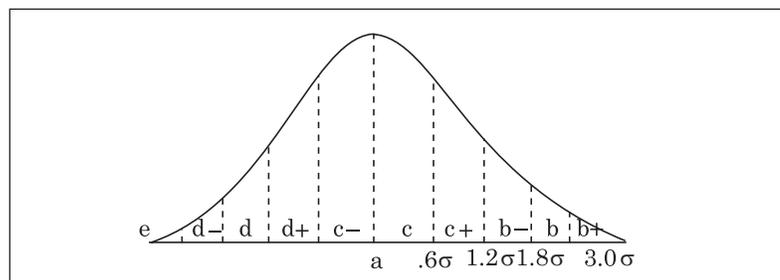
Fig. 26.8

Mean will be just laid in at point a from a to b is far away 6σ From b to b+ far away .6σ. Hence b's distance from a (.6+.6)=1.2σ. Similarly c's distance from a is 1.8σ a's 1.8+.6 =2.4σ and a+'s 2.4σ +.6σ =3.0σ.

1.   Mean e.g. from point a and .6σ' number of data between them (from table A)=22.57%. This is number of students which comes in grade b. This number will be 500.

$$=22.57 \times \frac{500}{100} = 112.85 \text{ or } 113.$$

Since on both side of mean destruction is same, therefore getting of b grade number will be 113 also.

2.   Similarly distance mean and b+ 1.2σ under this scores from table 38.49% but between mean and b comes 22.57%. Hence only getting b grade's number=38.49-22.57=15.92 or 16. This is in 500=80 some will be number of getting grade c+.

3.   Similarly distance between mean and a- is % 8σ and data between this = 46.41% is , hence number of getting a grade 46.41-38.49 = 7.92 or 8%, hence in 500, 8 $\times$ 5 = 40. Some number will be left to mean getting c grade.

4.   Percentage number of getting a and c = Distance between mean and a or c (2.40σ) will be the percentage of that number. The scores between mean and c- = 49.18 - 46.41 = 2.77 this in 500 = 2.77 $\times$ 5 = 13.85 = 14

5.   Similarly number of getting grade d and a+ = 49.865 (data comes upto 3.0 percentage) -49.865(data comes under 2.4σ)=.685% in 500 = 5 $\times$ .685 = 3.425 or 3. Similarly out of 500 student in each grade category number of student will be:

d	c-	c	c+	b-	b	b+	a-	a	a+
3	14	40	80	113	113	80	40	13	3

12. Suppose I.Q's distribution of 500 students are normal and their mean is 72, S.D(σ) is 10. In this 10%, 30%, 40, 15% grade is given to a,b,c,d respectively. Then find each two category dividing I.Q.

Mean does just two equal parts of normal distribution. There mean will be lies just in the middle of curve line. Upper 10% part under a and 30% under b. From mean to upto point c's whole part is 50%. From a to c it will be (30+10) = 40% comes under a and b. Hence between mean and point a 50-40=10% will be remain.
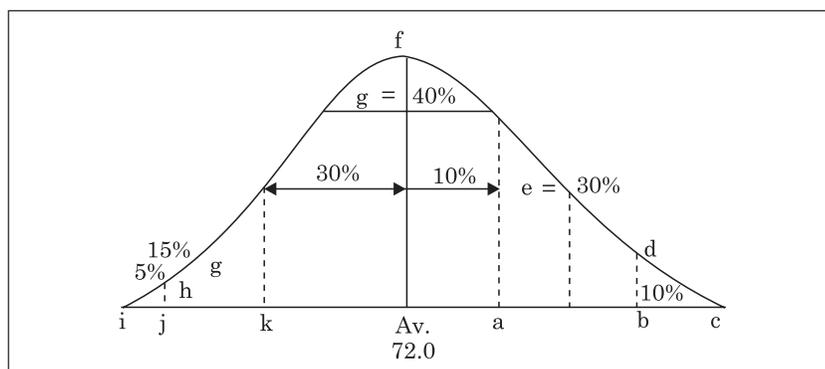
Fig. 26.9

Similarly from Q to R under S and P to Q 15% comes under d. Total parts under S and d = 5 + 15 =20/%. From mean to point R half part =50%, Hence between mean and P's part =50-20=30%. Both side of mean P to a till part is remain in which left side 30% and right had side 10% covers.

Each two category divider I. Q. b,a, p and Q points will be laid.

1. a, from mean lies such a distance, between that 10% data covers. From table 10% s σ distance = .25σ, but σ = 10 . Hence at that point which I. Q. will be .25 x 10 = 2.5 I.Q. up e.g. 72 + 2.5= 74.5 or 75.

2. Similarly b from mean as distance σ as between (10%+30%) = 40% data exists. From table this distance is 1.28σ. Since and mean= 72 therefore at this point situated I.Q.will be = 72 + 1.28 x 10 = 84.8 or 85.

3. Similarly at point P will be I. Q. left from mean from a distance.84σ because 30% scores lies between mean and .84σ. Therefore at this point will be situated I.Q. = 727.84 x 10 = 72-8.4 = 63.6 or 64

4. 'd' point from mean (30+15) =45% range area's distance. This distance in A 1.645σ is Therefore at this point will be situated I.Q. = 72 - (1.645 x 10) = 72 - 16.45 = 55.55 or 56.

Therefore at four division point situated I.Q. will be 56, 64, 75, 85 e.g. above 85 I.Q. in the a category, above 75 I.Q' in b category, above 64 in c category above 56 in d category and below 56 in S category.

Self Assessment

State whether the following statements are True or False:

4. In normal distribution half part of both side of curve is equal.
5. In positive skew mostly data lies right to mean.
6. There are four types of skews.
7. Kurtosis indicate towards the flatness and verticalness of the curve.

26.5 Measuring Divergence from Normality

Notes   In normal distribution mean, medium and mode all the three lies only at one point and half part of both side of curve is same.

In that symmetry presents as already has mentioned under characteristics of normal distribution. If distribution curve differ from this position then it is called abnormal distribution. Abnormal distribution can be of two types.

(a)   Skew

(b)   Kurtosis

(a) Skew

In skew abnormalness both value mean and median, having not coincided but lies differently and centre of gravity is remove either right or left. In normal distribution mean and median, both has some value and abnormalness is zero. As they close to each other as skew quantity will be least and as much as normal will be lesast. Skew is of two types also :

1.   Positive skew

2.   Negative skew

1. Positive skew: In positive skew mostly data is lies left side of mean and in right side a few data and is scattered as shown in the below figure e.g. less scores than mean is much more in number and more value data from that are also, but they are scattered to a far distance. In second positive skew median lies left to mean.
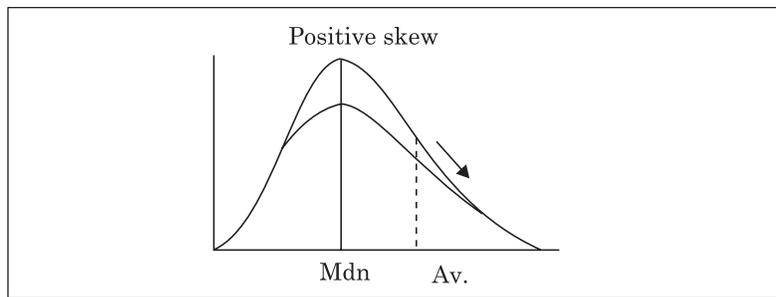
Fig. 26.10

2. Negative skew: In that condition mostly data are collected to the right of mean e.g. greater value data from mean have much in number and they are close to one another. Secondly median value is lies right to median e.g. median value is greater than mean. It is clear from below figure.
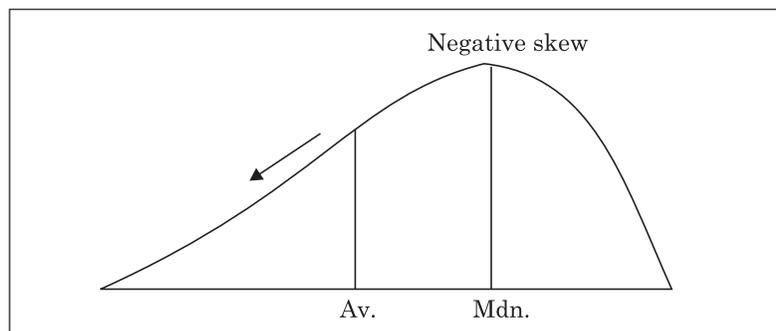
Fig. 26.11

Measures of skewness:-Skew abnormalities is calculated by following formula.

$$SK = \frac{3(\text{mean-median})}{\sigma}$$

...(1)

Second formula by percentile is of calculation.

$$SK = \frac{P_{90}P_{10}}{2} - P_{50}$$

...(2)

Having calculated by both formulae as much as skewness in quantity, as much as difference will be. Therefore they are not comparable.

(b) Kurtosis

Kurtosis indicates towards curve's flat and peaked position. Normal distribution curve should as much as flat and height, if more than that flatness and peakedress is found then it comes under kurtosis.

Normal distribution curve called mesokurtic also. That kurtosis's height is more than normal curve height that is called leptokurtic. That kurtosis's flatness more than normal curve flatness that is called platy kurtic. In the following figure these three position has been shown.

B A

C

A. Leptokurtic

B. Normal or Mesokurtic

C. Platykurtic
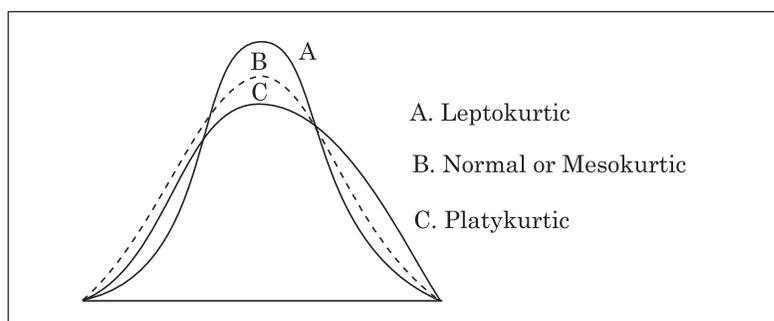
Fig. 26.12

Measures of kurtosis

Following is the formula of calculation of kurtosis: $Ku = \dfrac{Q}{P_{90} - P_{10}}$

The kurtosis of normal distribution curve is .263. If any curve is more than it then distribution is called leptokurtic.

Task   What do you mean by kurtosis?

(c) Reason for abnormal frequency distribution

Why any frequency distribution having not normal have non normal, there are a number of reasons behind it. In psychological and educational test it is essential to know it. In the following conditions skew or kurtosis position is accrued:

(1) Sample:

(1) When we measures any features or characteristics then we take only some limit number of that properly holder or characteristics holder and population one or two sample. Having measured that properties that result applies to whole population. As is does so that whole population measure is impossible.

🐧**?**

Did You Know?   Non-normal distribution is of two types skew and kurtosis.

Our result's precision and exactness depends upon this samples own characteristics. When this selection is not right or any important fault comes in this then measures of distribution is not normal too. For example in our sample mostly boys will be brilliant or lees intelligent then theirs data of distribution of intelligence result will not be some. Therefore it is clear that sample is such a type that in which measures related property or characteristics' distribution is normal, e.g. neither many of that property holder nor very few e.g. of all types are.

(2) Not only objects or persons' characteristics quantity distribution but also their number effects on their measures on distribution. If sample is too low e.g. in that very few things or persons are measuring, only then distribution is normal.

(3) A number of external effects which is related to measures related characteristics, caused occurred oddness in distribution of measures as a much older age, social status, language skill etc. as such a factor which is related to intelligence. If sample is too high or objective, did not pay attention on selection time and any one primness comes in it then measures in distribution occurs skewness or kurtosis.

2. Wrong and un-appropriate test

Second reason is uses of that tests which is not appropriate for that sample and whose formulation is not properly.

(1) Un-appropriate test neither very tough nor simple. As a result measures must be either in left or right. Therefore distribution will not be normal. If a test of 12 aged is given to 8 or 9 year boys then measures distribution will not be normal in first condition that is positive skew or in second condition it will be negative skew.

⚠

Caution   If test construction has not right then it will not reliable and exact. Therefore which measures will comes, may be their distribution is not normal.

(2) Similarly if administration of test has been not properly rather then distribution skewness is occurred.

26.6   Summary

- In statistics normal distribution has great importance. In several places use of normal distribution is of much worthful on the basis of normal distribution ours mean's utility, exactness and justification determines.

- In normal distribution by included percentage number and limitations we know total datas status. This is a great characteristic of normal distribution and it has great utility.
- In normal distribution value of mean, median and mode lies at midpoint of distribution and their value is equal also.
- This characteristics of normal distribution based upon theory of probability. Theory of probability has not only in statistics but also in all sciences great important.

26.7   Keywords

1. **Kurtosis:** Curve's flat and peaked position is called kurtosis.
2. **Table:** Table, name list, Tabulation.

26.8   Review Questions

1. What do you mean by normal distribution? Describe its characteristics.
2. What is called normal probability curve. Explain with examples.
3. How normal distribution table is used?
4. What do you mean by skewness of frequency distribution.

Answers: Self Assessment

1. Normal distribution	2. Mean	3. Middle	4. True
5. False	6. False	7. True.	

26.9   Further Readings

Books
1. Educational research methods—*Shareen and shashikala, vinod pustak mandir*
2. Educational techniques—*S.S. Mathur, Bhatt Brothers.*
3. Education Research Work Procedure—*L. Kaul, Vikash Publishing.*
4. Education Technique And Appraisal—*Dr Ram Pal Singh, Bhatt Brothers.*

Unit 27: Measurement of Dispersion QD, MD, SD

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Objectives

After studying this unit, students will be able to:

- Understand the meaning, definition and kinds of dispersion
- Understand quartile and mean deviation
- Understand standard deviation.

Introduction

Dispersion is that property of measurement by which it is calculated up to how much the value of terms is deviated from its mean values. The central tendency of whole series is found by mean values (mean, median and mode) but by this the complete and definite knowledge of different term values of series cannot be determined in the case when there is large difference in values of mean and other terms values. So in such situations there needs of measures which provide more information of term values i.e., how much deviation is of term values is mean values. Such kind of spread is called the measures of deviation or dispersion.

27.1   Meaning and Definition of Dispersion

Normally, the measures of scatter or spread of the separates scores around their central tendency is called the measure of variability or dispersion.
Some specific definition are as follows:-

1. **Crow and Crow,** "The extent to which cases tend to gather around the average or central tendency or the extent to which they disperse themselves is called their variability or deviation."

2. **Boring, Langfeld and Weld,** "Measures of variability tell us how widely the data scatter about their mean."

27.2 Kinds of Dispersion Measures

To get spreadness or dispersion in statistics mainly four measures are used.

1. Range
2. Quartile deviation
3. Mean deviation
4. Standard deviation

1. Range

Range is the simplest measure of dispersion. By this it can be explained without any calculation at a glance which of the two groups is homogeneous or which is heterogeneous.

R is the symbol of range and its formula is-

R = Maximum score – Minimum score.

Example   Suppose in mathematics ten students marks are as follows - 55, 52, 50, 48, 90, 45, 60, 40, 43, 44, then its range will be = 90 – 40 = 50.

There are some limitations of this measures also, therefore range should be used very limited. The greatest limitations of this measures is that only ends numbers has given importance not other scores. Therefore this measures of deviations does not give any information of group's internal scatterness.

Secondly, when number of N is lees or much gaps in frequency distribution, then in this condition range do not do exact measure or deviations. Therefore in such cases we should not use this measures.

Caution   When number of two samples is different then there should not use range to compare the deviations because there is a strong possibility of increasing range with the increase in number N also.

27.3 Quartile Deviation: QD

Quartile deviation is an improvement over range deviation. Under range measure only highest and lowest marks at the ends is considered and no importance is given to the middle scores of distribution, so there is no correct information obtained about the homoginity of groups. To remove this shortcomings in quartile deviation 50% scores of the middle has been given importance. 25% scores of above and below distribution is given no importance.

Q is its symbol and following is the formula:-

$$Q = \frac{Q_3 - Q_1}{2} = \frac{P_{75} - P_{25}}{2}$$

With the help of figure there is an attempt of more clarification of it.
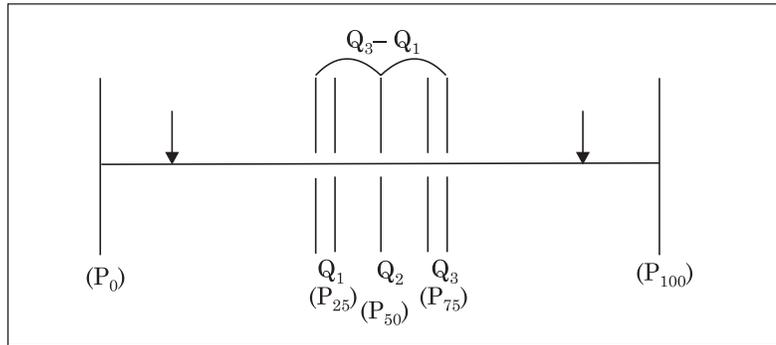
Fig. 27.1

Quartile range is also called semi-inter quartile Range. Some scholar has tried to define it as follows.

Notes   Skinner, " Quartiles are the three points that divide a distribution into four equal parts."

Odell, "The quartile deviation or semi-inter quartile Range is one-half of the distance between the first and third quartiles."

Calculation of Quartile Deviation: QD

Example: Calculate quartile from the following data—

	Table 27.1			
S. No	*C.L.*	*f*	*Cf*	
1.	40-42	5	50	
2.	37-39	8	45	← Q_3
3.	34-36	9	37	
4.	31-32	10	28	
5.	28-30	7	18	← Q_1
6.	25-27	5	11	
7.	22-24	4	6	
8.	19-21	2	2	
	N=50			

Now, $Q = \dfrac{Q_3 - Q_1}{2}$

and $Q_1 = L + \left(\dfrac{\dfrac{N}{4} - f_b}{f_a} \right) \times C.I.$ and Q_3

$$Q_3 \;=\; L + \left(\dfrac{\dfrac{3N}{4} - f_b}{f_a} \right) \times C.I.$$

Where Q_1 and Q_3 are the first and third quartile of group

L= Lower limit of the class interval in which Q_1 (P_{25}) and Q_3 (P_{75}) lie.

f_b= the sum of frequencies of all those classes which lie below the class of Q_1 and Q_3.

f_a= Frequency of Q_1 and Q_3 class

C.I.= Limit of class Interval.

From above example Q_1, i.e. the value P_{25} is as follows.

$$
\begin{aligned}
Q_1 \;&=\; 27.5 + \dfrac{(12.5 - 11)}{7} \times 3 \\[2mm]
&=\; 27.5 + \dfrac{(1.5)}{7} \times 3 \\[2mm]
&=\; 27.5 + \dfrac{(4.5)}{7} \\[2mm]
&=\; 27.5 + .64 \\[2mm]
&=\; 28.14 \;\left(\text{Note } \dfrac{N}{4} = \dfrac{50}{4} = 12.5\right)
\end{aligned}
$$

Similarly,

$$
\begin{aligned}
Q_3 \;&=\; 36.5 + \dfrac{(37.5 - 37)}{8} \times 3 \\[2mm]
&=\; 36.5 + \dfrac{.5}{8} \times 3 \\[2mm]
&=\; 36.5 + \dfrac{1.5}{8} \\[2mm]
&=\; 36.5 + .19 \\[2mm]
&=\; 36.69
\end{aligned}
$$

Hence,

$$
\begin{aligned}
Q \;&=\; \dfrac{Q_3 - Q_1}{2} \;=\; \dfrac{36.69 - 28.14}{2} \\[2mm]
&=\; \dfrac{8.55}{2} \\[2mm]
&=\; 4.28 \;\textbf{Ans}
\end{aligned}
$$

Self Assessment

Fill in the blanks:

1. The range of measure of separates scores from the central values to that group is called…………….. .

2. To find out deviation mainly four measures are used in …………… .

3. Quartile deviation is a improved form over ………………….. .

27.4   Mean Deviation: MD

Symbol = AD or MD

Garrett writes to clarify the meaning of mean deviation "The average deviation or mean deviation (AD or MD) is the mean of a deviations of all the separate scores in a series taken from their mean (occasionally from the median or mode). In averaging deviations to find the A.D., no account is taken of signs and all deviations whether plus or minus are treated as positive.

— Garrett 1958

Mean deviation is the mean of deviations of different scores from mean. To find mean deviation we find differences from mean to scores. We neither deduct mean to actual scores nor scores from mean rather than we find difference between mean and scores. This is the reason we do not take care of sign. In fact our aim is to find only deviation of means from scores, distance and range. To ignore plus (+) and minus (-) sign is the special feature in finding mean deviation therefore in statistics it is rarely used.

1.   Ungrouped data

2.   Grouped data

1. Mean deviation from ungrouped data: Following are the formula to calculate mean deviation of ungrouped data:

$$M.D = \frac{\Sigma |d|}{N}$$

Where,   M.D.   =   Mean Deviation

D   =   Difference of any scores from mean.

|d| =   Sum of deviation without sign

N   =   Total numbers of scores:

Illustration: Calculate mean deviation from following ungrouped data.

Table 27.2				
S. No.	X marks obtained	d	=	(X – M)
1.	10	10–18	=	– 8
2.	15	15–18	=	– 3
3.	10	10–18	=	– 8
4.	20	20–18	=	2
5.	25	25–18	=	7
6.	15	15–18	=	– 3
7.	25	25–18	=	7
8.	20	20–18	=	2
9.	17	17–18	=	– 1
10.	23	23–18	=	5
Σ |d| = 46				

$$M \;=\; \frac{\Sigma X}{N} \;=\; \frac{180}{10} = 18$$

Hence,   M.D. $= \dfrac{\Sigma |d|}{N} = \dfrac{46}{10}$ = 4.6 **Ans**

2. M.D. of grouped data: Following are the formula to use in finding out the mean deviation of grouped data.

$$\textbf{M.D.} \quad = \quad \dfrac{\Sigma |fd|}{N}$$

Illustration: Calculate mean deviation from following grouped data:

			Table 27.3		
S.No.	*C.I.*	*f*	*X*	*d*	*fd*
1.	55–59	1	57	27.4	27.4
2.	50–54	1	52	22.4	22.4
3.	45–49	3	47	17.4	52.2
4.	40–44	4	42	12.4	49.6
5.	35–39	6	37	7.4	44.4
6.	30–34	7	32	2.4	16.8
7.	25–29	12	27	–2.6	–31.2
8.	20–24	6	22	–7.6	–45.6
9.	15–19	8	17	–12.6	–100.8
10.	10–14	2	12	–17.6	–35.2
		N =50	M = 29.6		$\Sigma|fd|$ = 425.6

$$\textbf{M.D}. \quad = \quad \dfrac{\Sigma |fd|}{N} \quad = \quad \dfrac{425.6}{50}$$

$$= \quad 8.51 \textbf{ Ans.}$$

Important steps:

1. Find the mean of group's scores.

2. Find mid point of each class.

3. By deducting mean from mid-point, calculate deviations (X-M).

4. Find fd by multiplying of each deviation and their related frequency.

5. Find product of total $\Sigma|fd|$ of obtained products.

6. Calculate mean deviation by putting all these values in formula.

27.5   Standard Deviation: SD

During calculating mean deviation we do care of sign of deviations and it is the special feature of mean deviation. Hence to make it error free, mean deviation or standard deviation is calculated. In other word, we can say that standard deviation is an improved form of mean deviation.

To ward off the problems of signs under mean deviation squares of deviation are taken under standard deviations. So that minus sign is converted into plus signs. After that by finding average of these squared deviations its square root have been taken. This is called the mean deviation or standard deviation.

According to **Reichmann "The standard deviation is also known as root mean square deviation. It is the square root of the mean value of all the deviation squared taken from the distributions mean**.'

In general words, mean deviation is defined in this way-

Very generally, the standard deviation is a measure of how the scores cluster or disperse around the mean and is conventionality represented by Greek letter sigma.

$$\text{Symbolically, } \sigma = \sqrt{\frac{\Sigma fd^2}{N}}$$

Calculation: For the calculation of standard deviation, following three forms of questions have been used.

Case I   : When only ungrouped data has been given.

Case II   : When frequencies with ungrouped data has also been given.

Case III : When classified data has been given.

Case I   : When only ungrouped data has been given.

Such type of questions can be solved by two methods – Actual mean method and Assumed mean method. In these methods following formula are used—

$$\text{S.D.} \quad = \quad \sqrt{\frac{\Sigma d^2}{N}} \qquad \text{(Actual Mean Method)}$$

$$\text{And} \qquad \text{S.D.} \quad = \quad \sqrt{\frac{fd^2}{N} - \left(\frac{\Sigma d^2}{N}\right)^2} \qquad \text{(Assumed Mean Method)}$$

Illustration: Calculate standard deviation of following data by actual mean method

Table 27.4			
S.No.	*X*	*d = (X – M)*	*d²*
1.	10	10-18 = – 8	64
2.	15	15–18 = –3	9
3.	10	10–18 = –8	64
4.	20	20–18 = 2	4
5.	25	25–18 = 7	49
6.	15	15–18 = –3	9
7.	25	25–18 = 7	49
8.	20	20–18 = 2	4
9.	17	17–18 = –1	1
10.	23	23–18 = 5	25
N = 10	ΣX = 180		Σd² = 278

$$M = \frac{\Sigma X}{N} = \frac{180}{10} = 18$$

$$\sigma \quad = \quad \frac{\Sigma X}{N} = \frac{180}{10} = 18$$

$$= \sqrt{\frac{\Sigma d^2}{N}} = \sqrt{\frac{278}{10}}$$

$$= \sqrt{27.8} = 5.27 \text{ Ans.}$$

Table 27.5			
S.No.	*X*	*d = (X – M)*	*d²*
1.	10	10–17 = –7	49
2.	15	15–17 = –2	4
3.	10	10–17 = –7	49
4.	20	20–17 = 3	9
5.	25	25–17 = 8	64
6.	15	15–17 = –2	4
7.	25	25–17 = 8	64
8.	20	20–17 = 3	9
9.	17	17–17 = 0	0
10.	23	23–17 = 6	36
N = 10	ΣX = 10		Σd² = 278

Important stages

1. Systematized distributed scores.
2. Calculate actual mean from distributed scores.
3. Calculate deviation by using formula d=X–M.
4. Find the square of deviations d².
5. Find Σd^2 by adding deviations squares.
6. Calculate S.D. by putting all these values in formula.

Case I: When frequency with their ungrouped data is given.

Example: Calculate standard deviation of following data by assumed mean method

Table : 27.6					
S. No.	*X*	*f*	*d = (X – M)*	*fd*	*fd²*
1.	65	3	65–75 = –10	–30	300
2.	68	4	68–75 = –7	–28	196
3.	70	4	70–75 = –5	–20	100
4.	72	5	72–75 = –3	–15	45
5.	74	6	74–75 = –1	–6	6
6.	75	7	75–75 = 0	0	0
7.	78	6	78–75 = 3	18	54
8.	80	5	80–75 = 5	25	125
9.	82	4	82–75 = 7	28	196
10.	84	6	84–75 = 9	54	486
N = 50				Σfd = 26	Σfd^2 = 1508

Now, S.D. or σ $= \sqrt{\dfrac{\Sigma d^2}{N} - \left(\dfrac{\Sigma fd}{N}\right)}$

$= \sqrt{\dfrac{1508}{50} - \left(\dfrac{26}{50}\right)}$

$= \sqrt{30.16 - 0.52}$

$= \sqrt{30.16 - 0.27}$

$= \sqrt{29.89}$

$= 5.47$ Ans.

Note

1. If score is in the range of 10-20, then actual mean method is convincible.
2. If actual mean comes in decimal then use assumed mean method.
3. The selection of assumed mean data should be done carefully.

Case II- When classified data has been given.

Standard deviation of related question of grouped data is found by two methods- Long method and short-cut method- Following are the used formula in these methods:

$$\sigma = \sqrt{\dfrac{\Sigma fd^2}{N}} \text{ (Long Method)}$$

$$\sigma = \sqrt{\dfrac{\Sigma fd^2}{N} - \left(\dfrac{\Sigma fd}{N}\right)^2} \times \text{C.I. (Short Method)}$$

Example: Calculate standard deviation of following data by long method.

Table 27.7							
S. No.	*C.I.*	*f*	*X*	*fX*	*d(X – M)*	*fd*	*fd²*
1.	40–44	3	42	126	14.3	42.9	613.47
2.	35–39	4	37	148	9.3	37.2	345.96
3.	30–34	4	32	128	4.3	17.2	73.96
4.	25–29	7	27	189	0.7	4.9	3.43
5.	20–24	5	22	110	5.7	28.5	162.45
6.	15–19	3	17	51	10.7	32.1	343.47
7.	10–15	2	12	24	15.7	31.4	492.98
		N = 28		ΣfX = 776			Σfd² = 2035.72

$\mathbf{M} = \dfrac{\Sigma fX}{N} = \dfrac{776}{28} = 27.7$

$\mathbf{S,D,} = \sqrt{\dfrac{\Sigma fd^2}{N}}$

$$= \sqrt{\frac{2035.72}{28}}$$

$$= \sqrt{72.71}$$

$$= 8.52 \text{ Ans.}$$

Did You Know?　　　Standard deviation is also called the square root of average deviation.

Important steps:

1. Find the mid-point (x) of each class interval related formula is—

$$X = \frac{\text{Lower limit} + \text{Upper limit}}{2}$$

2. Find *fx* by multiplying mid-point of all class interval with their respective frequencies.

3. Find sum of all *fx*.

4. Calculate mean by using formula (M = Σ*fx*/N.

5. Calculate deviation (d) by formula d = X – M.

6. Calculate fd by multiplying each class frequencies to their deviation.

7. Find fd^2 multiplying fd and d.

8. Find summation of all fd^2.

9. Divide Σfd^2 by N.

10. Obtain square root of obtained quotient. This will be the required standard deviation.

Example: Calculate standard deviations of following data by short–cut method.

S. No.	C.I.	f	d	fd		fd²
				Table 27.8		
1.	90–99	1	+4	4		16
2.	80–89	4	+3	12	+ 40	36
3.	70–79	7	+2	14		28
4.	60–69	10	+1	10		10
5.	50–59	9	0	0		0
6.	40–49	9	–1	–9		9
7.	30–39	4	–2	–8	– 38	16
8.	20–29	3	–3	–9		27
9.	10–19	3	–4	–12		48
		N = 50		Σfd = 2		Σfd² = 190

Now,　S.D or σ $= \sqrt{\dfrac{\Sigma fd^2}{N} - \left(\dfrac{\Sigma fd}{N}\right)^2} \times C.I.$

Putting obtained values in the formula we get

$$\sigma \quad = \quad \sqrt{\frac{190}{50} - \left(\frac{2}{50}\right)^2} \times 10 = \sqrt{3.8 - (.04)^2} \times 10$$

$$= \sqrt{3.8 - .016} \times 10$$

$$= \sqrt{3.7984} \times 10$$

$$= 1.95 \times 10$$

$$= 19.50 \text{ **Ans.**}$$

Important Steps:

1. Assume appropriate class interval or the class-interval of the most frequency as assumed mean.

2. Assume the deviation of selected class interval as zero.

3. Find out deviation of all classes. For this above class (greater value) of assumed C. I. is given positive integral values as +1, +2, +3 and lower class intervals is given negative integral values as -1, -2, -3……….

4. Find out fd multiplying by each class interval's frequency and deviations.

5. Find out sum of fd keeping in mind their sign. This is called Σfd.

6. Calculate fd^2 multiplying each class intervals fd to d.

7. Find out summation of fd^2. This is called Σfd^2.

8. Calculate S.D. by putting obtained value in formula.

Self Assessment

Multiple Choice Questions:

4. Range is the _____ measure of deviation.

   a. Simplest   b. Complicated   c. Expensive   d. long term

5. Symbol of quartile is _____.

   a. R   b. Q   c. N   d. M

6. _____ Deviation is mean of deviations of different scores from means.

   a. Range   b. Mean   c. Median   d. Standard

7. Standard deviation is also called _____ of average deviation.

   a. Equal   b. Half   c. Square root   d. Full

27.6 Uses of Standard Deviation

Range

1. When standard deviation is to find out quickly.

2. When to get information of highest and lowest scores.

Quartile Deviation (Q.D.)

1. When the value of central tendency is shown by mean.
2. When distribution is incomplete.
3. When the value of some scores is either very high or very low.

Mean Deviation (M.D.)

1. When distribution is almost normal.
2. When deviation is dispersed excessively.
3. When normal reliability is needed.

Task　　　When do the deviation values used?

Standard Deviation (S.D.)

1. When more reliability is needed.
2. When to find correlation coefficient etc.
3. When distribution is normal.
4. When the value of central tendency is shown by the middle value.

27.7　Summary

- In normal scenes the measures of scattered or spread separate scores around their central tendency is called the measures of variability or dispersion.
- According to boring, Langfield and weld " Measures of variability tell us how widely the data is scattered about their mean."
- To find out deviation or expansion in statistics mainly four measures uses—
  1. Expansion (Range)　　2. Quartile Deviation　　3. Mean Deviation　　4. Standard Deviation

27.8　Keywords

1. **Quartile:** That point which divides the scores of distributions into four equal part.
2. **Deviation:** Difference of central value of that group from separate scores of any group.

27.9　Review Questions

1. With the help of following scores calculate range-15, 7, 19, 18, 21, 27, 18, 12, 29, 13　Ans 22
2. Find out quartile deviation from following table.

Table		
C.I.	f	
40–44	3	
35–39	3	
30–34	5	
25–29	7	
20–24	5	
15–19	3	
10–14	2	**Ans**. Q = 6.0

3.   Find out quartile deviation from following data.

Table		
C.I.	f	
55–59	1	
50–54	1	
45–49	3	
40–44	4	
35–39	6	
30–34	7	
25–29	12	
20–24	6	
15–19	8	
10–14	2	**Ans**. Q = 7.5

4.   Find out quartile deviation from following table.

Table		
C.I.	f	
80–89	5	
70–79	2	
60–69	3	
50–59	2	
40–49	5	
30–39	4	
20–29	3	
10–19	2	
0–9	4	**Ans.** Q = 21.67

5.   With the help of following data find mean deviation.

    4, 6, 8, 10, 12, 16, 18, 20   **Ans.** M.D. = 4.44

6.   With the help of following scores find mean deviation.

    6, 8, 10, 12, 14   **Ans.** M.D. = 24

7. With the help of following scores find standard deviation

(a) 12, 18, 17, 13, 14, 16   **Ans.** $\sigma = 2.10$

(b) 24, 23, 12, 14, 17, 18, 16, 20   **Ans.** $\sigma = 3.90$

(c) 4, 6, 8, 10, 12, 14, 16, 18, 20   **Ans.** $\sigma = 5.16$

(d) 16, 13, 18, 17, 20, 19, 21, 17, 22, 12
16, 16, 18, 15, 18, 19, 16, 13, 21, 17   **Ans.** $\sigma = 2.7$

8. With the help of discrete series find standard deviation.

X: 65, 68, 60, 72, 74, 71, 73, 80, 82,83

f : 3, 4, 4, 5, 6, 9, 6, 5, 2, 6   **Ans.** $\sigma = 6.36$

9. Calculate mean deviation with the help of following data.

Table		
C.I.	f	
40–45	3	
35–40	4	
30–35	4	
25–30	7	
20–25	5	
15–20	3	
10–15	2	**Ans.** M.D. = 6.9

10. Find out mean deviation from following data.

Table		
C.I.	f	
29–31	2	
26–28	3	
23–25	4	
20–22	3	
17–19	2	
14–16	1	**Ans.** M.D. = 3.52

11. Define mean deviation, at the same time with the help of following data calculate S.D.

Table		
C.I.	f	
100–104	3	
95–99	4	
90–94	4	
85–89	11	
80–84	3	
75–79	4	
70–74	2	**Ans.** $\sigma = 8.15$

12. Find out standard deviation from following data.

Table		
C.I.	f	
40–42	5	
37–39	8	
34–36	9	
31–33	10	
28–30	7	
25–27	5	
22–24	4	
19–21	2	**Ans.** σ = 5.70

13. Find out standard deviations from following data.

Table		
C.I.	f	
70–74	3	
65–69	6	
60–64	7	
55–59	8	
50–54	15	
45–49	10	
40–44	7	
35–39	3	
30–34	1	**Ans.** σ = 9.45

14. From following data calculate quartile mean and standard deviation.

Table		
C.I.	f	
60–65	2	
54–59	2	
48–53	6	
42–47	3	
36–41	8	
30–35	8	
24–29	4	
18–23	6	
12–17	10	
6–11	6	
0–5	5	**Ans.** Q = 12.88 M.D. = 14.35 S.D. = 16.62

15. From following data find out quartile mean and standard deviations.

Table		
C.I.	f	
77–83	3	
70–76	13	
63–69	16	
56–62	13	
49–55	6	
42–48	22	
35–41	18	
28–34	6	
21–27	1	
14–20	2	**Ans.** Q = 12.42 M.D. = 13.06 S.D. = 14.94

Answers: Self Assessment

1. Deviation   2. Statistics   3. Expansion or Range   4. (a) Simple

5. (b) Q   6. (b) Mean   7. (c) Square root

27.10   Further Readings

Books

1.   Educational Technique—*S.S. mathur, Bhatt Brohters.*

2.   Educational Techniques, Management and Evaluation—*J.C. Agrawal, Bhatt Brothers.*

3.   Education Techniques—*R.A. Sharma Bhatt Brothers.*

4.   Educational Research Methods—*Shareen and Shashikala, Vinod pustak mandir.*

Unit 28: Correlation: Rank Difference Method, Product Moment Method

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Objectives

After studying this unit, students will be able to:

- Understand the definition and kinds of correlation
- Understand coefficient of correlation
- Understand rank difference and product moment method.

Introduction

Generally, we say that those students who opt science are interested in engineering and medical field, commerce should be opted by those students who are interested in business, Hindi, English and Sanskrit should be opted by those who are interested in literature, music and art should be opted by those who have aesthetic value or rather than we say that persons of short-height are more talented than the tall persons, persons with oval forehead get more honours in society, ball headed man is wealthy etc. Behind these feelings have a long experience or special related facts. Along with our assertions or prediction of these kinds are not based on the observations of short duration only but plenty of logics can be gathered to fulfill it. For example, if we want to assure in the field of psychology how much an individuals achievements in one field have related to or affected to the other field, then in the language of Pschology, we will symbolyse this relationship in terms of variable by establishing relations among different variables. We can easily predict that the individual it can be selected for the particular profession or not .Along with the behaviour of the individual can be controlled according. The mutual relation among variables are called correlation. With the help of following examples the meaning of correlation can be done more clearly.

1. Effects of socio-economic conditions of the parents on child's performance.
2. Relationship between I.Q and Achievement.
3. Effects of Motivation on Learning.
4. Effects of Home Environments on child's social activities.
5. Role of Material Aids in increasing teaching-effectiveness.
6. Effects of Treatment-environment on child's morale.
7. Relationship between student morale and academic achievement.

28.1   Definition of Correlation

Some main definitions are as follows.

When two variable are related with each other in such a fashion that the increase in one variable causes increase or decrease in another variables or decrease in one variable causes decrease or increase in another variable, *i.e. vice-versa,* then the two variables are said to be correlated.

Thus, correlation is the relationship between two variables or two different sets of data.

Correlation deals with the relationship between two or more different groups of data in order to ascertain whether any relation exists between them or not and to obtain a numerical expression of the degree of such a relationship.   *—Bayliss*

Notes   Correlation is a statistical measures of the degree of association between two variables.

"The coefficient of correlation is almost as important to the Psychological tester as is the balance to the chemist."

—W.L Sumner, 'Statistics in school', Oxford Basic Blackwell, 1950

28.2   Kinds of Correlation

Correlation have mainly three types.

1. Positive Correlation
2. Negative Correlation
3. Zero Correlation

Positive Correlation

Positive Correlation occurs in that condition when inresent in one variables causes increase in other e.g., the students which gets maximum marks in mathematics the same students gets maximum marks in English or Vice-Versa, decrease of one variable causes decrease in other variable e.g, the students which gets minimum marks in art, the same student gets minimum marks in Hindi also, e.g., I.Q and academic achievement's relationship.

Example

High I.Q.   →   High Percentage of marks

Low I.Q.   →   Low Percentage of marks

According to above example the student whose I.Q. level is superior, his percentage of marks should be high also. In other words, a student who gets maximum marks in examination, his I.Q. level should be superior also. Right-now the student whose I.Q. level is low, his percentage of marks should be minimal also. In other words, a students who get-less sores in test, their I.Q. should also be less. This condition is of positive correlation.

Unsystematic graph shows correlation +1.00

One proportional line added it to a graph.
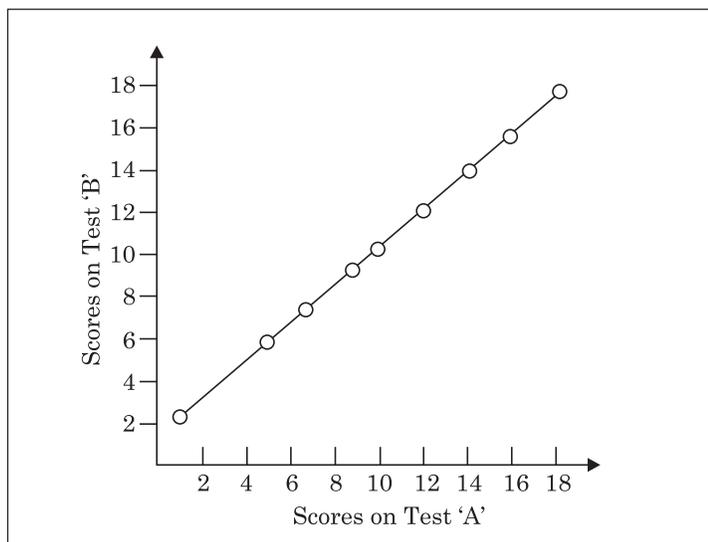
Fig. 28.1

Negative Correlation

Negative Correlation occurs at that condition when increase in one variable causes decrease in other variable e.g., the student who stands first in an examination, the same student gets last position in another examination and similarly all students' absurdities just reverse or its opposite, we say that when decrease in one variable causes increase in another variable, e.g., the student gets final position in one test the same student stands first in another test. In these condition, negative or negative perfect correlation occurs such type of perfect conditions are generally found less.

Example

More extrovert students   →   Low pass percentage

Less extrovert students   →   High pass percentage

According to above example, those student who is more extrovert they pass less or we can say that the cause of failure of students are their extrovert personality. Just then that student who is less extrovert e.g., they are introvert. They succeed in examination more or we can say that their cause of success is their introvert personality.

Unsystematic graph shows correlation -1.00.
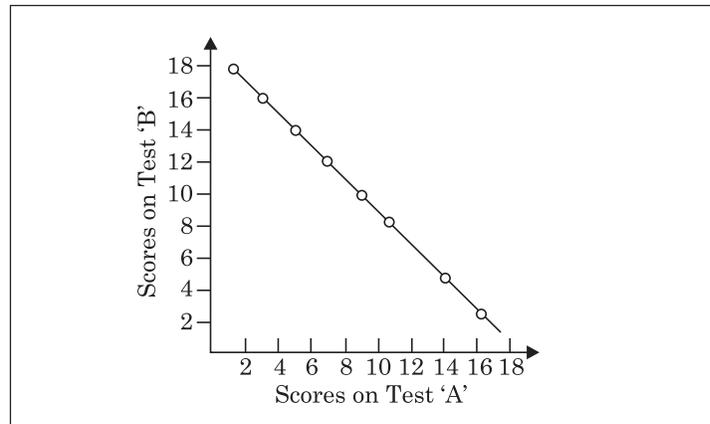
Fig. 28.2

Zero Correlation

Zero Correlation occurs at that condition when increases or decrease of one variables has no effect on other variable e.g. on the basis of student's one subject obtained marks we can not guess about his other subjects marks.

Example

Children from good social status   →   Pass percentage 80

Children from poor social status   →   Pass percentage 80

According to above example there is no correlation to children's social status to their academic achievement e.g, fail or pass. Children comes from either aristocrate or poor family theirs percentage of passing will be the same. In this way a good musician may be a good artist or maybe not. Unrelated graph shows correlation 0.
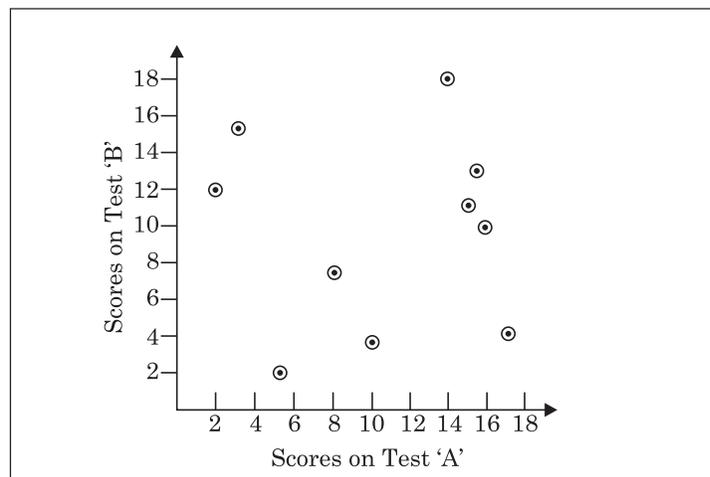
Fig. 28.3

Self Assessment

Fill in the blanks:

1. Correlation shows relationship ………………..two variables or groups

2. Correlations are mainly ………………… in types.

3. Those students who are more……………………. are less pass in examination.

28.3 Coefficient of Correlation

In educational field mostly two series of marks are needed to determine the amount of relationship. It can be expressed as coefficient of correlation.

On the basis of above discussion conclusion is drawn from it that in positive correlation increase in one variables causes increase in another also and decrease in one cause decrease in other also. In negative correlation decrease in one variables relates with another variables with more accuracy. Relationship will be considered as much close as the quantity of coefficient will be more. In Zero correlation on the basis of one subject's achievements cannot guess about other subject's achievement. All these three relationship numerically express as +1.00, -1.00 and .00 respectively. Generally these types of perfect conditions does not exist, hence correlation of this quantity are considered between +1.00 and-1.00.

In fact, correlation shows us what the nature of relationship of two variables is from this point of view correlation is that number which indicate us that how much two variables is related to each other e.g., how much the changes in one variable cause change in second variable. This correlation coefficient lies between +1.00 and -1.00 (±1) and symbolically represented by (ρ) or rho.

"The coefficient of correlation (r) is a convenient quantitative index of relationship, i.e. what is the degree of relationship? or, to what extent two variables are related with each other? The coefficient of correlation is almost as important to the Psychological tester as is the balance to chemist.**" *W.L. Sumner, 'Stat, in Schools'* —*Lindquist and Blummers.*

Interpretation of Correlation Coefficient or Results

To explain correlation coefficient or conclusions we take notice of two things ±0 sign and magnitude of results.

If correlation coefficients are positive then its meaning will be that, in a given distribution increase in one variables cause increase in another variables also or decrease in one variable cause decrease in another also. For example, if children's I.Q. and their subjective achievement find correlation then in this condition correlation coefficient will be positive and having analyzed of this mathematical fact it will be said that as increase in children I.Q. as will be increase in their subjective achievement.

Similarly, just opposite of it, if correlation are negative then its meaning will be that in a given distribution if one variables will decrease it causes increase another. For example, correlation is found between men's age and their memory then in this condition correlation coefficient will be negative and explaining to this mathematical fact it will be said that as men's age increases their memory will decrease.

For the explanation of correlation coefficient or drawn conclusion **Guilford's Table used**, which is following-

Quantity of Correlation Coefficient	Explanation
.00 to ±.20	Negligible
±.21 to ±.40	Low

±.41 to ±.70	Moderate
±.71 to ±.90	High
+.91 to ±.99	Very High
±1.00	Perfect

Methods of Computing Coefficient of Correlation

There are three main methods to computation of coefficient of correlation

1. Spearman's Rank Difference Method
2. Pearson's Product-Moment Method
3. Scatter-Diagram Method

28.4 Spearman's Rank Difference Method

We call rank difference method as series order method also. This method was postulated by Charles spearman and this method is called Spearman's correlation method after his name. Correlation coefficient obtained by this method are called Spearman correlation coefficient or called Spearman correlation coefficient or spearman's ranking correlation coefficient also. By this method obtained correlation coefficient are express by Latin language letter ρ (rho).

Where there are relatively few measures in the series, the Rank Difference method of correlation is employed generally. As the name indicates the size of the correlation coefficient (ρ) depends upon the sum of the differences in ranks between each pair of measures (a pair means one individual's measures in the two variables).

In this method both the scores of this variables are ranked separately on the basis of their size. After separating the scores of both variables calculate the difference of rank assigned on two variables and taking square of them, which is known as DV. After calculating the value ΣD^2 by the help of following formula calculate the value of correlation coefficient.

$$\rho \text{ or rho} = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)}$$

where,   ρ   =   Correlation coefficient

         ΣD^2 =   Sum of squares of rank difference

         N   =   Total no. of students

Illustration 1: Marks obtained by 12 students in two subjects mathematics and economics 12 students marks are given below. By Rank difference method calculate its coefficients coefficient.

Economics:	60	34	40	50	45	41	22	43	42	66	64	46
Math:	75	32	34	40	45	33	12	30	36	72	41	57

Solution: Find out Correlation Coefficient

Table 28.1						
Student	Economics	Math	R1	R²	D	D²
A	60	75	3	1	2	4
B	34	32	11	10	1	1

C	40	34	10	8	2	4
D	50	40	4	6	2	4
E	45	45	6	4	2	4
F	41	63	9	9	0	0
G	22	12	12	12	0	0
H	43	30	7	11	4	16
I	42	36	8	7	1	1
J	66	72	1	2	1	1
K	64	41	2	5	3	9
L	46	57	5	3	2	4
N = 12						Σd^2 = 48

$$\rho \;=\; 1 - \frac{6\Sigma D^2}{N(N^2 - 1)}$$

$$=\; 1 - \frac{6 \times 48}{12\,(12^2 - 1)}$$

$$=\; 1 - \frac{288}{12\,(144 - 1)}$$

$$=\; 1 - \frac{288}{12 \times 143}$$

$$=\; 1 - \frac{288}{1716}$$

$$=\; \frac{1716 - 288}{1716}$$

$$=\; \frac{1428}{1716}$$

$$=\; +\,0.83 \;\textbf{Ans}.$$

Explanation: The results of marks obtained by 12 students in both two subjects economics and mathematics show the high positive correlation between them.

Example: By following data find correlation coefficient between father and son height's

Height of father in inch	20	25	32	28	30	27	35	60	80
Height of son in inch	21	27	30	24	28	22	37	64	82

Solution: Calculate correlation coefficient between father and son height's.

Table 28.2					
Father's height	**Son's height**	**R¹**	**R²**	**D**	**D²**
20	21	9	9	0	0
25	27	8	6	2	4
32	30	4	4	0	0

28	24	6	7	1	1
30	28	5	5	0	0
27	22	7	8	1	1
35	37	3	3	0	0
60	64	2	2	0	0
80	82	1	1	0	0
N = 9					$\Sigma D^2 = 6$

$$\rho = 1 - \frac{6\Sigma D^2}{N(N^2-1)}$$

$$= 1 - \frac{6 \times 6}{9\,(9^2-1)}$$

$$= 1 - \frac{36}{9(81-1)}$$

$$= 1 - \frac{36}{9 \times 80}$$

$$= 1 - \frac{36}{720}$$

$$= 1 - \frac{1}{20}$$

$$= 20 - \frac{1}{20}$$

$$= \frac{19}{20}$$

$$= +0.95 \textbf{ Ans.}$$

Did You Know?   Rank Difference Method is developed by Charles Spearman.

Illustration: 3 By following data calculate rank correlation coefficient

Student	A	B	C	D	E	F	G	H	I	J	K	L
Science	50	54	56	59	60	62	61	65	67	71	71	74
Math	22	25	34	28	26	30	32	30	28	34	36	40

Solution:

Table 28.3						
Student	Science marks	Math Marks	R_1	R_2	D	D^2
A	50	22	12	12	0	0
B	54	25	11	11	0	0
C	56	34	10	3.5	6.5	42.25
D	59	28	9	8.5	.5	.25
E	60	26	8	10	2	4
F	62	30	6	6.5	.5	.25
G	61	32	7	5	2	4
H	65	30	5	6.5	1.5	2.25
I	67	28	4	8.5	4.5	20.25
J	71	34	2.5	3.5	1	1
K	71	36	2.5	2	.5	.25
L	74	40	1	1	0	0
N = 12						ΣD^2 = 74.50

$$= \ 1 - \frac{6\Sigma D^2}{N(N^2 - 1)}$$

$$= \ 1 - \frac{6 \times 74.50}{12(12^2 - 1)}$$

$$= \ 1 - \frac{447}{12(144 - 1)}$$

$$= \ 1 - \frac{447}{12 \times 143}$$

$$= \ 1 - \frac{447}{1716}$$

$$= \ \frac{1716 - 447}{1716}$$

$$= \ \frac{1269}{1716}$$

$$= \ +.739 \ \textbf{Ans}.$$

Explanation: The marks obtained in both subjects mathematics and science by 12 students show correlation is highly positive between them.

Interpretation: The value of rank correlation between science and mathematics is +.739. it is clear that correlation coefficient is positive and of high degree. Hence on the basis of this correlation coefficient it is said that the student obtained high marks in science they show tendency of obtaining high marks in mathematics also and the student obtained less marks in science, they show tendency of getting less marks in mathematics also. Along with most of the students have done so.

Example 4: By rank difference method calculate correlation coefficient of following two sets of data

Set A	80	80	80	75	75	62	74	66	71	59	67	67
Set B	75	75	69	73	62	58	70	61	61	61	63	72

Table 28.4					
Set A	**Set B**	**R$_1$**	**R$_2$**	**D**	**D²**
80	75	2	1.5	.5	.25
80	75	2	1.5	.5	.25
80	69	2	6	4	16
75	73	4.5	3	1.5	2.25
75	62	4.5	8	3.5	12.25
62	58	11	12	1	1
74	70	6	5	1	1
66	61	10	10	0	0
71	61	7	10	3	9
59	61	12	10	2	4
67	63	8.5	7	1.5	2.25
67	72	8.5	4	4.5	20.25
N = 12					ΣD2 = 68.50

$$\rho = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)}$$

$$= 1 - \frac{6 \times 68.50}{12(12^2 - 1)}$$

$$= 1 - \frac{411}{12(144 - 1)}$$

$$= 1 - \frac{411}{12 \times 143}$$

$$= 1 - \frac{411}{1716}$$

$$= \frac{1716 - 411}{1716}$$

$$= \frac{1305}{1716}$$

$$= 0.76 \textbf{ Ans.}$$

Explanation: This result show high positive correlation between two sets of data.

Limitations of Rank-Method: Rank difference method is not more reliable. In this method care is taken only on ranks, their own value has no significance. For example A, B, C's marks in mathematics 30, 40, 50 respectively and in English 70, 80, 90, then in first and second condition rank will be only

3,2,1. Now if English's marks is done 100, 110, 120 then their rank will be same. Now in this method in every condition answer will be some. Obviously, this method is not more, correct.

Utility of Correlation Coefficient: The main utility of correlation coefficient are as follows-

1. Helpful in Prediction
2. To determine reliability of test
3. To know the estimation of validity test
4. Useful in diagnosis
5. To get the information of heredity and effects of environment.
6. Elimination of false beliefs
7. Use in factor-analysis
8. In establishing the cause and effect relationship

Besides aforesaid points utility of correlation coefficient can be cleared as follows-

1. If a student has scored highest in home test then on the basis of that we predict that the student must stand first in board examination.
2. To know reliability either we apply Test-Retest Method or Split Half Method or any others we must find out the value of correlation coefficient.
3. In validity determination we correlate out of test to any criterion and on the basis of correlation coefficient validity is known.
4. If we had proved that in science and mathematics exists positive correlation by given test on a big group and if we do not see directly in class then in this condition, correlation solves our problems
5. **Francis Galton, Karl Pearson** and **Thorndice** have done many experiments to observe the effects of heredity and environment on peoples.

Example　　Having experimented on 5000 boys Karl Pearson proved that there is no relation of face and physical appearance to their mental ability.

7. To understand the form of intelligence Spearman was the first to take help of factor-analysis-technique.
8. What is the impact of environment on children's achievement and motivation, this type of relationship is seen also.

Task　　Express your views on the application of correlation coefficient.

Self Assessment

State whether the following statements are True or False.

1. Correlation is a measurement at the approximate level between two variables.
2. Positive correlation occurs when increase of one variable causes decrease in another variable

3. Rank difference method is also called series rank method.

4. There is no relation between children motivation and their academic achievement.

28.5 Product Moment Method

This method is called Pearson method.

Two variables x and y which express some features (time ,place etc.) of the values of infinite pairs like (x_1, y_1), (x_2, y_2).... (x_n, y_n) respectively. In present studies use of Karl Pearson method is used between two variables in linear correlation.

Karl Pearson's correlation coefficient is defined by $r(x,y)$ following—

$$r(x,y) \quad = \quad \frac{\sum_{i=1}^{n}(x_i - \overline{x})(\overline{y}_i - \overline{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sqrt{\sum_{i=1}^{n}(\overline{y}_i - \overline{y})^2}}$$

Or generally $r \quad = \quad \dfrac{\Sigma(x - \overline{x})(y - \overline{y})}{\sqrt{\Sigma(x - \overline{x})^2}\sqrt{\Sigma(y - y)^2}}$

Where $\overline{x}$ and $\overline{y}$ are AM's of x and y series respectively.

This method is called the direct method of Karl Pearson calculation.

If there is no possibility of confusion in it then we write r (x, y) as only r.

By mathematical method it can be proved as $-1 \leq r \leq 1$.

If correlation between two variables is linear then the explanation of correlation coefficient of Karl Pearson will be done by following way.

Value of 'r'	Status of correlation linear between variables
$r = +1$	• Perfect clear Positive Correlation
$0.75 \leq r < 1$	• High level Positive Correlation
$0.50 \leq r < 0.75$	• Normal Positive Correlation
$0 < r < 0.50$	• Low level Positive Correlation
$r = 0$	• Absence of correlation
$-0.50 < r < 0$	• Low level negative correlation
$-0.75 < r \leq -0.50$	• Normal negative correlation
$-1 < r \leq -0.75$	• High level of negative correlation
$r = -1$	• Perfect clear negative correlation

Remarks 1. Karl Pearson's correlation coefficient can be described as product moment correlation coefficient or Karl Pearson moment correlation coefficient also.

Remarks 2. In Karl Pearson's correlation coefficient r can be indicated by $\rho(x, y)$ or only by ρ also.

Letter ρ is Greek alphabet 'rho'

Remarks 3. Karl Pearson's geometrical correlation coefficient is called coefficient of calculation (determination) also.

For example

If r = 0.753 then determination of coefficient will be $(0.783)^2$ = 0.567.

Coefficients of determination always exist between 0 and 1 (in which both are included)

Remarks 4.

$$r = \frac{\Sigma(x-\overline{x})(y-\overline{y})}{\sqrt{\Sigma(x-\overline{x})^2}\sqrt{\Sigma(y-\overline{y})^2}} \text{ which is described.}$$

$$r = \frac{\Sigma(x-\overline{x})(y-\overline{y})}{\sqrt[n]{\dfrac{\Sigma(x-\overline{x})^2}{n}}\sqrt{}\sqrt{\dfrac{\Sigma(y-\overline{y})^2}{n}}}$$

$$r = \frac{\Sigma(x-\overline{x})\ (y-\overline{y})}{n\sigma_n\sigma_y}$$

Example: With the help of following chart calculate correlation coefficient

X	10	12	15	8	5	16
Y	15	16	8	10	11	12

According to that above question will be solve likewise.

Table 28.5						
X	Y	x	y	x^2	y^2	xy
10	15	-1	+3	1	9	-3
12	16	+1	+4	1	16	+4
15	8	+4	-4	16	16	-16
8	10	-3	-2	9	4	+6
5	11	-6	-1	36	1	+6
16	12	+5	-0	25	0	0
66	72	0	0	Σx^2 = 88	Σy^2 = 46	Σxy = –3

Mean at x = 11 and y = 12 respectively,

1. First we calculate mean of both series separately.

2. Then we will calculate difference from mean of both series. From each number of first series we deduct mean value. Thus we will get mean value (11) and difference from number x. Similarly we will deduct mean value 12 from each number of second series and in this way we get Y column.

3. Now in the next column we square x and y column's number. Thus we get x^2 and y^2 column.

4. Again we multiply the number of x and y column in the next column Thus we get xy column.

5. Again we add three column viz x^2, y^2 and xy separately. This will be written as Σx, Σy and xy.

After doing all these calculation now we will use formula. By product moment method, correlation coefficient will be calculated by following formula.

$$x = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \times \Sigma y^2}}$$

In the above question

$$\Sigma xy = -3$$
$$\Sigma x^2 = 88$$
$$\Sigma y^2 = 46$$

Hence,

$$r = \frac{3}{\sqrt{(88)46}}$$

$$= \frac{-3}{\sqrt{4048}}$$

$$= \frac{-3}{63.62}$$

$$= -0.047.$$

6. According to a third method we do not calculate actual mean rather than we use assumed mean. Below the same question has been solved by assumed mean.

Table 28.6						
X	Y	x	y	x²	y²	xy
10	15	0	5	0	25	0
12	16	2	6	4	36	12
15	8	5	-2	25	4	-10
8	10	-2	0	4	0	0
5	11	-5	+1	25	1	-5
16	12	+6	+2	36	4	+12
66	72	0	0	94	70	+9

In the above question actual mean are $x = 11$, $y = 12$

Whereas assumed mean x = 10 and y = 10

$$C_x = 1, C_y = 2$$

C_x (first difference of actual mean and assumed mean = 11 – 10 = 1

C_y (Second's difference of actual mean and assumed mean) = 12 – 10 = 2

$$C_x^2 = (1)^2 = 1$$
$$C_y^2 = (2)^2 = 4$$
$$\sigma_x = \sqrt{\frac{\Sigma x^2}{x1} - C_x^2} = \sqrt{\frac{94}{6}} - 1 = 3.93$$
$$\sigma_y = \sqrt{\frac{\Sigma y^2}{N} - C_y^2}$$

$$= \sqrt{\frac{70}{6}} - 4 = 2.76$$

According to formula

$$r_{xy} = \frac{\dfrac{\Sigma xy}{N} - C_x . C_y}{\sigma_x . \sigma_y}$$

$$= \frac{\dfrac{9}{6} - 1 \times 2}{3.83 \times 2.76}$$

$$= \frac{-.5}{10.57} = (\text{-}0.047).$$

This method is used in such a condition which is convenient and useful in which actual mean comes in decimals examples 104.3 or 98.6 etc because in such a condition deduction of such mean from true scores and to make their squares is very tough. Hence in place of actual mean we take mean of perfect integer around scores. This is called assumed mean. By doing so difficulties of x and y and making their squares is removed.

In fact, the use of rank system (rho)'s is more appropriate when to calculate correlation coefficient of less scores. Up to a range of 30 scores rank method can be used. Calculate correlation coefficient by product moment method of more than this number of scores.

Correlation coefficient (rho) computed by rank method almost equal to calculated by product moment method. **J. P. Gilford** statement is that in any condition correlation coefficient calculated by both methods is not more difference than 0.018 and in each condition correlation coefficient ρ (rho) calculated by product moment method (*r*) is greater than the correlation coefficient calculated by Rank system (only left to condition Zero and + 1.0 correlation coefficient). But this statement is not correct through practical approach. By previous example it is clear. By Rank Method result ρ is + 0.085 and by Product—Moment result is –0.047. Difference of both is approx 0.038. Second, ρ (rho) is greater then *r*. Product moment correlation coefficient is calculated only in those condition where following conditions is fulfilled:

1. When sample is large.
2. When distribution of scores is even.
3. When measurement is available in continuously.

28.6 Summary

- When two variables are inter-related in such a way that increase in one causes increase in second also or vice-versa, then in that condition we can say that correlation exists between these two quantities.

- Correlation is of three types—1. Positive correlation, 2. Negative correlation, 3. Zero correlation

- In educational field mostly the quantity of two series need to determine. This relationship can be expressed as coefficient of correlation.

- Rank method is called series rank method also. This method had been postulated by Karl Spearman and name of we call this method Spearman correlation method after his name and we called the correlation coefficient obtained by this method as Spearman's correlation coefficient or Spearman's series rank correlation coefficient also.

- Rank method is not more reliable. In this method only ranks of numbers has been considered their own value has of no importance.

- This is called direct method of computing of Karl Pearson's correlation coefficient.

28.7   Keywords

1. **Rotation**—rotating, revolving.
2. **Scattering**—Scatter, Spread.

28.8   Review Questions

1. What is meant by correlation? Does it always reflect cause and effect relationship between two variables?

2. What are main characteristics of the Karl Pearson's correlation coefficient. Upon which concepts this formula is based?

3. What do you mean by correlation coefficient? Explain its general rules.

4. By Spearman's Rank Difference Method calculate correlation coefficient.

Student	A	B	C	D	E	F	G	H	I	J
Math	78	36	98	25	75	80	25	62	36	40
Hindi	84	54	36	60	54	92	36	62	36	98
									(Ans. 0.46)	

5. By following data calculate Spearman's correlation coefficient-

X	15	25	38	25	15	12	40	25
Y	40	60	20	25	30	50	20	30
							(Ans. 0.64)	

Answers: Self Assessment

1. between	2. Three	3. Extrovert	4. True .
5. False	6. True	7. False	

28.9   Further Readings

Books   1.   Educational Research's work procedure—*L. Kaul, Vikas Publishing*

2. Educational Techniques and Assessment—*Dr. Rampal Singh, Bhatt Brothers.*

3. Educational Technique—*S. S. Mathur, Bhatt Brothers.*

4. Educational Technique Management and Evaluation—*J. C. Agrawal, Bhatt Brothers*

Unit 29: Chi-Square Test

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Objectives

After studying this unit, students will be able to:

- Understand the meaning and structure of non-parametrical test
- Understand Chi-Square Test.

Introduction

It has been already said that the use of parametric test like - T- test and F – Test's of depends upon several conditions. It can be used till these conditions is not fulfilled. These two equal distribution and homogeneity of variance are the most important conditions. These does not fulfils many conditions of research. Hence in that these test cannot be used. In this condition non-parametric test is used. Each paramedic test has a number of non-paramedic options are available.

29.1   Meaning and Structure of Non-Parametrical Test

Use of Parametrical test is based upon some concepts regarding population. Their applications depends upon the characteristics of these parameters. Hence these are called parametrical test. Just its opposite non-parametrical test does not impose any condition of anyone regarding parametrical population, therefore these are called non-parametrical tests. In some non-parametrical test some concepts are vested, but they are least and of general types. In the universe, there is no condition regarding distribution of variables. Therefore, generally it is called is distribution free statistical method. In non-parametrical statistical techniques groups are compared on the basis of distribution of variables in place of prameters such as mean, variance etc.

Advantage of Non-Parametrical Tests

These tests have following advantages.

1.   In the condition of very low sample (N=6) only these tests can be used.

2. This test can be used where the samples have been categorized in different population groups

3. Whatever may be the shape of distribution of variables in the whole population these tests have the capacity of correct statement of probability of available results.

4. When thesis is available in the form of categories and ranks then the application of these tests is possible.

5. Understanding these tests, learning their application and computation regarding these etc. are very simple.

6. It can be used in those circumstances in which parametrical test is applicable.

7. In any condition of parametrical test where their conditions do not fulfils, non-parametrical tests can be used.

Demerits of Non-parametrical Tests

These tests have some own limitations also which is mentioned below-

1. In the condition of any one parametrical test as much power of the test on sample of definite size is available as to get the same power at test in the condition of non-parametrical test sample's size will be made to increase In other words, there tests power is less.

2. There is none tests in which interaction affects of variables can be studies. In spite of these difficulties non-parametrical tests have great importance because research condition is such a way in that parametrical conditions is fulfiled and alternative are found out.

Some specific and more used non-parametrical tests have been described in this chapter.

Non-parametrical Independent Design Group

Under this heading those non-parametrical tests has been dealt which is used in comparing of independent groups.

Self Assessment

Fill in the blanks:

1. Chi-square design is ……………………….of mutual relationship of two variables.

2. In the case of single sample to find out expected frequencies………………hypotheses can be used.

3. Chi-square is an alternative of non-parametrical test of …………………………...

29.2   Chi-Square Test

Chi-square (χ^2) is such a non-parametrical statistical method in which it is tested that a frequency distribution which is obtained by research is significantly differ or not on the basis of expected frequency distribution. If they are not different then both is considered to be associated. Thus Chi-Square is a test method of mutual relationship of two variables or two frequency distribution. The help of this analytical method is taken to know whether the difference between obtained and expected frequencies is only a chance or a realistic. There are a number of types of this design. It is used mainly in four different conditions. These are:

1. One way status
2. Two independent group's status
3. Contingency-analysis
4. More than two independent groups' status

1. One way Status

This method is used where there is acquired frequency distribution is compared to such a distribution which is a standard distribution and which is expected from a definite hypotheses as a normal probability hypotheses or normal distribution's hypothesis. It will be clear from following given example.

Example 1

One researcher try to know whether the educated females like to do jobs. To know this he selected 48 educated females and asked her if she likes doing job. She was told to choose one out of three alternatives ('yes', 'no' 'neutral'). He got each answer's frequencies like this-24, 12, 12. On the basis of normal distribution he tested if obtained distribution (24, 12, 12) is significantly differ from normal distribution (16, 16, 16). He is assumption was that if really females likes doing job then their distribution should be differ from expected distribution (16, 16, 16) i.e, if they are not serious about doing jobs or hot then 48 women's distribution answer under three alternate will be same (16, 16, 16). He tested this distribution by Chi-Square method to know whether the obtained distribution is significantly different or not. To do this he prepared a table and on the basis of that he calculated the value of Chi-square. The whole method of this calculation has been given in the following table.

Notes   Chi-square design is a method of two variables or two frequencies mutual relationship.

Table 29.1: One sample Chi-Square Test				
	Preferred	Not-preferred	Indifferent	Total
Fo	24	12	12	48
Fe	16	16	16	48
Fo-Fe	8	4	4	
$(Fo-Fe)^2$	64	16	16	
$\dfrac{(Fo-Fe)^2}{Fe}$	4	1	1	6 = x^2 value

In the above table Fo's meaning is required frequencies, Fe's meaning expected frequencies. This one-way sample is an example of Chi-square because in this data has been collected from only one sample (48 females) i.e, only one sample has been used.

Formula of Calculation of Chi-square is

$$x^2 = \Sigma \frac{(Fo - Fe)^2}{Fe}$$

In which meaning of Fe is expected frequencies and Fo's meaning is required frequencies.

By above formula table-1 each category Chi-square value has been calculated. After that the values of all categories are sum up. This whole Chi-Square has got 6.0.

Example   As in T-test the value of T is tested for significance, in the same way, in Chi-Square test, the significance of value of Chi-square is tested on the basis of Chi-Square in table-D.

If obtained Chi-value is equal to or more than the given value in the table-D, then it is considered as significant. Rest of the problem process and argument just is as T-test.

Calculation of Dependent Factors (*df*)

In the use of table-D concepts of *df* is used. The formula of getting it is (*r*-1) x (*k*-1) i.e, deducting one from each number of row and column, remaining is multiplied mutually. In the Previous example there are 3 Rows and Columns. Thus *df* = (3-1) x (2-1) = 2.

Relevancy- In table D there are 2*df* and at 0.5 level Chi-value is 5.991. Obtained value is 6.0 which is more than table value.

Hence hypotheses H_o that "there is no difference between both distribution" reject it, this conclusion will be drawn that there is significant difference in distribution. In other words it will be to say that females like doing job because "yes" answer frequencies is maximum. If "no" answers frequencies may maximum then conclusion is that females do not likes doing job. Hence, in fact what will be the conclusion, this depends upon data frequencies observations.

If test is to be done from one side then the value of Chi in table D at 0.05 levels observes in column. 01 and for .01 observe in column 0.02

Hypotheses of Expected frequencies

In the condition of oneway sample to know expected frequencies, the concept of "normal probability" can be used as it has been cleared in previous given example. Besides this "normal distribution" concept it can be used also. It depends upon condition of research which method will be used and where. For example if we try to know that any class scores distribution is normal or not then expected frequency will be calculated on the basis of normal distribution.

Limitations of Chi-Square

The application of Chi-Square is prohibited in following conditions.

1. When df only one e.g., K (group) = 2 and any expected frequency is less than 5.
2. When df is more than 1 but more than 20% frequency is less than 5 or any expected frequency is less than 1.

2. Two Independent Group Design

In this condition two independent groups are compared on the basis of Chi-Square, exactly as in T-test, by finding the value of T. The difference is so much that by finding the valve of Chi-square in place

of T their relevancy is tested and conclusion is drawn whether the both groups are different from any characteristics or are dependent variables to each others Both groups are not different to each other, this hypotheses (Ho) is the base of the test. Hence Chi-Square parametrical test is an alternate of non-parametrical. In case the conditions of T-test is not fulfilled it can not be used in that ase Chi-Square can be used. For example suppose a researcher wants to know "If there is any difference in the desires of doing a job between male and female." He asked one question to each of male and female and puts three alternative of answers "yes", "no" and "natural's" and he gets data. In this condition Chi-Square test can be used.

Method of Use

There will be the same method as in Chi-square Test which has already been described in the case of one way group but there is a difference in this condition in which two groups is used in place of one group. Preparing the table the each column's Chi-Square will be computed and in the end summing all those will give Chi-Square.

The formula to find out Chi-Square is afore e.g.,

$$\text{Chi-square } = \Sigma \frac{(\text{Fo} - \text{Fe})^2}{\text{Fe}}$$

By following illustration method of computation has been clarified.

Example 2

Suppose that the above given question, researcher has asked to 90 males and 100 females and get answer in the form of 'yes', 'no' and 'neutral'. Having prepared the frequency distribution table and test of this hypotheses that "There is no any wrathful difference between male and female about doing desired job". Following table shows data and computation method.

Table. 29.2: Relation between Necessity and Sexuality.					
		Response		Mode	
		Yes	No	Indifferent	Total
Male	Fo	14.0	66.0	10.010.0	90
	Fe	196.42	62.52	8.05	
	Fo-Fe	5.42	30.48	1.95	
	$\dfrac{(\text{Fo} - \text{Fe})^2}{\text{Fe}}$	1.51	.20	0.47	
	Fo	27.0	66	7.0	100
Female	Fe	21.57	64.44	9.0	
	Fo-Fe	5.43	3.49	2.0	
	$\dfrac{(\text{Fo} - \text{Fe})^2}{\text{Fe}}$	1.30	3.18	0.49	
Total			41	17132	190

To solve out this problem, each column frequencies will be calculated in the value of Chi-Square and finally all values will be solved by putting following procedure.

1. *Fe* (1) *i.e.*, cell-1= $\dfrac{41}{190} \times \dfrac{90}{1} - 19.42$ (out of 190 total *Fe* for 'yes' response = 41; how many out of 90, total of first row).

2. *Fe* (2) *i.e.* for cell -2 = $\dfrac{132}{190} \times \dfrac{90}{1} = 16.52$ (out of 190 *Fe* for 'No' response=132; how many out of 90).

3. *Fe* (3) *i.e.* for cell-3 = $\dfrac{17}{190} \times \dfrac{90}{1} = 8.05$

4. (out of 190 Fe for cell -3, indiff. Response=17; how many out of 90)

5. *Fe* (4) = $\dfrac{11}{190} \times \dfrac{100}{1} = = 21.57$ (same argument).

6. *Fe* (5) = $\dfrac{132}{190} \times \dfrac{100}{1} = 64.44$ (same argument)

7. *Fe* (6) = $\dfrac{17}{190} \times \dfrac{100}{1} = = 9.00$ (same argument)

After that we find out (*Fo-Fe*) for each cell. These values are also given in the table for each cell. and divided by *Fe* convert it into Chi- Square. There are respectively 1.51 + 2.0 + 0.47 + 1.30 + 0.18 + 0.49. The sum of all these i.e, $\Sigma\chi^2$ = 4.51.

Relevancy of Chi-Square

In table D (2 x 1 = 2*df*) at level 0.05 Chi value is 4.991 but obtained value is 4.15 which is less than table value. Hence at level 0.05 H_o *e.g.*, "there is no difference" hypotheses can not be rejected. As a result of this "there is no difference" will have to accept because the value of Chi-Square is not significant. It can be happened by incidentally also.

Conclusion

Therefore the conclusion is drawn that there is no relationship of sex to desire of doing job.

3. Contingency Analysis

If distribution of frequencies is in the form of 2 x 2 table, then there is another method to calculate Chi-square which is very simple and used in most conditions. In this rows (*r*)'s number is 2 and columns (*k*) number is 2 also. Hence in this *df* = (r-1) (*k*-1) e.g., (2-1) (2-)-1. To find out Chi-Square following formula is

$$x^2 = \frac{H\left[|AD-BC| - \dfrac{N}{2}\right]^2}{(A+B)(C+D)(A-C)(B+C)}$$

In which $|AD\text{-}BC|$'s meaning is that deduct AD form BC or *vice-versa*

In the above formula deduct N/2 from (AD-BC) which is called (Yates Correction)

The reason of this obtained Chi values' have to make to their actual e.g., theory based and expected Chi-Square distribution. According to **Moron**e (1954) tabulated distribution is bionomical distribution is which is not continuous whereas Chi-Square distribution is continuous. Therefore to make similar binomial distribution into Chi-Square distribution this correction is to be done.

Example-3

A researcher try to know if students' socio-economic status affects their academic achievement. He selected 48 of low level Socio-economic students and divided their academic achievements into two category-success and failure. He arranged this data into 2 x 2 table calculate Chi-Square value on contingency formula and tested the hypotheses. Following table and based calculation are given below:-

Table. 29.3 : Examination Result			
	Fail	Pass	Total
SET	36(A)	12(B)	48
SES	32(c)	16(D)	48
Total	68	28	96

To know the answer of this question Chi-Square test can be followed. In this data 2 x 2's contingence table is prepared and putting the value in formula.

$$x^2 \;=\; \frac{H\left[\,|AD-BC|-\dfrac{N}{2}\right]^2}{(A+B)(C+D)(A-C)(B+D)}$$

$$=\; \frac{\left[\,96\big|(36)(16)-(12)(32)\big|-96/2\right]^2}{48\times 48\times 68\times 28}$$

$$=\; =\frac{96\left[576-384-48\right]^2}{4386816}$$

$$=\; \frac{1990656}{4386816}$$

$$=\; 0.4537 \text{ for } df$$

Relevancy and Conclusion

At 1 df and 0.05 level in table D, value of Chi-Square is 3.841. Obtained Chi-Square value is 0.4537 which is very low than table value. Hence H_o hypotheses "both groups (HSES & LSES) there is no difference" cannot rejected. Obtained Chi-Square is not wrathful e.g., it can be happened incidentally also. Therefore final conclusion will be that students' Socio-economic level does not affect their academic achievement. It seems that there is no relationship between socio-economic level and academic achievements.

2 × 2 Contingence Methods limitations.

Did You Know?   Contingency method is used only when expected frequencies is fairly large.

If this condition is not fulfilled then by combining nearly frequencies by reducing number of cells frequency of 2×2 table can be increased. More than that following points is considered necessary.

1. When the size of N is greater than 40 then for continuity use of application is must for correction.

2. When N lies between 20-40 then use above formula only when, all expected frequency of cells is 5 or greater than 5.

Caution   When N is less than 20 then Chi-Square should not be used

4. More than two independent group status

If there are two or more than two Independent Group to be compared then Chi-square method can be used. In this situation frequencies are arranged in K x r table. Hypothesis (H_o) is remained as previous. k is not different from themselves. χ^2 test is done in the same way as it is explained earlier. But in this method calculation of frequencies of all cells is different. It will be explained with suitable examples later on.

It is the regular option of one-way analysis of variance. If any research is in more than two group but if the condition of F-test is not satisfied then it will be used.

Illustration

A researcher measures intelligence of 100 students of a class to know that there is any relationship between intelligence and academic achievement and categorized it into three groups-extraordinary, reasonably intelligence and less intelligence. Thus he divides academic achievements into four category as a first, second, third and fail. He prepares a table 4 x 3 by taking the students falling in the group whose size and Chi-Square calculation is given below.

Table 29.4: Academic Achievement					
Wisdom	Fail	III Division	II Division	I Division	Total
Maximum O	5	6	9	8	28
Wise E	5.88	8.40	7.84	5.88	
O-E	.88	2.40	1.16	3.88	
Sample O	5	16	13	8	
Wise E	8.82	12.00	11.76	8.82	42
O-E	3.82	3.40	3..40	.82	
Minimum O	11	8	6	5	30
Wise E	6.30	9.0	8.40	6.30	
O-E	4.70	1.0	2.40	1.30	
Total	21	30	28	21	100

In table 27.4 before obtained frequencies of each cell has given and before E expected frequencies is given. To calculate expected frequencies multiply the sum of each cell and each column then divide it by sum of frequencies (*N*). Behind this there is an argument. Take cell one. In this all persons are those which lie in first line and in first column. The probability of any one person in this line will be obtained by dividing the sum of all number (N) by 100 e.g., that will be 28/100. Similarly the probability of the person in first column will be 21/100. Hence his probability in first line and in first column will

be $\frac{28}{100} \times \frac{21}{100}$. This is the probability which occurred in one . total frequency is 100. Hence out of 100

how many will be the probability $\left(\frac{28}{100} \times \frac{21}{100}\right)$ multiply it by 100. Thus total expected frequencies of

first cell will be $\frac{28}{100} \times \frac{21}{100} \times \frac{100}{1}$ =5.88

Similarly by multiplying all the sums of expected frequencies of the cells and their columns will be divided by 100. All other cells expected frequencies can be found. It is numerated in table 4 on the basis of that by previous formula each cells Chi-Square can be find out.

Task   Throw light on Chi-Square having more, than two independent groups.

$\chi = \frac{(O - E)^2}{E}$ i.e.

(.88)² + 5.88 / (2.40)² + 8.40 / (1.16)² + 7.84 / (3.88)² + 5.88 / (3.82)² + 8.82 / (3.40)² + 12.60 / (1.24)² + 11.76 / (.82)² + 8.82 / (4.70)² + 6.30 / (1.0)² + 9.0 / (2.40)² + 8.40 / (1.30)² + 6.30

Having calculation of above value Chi-Square =

.774 + .686 + .172 + 2.560 + 1.654 + .917 + 1.538 + 0.76 + .506 + .111 + .686 + .268=12.948

Relevancy and Conclusion

In this example *df* = (4-1) (3-1) = 6.

In the table D at *df* 6 and .05 level Chi-Square is 12.59. Obtained value of this example is 12.948 which is more than table value. Hence "intelligence does not affects academic achievements" of Ho. Or "there is no relationship of intelligence with academic achievement". It is rejected and this conclusion is formulated that intelligence affect academic achievements or they are related to each other.

Self Assessment

State whether the following statements are True or False:

   4.   Chi-Square distribution is continuous.

   5.   Contingency method is used where there is expected frequencies of fairly very small.

   6.   In Chi-Square test means each cell expected frequencies calculation method is different

   7.   When to compare less than two independent groups then Chi-Square can be used

29.3 Summary

Parametrical test's based upon some assumption. used regarding population characteristics Just its opposite non-parametrical test does not impose any condition regarding. Population regarding parametrical Therefore it is called non-parametrical test.

- Chi-Square is such a parametrical statistical method in which it is tested that any frequency distribution which is obtained frm any research that on the basis of any hypotheses from expected frequencies distribution differ significantly or not

- There are a number of types of there design mainly it is used in four different condition. 1. One way condition 2. Two independent groups condition 3. Contingency analysis 4. More than two independent groups condition

29.4 Keywords

1. **Theory based:** on the basis of theory.

2. **Negative:** underscores that numbers which is negative value is called negative.

29.5 Review Questions

1. What do you mean by non-parametrical test? Mention its merits and demerits.

2. What do you mean by Chi-Square design? Mention its types.

3. What do you mean by two independent groups design? Describe it.

4. What is contingency analysis ? Describe.

Answers: Self Assessment

1. Test method	2. Equal or normal distribution	3. T-Test
4. True	5. False 6. True	7. False

29.6 Further Readings

Books
1. Academic Research Methods—*Shareen and Shashikala, Vinod Pustak Mondir*
2. Academic Techniques—*S.S. Mathur, Bhatt Brothers*
3. Education Technique—*R.A. Sharma, Bhatt Brothers*
4. Academic Technique and Assessment—*Dr Ram Pal Singh, Bhatt Brothers*

Unit 30: T-Test

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Objectives

After studying this unit, students will be able to:

- Understand main basis of statistical analysis
- Understand parametrical test: T-Test
- Understand single-end and double-end test.

Introduction

In the last few chapters strategy of experimental design, their types and rules had been explained. In the coming chapters some specific methods of statistical analysis of data have been described. Researchers collected various types of data in different conditions. All types of data analysis by any one statistical method is not possible. Various types of data analysis is done by a numerous methods. There are number of statistical methods which can be used. Hence researcher has to select a method which is more suitable according to problem's nature, purpose and in context of collected material. Therefore, for a researcher it is quite pertinent to know, which are the main methods, which method to be used in which condition and how it can be used. In coming chapters different statistical methods have been described in this context.

30.1   Main Basis of Statistical Analysis

In the present chapter some matters related to statistical analysis process have been explained. It seems to be important to do so these are the main basis of statistical analysis.

1. Basic Procedure
2. Null Hypothesis

3. Relevancy Test

4. Types of error

5. Statistical Test Sample

6. Parametrical Test

7. Non-Parametrical Test

1. Basic Procedure

In every experimental research of statistical analysis process, following steps are followed.

1. Mention of statistical hypotheses or null hypotheses.

2. For the rejection of null hypotheses one suitable statistical test (As a T-Test or F-Test or any other test) selection

3. For the rejection of null hypotheses, selection of relevancy level. (as a 0.01 or 0.05) and their mention.

4. Under step-2 fixed value of statistical test's computation

5. Under Step-4 compare obtained statistical value to that related stabilized Statistical value and on that basis to take decision that null hypothesis should be rejected or not.

6. Conclusion drawing regarding research analysis.

2. Null Hypothesis

The first gateway of experimental data analysis from where to enter is null hypothesis. It was invented by late scientist, mathematician Ronald Fisher. Research hypothesis like scientific hypothesis or also called substantive hypothesis which is only on operational statement and in which between two variables any relationship specially vested, changes into null hypothesis because it is null hypothesis whose statistical test is possible. On the basis of that rejection regarding research hypothesis something to say or draw conclusion is possible. There is not any statiscal method on the basis of which basis research hypothesis can be accepted or rejected directly and drawn conclusion can be drawn regarding that. Only null hypothesis rejection or non-rejection basis formulation of conclusion regarding research hypothesis is done. Due to this reason research hypothesis is called alternative hypothesis H_1 also. If null hypothesis (H_0) is rejected then alternative hypothesis (H_1) i.e., research hypothesis is accepted. Similarly if null hypothesis (H_0) can not be rejected then research hypothesis i.e., alternative hypothesis (H_1) can be rejected. In null hypothesis there is an inverse relationship between H_0 and H_1. In construction of research design it is necessary to mention two types hypothesis, in the begining.

Null-hypothesis is rejected at that condition when obtained statistical value. (T.F, Chi-Squares, etc.) pre-determined relevancy level is equal to given value of table or more than that. In this way H_0 is the base of testing data.

3. Relevancy-Test

The purpose of relevancy test is to know that the results obtained on statistical test basis, that is not due to incidence e.g., that is due to that variables, that treatment on independent variables whose effects is studying. When H_0 is rejected at any level of relevancy then it is accepted that obtained result occurred due to independent variables or treatment. This is not purely co-incidental. In other words. obtained result is real e.g., occurred as a result of independent variables assumed as. Thus ahead logical order vested in relevancy test.

H_0 Rejected → worthful result → real result e.g., under experiment treatment's effect's cause, not by incidentally

H_0 - not rejected → result worthless → result by incidentally e.g., under treatment effect's absence.

Regarding this context it is quite necessary to understand the concept of relevancy level. It is known as Alfa (α) a Greek Letter. Its meaning is that " That concept which researcher select to reject of null hypothesis" for example .05 level chore for that purpose then its meaning will be that obtained statistical value (T, F, χ, etc.) probability of occurrence is equal or less than .05 then H_0 will be rejected. Hence is relevancy level is determined at that time it is fix also when null hypothesis (H_0) will be rejected. Thus relevancy level is that criterion, that base which is use to reject in H_0 Alfa or relevancy level is such a dividing point on normal probability curve below that all probability exists that rejected H_0 and above that all those which does not accept it. For the rejection of null hypothesis generally .05 and .01 level is used. But it selects arbiter ally. As per rule selection of relevancy level should be scientific and logical.

Consequently its selection should be done prior to collection of data because sample size is such on element which to pay attention in decision making. Hence researcher keep in mind problems nature on the basis at result's importance and required accuracy Alpha should be selected. To take decision of it got answer of such types of questions

1. How important are the results?
2. How much risk is there in incorrect result?
3. How much accuracy is required ?
4. According to conditions What is the possibility of change error occurrence? Etc

4. Types of Error

Whatever may be the type of research design are and whichever alpha level may be, null hypothesis (H_0) rejected or not rejected very natural of being error. As relevancy level determined these error is determined also. Null hypotheses rejected or not rejected causes two types of error, it is called type-I, type- II, errors. The meaning of type – I error is H_0's wrong or incorrect rejection e.g., having it true be that is rejected. In other words, its meaning is that draw conclusion that independent variables or treatment has effected on dependent variables whereas really there is no effect because in dependent variables occurred or available changing happened only by incidence. Second type error's meaning Ho incorrect or wrong acceptance e.g. accept Ho where as it should be rejected.

In other words conclusion drawn from it that there is no effect of independent variables on dependent variables whereas it do, no relationship but relationship is. Type- I depends upon error's probable relevancy level. If relevancy level is large (as in place of .01, .01) then H_0 rejection as incorrect form possibility increase e.g. type –I error vested in relevancy level and it is called Alpha (α) Type – II error is called Beta (β). The limitations of these two types of error depends upon sample result. Therefore it is said that alpha (α) and N (Sample result) regarding these two take decision begning of research. **Segal's statement** is that "If we want to less there two types of error then we should increase result of sample (N)."

There is a special type of relationship between two types of error. If we try to less one type of error then other types of error increased. Therefore researcher should compromise between there two types of error and try to maximize balance. The meaning of statistical test is "H' s correctly rejection". Which can be express by following formula.

$$\text{Power} = 1 – \beta \text{ (type – II error)}$$

Since type – II error probability increase in sample N causes less, it can be understood clearly that having greater the result of sample statistical test power is increased.

5. Statistical Test Sample

To know relevancy of hypothesis' test any one statistical test (T-Test or F-Test) uses.

Every Statistical method or test out of these depends upon any specific statistical model. As a T-Test's base in T distribution model. Similarly F-Test's base is F distribution. Some types of many statistical model or tests are which uses in various condones for the test of hypothesis. Therefore this problem arise that in any one condition which statistical method used. Availability of a number of alternatives, selection any one of that must be a sound base and logic.

One the most important rule is that Statistical method should be used which is most powerful in that condition e.g. in which null hypothesis' incorrect rejection possibility less and right rejection possibility is more this is called statistical test power. Hence in the selection of Statistical model one matter keep in mind that is his power. Besides this some other matter pay attention also, as a- method of sample selection, characteristics of population, types of measures scale to be used for measuring etc. regarding all those each statistical test have some conditions. Fulfilling these conditions that test uses. Some statistical tests are such that whose conditions are most complicated and therefore they are most powerful. Secondly some tests' conditions do not exist if it exists then very ordinary nature. Therefore there tests is not more powerful. The result getting on these basis they are not much accurate or valid and is of general natures but it should be memorized that if powerful tests conditions and their basic concepts do not fulfill then in that condition their result may be least accurate with respect to less powerful tests result. Therefore, important is to observe that in the given condition which test is more powerful. Not any statistical method are such that which being more powerful in all circumstances.

Power and basic assumptions point at view two types of statistical model which uses. That is

(i) Parametric

(ii) Non-parametric

Under parametric test, T-Test, F-Test and their various forms comes. There tests are more powerful, although its conditions are very tough and hard therefore, they are powerful only when their conditions are fulfilled On the other hand, non-parametric tests whose nominal conditions, in some parameter related no conditions terms and conditions and basic concepts of each has been mention ahead.

6. Parametrical Test

According to mostly writers major parametric tests conditions are following-

1. The selection of sample from that population is which distribution of variables are normal. Regarding this Nunlee's statement is that without fulfilling this condition, whenever any big problem does not arise, distribution of modules is not much different from normal distribution (as a J- curve). Nunlee added further that if this rule is broken, it does not cause great loss because T-Test and F-Test are considered to be more powerful and "concepts of normal distribution not fulfilling affect result to very low degree.

2. Second assumption is homogeneity of distribution. The meaning of it is that all comparable groups must be alike to inside group distribution. In the condition of F- Test use it consider to be more powerful. If does not so, F-Test's result relevancy not comes prevail whereas in really between groups significant difference will be.

   Regarding above two conceptions **Karligar Bonu** (1960), **Anderson** (1961), **Games** & **Lukas** 1966 etc. Statement is that "There is given more stress than to need on normal distribution and homogeneity".

3. A third concept is that available measures on variables should be of continuous and equal interval so that mathematical mechanism editing will be possible.

4. A fourth concept that is mentioned by **Segal** is it that distribution of units in groups and their selection from population should be done by normal probability method e.g., observations, measuring etc. Should be independent.

If these conditions or concepts do not fulfill in any research process then regarding parametric test this statement that they are not more powerful, is not appropriate. Perhaps, it is difficult to say what is power of any test. At that condition regarding accuracy of research result guess is tough also consequently in that condition probability of hypothesis test mention is not meaningful.

7. Non-Parametric Test

Regarding non-parametrical test measurements' distribution like normal distribution does not bound any concepts. From this approach they are called distribution free tests. Similarly continuity of measures and their equal interval being condition does not impose. The uses of these tests can be done in very small sample condition. Hence it is called small sample test. In condition of very small sample parametrical test cannot be used.

The use of non-parametrical test is done in following condition.

(i) When data or measures (e.g. – I, II, III) or in form of ranks.

(ii) When distribution of scores is too skewed or how will be the distribution, it is not possible to guess.

(iii) When the magnitude of sample is very small.

(iv) When data is not in discrete only available in tendencies.

It is clear frm above description that at the time of selection of statistical test a number of things to be considered. Specially

(i) Power of test

(ii) Basic concepts of test

(iii) Form of available scores, etc

In the next few chapters important parametrical and non-parametrical test has been described. Where and how they uses, mention it in detailed.

Self Assessment

Fill in the blanks:

1. Null hypothesis was invented by scientist mathematician ……………………..
2. Research hypothesis is also called ……………………hypothesis (H_1)
3. Base of T-Test ………………..is model.
4. The meaning of statistical test power accuracy (H_0)……………………..

30.2 Parametrical Test: T-Test

Parametrical test deals with T- Test and F- Test. In this chapter only T-Test has been described. If groups are constructed only independent variables e.g. manipulation of independent variables has been done in two categories and only these two groups compares on dependent variables is to be done then at that condition T-Test uses. T-Test is a parametrical test and in this only one independent variables which is manipulated by two or more than two groups. These types of research design are called single variable designs.

From this point of view T-Test is of two types-

(i)   Independent group based

(ii)   Correlated or remeasurable based.

Independent groups' condition both two groups unit differs. In the condition of correlation groups one unit of a group keeps under two treatment. If unit matched distributed in two groups rather groups' unit differ they are consider to be correlated. T-Test is used in both conditions but their formula is different.

From an another print of view both types of T-Test have two forms

(i)   Small –Sample based

(ii)   Large-Sample based

In both these conditions separate formula is usesd. Thus T-Test has total four types-

(i)   Large Sample independent group

(ii)   Large Sample correlated group

(iii)   Small Sample independent group

(iv)   Small Sample correlated group

Each is described separately ahead.

1. Large Sample Independent Group T-Test

This test is done where number of groups are two, group is independent, sample is large and fulfills the condition of parametrical test. In this comparison is done on the basis of mean difference. Hypothesis which is to be tested that is as follows " There is no significant difference between mean's of groups". For this, difference of mean is converted into T-Value or (C.R. Value) obtained, T or C.R. Value is compared with at pre-selected significant level (.05 or .01) value given in T-Table on the observations of value of T in table degrees of freedom is keep in mind. If obtained T-Value at that significant level and at that degree of freedom equal to table value or more than that null hypothesis (H_0) is rejected and accepted alternative hypothesis (H_1). If this obtained value is less than table value then in place of H_0, H_1 is rejected. Thus indirectly or H_0 is not rejected drawn conclusion regarding research hypothesis. It will be cleared from given below example.

Example   Hypothesis- An eleven years old boys' achievement-motivation level and his academic achievement has no difference.

Analytical Design: - high achievement motivation and low achievement motivation an eleven years old boys two independent group constructed, calculate their mean and deviation value separately of their academic achievement (marks in the test).

In the table of following example data has been presented.

Table 30.1: Relationship between achievement Motivation and Academic Achievement		
	Group I **Low motivation**	**Group II** **High motivation**
Mean	88.80	90.5
Deviation	7.81	11.56
Numbers	83	97

This is an example of large sample independent group. From this C.R. calculation process is as follows.

Step 1: Calculate S.E. of each mean its formula is

$$\text{S.E.} = \frac{\text{S.D.}}{\sqrt{N}}$$

Hence, $\quad \text{S.E}_1 \quad = \quad \dfrac{7.81}{\sqrt{83}} = .857$

$$\text{S.E}_2 \quad = \quad \frac{11.56}{\sqrt{95}} = 1.22$$

Step 2: Now on this basis calculate S.E._D (S.E. of difference).

Its formula is

$$\text{S.E.}_D \quad = \quad \sqrt{\left[(\text{S.E.}_1)^2 + (\text{S.E.}_2)^2\right]}$$

Formula (1)

Accordingly this formula $\text{S.E.}_D = \sqrt{\left[(.857)^2 + (1.22)^2\right]}$

$$= 1.493$$

Step 3. Now calculate value of T. Its formula is –

$$T \quad = \quad \frac{D}{\text{S.E.}_D} = \frac{1.70}{1.493} = 1.138$$

Step 4

Test of Significance- For this 196 df and at level .05 in table (B) given t value (1.97)is now compared with obtained t value. It is clear that obtained t value 1.138 is less than 1.97 from table t value. Hence this difference at level .05 is not relevant. If not relevant at that level then it will not be relevant at level .01 also. Hence H_o cannot be rejected. As a result H_0 (having difference) is rejected.

Step 5

Conclusion- Therefore conclusion is drawn that both groups' mean has no real difference, e.g., probably there is no relationship between achievement motivation and academic achievement.

Large Sample Correlated Group T-Test

In example-1 given method is used there, where, groups are independent, but when groups are correlated or matched then following method is used. In this to calculate standard error (S.E) formula is same as example- 1 but to calculate S.E._D formula is following

$$\text{S.E.}_D \quad = \quad (\text{S.E.}_1^2 + \text{S.E.}_2^2 - 2r_{12}\text{S.E.}_1\text{S.E.}_2)$$

Formula (2)

$$= \quad \sqrt{\left[\frac{1}{N}\left(\text{S.D.}_2^2 - 2r_{12}\right)\left(\text{S.D.}_1 \times \text{S.D.}_2\right)\right]}$$

Similarly to calculate value of t, formula is same as before e.g.

$$t \quad = \quad \frac{D}{\text{S.E.}_D}$$

It has cleared by below given example.

Illustration 2. Eleven years old 625 boys were given a test of personality balance At that their mean & standard deviation (S.D.) 96.7 and 8.0 respectively found. After that they have been given collective consultation. After two months again he had been given some test. This time mean of their equilibrium was 106.7 and S.D. 10.0. the correlation at both times test was found 0.52. Was collective consultation was impactful?

To get the answer of this question both times equilibrium test's mean's difference relevancy will be needed to test, because both groups are correlated. Therefore to calculate their mean difference $S.E._D$ formula-2 will be used. Whole process will be as follows.

1. $S.E._1$ (first time mean) $\dfrac{S.D.}{\sqrt{N}}$ $= \dfrac{8}{\sqrt{625}}$ $= \dfrac{8}{25} = 32$

2. $S.E._2$ (Second time mean) $\dfrac{S.D.}{\sqrt{N}}$ $= \dfrac{10}{625}$ $= \dfrac{10}{25} = .40$

3. $S.E._D$ $= \sqrt{(S.E._1^2 + S.E._2^2 - 2n_2 S.E._1 S.E._2)}$

   $= \sqrt{\left[(.32)^2 + (.40)^2 - 2 \times .52 \times .32 \times .40 \right]}$

   $= .3596$

After the use of second alternate formula $S.E._D$ value will be same

$$t = \dfrac{D}{S.E._D}$$

$$= \dfrac{106.7 - 96.7}{.3596}$$

$$= \dfrac{10}{.3596}$$

$$= 27.80$$

This t value at each level of table-B 624 *df* (N-1) is much more than given value. Hence H_o is rejected and conclusion is drawn that collective counsel treatment effects equilibrium definitely.

Computation of Degrees of Freedom

It is necessary to memorize in the condition of independent groups computation of degrees of freedom done on the basis of formula $n_1 + n_2 - 2$. The reason of this is that in the condition of correlated and matched group one person tested twice. Hence correlation is formulated with their measurement. Second times obtained measure of test freedom get less because due to group remain some second time achievement cannot be complete differ and independent.

Hence measures comes in first times that cannot be complete free from second times. Therefore one person twice measure do not give two *df* but one *df*. In this way correlated group condition to calculate *df* N – 1 formula uses.

2. Small Sample Independent Group T- Test

If the sum of both two independent groups units is less than 30 then it is considered as small sample. In this condition S.D and $S.E._D$ calculation formula are different. Rest process is same as before. To

calculate S.D. and S.E.$_D$ formula is as follows.

1. $\sqrt{\left(\dfrac{\Sigma x^2 + \Sigma y^2}{N_1 + N_2 - 2}\right)}$

In which Σx^2 and y^2 are the sum squares of differences from their mean of both respective groups.

2. $\text{S.E.}_D = \text{S.D.} \sqrt{\left(\dfrac{N_1 + N_2}{N_1 \times N_2}\right)}$

Clarification of computation of whole process is done through ahead given example.

Table 30.2					
Group X			**Group Y**		
X	**x**	**x²**	**Y**	**y**	**y²**
110	4.5	20.25	115	2.0	4.0
112	6.5	42.25	112	-1.0	1.0
95	-10.5	110.25	109	-4.0	16.0
105	-0.5	0.25	112	-1.0	1.0
111	5.5	30.25	117	+4.0	16.0
97	-8.5	72.25			
112	6.5	42.25			
102	-3.5	12.25			
Sun = 844 N$_1$=8 Mean =105.5		330= Σx²	565 N$_2$=5 Mean =113.0		38 Σy^2

1. Pooled S.D. $= \sqrt{\left(\dfrac{\Sigma x^2 + \Sigma y^2}{N_1 + N_2 - 2}\right)} = \sqrt{\left(\dfrac{330 + 35}{8 + 5 - 2}\right)} = 5.78$

2. S.E. $= \text{Pooled S.D.} \times \left(\dfrac{N_1 + N_2}{N_1 + N_2}\right) = 5.78 \times \sqrt{\left(\dfrac{13}{40}\right)} = 3.302$

3. C.R. (t) $= \dfrac{\text{Diff.}}{3.302} = \dfrac{7.5}{3.302} = 2.271$ for *df* 11

Task   How degree of freedom is computed.

---

4. **Conclusion:** In table – B, 11*df* ($n_1 + n_2$ – 2) and at .05 level value of *t* is 2.20 but obtained value of + is 2.271. Hence difference of both two mean's in real. Therefore at this level H can be rejected. At .01 level, it is not relevant because at that level value of *t* is 3.11 and obtained value is less than that.

This analytical method is very important in the context of studies done in laboratory because in these studies result of sample is less but in this conation groups homogeneity or conformity test is necessary only homogeneity of variance exists then this method uses.

4. Small Sample Correlated Group T- Test

In this condition $S.E._{.D}$ calculation formulas some which is use in large sample correlated group e.g., in this condition

$$S.E._{.D} \quad = \quad \sqrt{S.E._{.1}^2 + S.E._{.2}^2 - 2r_{12} \times S.E._{.1} \times S.E._{.2}}$$

But to obtain there is a second formula also. Its base is both groups measurement difference description. Calculate mean and standard deviation (S.D.) of differences. It is named as D and S_D. On this basis $S.E._{.D}$ is calculated that formula is—

$$S.E._{.D} = \frac{S_D}{\sqrt{N}}$$

This $S.E._{.D}$'s $\dfrac{D}{S.E._{.D}}$ by formula converted into T Value. It will be cleared from following example.

Table 30.3			
X	**Y**	**D**	**D²**
100	105	-5.0	25
90	95	-5.0	25
106	100	+6.0	36
95	105	-10.0	100
102	99	+3.0	9
104	98	+6.0	36
90	110	-20.0	400
105	106	-1.0	1
99	100	-1.0	1
		ΣD = - 27.0	ΣD^2= 633

1. $\bar{D} = \dfrac{-27}{9} = -3.0$

Let d = (D – $\bar{D}$), a deviation score in D. Then:

2. $\Sigma d^2 = \dfrac{\Sigma D^2}{n} = 633 - \dfrac{(-27)^2}{9} = 552.00$

3. $\sqrt{\left(\dfrac{\Sigma d^2}{n-1}\right)} = \sqrt{\left(\dfrac{552.0}{8}\right)} = 8.306$

4. $\dfrac{S_D}{\sqrt{N}} = \dfrac{8.306}{\sqrt{9}} = 2.768$

5. $Z(t) \dfrac{\bar{D}}{S.E._{.D}} = \dfrac{-3.0}{2.768} = -1.08$

If having used formula 2 calculated value of T will be same as aforesaid method. In table B, $8df$ (N-1) and at .05 t' s value is 2.31. Obtained T value is 1.08 which is less than table value. Hence H_0 can be rejected. Therefore research hypothesis (H_1) e.g., " difference is" is rejected and established this conclusion that between measures of X and Y there is a significant difference.

This method can be used in case of large sample correlated groups also. From computation point of view, this method is very simple, but on that basis we get less information. By this, both groups correlation between scores knowledge is not acquired and neither by its groups' means and standard deviation (S.D) is to be found.

But it should be remaindered that large and small sample correlated groups in both conditions calculation of value of T, method is some but if group has been matched equal on the basis of their mean and S.D. Then to calculate S.E.D formula is folling.

$$\sqrt{\left[S.E._1^2 + S.E._2^2 \times (1 - r_{xy}^2) \right]}$$

Rest Process in this condition is same as before also.

?

Did You Know?   Each statistical method or test based upon a specific statistical model.

Self Assessment

Multiple Choice Questions:

5. To test the hypothesis any one ……………… test is used.

    (a) Mathematical   (b) Statistical   (c) Political   (d) None of there

6. From basic assumptions point of view statistical models of …………… types.

    (a) One   (b) Two   (c) Four   (d) Five

7. T-Test is a……………. test.

    (a) Parametrical   (b) Non-Parametrical   (c) Sample   (d) Homogeneous

8. This type of research (T-Test) design ……………….is called.

    (a) Bi-Variables design   (b) Variable design

    (c) Single Variable designs   (d) All three

30.3   T-Test: Special Remark

Regarding T-Test's uses some concepts have been mentioned. Some of there are- (i) In population distribution of variables being normal (ii) Sample's population's variance being homogeneous. It can be tested by statistical methods also. It has been mentioned in the higher level books of Statistics as **Hedge's** (1973) book etc. Again it is important thing that T-Test is a powerful statistical test and its result is not much affected if above concepts are broken, but different size independent groups condition is its exception. In this condition if homogeneity of variance does not fulfill conditions then result will be affected to a great extent. Therefore in this condition, concepts must be tested. If this condition does not fulfill then T-Test should not be used. In large sample condition rather not fulfilling there condition does not make special difference, but in small sample condition lack of conformity

Notes

of variance affects result. But in this condition too, if result of sample (Ns) is equal then problem can be reduced some degree.

Caution   In the condition of small sample before use of T-Test homogeneity of variance must be tested.

30.4 Single-end and Double–end Test

The explanation of this concept has done in chapter.10 under experimental design. Here only to explain that in case of single-end test how to observe table's T value. For single end test in table at level .05, .10 column and at level .01 in .02 column value of *t* is observed. If on double – end basis obtained *t* value at any significant level not comes significant then to use of single –end test sometimes occurred significant. But to decide which test *t* (Single – end or double- end) will be used, taken prior to collection of data at planning level should be done.

To increase senility of T- Test

Notes   The meaning of sensitivity of independent variables or treatment's effect on dependent variable presents their capability or their work efficiency.

Several such measures by that T-Test's this senility can be increased. It has been mentioned ahead.

1. **To Decrease the level of noise**: In this respect the meaning of noise is effects of uncontrolled variables. There effects present in many forms. Experimental design's rules and under different types it has been mentioned already. Mainly its sources are-

    (i)   Direction given to persons under research.

    (ii)   Incomplete control of post studies variables

    (iii)   Management of study and no control over circumstances

    (iv)   Researcher's bias and

    (v)   persons under research mental set.

Hence due to occurred "noise" (effects), to control it do every possible measures so that experimental effects which is occurred due to independent variables or treatment, explored come before.

2. **To increase size of sample**- To increase the sensitivity of T- Test it is the second measure. To do so random error minimizes and type – I and type – II errors' are decreased. In this way ,effects of independent variables is more cleared.

3. **To remove the effects of "Floor" and "Roof"** – Its meaning is that to measure the variables' used tests should be neither very simple then mostly persons mark will too high, may be cent-percent. At that condition some of them to go high in the tests possibility is decreased. As a result difference will be less due to occurred by treatment. This situation is called "Collide form roof move down towards floor incidence". Consequently if test is very hard then a

great may number of persons (from marks approach) do not rise above floor. This is called "Floor effect". In this condition treatment effects does not be cleared. Therefore test should be neither very tough nor very simple, then T-Test's sensitivity increases.

4. **To Increase the reliability of Measures**: To do so increase the reliability of Psychological test do one rather many times measures and taken their average and can be done to control properly measuring conditions and management.

5. **Selection of a more Suitable Design:** In study – 10 a number of experimental designs have mentioned. Under this included independent group design, matched group design, correlated repeated group design. T-Test's Sensitivity much in repeated measures design, less than that in matched group design, and least in independent group design. It so happen due to more and less controlling of studied variables. In independent group design. It so happen due to more and less controlling of studied variables. In independent group design this control is least. Hence to increase the sensitivity of T- Test; one measures is that to choose that design in which T-Test sensitivity is most, but it is not possible always. At that condition T- Test sensitivity too less than other two. Therefore it is necessary to keep in mind each merits and demerits and their suitability. Although if in the condition at research it is possible to select such a design which covers most sensitivity of T-Test.

30.5 Summary

- The first gateway of research data's analysis, through which enter is null hypothesis. It had been invented by Late Scientist, mathematician Ronald Fisher.

- If on independent variables only group has constructed or manipulation of independent variables have divided into two groups and comparison is do only these two groups with dependent variables, then at that condition T- Test can be used.

- T- Test is a parametrical test and in this only one independent variable is there which can be manipulated in two or more than two categories.

- T-Test is of two types – (i) Independent group based and (ii) Correlated or remeasurable based.

- Small sample correlated group test can be used in case of large sample correlated group. From computation point of view this method is very simple, but on that basis very few information can be obtained.

30.6 Keywords

1. **Null Hypothesis** – The first stage of experimental data analysis, from where research starts, called null hypothesis.

2. **Equal Interval** – having equal distance, having equal interval.

30.7 Review Questions

1. Mention main basis of Statistical analysis.

2. What do you mean by Parametrical T- Test? Mention its types.

3. Describe single- end and double – end test.

4. Throw light on large sample correlated group T- Test

Answers: Self Assessment

1. Ronald Fisher   2. Alternative   3. T- Distribution   4. Rejection

5. (b) Statistical   6. (b) Two   7. (a) Parametrical   8. (c) Single variables design

30.8 Further Readings

Books

1. Academic Techniques Management and Assessment—*J.C. Agrawal, Bhatt Brothers*

2. Educational Research Work Procedure—*L. Kaul, Vikas Publishing*

3. Education Technique—*R. A. Sharma, Bhatt Brothers*

Unit 31: F-Test

CONTENTS

Objectives

After studying this unit, students will be able to:

- Understand one-way analysis-variance and normal probability group design
- Understand one-way anova
- Understand two-way analysis
- Understand randomized block design and Co- variance analysis.

Introduction

In previous chapter statistical analysis' T- Test had described. The use of T- Test can be done only in that condition in which only two groups are to be compared.

In its one independent variable give only two treatment or divide at two levels, but condition of research is not always same that they are limited to independent variables of two levels or two treatments. In a number of condition independent variables' division in many treatment or many level understood to be more required. At that condition. more than two groups are mutually compared. For example at motivation level what impact on students academic achievement, to studies there researcher determines three (much more motivated reasonably motivated, very low motivated) or more than three level, all students three or more than three groups divided and compare it to academic achievement than

studies. In this condition T- Test cannot uses. In this condition that method, that test's uses, that is called analysis of variance. It had invented by **Ronald Fisher** in short it is called Anova.

In analysis of variance in place of two mean's difference, total variance of groups total measures, and their different parts or section is the base of analysis. Behind the use of it some concepts are followed which is mentioned in context of T- Test. Like T- Test this test which is called F- Test, is an parametrical test. Hence this test uses when parametrical test concept fulfills. This is a very versatile test which has many transformed form and which can be used in many research conditions. The most general form of its simple analysis of variance and completely randomized groups design or one-way analysis of variance.

Second complicated form is two–way Anova and factor analysis. Firstly, simple variance analysis method will be mentioned.

31.1   One–way Analysis- variance

The literally meaning of 'variance' is difference, but in statistical language its meaning is 'Average of Squares of difference '. This difference is taken from score and mean.

Basically variances' formula is:-

$$\text{Variance } = \frac{\Sigma(x - \overline{x})^2}{N}$$

or and in more impure form $= \dfrac{\Sigma(x - \overline{x})^2}{N-1}$ or $\dfrac{\Sigma x^2}{N-1}$

1. Parts of Total Variance

Notes   Total variance e.g., from sum of score's mean's taken differences' squares can be divided into many sections or components.

At least two parts or section are always there. These are: between group variance and within groups variance. If these two are added then it will be equal to total variance. By given below example it will be clarified:

Table 31.1 Data of three groups

A-1			A-2			A-3		
X_1	x_1	x_3^2	X_2	x_2	x_3^2	X_3	x_3	x_3^2
6	2	4	4	1	1	6	+1	1
2	–2	4	2	–1	1	5	+0	0
3	–1	1	5	2	4	4	–1	1
5	1	1	1	–2	4	4	–1	1
4	0	0	3	0	0	6	1	1
$\Sigma X_1 = 20$			$\Sigma X_2 = 15$			$\Sigma X_3 = 25$		
$\overline{X}_1 = 4$			$\overline{X}_2 = 3$			$\overline{X}_3 = 5$		
Σx^2		10			10			04
$\Sigma X_1 = 60$								

Suppose that above table shows three independent randomized groups' (high motivation, normal motivation, low motivation level) boys present academic achievement's scores. We can say these groups as A-1, A-2, A-3. On the basis at analysis of this table it is to be tested that "Does motivation effects on academic achievements".

On the basis of this table firstly calculate total variance which is presented in example -1

Example – 1

Computation of total variance			
X	x	x^2	
6	2	4	
2	–2	4	$e(V_1) = \dfrac{\Sigma x^2}{N-1} = \dfrac{34}{14}$
3	–1	1	Total variance = 2.428
5	+1	1	
4	0	0	
4	0	0	
2	–2	4	
5	+1	1	Using formula $\dfrac{\Sigma x^2}{N}$ value comes to
1	–3	9	$\dfrac{34}{15}$ = 2.266
3	–1	1	
6	2	1	
5	1	1	
4	0	0	
4	0	0	
6	2	4	
X = 60 $\overline{X} = 4.0$ $\Sigma X^2 = 34$			

This total variance is supposed to be occurred due to two reasons. Firstly due to that difference which is vested at three levels of motivation. Secondly due to that difference which lies in each group of boys. Due to these two reasons occurred, variance is called – (i) Intergroup variance and (ii) within group variance.

1. **Inter group variance** due to treatments and within groups variance sampling error or chance error which is called randomized error and that after matched all groups remain something suppose to be occurred due to those. Within groups variance in every experimental researches known as error.

2. **Between Groups Variance** Below given example -2 table's basis in which three groups' mean has been arranged as measures between groups variance is calculated. By this formula $\dfrac{\Sigma X^2}{N=1}$ we get 1.0 and by formula. $\dfrac{\Sigma X^2}{N-1}$ we get .666

Example 2

Calculation of variance			
X	x	x^2	
4	0	0	
3	–1	1	
5	+1	1	$(V_b) = \dfrac{\Sigma x^2}{N-1} = \dfrac{2}{2} = 1.00$
$\Sigma X = 12$			by using formula $\dfrac{\Sigma x^2}{N}$, it
M = 4.0			results $\dfrac{2}{3}$ = .666
$\Sigma x^2 = 2$			

3. **Within Groups variance:** Table – 29.1's each group's (A-1, A-2, A-3) within group variance calculation formula is same as given previously. To find it calculate three groups variance separately and then their average taken. Is Each group's Σx^2 given in table -1. This is 10, 10, 4

respectively. In each N – 1 = 4 Hence within groups variance is $V_b = \dfrac{\dfrac{10}{4} + \dfrac{10}{4} + \dfrac{10}{4}}{3} = \dfrac{6}{3} = 2.0$

(By formula $\dfrac{\Sigma x^2}{N-1}$) within group variance $V_b = \dfrac{\dfrac{10}{5} + \dfrac{10}{5} + \dfrac{10}{5}}{3} = 1.60$ (By formula $\dfrac{\Sigma x^2}{N-1}$)

By both formula above both types of variance are following.

(i) By formula $\dfrac{\Sigma x^2}{N-1}$ (a). V_b = 2.0 (b) V_w =1.0

Hence, accordingly this formula

$$V_b + V_w = (2.0+1.0) = 3.00$$

(ii) By formula $\dfrac{\Sigma x^2}{N}$ (a). V_b = 1.60 (b) V_w = .666

Then accordingly this formula

$$V_b + V_w = 1.60 + .666 = 2.266$$

(iii) According to formula $\dfrac{\Sigma x^2}{N-1}$

Total variance (V_b) = 2.428

According to formula $\dfrac{\Sigma x^2}{N}$, $\qquad$ V_b = 2.266

According to formula $\dfrac{\Sigma x^2}{N-1}$

$$V+(2.428)= V_b + V_w \quad (3.0)$$

According to formula $\dfrac{\Sigma x^2}{N}$

$$V + (2.266) = V_b \quad (1.60 + .666) = 2.266$$

On the basis of above calculation it can be seen clearly that using formula $\dfrac{\Sigma x^2}{N}$ total.

Variance (V_t) which is 2.266 inter group variance (V_b) and within group variance (V_w) which is 1.60 as .666 respectively, is exactly equal to sum. Therefore, it is proved that total variance is equal to sum of intergroup and within group variance. It can be expressed by formula as following.

$$V_t = V_b + V_w$$

But using formula $\dfrac{\Sigma x^2}{N-1}$ It is not found so.

There remains a little difference. In this condition V_t = 2.48 and V_b + V_w= 1+2= 3.0. This difference occurs due to that in formula $\dfrac{\Sigma x^2}{N-1}$ in place of denominator degrees of freedom (N-1) concept is used.

Accordingly mathematics rule to do so is more scientific and satisfactory, because on the basis of this formula available value lies value of population's very close. Therefore this is the formula which is always used always use to get value. Here formula $\dfrac{\Sigma x^2}{N}$ is used only to clarified that V_t can be divided in two parts always into (V_b and V_w). V_b as SS_A and V_w as SS_w and V_t as SS_T can be written. Hence SS_T = SS_A + SS_w. Always this formula should be remembered.

4. **Between groups variance's (SS_A) explanation :** Between groups variance that variance which gets by each groups mean and three groups (if more than three, then all those) collective mean's differences squares divided by N-1. From example -2 it is clear. The occurrence of this variance's cause consider to be independent variables (their at different levels taken difference or various treatments)

Notes   Between groups variance is that variance in which subvariable or vested independent variance affects and for the research of that experiment is done.

This variance dose not completely occur due to subvariable (independent variables). At least randomized error (by choice error), error lies. If variance is more than that error then it can be accepted due to treatment.

Within groups variance's (SS_W) explanation

This is that variance which occurred due to in separate groups lies persons or between units remain difference. This is correct that group's by randomized post studied variable controlled, try to make matched, rather than it no happen difference between units completely eliminated. Due to this reason within groups variance not complete Zero. This remain variance is called SS_W and it is considered to

be by chance. The characteristics is that it can be estimated, but cannot eliminate completely. Therefore ,it is named as "error".

F-Ratio

Example   On the basis of SS_A and SS_W the decision is taken over this matter that experimental effect e.g., independent variables or treatments are affected dependent variables or not.

In Anova the significance of difference of groups, their mutual comparison basis is this ratio. This ratio means SS_A/SS_w is called F-ratio. **Sir Ronald Fisher's** one pupil **Snedecor** as mark of their respect, named this ratio **F**.

If parametric tests concept fulfils and taken many randomized sample calculate F-ratio then their distribution will be normal, as in the assumption of mathematician. On this basis **Snedecor** has prepared F-value's a table taken different degrees of freedom which is called **F-Table**. This is present is the end of this book under appendix table-C. In this table given F-value is compared with obtained F-Value then conclusion is drawn. Behind this assessment the logic is as types. If make difference of treatment does not affect on dependent variable then the value of SS_A must be equal to SS_w. In that condition F's value will be 1.0

Thus if independent variables have effect's dependent variables really means that is cause of dependent variables the F's value should be greater than 1.0 but how greater is 1.0 then it can be said that independent variables or treatment's effect is significant or real?

The solution of this problem solved by given value of T- Table. Process is this type that on the basis of data firstly calculated F' Value. Then this F- value is compared with given value of table. If on the basis of data obtained f value table's at any level of 0.05 or 0.01 determines equal to the given value of decrees of freedom or more than that then null hypothesis is rejected and conclusion is drawn that treatment is effected on dependent variables really. Regarding F- value some other facts should be understand properly also. There are—

1.   The rule to calculate F value is that between SS_A and SS_w which is greater that is put on place numerator and second on place of denominator anyone of both can be greater. Hence either of them can be put up and down, but in variance analysis condition SS_A Should be kept above always. If in any condition SS_A is less SS_w is more then there is no need to calculate F' value because then at once it is cleared that there is no effect of treatment on result mean F is not significant.

2.   F – Test inevitably one – tailed test because regarding this it is to be considered that Did SS_A Value from SS_w as much as higher that it is called significant? For that SS_w is kept on the middle point (0.0) normal distribution curve and it is observed that how much above is SS_A Above curve's one end expand in one direction. Therefore it is an single test.

3.   The concept of degrees of freedom in F- Test is most important. Its use is to select the value of table based value with which compares obtained F – value. For this F- ratio table C's understand through and through essential. In this table at the top in horizontal direction SS_A degrees of freedom (*df*) and left side in column vertically SS_w's df observed from both side move where meet at an point at that place two value available. In these one is light black colour and other dark black colour. Dark black colour holding means greater value level of 0.01 and light colour holding means small value level of 0.05 is. All these matters will be cleared by ahead given examples.

31.2 Normal Probability Group Design

Single-way Anova

In the previous chapters SS_t, SS_A, SS_w calculation had been shown but by which method they had been calculated actually they are not used. Actually which method is used that step is at follows:

1. Calculate Correction terms value (c)
2. Calculate SS_t
3. Calculate SS_A
4. Calculate SS_w
5. Convert SS_A and SS_w into mean
6. Calculate F – ratio
7. Compares it with table value
8. On the basis of significant test drawn conclusion

Example 3

Table 31.2: Single Way Answer Variance Analysis		
X_1	X_2	X_3
6	4	6
2	2	5
3	5	4
5	1	4
4	3	6
20	15	25 =ΣX=60

(Having obtained measures on dependent variable for all the subjects in the different groups a table like the above is prepared. In this X is our independent variable which has three treatment conditions or levels, X_1, X_2, and X_3. The analysis of variance will follow the following steps):

1. Correction Term (C) = $(\Sigma X)^2/N = (60)^2/15 = 240.0$
2. SS_T = In Table-2 squares of total data's sum has been given
   $Ex^2 - c = (6^2 + 2^2 + \ldots 4^2 + 6^2) - 240.0 = 34.0$

3. $SS_A = \dfrac{(SX_1)^2}{N_1} + \dfrac{(SX_2)^2}{N_2} + \dfrac{(SX_3)^2}{N_3} = C$

If N is equal in all groups then aforesaid formula will be written as $\dfrac{\Sigma x_1^2 + \Sigma x_2^2 + \Sigma x_3^2}{N} - C$; Putting all value

$$SS_A = \frac{(20)^2 + (15)^2 + (25)^2}{5} - 240 = 10.0$$

4. $SS_W = SS_T - SS_A = 34.0 - 10.0 = 24.00$

5. Mean $SS_W = \dfrac{10}{2}$ = 5.0 as here three group are and *df* is (3 – 1) =2

6. Mean $SS_W = \dfrac{24}{12} = 2.00$ *df* will be 12.

7. F-ration $\dfrac{MSS_A}{MSS_W} = \dfrac{5}{2} = 2.50$

8. **Significance** – F value is not significant because at 2, 12 df and at level .05 table – C's F value is 3.88 Hence H_0 cannot be rejected Result is not significant.

9. **Treatment is not differ to one** – another and each have equal effects on depend variables. In other words independent variable X does not affect dependent variables.

Remarks- 1

Calculation of SS_w's degrees of freedom can be done by two types:

(i)   From each group's N deduct 1 and adding all remainders as it is done in previous example (5 – 1) + (5 – 1) + (5 – 1) = 12 is done.

(ii) Second method is that from whole *df* group's *df* number deducted, as in previous example total *df* number is 15 – 1 = 14 and group's *df*'s number is 3 – 1 = 2. Hence *df* of SS_w = 14 – 2 means 12.

(iii) SS_A's degrees of freedom number acquired from deduction of 1 from total number of groups.

Remarks -2

It observed also that to calculate SS_t and SS_A Method is same which had clarified in example -1 and 2. Only it is difference that in that example this method is in form of mean and each's deviation whereas in this example is in based upon raw score's use. In deviation form that's formula was $\Sigma x^2/N_1$ but in

fundamental numerical form this formula is $\Sigma x^2 - \dfrac{(\Sigma x)^2}{N}$

In which $\Sigma x^2/N_1$ is correction term (C). This C to calculate SS_A and SS_t remains same. Hence it is calculated once in the beginning because in this method fundamental digits are used. Hence the, meaning of SS_T is sum of square of total scores separately. Like wise the meaning of SS_A is sum of columns separately squares total.

Did You Know? SS_A/SS_w is called F- ratio also.

31.3   One–way Anova

In previous example taken independent groups one-way Anova's method had been explained. Here some method is explained in context of repeated measures design. In this condition only one group of persons is kept under treatment. As in pre-test and post-test design groups of a persons firstly and later is tested twice. Thus persons one or two variables make equal and after that distributed in groups then their measures. In these two types of management Anova (one-way) repeated measures design is used. Under this method which is calculated that is a little different to previous independent groups method. Repeated measures design's special utility vested in this matter by that between groups' unit lies occurred variance due to difference of that and that is called error of variance, it becomes less

and in this way research's accuracy and validity is increased. Therefore it is a powerful medium of controlling of heterogeneity of subjects, but it is not understood from that these difference, variances are completely ended. Some still remain, but the must be less, because in this units of one group is worked like controlled groups units.

A main demerits of this design is that in this units pre –test is effected on post –test. After pre test there is great change comes in units and they are not representative of whole population in which they are selected. Due to there two causes precision of experiments and external validity both has undesirable effected. Being there difficulties this design is considered to be superior to independent group design. It is called within group design or correlated group design. In this design a new sources of variance added which is called between subjects variance or SS_s which is eliminated from $SS_T = SS_A + SS_s + SS_w$ is called SS_{error} also. It will be cleared from ahead example and how these variance are calculated and how the conclusion is drawn.

Example 4

On recall remembering order's study of effects 8 students have been given 10 pair of words and after two days he has to recall it. After that another 10 pair of words is given for remember and after two days he has to say recalled it. Thus remembering, recall this work goes on for 6 schedule. On this basis which hypothesis had been to test that had "on recall there is no effects of remembering order". As is prejudice that after first schedule recall is the most and after that it becomes less gradually.

For the clarification/of data/ of test method data has been presented in following tale. For statistical computation and analysis including a little changing some steps have been followed which has been already mentioned in independent group case. This is as follows.

Table 31.3: Serial Number of Table							
Subject	L-1	L-2	L-3	L-4	L-5	L-6	Total
S_1	7	3	2	2	1	1	16
S_2	4	8	3	8	1	2	26
S_3	7	6	3	1	5	4	26
S_4	8	6	1	0	2	0	17
S_5	7	2	3	0	1	3	16
S_6	6	3	3	1	1	1	15
S_7	4	2	0	0	0	0	6
S_8	6	7	5	1	3	2	24
Total Σ =	49	37	20	13	14	13	146

In this case for the fulfill of analysis we will follow the previous example of independent group design.

1. C $= (146)^2/48 = 444.08$

2. SST $= (7^2 + 4^2 .... (0)^2 + 2^2) - 444.08 = 740.0 - 444.08 = 295.92$

3. SS_A $= \dfrac{(49)^2 + (37)^2 + (20)^2 + (13)^2 + (14)^2 + (13)^2}{8} - 444.08$

   $= \dfrac{4704}{8} - 444.08 = 143.92$

4. SS_s $= \dfrac{16^2 + 26^2 + 26^2 + 17^2 + 16^2 + 15^2 + 6^2 + 24^2}{6} -$ 444.08

   $= \dfrac{2990}{6} - 444.08 = 54.25$

5. $SS_{e \times r} = SS_T - (SS_A + SS_s)$

   $=$ 295.92 $-$ (143.92 + 54.25)

   $=$ 295.92 $-$ 198.17 = 97.75

In the a for said the meaning of $SS_{e \times r}$ is occurred variance by interaction between columns and rows. It is called interaction.

6.   Mean SS_A = 14.92/5=28.78

7.   Mean $SS_{e \times r}$ = 97.75/35=2.79

8.   F-ratio = $\dfrac{28.78}{2.79} = 10.32$

9.   Conclusion: In table C 3, 35 df and at level 0.01 F's value is 3.59 Obtained F-value 10.32 is which much greater than table value. Hence to avoid Ho the conclusion is drawn that memorizing order definitely effects on recall after first catalogue recall was at most. After that it become less gradually.

Computational Explanation

In the case of repeated measures design method of calculation is a litter different to that of independent groups design case. In this case each person is measured, second, third, fourth etc means more than one measure therefore between the scores of them correlation is occurred. In other words, between the pair of subjects also a new type of variance is occurred. Although in each group same persons are, but after a test a number of differences occurred in them and they are not same, as it was prior due to this cause a new type of variance is a added. Hence SSτ have three parts $SS_W + SS_A + SS_S$. Among these SS_W is understood as that variance which occurred due to persons one groups keeping different measuring conditions. It is called between rows variance SS_r or SS_a also Like SS_A is also a systematic variance SS_S. Between the scores of group as much as correlation exists, systematic variance is as much as also and variance of error is also less. Therefore SS_t or SS_r rows is computed. It has been cleared under example's Step -4.

Between independent group design and repeated measures design from statistical analysis point of view second difference is occurred in selection of error term means SS_w. In case of independent group design, this is SS_w, but in repeated measures design, it is residual variance which is called interaction variance e.g., $SS_{c \times r}$ also. In fact in case of repeated measures design calculation of SS_w is not possible, but keep in mind that both SS_w and SS_{res} are presents estimate of error, rather SS_{res} is considered to be a much better estimate. Hence in case of repeated measures design rather SS_w, SS_{res}'s calculation of F value uses. Its calculation as previous example's in step has shown from SS_T sum of and SSe is done after deduction of it therefore it is called residual or remainder variance.

31.4   Two-way Analysis of Variance (Independent Group)

The use of aforesaid motioned method as is explained in illustration, uses there, where only one group of unit measured on dependent variables again and again or used matched group, but it can be used

in that case also where to control any one variable. Its one example is given below. This method comes under the category of two–way analysis of variance.

Example 5

A researcher want to study about an eleven years old boy's home environment effect on his psychological development. He collects scores of five schools' boys' home environment and his psychological developments on home environment he prepares school wise boys' two groups (desirable and non-desirable home environment). School wise their on dependent variables (developments) scores in the form of mean he having arranged in the following table, by F- Test he want to analyze it. But he is doubled that various schools environment much differ to one another causes effects of school. Can stop to prevail of effects of home environment. Therefore it should be controlled. Hence he uses previous method by following type so that effects of school should be ended.

School	Home environment		Total
	Low groups	**High groups**	
1	56	35	91
2	59	38	97
3	62	32	94
4	57	31	88
5	52	45	97
Means	286	181	467
	6.36	4.02	

Table 31.4 : Home Environment and Psychology Relationship between development (N = 9 in each Cell)

It can be done exactly as it had been done in previous example, in that due to differences between subjects variance had been ended (differences between lines) observed this whole process as it is.

1. C (Correction term) = $(467)^2/10 = 21808.9$
   (Taken each groups mean scores as individual

2. $SS_T = (56^2 + 59^2 ……… 31^2 + 45^2) -$ C =   1204.1

3. (Home environment) = $\dfrac{286^2 + 181^2}{5} - C$ =1102.5

4. SS_{row} (school) = $\dfrac{91^2 + 97^2 .... 88^2 + 97^2}{2} - C$

5. $SS_{res} = SS_T - (+ SS_{schools})$

   $= 1284.1 - (1102.5 + 30.6)$ = 151.0

6. Mean $SS_{(A)} = 1102.5/1$, *df* being 1   = 1102.5

7.   Mean SS_{res} = Mean $SS_{H \times S}$ = $\dfrac{151 - 0}{4}$ =37.75

8.   F = $\dfrac{1102.5}{37.75}$ = 29.20.

9.   **Conclusion** – in table C,1 4 *df* and at level .01 value of F is 21.27 where as researcher's obtained value is 29.20 which is greater than table value. Hence H_0 can be rejected and conclusion is drawn that home environment effects children's psychological development's

In this like previous written method SS_T is divided into three parts – SS_A + SS_{school} + SS_{res}. Due to differences of school occurred variances $(SS_s)_{row}$'s eliminated from SS_T. It is to keep in mind if the number of boys of school's is some then mean of scores assumes one by one scores can be applied in table. From computation point of view its result is not affected. This whole process is some as, as mentioned in example –4.

Error- Variance (SS_{res})

Under example -4 & example -5 which error of variance has been mentioned, it has many a name as a –remainder or residual variance and interaction variance, similarly it can be written as many types as a SS_{res}, $SS_{e \times v}$ etc. this is that variance which due to treatments, remains not any difference exist and which is by by chance or randomized method selection of unit and distribution in groups remain differences between them occurred as assumed. Consequently this is that variance which form total variance, both treatments' (SS_A) and school's variance (SS_s) remain after deduction of those therefore it is considered to be more accurate than SS_w. If effects of differences of school's environment, effects of studied variables and effects of treatments eliminated completely then $SS_{c \times r}$'s value will be equal to SS_w otherwise. Value of $SS_{c \times r}$ always less than SS_w. If it is less than that, then it should be understood as by chance and in that case SS_w should be used for F- value.

Self Assessment

Fill in the blanks:

1.   F – Test is a ……………………. test.
2.   The meaning of variance in statistical language …………………
3.   F- Test is definitely ……………… test.

31.5   Two – way Analysis of Variance (Correlated Group)

Two- way (independent group) variance analysis example has been presented in previous page (example 5), but such a case of research may be in which groups are correlated or matched. In this case also Anova can be used but its method is rather a little change with respect to previous method. Two –way analysis of variance's (Correlated group) this method's example has been given ahead.

Example -6

A researcher want to study a six-year old children effects of practice on learning. He controlled sex effects. Hence he choose 5 boys and six girls randomly and then practice trial's taken under. After every trial measures their improvements. Thus which data available at that basis ahead table has prepared and calculate necessary variances. Whole calculation has been shown below table.

(Two – way – variance)
Correlated measures Design
Process of Learning

	S_S	I	II	III	IV	V	Total
				Table 31.5			
	S_S	I	II	III	IV	V	Total
	1	4	7	3	4	6	24
	2	3	4	6	9	7	29
Boys	3	2	2	8	5	8	25
	4	5	5	5	8	5	28
	5	4	6	7	6	9	32
Ex		18	24	29	32	35	138 (Group-I)
	1	6	3	4	8	10	31
	2	8	5	5	7	8	33
Girls	3	4	5	5	5	9	28
	4	3	3	6	6	10	28
	5	6	6	8	9	10	39
Ex		27	22	28	35	47	159 (Group-II)

In this analysis following steps are included-

1. C = total number's (is divided in) group I and group II sum of squares

$$= \frac{297^2}{50} = 1764.18$$

2. SS_t = 1991 – 1764.18 = 226.82

3. SS_t = Sum of squares the total of all the ten groups divided by n minus the correction

$$= 18^2 + 24^2 + \ldots\ldots..+ 35^2 + 47^2/5 – 1764.18$$

$$= \frac{9421}{5} – 1764.18 = 1889.2 – 1764.18 = 120.02$$

4. SS_t = Sum of squares of the totals of all the rows divided by n minus the correction term

$$= 24^2 + 29^2 + \ldots\ldots….. – 28^2 + 39^2/5 – 1764.18$$

$$= \frac{8989}{5} – 1764.18 = 1797.8 – 1764.18$$

$$= 33.62$$

5. SS_{Trials} = Sum of squares of the totals of all the trials (column sum of scores for boys and girls both for each trial divided by n minus correction).

$$= \frac{45^2 + 46^2 + 57^2 + 67^2 + 82^2}{10} – 1764.18$$

$$= 18603/10–1764.18$$

$$= 1860.3–1764.18 = 96.12$$

6. SS_G = Sum of squares between Groups of boys and girls

$$= \frac{138^2 + 159^2}{25} - 1764.18$$

$$= \frac{44325}{25} - 1764.18 = 1773 - 1764.18 = 8.82$$

7. SS_W = Within groups sum of squares.

This is obtained by subtracting between-groups variance from SS_8 (sum of squares among subjects).

$$= 33.62 - 8.82 = 24.8.$$

8. $SS_{S \times Trials}$ = This can be obtained by subtracting SS_s and SS_{Trials} from SS_t (total sum of squares).

$$226.82 - (33.62 + 96.12) = 97.08.$$

9. $SS_{Groups \times Trials}$

This we can get by subtracting SS_{Groups} (Sum of squares between groups) and SS_{Trials} from SS_{rr} as follows:

$$120.02 - (8.82 + 96.12) = 15.08.$$

10. Pooled $SS_{S \times Trials}$

This we can get by subtracting $SS_{Groups \times Trials}$ from $SS_{S \times Trials}$. It is used as the error term for determining the significance of treatments.

$$= 97.08 - 15.08 = 82.0$$

Table: 31.6				
	SS	*df*	*Mean SS*	*F*
Groups (Sex)	8.82	1	8.82	3.44 Sig. at .05 level
Within groups (error)	24.80	8	3.10	
Trials	96.12	4	24.03	9.386**
Groups × Trials	15.08	4	3.77	1.472 Not Sig.
Pooled SS $_{s\times Trials}$	82.00	32	2.56	
		49		

**Sig. at .01 level

Conclusion – In F table –C 4, 32 *df* and at level 0.01 F's value is 4.02 *wf* whereas exercise obtains F – value is 9.386 which is much greater than table value. Hence H_0 is rejected and conclusion is drawn practice necessarily effects on improvements. Sex's F-ratio (3.44) is significant at level .05. Hence it will be accepted that sex's effects on improvements means difference between boys and girls improvements, but interaction variance (1.472) is not significant on that basis it will be to say practice and sex when interaction with each other then there is no significant effects on improvements.

Two–way Anova's (correlated group) is used there where two independent variables are there and one group of units has been measured on dependent variables again and again. It can also be used where controlled effects of one variables to study of others effects.

31.6 Randomized Block Design

In the beginning of this chapter randomized group design had been described. In that units it was distributed in group by randomized method and it assumed that group was matched from true study point of view, but in fact they do not matched. In their units rather remain difference due to that accuracy of research becomes less units, specially among men a number of differences exists. In groups their randomized distribution is not able to eliminate completely these differences and diversities. As a result effects of treatment does not seem. Hence to less these differences and to increase accuracy of research and internal validity purpose researches is used on another design which is called "randomized block – design. In short it is written as RB–k design which means number group based randomized block design. By this design which data gets their variance analysis too accordingly given method of example – 5 in which in place of error do not use SS_w rather used SS_{exr}. In the given example ahead its whole process has been mentioned.

Example – 7

A researcher wanted to stay an eleven years old boy's learning two techniques of behaviour-control (admire and punishment) effect consequently wanted to control intelligence because intelligence is considered to be main factor of learning. So he formed blocks of 3-3 boys of equal. In one block boys I.Q were 119, 120, 121 respectively, in second I.Q. was 110, 111, 112 third 99, 100, 101, in fourth 90, 91, 92 in forth 81, 82, 83. From each block one boy's randomizely he has been distributed in three group (admired group, punished group, controlled group). Experiment goes on for one month. After that his learning has measured. Whole data had been adjusted in the table by following types. After that variance analysis has been done. Whole computation process is given in the table below.

Table 31.7 Randomized Block Design				
Class	Prized Group	Punished Group	Controlled Group	Total
1	14	13	10	37
2	13	14	11	38
3	15	10	12	37
4	18	14	13	45
5	10	11	14	35
Sum	70	62	60	192

Now, the ANOVA was carried out. The following values were computed stepwise.

1. $C = (192)^2 / 15 = 2457.6$

2. $SS^T = 14^2 + 13^2 .... 13^2 + 14^2) - 2457.6$

    $= 2526 - 2457.6 = 68.4$

3. $SS_A = \dfrac{70^2 + 62^2 + 60^2}{5} - 2457.6 = 2468.8 - 2457.6 = 11.2$

4. $SS_{Blocks} = \dfrac{37^2 + 38^2 + 37^2 + 45^2 + 35^2}{3} - 2457.6$

    $= 2477.3 - 2457.6 = 19.7$

5. $SS_{exr} = SS_T - (SS_A + SS_{Blocks})$ = 68.4 – (11.2 + 19.73)

   = 68.4 - 30.93 = 37.47

6.   Mean $SS_A = \dfrac{11.2}{2}$ = 5.6, *df* being 2

7.   Mean $SS_{c \times r} = \dfrac{37.47.2}{8}$ = 4.68 *df* being 8(2 x 4, i.e., 2 for columns and 4 for rows)

8.   F-ratio = $\dfrac{Mss_{(A)}}{Mss_{(C \times r)}}$ = $\dfrac{5.6}{4.68}$ = 1.96.

9.   **Conclusion –** obtained F-ratio (1.196) in table C 2, 8 *df* and at level 0.05 given value is less than 4.46. hence H_0 cannot be rejected. The conclusion is drawn that there is no difference in behavior controlling methods. He has no effects on learning.

Simply it can be known $SS_{black \, x \, treatment}$. Or remainder variance can never be greater then SS_w. Its size SS_{blocks} depends upon its magnitude. If it is greater than $SS_{c \, x \, r}$ result will be least.

Utility of RB–*k* design or advantage of this design

1.   In this difference becomes least between units because made it matched and distributed in the block. Due to this reason error variance SSw is also less and experiment internal validity is increased.

2.   Due to difference in block which variance occurred it is eliminated also. Hence due to this error become least.

3.   This design is superior to independent group randomized design. Its efficiency can be calculated by formula $\dfrac{MeanSS_w}{Mean \, SS_{c \times r}} \times 100$. It is clear from that this design is superior to randomized design.

4.   This design is very flexible. Taken a number of levels of treatments and blocks, it can be analyzed.

5.   The simplicity of analysis is its additional characteristics.

Demerits → One demerit of this design is its inconvenience. When treatments are more in number then in due to larger number in block it is tough to make it similar. In one block such a larger number exists makes more unconveniciable and if it matched more than one variables then it becomes more and more tough.

31.7   Co-variance Analysis

In experimental research controlling of true study variables is considered to be most important, because in absence of that result can not be more accurate and valid. To attain this purpose a number of measures and methods has been mentioned. Among these one is analysis of covariance. In short it is called ANCOVA. This is an extended form of ANOVA. ANCOVA is a statistical method of controlling of variables. Due to this research's result' accuracy is increased. In previous example randomized block design had been described in which on intelligence matched units under treatment it had been distributed in this way intelligence had been controlled. In co-variance analysis does

not do so their measures can be done and by statistical analysis their effects can be eliminated. In variance of treatments (SS_{TT}) having corrected by statistical method on covariate intelligence, due to lies differences between units occurred effects can be eliminated. Later measures' regression effects on initial measures which is called between groups regression, is possible by medium of that. Thus co-variance analysis is such a statistical method in which various treatments' among distrinution test of significancy of differences is done as long as, when from that, that variance is eliminated which occurred among them in the begning due to true study variables or variables. In other words from between groups variance in covariates by initials differences occurred variances eliminated means after correction this analysis is done. Hence from $SS_{T(y)}$, $SS_{A(y)}$ and $SS_{w(y)}$ that variance is eliminated which occurred due to X (covariate) and Y (sub variable) correlation. Thus final analysis is done on the basis of these corrected variances. It will be cleared from next example.

In the following table suppose X variable is intelligence and Y boys' learning achievement. Three treatments groups (applaused, punished and controlled). Researcher wants to know that on boys' learning achievement these treatment effects significantly separately, but he wants to control intelligence effects whole data has been presented in the table and steps of analysis process has been given below.

Example 8

Table 31.8: Co-variance Analysis								
Admired group			*Punished group*			*Controlled group*		
X_1	Y_1	X_1Y_1	X_2	Y_2	X_2Y_2	X_3	Y_3	X_3Y_3
33	18	594	34	31	1054	34	15	510
42	34	1428	55	45	2475	4	8	32
40	22	880	9	1	9	12	18	216
31	24	744	50	33	1650	16	15	240
Sum 146	98	3646	148	110	5188	66	56	998

1. First of all, we have to find out three correction terms for X, Y and XY:

    (a) C_x (correction term for X)   = (146+148+66)²/12

    =(360)²/12=10800.0

    (b) C_y (correction term for Y)   =(98+110+ 56)^2 / 12 =5808.00

    (c) C_{xy} (correction term for XY)   = (Σx)(ΣY)/N

    = $\dfrac{360 \times 264}{12}$ = 7920.00

2. Now, total sum of squares has to be calculated for X, Y and XY:

    (a) $SS_{T(x)}$ = (33² + 42².... 12² + 16²) – C

    = 13748.0–10800.0

    = 2948.0

    (b) $SS_{T(Y)}$ = (18$_2$ + 34$_2$ ..... 18$_2$ + 15$_2$) – C

    = 7454.0–5808

    = 1646.0

    (c) $SS_{T(Xy)}$= Sum of XY total for each treatment group-C

    = (3646+5188+998)–C

= 9832 – 7920

= 1912.0

3. Now, we have to calculate between –groups sum of squares for X, Y and XY as follows:

(a) $SS_{A(X)}$ = $\dfrac{146^2 + 148^2 + 66^2}{4} - C$

= 11894.0 – 10800.0 = 1094.0

(b) $SS_{A(Y)}$ = $\dfrac{98^2 + 110^2 + 56^2}{4} - C$

= 6210.0 – 5808.0 = 402.0

(c) $SS_{A(xy)}$ = $\dfrac{X_1Y_1 + X_2Y_2 + X_3Y_3}{4} - C$

= $\dfrac{146 \times 98 + 148 \times 110 + 66 \times 56}{4} - C$

= 8571-7920

= 651.0

4. Now, SS_W for X, Y and XY can be calculated by just subtracting SS_A from SS_r

a. $SS_{W(x)}$ = 2948.0 – 1094.0 = 1850.0

b. $SS_{W(Y)}$ = 1646.0 – 402 = 1244.0

c. $SS_{A(xy)}$ = 1912.0 – 651.0 = 1261.0

Upto this point the calculations were done exactly in the same way as they were done in case of simple analysis of variance. After this, now adjusted values of $SS_{T(y)}$ and $SS_{w(y)}$ have to be calculated. It is here stage that, adjustment for initial differences on the covariate X has to be made. The procedure is as follows:

5. (a) Adj. $SS_{T(y)}$ = $SS_{T(y)} - \dfrac{SS_{T(xy)}}{SS_{T(x)}}$ =1646.0 – $\dfrac{(1912)^2}{2948}$ = 405.93

(b) Adj. $SS_{W(y)}$ = $SS_{W(y} - \dfrac{SS_{W(xy)}}{SS_{W(x)}}$ = 1244.0 – $\dfrac{(1261)^2}{1854}$ = 386.33

(c) Adj $SS_{A(y)}$ = 405.93 – 386.33 = 19.6

Adj. $SS_{A(y)}$ is calculated by subtracting Adj. $SS_{W(y)}$ from Adj. $SS_{T(y)}$

6. Next step is to convert Adj. $SS_{A(y)}$ and $SS_{W(y)}$ into mean squares by dividing them by their degrees of freedom as follow:

(a) Mean Adj. $SS_{A(y)}$ = $\dfrac{19.6}{2}$ = 9.8, *df* being 2.

(b) Mean $SS_{W(y)}$ = $\dfrac{386.33}{8}$ = 48.29, *df* being 8 as one more *df* is lost in case to ANCOVA as compared to ANOVA.

7. F-ratio = $\dfrac{\text{MeanAdj.SS}_{A(y)}}{\text{MeanAdj.SS}_{W(y)}}$ = $\dfrac{9.8}{48.29}$ Not Sig.

8. **Conclusion**—H_0 cannot be rejected value of Mean Adj. $SS_{.A(y)}$ is less than mean Adj $SS_{w(y).}$ Hence there is no need to calculate. F- ratio. It will be less than that therefore it can not be significant. Therefore conclusion is drawn that after the controlling of intelligence no effects of treatments on boys' learning achievement.

ANCOVA Vested Conceptions

The use of ANCOVA is based upon those conditions and conceptions. That is.

Caution   Treatment groups' should be selected from one population by randomization

1. Within groups corrected measures' distribution should be normal.

2. Treatment groups should be homogeneous.

3. Y measures' (Later) on X measures (initials) regression should be equal in each treatment group.

4. Regression should be linear.

Utility of ANCOVA

In the following conditions ANCOVA has much utility.

1. Where intact groups are used, as a in education field to use on any school's total class because it is not possible to exit separately only some boys out of class not possible to experiment on them. In that case it is not possible also unit by randomizedly distributed in groups, but from many point of view much differ to one another therefore differences between them affected result adversely. To eliminate it a couple of important variables can be controlled by medium of ANCOVA.

2. In the beginning if any variables between units being differences is not seem and later on it is necessary to eliminate their effects then use of ANCOVA proves to be useful-

Task   Express your views on the utility of ANCOVA.

Multiple Co-variance Analysis

Above one covariate's example has been presented, but co-variance analysis can be done in that case also where more than one covariates are to be controlled. Upto two covariates calculation is simple, but more than one covariates are needed to be controlled then calculation is much long and tough, but there are no changing in rules. This method can be used with randomized block design also with

Latin groups design and factorial design can be used also. **Kirk** (1968) and **Lindquist** (1970) has explained it in more detail.

Self Assessment

Multiple Choice Questions:

4. In repeated measures designs only one persons ………………………is kept in all treatments.

    (a) organization   (b) Caste   (c) groups   (d) structure

5. By randomized block design ………………is obtained

    (a) Rule   (b) data   (c) interactions   (d) generalization

6. In experimental research true study variables ………………is most essential.

    (a) Controlling   (b) measuring   (c) accuracy   (d) result

7. ……………..Design is superior to randomized block design

    (a) factorial design   (b) Latin square   (c) ANCOVA   (d) ANOVA

31.8   L.S.D. (Latin Square Design)

This design is superior to randomize block design. In there two true study variables can be controlled. Like block design to make similar groups in these also, blocks are used, but in this on two true study variables make equal blocks. Thus each units of blocks at least equal on those two variables. The different levels of these true study variables are distributed in rows and columns. Thus in L.S.D gets information about effects at true study variables.

Concepts

The use of this design is only possible:

When blocking variables are equal to the number of treatments. Treatments are distributed in rows and columns by randomly. At the same time it keeps in mind too that each treatment should become in each column and row once. In each cell of row and column should become only one treatment.

An another condition of this design is also that the effects of treatments should be additive and they should not do interactions with rows and columns. Consequently rows and columns should not have inter action to each other. Below by on example its process of use has been explained.

Suppose that a researcher want to study the general activities of mice effects of one medicine five dose but he thinks that age of mice is also on component that affects their activites. Hence for the controlling of age he makes five block of equal age of mice–one in 5-6 months, second in 7-8 months, third in 9-10 months fourth in 11-12 months and fifth in 13-14 months. In each block keeps 5 mice. If experiment is such that in one day only 5 mice can be tested then he thinks that day to-day occurred changing effects result then he try to control it also keeping all those in minds to analyze of data he prepares a following types table. In this days above as headings of columns and blocks of ages left side from up to down wardes. After that taken on from each blocks of mice by randomly in five days prepares distribution separately. Aforesaid table takes form of this type:

Example 9

Table 31.9: Latin Square Design					
Age in Months	Mon.	Tues.	Wed.	Thur.	Fri.
13-14	1	3	4	2	5
11-12	5	4	3	1	2
9-10	2	5	1	4	3
7-8	4	2	5	3	1
5-6	3	1	2	5	4

After that treatment's (medicine) different doses' by randomization is imposed in each row and column, but the condition is that each treatment come only once in row and column. Thus distributed treatments. Which order prepares that is presented to ahead given table.

Table 31.9 (A): Treatment Facility					
Age in Months	Mon.	Tues.	Wed.	Thur.	Fri.
13-14	A	E	C	B	D
11-12	D	C	B	A	E
9-10	E	A	D	C	B
7-8	B	D	A	E	C
5-6	C	B	E	D	A

These A, B, C, D and e letters denote five levels of drug in which.

A = 10 mg,   B = 15 mg,

C = 20 mg,   D = 25 mg,

E = 30 mg,

Suppose the experiment was conducted and the researcher obtained following scores on the dependent variable.

Table 31.9 (B): Latin Square design data						
Age in Months	Mon.	Tues.	Wed.	Thur.	Fri.	Total
13–14	8	10	4	6	10	38
11–12	8	2	4	14	15	43
9–10	12	10	6	5	9	42
7–8	5	4	12	14	3	38
5–6	3	7	12	7	10	39
	36	33	38	46	47	200

The analysis of the data cast in this table is done as follows:

1. $C = \dfrac{\Sigma X^2}{N} = \dfrac{200^2}{25} = 1600.00$

2. SS_t = Sum of squares of all scores in the cells minus the correction term.

    = 1948.0 – 1600.0 = 348.0

3. SS_{age} = Sum of squares of all the row totals divided by N minus the correction term.

    $$= \frac{38^2 + 43^2 + 42^2 + 38^2 + 39^2}{5} - 1600$$

    $$= \frac{8022}{5}$$

    $$= 1600 = 4.4$$

4. SS_{Days} = Sum of squares of column totals divided by column n

    $$= \frac{36^2 + 33^2 + 38^2 + 46^2 + 47^2}{5} - 1600$$

    $$= 1630.8 - 1600 = 30.8$$

We, now, have to find out the sum of all scores for A, B, C, D, and E with the helAp of table -1 – How to do it is demonstrated below:

A = 8 + 10 + 12 + 14 + 10 = 54, i.e., In A sum of all five columns datas

B = 5 + 7 + 4 + 6 + 9 = 31, i.e., In B sum of all datas of five columns

C = 3 + 2 + 4 + 5 + 3 = 17 i.e., In C sum of all datas of five columns

D = 8 + 4 + 6 + 7 + 10 = 35, i.e, In D sum of all datas of five columns

E = 12 + 10 + 12 + 14 + 15 = 63, i.e., In E sum of all dates of five columns

5. $SS_{Tr} = \dfrac{54^2 + 31^2 + 17^2 + 35^2 + 63^2}{5} - 1600$

    $$= \frac{9360}{5} - 1600 = 1872 - 1600 = 272.0$$

6. $SS_W = SS_{TC} - (SS_{age} + SS_{days} + SS_{Tr})$

    =348-(4.4+30.8+272.0)=348-307.2=40.8

Table 31.9 (C): Summary of Results				
Sources of Variance	*SS*	*df*	*Mean SS*	*F*
Age	4.4	4	1.1	
Day	30.8	4	7.7	2.26
Drugs	272	4	68	20
Mistakes	40.8	12	3.4	

Thus, it is clear from obtained results that drugs' different doses effect the significance on the level of mice activities separately, because treatments' variances' difference at level .01 is significant. In the above example, treatments' F-value is (20.0) which at 4, 12 *df* at level 01 in relevant. Hence the conclusion is drawn that drugs affect activities of mice.

Uses of Latin Square Design

This design is much useful in that condition where researcher wants to control two true study variables effects. These variables are those which are related to dependent variable and if it does not control then result's accuracy and validity becomes doubtful. Hence by medium of blocking they are done inactive. In Biology and medicine science L.S.D has great importance because in these effects of differences lies between units are ended, drugs or independents variables' effects studies creatures' behaviour effects. Through medium of blocking these true studies' effects are become Zero in this design on these variables matched the unit keeps them in one block. Thus to make several blocks this design is used. For example if block is to be prepared on weight and size basis then prepare in this type.

Table 31.10			
Weight	Small	Medium	High
40 – 50 kg.			
60 – 70 kg.			
80 – 90 kg.			

Thus weight and size different levels can be distributed in columns and rows and their effects can be eliminated from experiment

Its second utility is in treatment counter balancing as is shown in following table.

Table 31.11			
	S-1	S-2	S-3
Group-1	a_3	a_1	a_2
Group-2	a_1	a_2	a_3
Group-3	a_2	a_3	a_1

It is clear from above table each treatment under counter is equally happened.

Comparison of error of perfect randomized groups and block design and L.S.D

Example   From the point of view of accuracy and validity of research. L.S.D is superior to both–perfect randomized groups design and randomized block design because size of error is less than both of them.

It can be cleared by as follows:

Perfect randomized group design error-perfect variance (SS_{tr}) – treatment variance (SS_{Tr}). Error

in randomized block design error = SS_{Tr} – SS_{blocks} i.e., SS_{Tr} – SS_{rows}

But error in L.S.D = SS_{Tr} – (SS_{rows} + $SS_{columns}$)

It is clear that in L.S.D., due to occurred error by SS_{column}, less on extra part it becomes less with respect to both of above.

Randomized Groups Independent Replication

In this design degrees of freedom becomes less because both columns and rows *df* from *df* of SS_w is to be subtracted. Due to this reason it become essential with more *df* SS_w calculated. To fulfill this purpose beside whole experiment taken Latin Square indecently replication should be done. These Latin Squares should be free from Pervious Squares and they should be selected by randomization. Including all those Latin squares doing analysis number of *df* increased and obtained the result more accurate. In this effect of treatments seems clearly.

31.9 Summary

- Like T-Test this test which is called F-test too, is a parametrical test. This is a most used test which has a a number of changed form and which can be used in many experimental conditions.
- The meaning of variance in literally is difference, but in statistical language its meaning is "average of squares of differences". These differences are taken frm scores and mean.
- Between group variances is that variances which each group mean and collective mean of three groups' differences squares gets by divided N-1.
- SS_A/SS_w is called F-ratio. **Sir Ronald Fisher's** one pupil **Senedecor** as a respect to him named this ratio.

31.10 Keywords

1. **Variance –** difference, under statistics obtained data-average of square of differences.

2. **Design –** Construction, Types form.

31.11 Review Questions

1. What do you mean by single – way variances analysis?
2. What is randomized groups design? Mention with examples?
3. Throw light on repeated measures design

   Or

   Illustrate single way ANOVA with example.
4. What do you mean by two way analysis of variance? Explained in detail.
5. What is called randomized block design? Illustrate with example
6. Explain Latin square design (L.S.D).

Answers: Self Assessment

1. Parametrical	2. Average of square of difference	3. One ended
4. (c) group	5. (b) data 6. (a) control	7. (b) Latin square

31.12 Further Readings

Books
1. Academic Technique and Assessment – *Dr. Rampal Singh, Bhatt Brothers*
2. Education Technique – *S. S. Mathur, Bhatt Brothers.*
3. Academic Technique Management and Assessment – *J C Agarwal, Bhatt Brothers.*
4. Education Technique- R. A. Sharma, Bhatt Brothers.

Unit 32: Preparation of Research Report

CONTENTS

Objectives

Introduction

32.1   Format of the Thesis

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32.7   Evaluation of Report

32.8   Summary

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Objectives

After studying this unit, students will be able to:

- Understand format of the thesis and style of writing
- Understand construction of tables and figures
- Understand reference material and presentation of on appendix
- Understand typing of report and evaluation.

Introduction

After the completion of research work whole description is presented in the format of thesis. How thesis should be prepared, regarding this at international level with a little change has followed a universal law. For researches knowledge of there rules and methods is essential. According to there rules and methods he should have prepared his thesis. It has been described in this chapter whole materials of chapter has divided in following parts.

(a)   Format of the Thesis

(b)   Style of writing

(c)   Constructions of the Tables and Figures

(d)   Presentation of Reference Material

(e)   Presentation of Appendix

(f)   Typing of Report

(g)   Evaluation of Report

32.1   Format of the Thesis

Under this, this matter has been explained that after the completion of research, how should be presented their whole description in written format mean, how should have been thesis's written format. From this point of view whole thesis is divided in following

1. Preliminary Needs

(i)   Title Page

(ii)   Letter of Approval

(iii)   Acknowledgement

(iv)   Preface

(v)   Contents

(vi)   List of Tables

(vii)   List of Figures

2. Main Contents

(i)   Introduction

      (a)   Statements of the problem

      (b)   Purpose of the problem

      (c)   Analysis of related Researches

      (d)   Basic Concepts of hypothesis

      (e)   Statement of Hypothesis

      (f)   Describe of Technical Terms

(ii)   Survey of Related Literature

(iii)   Process and Method of Study

(iv)   Result of Study

(v)   Explanation of Result of study

(vi)   Summary (whole description's)

3. Reference Materials (Bibliographic, Appendix, etc.)

1. Primary Needs

In each thesis prior to describe of research, according to rule and tradition of universities some pages are added due to formality. In these title page, letter of approval, acknowledgement, preface, content's (catalogue of chapters) list of tables and list of figures pages are included.

I. Title page

In this page which information is given- that is as follows- (i) heading of the problem, (ii) Name of the researched (including titles), (iii) Faculty and name of that university where thesis is to be presented,

(iv) Name of the title for which thesis is presented, (v) the year in which it is presented. How these information should be typed on the pages. Regarding this special rule is as follows-

(i) Heading of problem is typed in capital letters. Between the page both side left equal margin from top 1½" space is left. If title is more than one line then it is printed in double space and reverse pyramid format. See specimen on next page. This is in English but in Hindi it should be appeared in some format.

(ii) This page's important term's first letter of other all information's is typed in capital letters. Saw specimen given on this page.

There is no question of capital letter in Hindi. Hence problem heading in a little large size and rest all information can be typed a little less size. In electrotyping such an arrangements is given. If there is not such arrangement then problem heading can be under lined.

II. Letter of Approval

If according to rule of university letter of approval attachment is necessary then done their photocopy attached in thesis as per as.

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**A STUDY OF THE RELATIONSHIP BETWEEN PERSONALITY
FACTORS AND ADMINISTRATIVE EFFECTIVENESS
OF THE PRINCIPALS IN ORISSA**

By
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A THESIS
Submitted to the University of Meerut (U.P)
in Fulfillment of the Requirement for the
Degree of Ph. D. in Education.

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DEPARTMENT OF EDUCATION
Institute of Advanced Studies
Meerut University (U.P.)
1984

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LIST OF TABLES

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III. Acknowledgment Page and Preface

In each thesis after letter of approval one on two pages are acknowledgement and preface. Preface deals in very short purpose and scope of research is to be mentioned. After that from that persons get important help is research work, express grateful to all of that, but gratefulness should not be exaggerated. This should not be flirting. Should be objective. Whenever it is not necessary gratefulness and acknowledgement do not keeps separately rather it should be written together.

IV. Contents

After that in each thesis those are the pages in which it is shown that what is in thesis very first page of it space leaving 1" from top and in middle of page "Vishay-Suchi" (if in Hindi) or "Table of Contents" in English is typed. From that, "leave space left side in capital letter, approval sheet, acknowledgement and preface etc. chapters and bibliography etc. heading given double space between each are typed. If thesis is in English then from where chapter begins, above that chapter heading is typed whose only first letter is capital. Each heading's right side there page number is given from where page number is starts, above ½" that heading page is typed whose only first letter is capital. There is no question of capital letter arise in Hindi.

From letter of approval upto table of figures number of pages should be in Roman digit (as a I, III, IV etc.) and after that all page are numbered in Arabic digit. Bibliography and appendix's page number 100 in order of thesis's page number goes on ahead.

Chapter headings is in capital, but their sections heading in small letters (first letter in capital) are typed each titles page no. as per given in thesis and term of heading also as per thesis.

As far as possible heading should be in one line and syntax should be same. Contents specimen has been given on the previous page.

V. List of Tables

After content those pages are on which tables and figures list in presented list of tables and figures is typed on separate page. Under this which information are presented, that is (i) order Number of tables and figures (as per thesis) which is types in Arabic digits, (ii) heading of tables (iii) Number of that page on which their available in thesis on the previous page its specimen is given, see that.

2. Main Contents

Notes   In the Main contents of thesis, research work is described. This part is mainly readable and of permanent importance.

Under this basically six chapters are included. (*i*) Introduction (*ii*) Survey of related literature (*iii*) Design of the study (*iv*) Analysis of data, result and their interpretation (*v*) Utility of conclusion and suggestion for next research (*vi*) Summary

I. Introduction

Under this heading researcher presents whole introduction means he throws light on that how problem is originated, how it is differ from related research, what is their extensive meaning, what are their variables, what is their meaning, what is the purpose of problem, what are their hypothesis, what is their scope, what is their importance, etc.

II. Survey of Related Literature

Under this related to problem whatever literature is available, their to be studied if it seems necessary at suitable place it is mentioned. Some educationists its mention in whole thesis where consider to necessary and significant, thereby should be used, in the favour and for that a separate chapter made don't consider appropriate. Regarding this it is appropriate that or he does not think so, research should do accordingly his own thesis guidelines. If a chapter is prepared then it is divided into many perspective for fulfillment of different purpose it should be mentioned. Having studied of previous research in the field of problems or have got answered of questions, next more how much, why and

in what direction need of research is. What is the importance of research that whole introduction, hypothesis of problems' how related literature presents a logical base, how has defined in related literature variables of hypothesis, how they have measured etc a number of aspect are in the explanation of that related literature and survey of informations can be much beneficiary. In this chapter what out to be and how whole matter should be composed regarding this not any format can be this is depends upon to a far extent types of problem.

III. Methods of study and research process

In the third chapter of management whole process of research is described. Researcher writes correctly and in details that how research has been done. Under this definition of population, method of selection of sample, definition of variables, description of test to use their measure, information's analysis method etc are described in details what will be written, this depends upon to large extent that what types of study is. Specially paid attention is that not any important information should be left. In reader's mind on reading time this question should not arise that how it had been done.

IV. Analysis of information and result

Generally in the fourth chapter of thesis data and information's analysis and research results are presented. This is an important part of whole research process. Data can be of quantitative or qualitative or anyone of them or both types. Regarding their presentation it will not be appropriate to mention any fix rule or process become this is depends upon that what types of problem is and what types of related data is. A general suggestion is that presentation of data and their analysis accordingly hypothesis. Having done the statement of hypothesis it should be explained that for the testing of that which types of informations and data have collected it should be presented in the form of table properly after that how their analysis have been done what result got, it should be mentioned in that order result's explanation should be given. Explanation means evolution of significancy of result is a tough job. In this researcher's method, short comings of process itself error occurred in the collocation of data, available result of previously done research etc keeping in mind and having mentioned 1+ it is to statement that how far logical the obtained result, probable and reliable are. If other research's result is different from any result have been come then it is essential to mention why it is so.

V. Suggestion for next research and utility of results

Not any research is comple in itself Hence researcher feels for a number of times during this work that if it is done by another types, another types of information is collected, big sample is selected or taking different population research is done analysis any other method is used then it will be much better. Similarly during research work. Some new research problems prevails in his mind, But he himself now could neither research on another problem and nor can change in their process.

Hence thesis's in the IV chapter or prepared a separates chapter-V presented in that. In this sequence obtained result of that chapter how can they useful in education's field mentions that general for this to keep a separate for this is considered to be more suitable.

VI. Summary and conclusion

This is final is final chapter of thesis. In this chapter researcher is presented whole thesis's work procedure and all chapters (except chapter-II) Summary. This is the chapter which is read much. Examined reads this chapter at first. In chapter-II survey of related literature is done. It is not necessary to present their summary separately it is to write in short with statement of problem. It is written in 15 to 20 pages sufficient.

Some researcher is submitted this chapter as an extract. In fact obstruct is differrent from "Summary and conclusion" of Chapter. It is a rule to write obstruct in approx 600 words. According to rule of university its 4 or 5 copies demanded separately. In somewhere it is tradition to add it in the begning. Its purpose to know reader should reat it completely or not.

3. Reference Material

After the completion of six chapters in the some order reference material is included in the thesis. Under this firstly presented bibliography.

After that in some order appendix is presented. How it can be written and presented, it has been mentioned in details ahead.

Self Assessment

Fill in the blanks:

1. After completion of research work……….. to be presented in the format.
2. Problem's heading in capital letters …………is done.
3. In each thesis after letter of approval acknowledgement and ………… are.
4. From letter of approval to list of figures page number………… marked up in digit.

32.2 Style of Writing

In the previous section-9 it has been mentioned that what, where is written in thesis. In this section it try to explain how all those should be written.

Report of research or thesis is a scientific and technical report. That is read by experts that know it very well that in that where, what and how it should be written, Hence keeping in mind expert's approach the thesis should be written. At international level approved indices (Compbell, 1954 Dugdell; 196 Turabian, 1960) can be found introduction there approaches. Each researcher before to write thesis having read any one of them that instruction should be followed from begging to end some general suggestion are presented below:

1. Style of writing should be fact based objective, logical and simple. To say matter indirectly, that is not based on facts; being impulsive and sentimental, to say his matter being very defensive, try to affect reader unnecessarily express in style-there are considered to be the demerits of style of writing.

2. In writing style researcher's schoolship, the in intensive technical study, art of writing and mastery over language should be seems clearly.

3. **Collection of description--** The collection of description of each chapters should be in order and symmetrically means firstly it should be divided in main parts. Main parts heading in the centre of page and subsection's headings should be written left in the margin under each section and subsection related matter should be captured each section and subsection collection of thoughts should be symmetric means which thoughts prior to that or should be captured later that can written in that order. Something is written somewhere, some any another place, it should not be done. Related thoughts should be come at one place and in same order at which order they are related to one another. This coherence is most required aspect of style of writing. Every section and subsection have a theme. Keeping that in centre all thought around that should be collected systematically. In each section and subsection descriptions' thought' facts, logics as required should be made a series consequently it should be so much collected that their one link exit from between then series broken append at once.

4. **Language--**The purpose of research report is to give reader objective information of research. Language is an powerful medium of this information. Hence it should be such a type that it can succeeded in their purpose because p[purpose of report of research is to give objective information hence figure of speech language, use of tough language, is use of hard word,

rhythmic language use, use such a word which is not in use now a days should not use long sentences. Such a type of language creates difficulties to understand thoughts and facts. Language should be simple and clear so that study related matter understood quickly and avoid misunderstood. If any words or concepts use is inevitable about that it seems to be difficult to understand then and there clarify it two or three sentences.

5. **Balance and specification-** It is to be necessary in whole report's descriptive material presentation balance is must means description's different sections, Subsection etc write to need in as details, so will have written. Any me chapter very extensively and second unnecessarily in short write creates imbalance in report. This balance must be maintained in each chapter within also. Any important aspect is having written 8-10 lines and to finished it, and to finished it, and of general importance aspect is written in many pages is an enplane of imbalance. In report same point of thoughts or words or statement is such that which is specific. It needs stress on them so that they attracts reader. Hence it is to write in underlined, in capital letters or a different front style in this specification process balance is necessary also. Where is to stress necessary, only there is given. Worthless thoughts, statements, words to give on those is not appropriate.

6. **Unity and clearness of thoughts-** In the whole description of report the unity of thoughts and material is much essenmtial. Research's any one aspect related all thought should be appeared in one place. If pective is of formulation of one test then its whole description should be appeared in chapter there in one place. At different place or in that chapter or in other chapters related to that material should not be scattered. This unity of report presentation increased the clearness of report. Clearness is most important charactertices of report writing.

7. **Some other suggestion-**In the writing of report researcher should keep following matter in mind-

   (i) In writing of report third person is used, e.g. "researcher experienced, I experienced" not.

   (ii) In the text of report abbreviations is not used. Their use is prohibited in footnote, bibliography, appendix and table.

   (iii) Percentage is written in words, not% like this

   (iv) In the begning of sentence number is written in words, not in digit

   (v) That number which is less the 100, written in words, not in digit

   (vi) Between paragraph thoughts is given number then that serial number is written in brackets, as   (3) or (c)

   (vii) Whatever done in past by researcher or by some other persons, at the time of their mention uses past tense as a "Selection of Sample" had been done by randomization and this was based upon city's 110 schools

   (viii) But when given table, given r4esult of research and pre established and universal statements, rules, theories is mentioned then use present tense. As a "It is clear frm this table' "Skiner's refroze theory indicates towards this' one the basis of analysis this conclusion is drawn' etc.

32.3   Construction of Tables and Figures

In each research report tables and figures from subject clarification point of view has great importance. That matter which takes many paragraphs to understand it clear from only one table study. Some

is to say about figure also Hence tables and figures how can be types, to know this for researcher is essential.

1. **Rules Regarding Tables** – Regarding construction of table some rule is as follows-

   (i) In a well constructed table a number of mutually related facts is adjusted such a way that he can express any one main though is as a – a samples many characteristics (as a total number of units, Number of School, number of boys and girls, all their different test scores etc) can be shown in one table. If it will be explained then to write a paragraph

   (ii) Table should be prepared in such a way that each matter understood one self means it should be self explanatory.

   (iii) General and simple numerical facts under text should be written reflective. There is no advantage to make table for that e. g. Total 120 school, 40 out of them had selected and in this 40 from each school 10 percent units had selected to show such a simple truth there is no need to prepares a table.

   (iv) Some general types statistical facts in the order of text on informal table (in which heading of table, column and rows are not) form can be presented writing one sentence after that insert: (colon) below that presented as a total number of boys and girls that appered in there three test- as follows was.

	Boys	**Girls**	**Total**
Intelligence test	170	180	250
Interest	190	80	270
Personality test	150	100	250
	510	360	770

   Such a type of table is not mentioned in content.

   (v) In that sentence as a context indicates towards table, after that sentence table is presented, Never before that it presented.

   (vi) If table is to large that after that sentence it cannot captured on some page then after ending the final paragraph should be presented to next page.

   (vii) If table is greater than half page then it should be presented in one whole page centre.

   (viii) Which tables that is great than one page, it should be presented in appendix.

   (ix) In whole report from beginning to end (including index also) all table number continuously.

   (x) There is two methods to write order number of table. In one on the top most written table ahead of it in Arabic written their table number and below that leaving two space their title is written. In the end of heading not insert any punctuation marks. If table in English then (TABLE) and below their heading both typed in capital letter. If heading is longer than one sentence then it is typed in single space in the form opposite pyramid. In the second method order number of table keep separate in one line written in the beginning of heading line, —**Table 40- group a intelligence test scores.**

   (xi) Table's columns and rows' heading should be written in very short and their order number in bracket should be written below that if heading is big then it be broad side typed.

   (xii) Table related footnote, just below table leaving a ½ space typed, not in end of page.

   (xiii) Column's heading above one double or darked horizontal rule and below that single line is drawn. In the end of table one single horizontal line is drawn.

2. **Rules related to figures-** Regarding presentation of figures following rules are-

   (i) Order number of figure in Arabic number below term figure- fig. puts ahead and their heading either to but word figure or written in that line or just up of figure or under the figure an where can be written in whole report from beginning to end all figures order number is putting continuously.

   (ii) Heading of figure in capital letter and if more than one lines then presented in the form of opposite pyramid, There is no punctuation marks puts in end of headings.

   (iii) Figure is presented after just that lines in which there caption has come.

32.4 Presentation of Reference Materials

In report each researcher is to present a number of authors, researcher and expert's view, statements etc. context here and there. In each chapter such references are included. All of those separately symbol number within the text where context is come to be presented and in the end in the bibliography their full detail is to given. In anywhere complete description in the below page in form of footnote is given. Footnotes and catalogue of context books presented to complete description a little difference is occurred. It will be clarified later.

There are a number of methods to denote symbol marks of context within the text. Most general method is that which context appears where, there in bracket author's name and after that putting come the publication year of that book is inserted as a (Bhatnagar, 1993). All there context book prepare a catalogue alphabetically added the end of theirs order second method in bracket only write that order humber which appears in the end of book in catalogue is as a (60). Its meaning will be full description of context books in catalogue order number is given at 60. A third method is based on footnote. Under this context appears within the text in super of context footnote order number putting in Arabic digit whose meaning is that their full description bottom of page is given in the footnotes.

Presentation of quotation in report, some rules also which are as follows:-

First of all it should be remembered that it is not considered to be good to use much quotations in the reports. It is quite inevitable then quotation should be used other rules regarding this is given below.

1. Quotations

Regarding quotations some rules are as follows.

   (i) Quotation should not be too long. Small and under stance ended quotations is considered to be good. It should be closed with quotation

   (ii) Under quotation if appeared another quotations then it should be enclosed by single quote.

   (iii) Last word of quotation up half space typed context in Arabic digit if sentences is typed just after punctuation marks. This symbol number should be same as given in footnotes with their details

   (iv) Long quotations (four or more than four typed lines) in a separate paragraph in single space in the centre of page without quotation marks is typed. In this long quotation if any another quotations comes then it should be closed by double quotations marks. The quotation which is abnormally long that is presented in appendix.

   (v) If any footnote is presented by in the format of footnote then in the form of paragraph in single space and kept under quotation marks.

(vi) Kf first word of quotation from grammatically in sentence aforesaid which has been said related to that then it is written in small rather than capitals, whether in original sentence it may be capital, such a question arises only in English, in Hindi there is no such question arises.

(vii) After last quotation marks only one punctuation marks is used. If full stop or coma then that is under quotation marks, colon or semicolon are then outside quotations marks if question mark or exclamation mark keeps under quotation marks. But question mark is not a part of quotation, part of a sentence then it is kept outside quotation marks.

2. Footnote

Regarding footnote rule are as follows:

(i) Footnotes in the bottom of page below text typed given three space from left to right one space Below text one two inch long line from left to right is typed. From two space below of that footnote is typed.

(ii) Footnote is typed in single space, but between two footnote are given two space

(iii) First line of footnotes like Para line typed from left to right leaving three space and their first word's half space above their citation number which comes in text, that is typed.

(iv) The number of footnote given either by page wise or in whole report from begin to end in a series. It is more convincible to put down pagewise

(v) If cited material is any formula of table then on that not put quotation symbol number rather it is shown by any asterisk or any other symbol mark.

(vi) In thesis published essays and published books and in report which method is followed that is differ from thesis method

(vii) If in a context booked footnote, some pages and some footnotes appears again then putting their context symbol number only that is (lbid) is written. If context material is some, but page number is differ then some page 8 (lbid, p.s) as follows is written

(viii) If any footnotes references has been comes before after that another footnotes appears after that again some context comes, then in footnote author's name, after that semicolon and after that abbreviations (op.sit) and their page number is written. If any writers'. More then one books citation presented in thesis then related to context specific books' name is also given each times but the page number is some then 'loc.cit' is used.

These three abbreviation's uses specimen has been given below-

1. P. Bhatnagar, In applied sciences research's experimental design, Loyal Book Depot. Merrut 1993 page 220

2. lbid

3. lbid 214

4. Mauli, Jeorge J. The Science of Educational Research, Ureshiya Publishing House, Pvt. Ltd. New Delhi 1964, page 308

5. Bhatnagar, loc-cit (means Bhatnagar's book and same page)

6. Waan Dalen, D.B. Understanding Educational Research, Macgraw Hill Inc. New York, 1966, Page 360

7. Bhatnagar op. Cit. 260

8. R.P Bhattnagar, Education Administration, Loyal Book Depot. Meerut 1989, Page 52

9. Bhatnagar "Design of Research" Op. cit page 240

Some other mostly used abbreviates are given below. It is generally uses in books and thesis

Ch., chap, chaps.	Chapter (s)
e.g.	for example
ed., edd.	edition (s)
ed., eds.	editor (s); edited by
et. al.	and other (Bhatnagar et al.)
i.e.	that is
MS, MSS	manuscript (s)
mimeo.	mimeographed
n., nn.	footnote (s) *e.g.n.* 10 or nn. 2.4
p.pp.	page (s)
passim	here and there
Pt. Pts.	part or parts
sec., secs.	section (s)
trans.	translated by
rev.	revised or revision

3. Bibliography

(a) Bibliography is presented in the end of thesis in chapters "summary and conclusion" It is included under appendix. The presentation of footnote and bibliography appears a little different. In footnotes author's first name comes first and later on last sub name e.g., R.P. Bhatnagar. But in reference book his surname comes first and initial name comes later, e.g; Bhatnagar, R.P. Second difference is that footnote is types as paragraph means their first line from left, leaving three space from margin is typed so that other lines of below appears to be left side but is context catalogue first line starts from margin and other lines starts leaving 3-4 space leaving from margin and typed. Thus is context catalogue first (top) appears in the left side where as other lines shifted within it will cleared from below given example.

Footnote – (For books)

R.P. Bhatnagar; **In applied Sciences research's design**, merrut: Loyal book depot Second No. 1993
    Bibliography (For book)

Bhatnagar, R. P. **in applied science research design,** Merrut: Loyal book depot; Second No. 1993

(b) **In bibliography whole order of description is as follows-** (i) Author's sub name (ii) Actual name (iii) Title of books which is underlined in typing thesis (iv) edition (v) valume if more than one (vi) If more than one (vii) Publication place (Viii) Name of publisher (iX) year of publication of copyright year.

(c) **In any journal printed essay's context description is as follows-** (i)Sub name of author (ii) Actual name (iii) Heading of essay (iv) Name of journal which is underlined (v) volume number (month, day , year (vi) Page.

(d) **In daily news paper printed context material description is presented by following types-** (i) News paper is underlined, (ii) Month, day, year (ii) Page if authors name is also then like books comes before news papers name.

(e) **Unpublished material context description is given as follows-** (i) author sub name (ii) Actual name (iii) Heading of material which is underlined   (iv) Types of thesis e.g. Ph. D thesis, or report or any paper presented in press conference etc. (v) Place where presented or where available. In bibliography context description regarding some rules are as follows-

(i) If one writer more than one bibliography appears then there is no need to write authors name each time. After first context some writers appears second context then rather to write the name of author a six space long rule is drawn. After that putting come rest description is presented after first context will be appeared context presented alphabetically.

(ii) If any bibliography two or three writers are then first writers sub name comes first then actual name after that, but later both actual name comes first and sub name after that if number of author more than three then only given first writer's name after that putting semicolon at or and other is written.

(iii) If there is no one author of book rather than editor writing their name after that in bracket (ed) is written.

Example   It is sufficient to write city name in place of publication place, but place is such that it is little known then their full address is written necessary.

Self Assessment

State whether the following statements is True or False:

5. In the third chapter of thesis, research process is mentioned.
6. The purpose of research report is to give reader's objective information of research
7. In report the number less than 100, is written in digits.
8. No research is perfect in it self.

32.5 Presentation of an Appendix

In every thesis there are three types of appendix added- (i0 Bibliography, (ii0 Psychological tests and other tools which is used in collection of data and (iii0 statistical material etc, e.g., different tests scores long table, etc. which had not been presented in the chapters of thesis. Among those first of all, placed bibliography. The one page before first page on fly sheet in the middle appendix (a) bibliography is typed from next page list begins. At that page in the top heading "Bibliography" is typed pagination is done in the order last page of last chapter. Flysheet is also included in pagination. First page of bibliography and page number of fly sheet like other chapters heading page in the bottom of page putting in centre with all other appendix flysheet in also appears. That is also included in pagination. In appendix (b) Psychological tests and other instruments, its flysheet appendix (c) Tests and tools is typed. Similarly in appendix (d) statistical and other data appears. On that flysheet appendix (e) data is typed. There is no need to give calculation of result under this. But raw data must be given without that thesis is considered to be incomplete.

32.6 Typing of Report

Did You Know?   For typing of report white 'Brand' paper is used.

Generally $8\frac{1}{4}$" x 11" Size paper is used for typing that weight should be 20 pounds. For second and third copy light paper can also be used.

Report should be typed by an experienced typist has typed some report prior and that it knows how tables, figures, footnote, bibliography are typed. After that researcher himself should guide him. Typing pages should be read side by side and mistakes should be removed. It is a tradition in typing to leaving space $1\frac{1}{4}$" top and bottom $1\frac{1}{2}$" in the left side and 1" right hand margin. It is re commended that to use PICA type typewriter, but electronic typewritten can be used also whatever typewriter is used from beginning to end that typewriter should be used. There is no need of carbon copy any more, because all researcher will have used photocopy. But if to do carbon copy then a black carbon paper and medium range ribbon should be used. Before giving hand-written manuscript read it thoroughly. Generally in the pagination of footnotes, bibliography, examples, tables and figures mistakes have been found. Having repeat a many times should be checked.

In the each page of typed two or three corrections are valid, but more than this cutting, increase number of words, add sentences in the middle is not approved such a page should be typed again.

On each page of report page number is printed. Preliminaries needed pages are given roman number and it is printed at centre of bottom. On titl page do not put any page number, but it counted as (I). Hence next to this page number II is put on approval letter neither page number is put on nor counted it. Rest on all pages in Arabic number top of the page right hand side number is put on, but each chapter's first page number put on centre of bottom.

32.7 Evaluation of Report

After the completion of report writing before giving for printing the researcher should evaluate it himself. As there is not universal base of evaluation, no any fixed criterion of that, but some writers regarding this give some suggestions. That can help researcher. **Waan Dalen** has presented a questionnaire in his book. This question of that questionnaire helping in to know how much report prepared by him is of reasonable level and what shortcomings have been left in them. **Waan Dalen** has included all aspects related question of thesis in this with some correction that questionnaire has been presented here.

1. Headings of problems

(i) Does heading explain scope of problem correctly in a definitely format?

(ii) Has it been written clearly, precise and descriptive format

(iii) Have unnecessary words and phrases eliminated from that?

2. Primary Needs

(i) Have tile page of report, letter of approval, acknowledgement, table of contents, table list and figure list all systematically and according that rules which mentioned already?

(ii) Has all those paginated correctly?

3. Problem statement and their description

(i) Have all those aspects of problem analyzed correctly, which is important as a previous have done research's relation with problem their variables definition, importance of problem, their purpose, etc?

(ii)   Which relation has been supposed between problem based variables, has their probability logical verification been done?

(iii)   Has problems to be fundamental clarification done?

(iv)   Has problem's scopes clarification done?

4. Related literature and survey of informations

(i)   Has related to problem based variables previously did research's completely surveyed been done?

(ii)   Has that survey been done from criticism point of view?

(iii) Has from that survey the conclusion is drawn that on present research on problems was to be done necessary?

(iv)   Does survey gives as the critical base of problem?

5. Formation of hypothesis and statement

(i)   Is there any theoretical base of hypothesis?

(ii)   Can hypothesis be tested?

(iii) Are deduced consequences logical?

(iv)   Has hypothesis been written clearly and in short?

6. Method and process

(i)   Has population been defined corrected?

(ii)   Is sample representative of population?

(iii)   Have for the collection of data suitable instruments, reliable and valid tests been used?

(iv)   Are those instrument and tests suitable from another point of view?

(v)   Have these instruments and tests been used properly?

(vi)   Have necessary material and information etc been collected?

(vii)   The method which has been used has their satisfactory reason been presented?

(viii) Has previously done research used method clearly been critically explain?

(ix)   Have it been mentioned that from where and how data collected?

(x)   Has in use of statistical methods their underlying assumptions been paid attention?

(xi)   Has research's internal and external validity's effecting elements been tried to control?

7. Presentation and analysis of thesis

(i)   Has collected data's presentation according to rule been done?

(ii)   Has each hypothesis's test been done independently?

(iii) Has conclusion's objectively previously done research' introduction been explained?

(iv)   Is result is based upon research data?

8. Summary and conclusion

(i)   Is summary short and clear?

(ii)   Is summary based upon research work?

(iii) Are given suggestion for next research solid and logical?

(iv)   Has result's utility been explained?

9. Bibliography list and appendix

(i)   Has bibliography, style and construction according to rule done?

(ii)   Have all bibliography been included?

(iii) Have all required materials been presented in appendix?

10. Report's format and style

(i)   Have chapters' composed accordingly rule?

(ii)   Has pagination been done correctly?

(iii) Is language and style according to rule?

(iv)   Has in each chapter material description been presented by balanced manner?

(v)   Have in the printing all those precautions been taken which are mentioned already?

32.8   Summary

- After the completion of research work whole description is presented in thesis format in which format thesis should be prepared, regarding this at international level with a little changing general accepted rules are followed.

- In each thesis, before the description of research according to the rules and tradition of university some pages are added due to formality reason in these title page, letter of approval, acknowledgement, preamble, contents (chapter list) table list and figure list pages are included.

- In each type of thesis three types of appendix are added – i. Bibliography ii. Psychological test and iii. Statistical data

- After the completion of report writing and before giving to printing, researcher should do assessment himself.

32.9   Keywords

1. **Approval**—Support, Taking approval before starting any research work.

2. **Appendix**—In the end of thesis writing given supplementary material.

32.10   Review Questions

1. Describe the format of description presentations?

2. What do you mean by style of writing and how it should be written?

3. How tables and figures are drawn?

4. How cited material is presented?

5. What do you mean by assessment of report? Describe it

Answers: Self Assessment

1. Thesis   2. Printed   3. Preamble   4. Roman

5. True   6. True   7. False   8. False

32.11 Further Readings

Books   1.   Academic Research work procedure—*L. Kaul, Vikas Publishing.*

2.   Academic Research Methods—*Sharin and Shashikala, Vinod Pustak Mandir.*

3.   Academic Technique and Assessment—*Dr Rampal Singh, Bhatt Brothers.*

4.   Academic Technique Management and Assessment—*J.C. Agrawal, Bhatt Brothers.*