Chapter 13

Tools of Research

A great variety of research tools are of many kinds and employs distinctive ways of describing and qualifying the data. Each tool is particularly appropriate for certain sources of data yielding information of the kind and in the form that would be most effectively used. Some of these devices merely identify the presence or absence of certain aspects of a situation. Others collect qualitative descriptions which may involve comparisons or contracts between elements present in the situation. Other devices yield quantitative measure in scale measures or in scores. The measurement of what is identified adds an important dimension to description; not only what but how much is revealed.

Many of the tools of research have been designed to yield quantitative measures. Others yield description that may be refined by counts of frequency of appearance. This qualification of data is an essential part of research. While some judgement cannot be expressed in frequency counts percentages, or scores, most data are made more meaningful by qualification. In addition to frequency counts and percentage or fractional comparisons, data may be refined by numerical ratings, rank order placement, paired comparisons, social distance scales, equal appearing intervals, summated ratings and standardized score values. Some important tools of research which are most frequently used in behavioural science research have been discussed here:

1. Questionnaire,
2. Schedule,
3. Rating Scale, and
4. Tests,

1. QUESTIONNAIRE

The questionnaire may be regarded as a form of interview on paper. Procedure may be regarded as a form of interview on paper. Procedure for the construction of a questionnaire follows a pattern similar to that of the interview schedule. However, because the questionnaire is impersonal it is all the more important to take care over its construction. Since there is no interviewer to explain ambiguities or to check misunderstandings, the questionnaire must be especially clear in its working. The variety of possible answers to each question must be anticipated more fully than for an interview. The questionnaire is probably the most used and most abused of the data gathering devices.

Definition

A questionnaire is a form which is prepared and distributed for the purpose of securing responses. Generally these questions are factual and designed for securing information about certain conditions or practices, of which recipient is presumed to have knowledge. Goode and Hatt have defined questionnaire as a device for securing answers to questions by using a form which the respondent fills himself.

According to Barr, Davis and Johnson "A questionnaire is a systematic compilation of questions that are submitted to a sampling of population from which information is desired."

As the term generally used. in educational researches, "the questionnaire consists of a sense of questions or statements to which individuals are asked to respond the questions frequently asked for facts or the opinions, attitudes or preferences of the respondents."

Goode and Hatt have given an illustrated definition of questionnaire.

"In general words questionnaire refers to a device for securing answers to questions by using a form which the respondent fills in himself."

In questionnaire forms are used and the respondents fill in themselves, thus questionnaire place heavy reliance on the validity of the verbal reports. This instrument is widely used by researchers for a number of reasons.

Significance of Questionnaire

Beginners are more commonly tempted to this tool, because they imagine that planning and using a questionnaire is easier than the use of other tools. It is also considered to be the most flexible of tools and possesses a unique advantage over others in collecting both qualitative and quantitative information. Critics speak of it as the lazy man's way of gaining information, because it is comparatively easy to plan and administer a questionnaire. "As a matter of fact, preparation of a good questionnaire takes a great deal of time, ingenuity and hard work."

Common Faults

Questionnaire prepared by novices suffer from such errors as:

1. *Too lengthy*: They contain a large number of questions requiring lengthy answers.
2. *Vague*: Items are imperfectly worded and improperly arranged.
3. The proforma itself is poorly conceived and badly organized.
4. The subjects touched by the items of the questionnaire are trivial importance.

We should also beware that this device suffers from certain inherent drawbacks. These according to T.K. Kelly are:

1. It is not possible to justify the selection of the sample of respondents with demonstrable fairness.
2. Benefits of the study seldom acquire to the respondents.
3. It requires a large amount of investment on the part of the investigator.
4. The respondent may not possess the expertise required for giving the answer.
5. Educational administrators are allergic towards questionnaire since they receive a large number of them, day in and day out. The arrival of a new questionnaire irritates them as they believe that it constitutes an encroachment upon their busy schedule of work.
6. It is also wrong to imagine that questionnaire technique is a quick and easy method of investigation. On the contrary, the responses are rather slow and disappointing because of their incompleteness, indefiniteness and hostile attitude of the recipients, who feel bored by the quantum of the questionnaires, that they receive.
7. Their casual responses furnish a very flimsily basis of valid generalization.

Design of the Questionnaire

In order to gain acceptance for his questionnaire, the researcher should design an appealing format. Many unattractive questionnaires end up in a wastebasket rather in the hands of the sender. To improve the attractiveness of the instrument, choose a title that is clear, concise, and descriptive of the research project, and use well typed or printed questions that are properly spaced and easy to read. It is generally advisable to group questions of a similar nature together.

Type of Questionnaire Items

The two commonly used types of questionnaire items are the unrestricted, or open form items, and the restricted, or close form items. Each type has its advantages and disadvantages, so the researcher must decide which is more likely to yield the data needed in a particular research project.

The open formed item is also referred to as the "Open end", "Short-answer", or "Free-response" item because offer the question there is a space provided in which the respondent is asked to write his answer. This type of item permits explanation, but responses can be difficult to summarize and tabulate. The responses also may be too brief, or the respondent may have omitted important information.

The open form item is of most value when unrestricted, in depth responses are needed. An example of this type of questionnaire item follows:

In your opinion, what might your high school have done to prepare you more adequately for college?

The closed form item sometimes is referred to as the "restricted" or "structured" type. It consists of a question or a statement to which a person responds by selecting one or more choices, such as "Yes" or "No". In one variation of this type the respondent may be asked to underline award from the two or more alternatives. Another variation requires the ranking of choices.

The close form item facilities the tabulation and analysis of data. It also improves the reliability and consistency of the data. One limitation of this kind of item is that the respondent does not have the opportunity to explain why he has given certain responses, and this may be important in some kinds of research studies. The close form item also limits the scope and depth of responses, so its use in measuring attitudes, feelings and certain aspects of behaviour may be limited. It is possible also that the answers from which the respondents must choose are not the proper ones for all of the individuals who are given the questionnaire. An example of a closed form questionnaire item follows:

If group tests are used in your school, by whom are they administered?

(*a*) Administrators   (*b*) Consellors,
(*c*) Psychologists,   (*d*) Psychometricians,
(*e*) Teachers, and   (*e*) Others

Elements of Questioning Method

In using the questioning method there are six elements to be considered :

   (*i*)   The content of the questioning; which includes both why the researcher is asking the questions and why the respondent believes they are being asked, since these are not necessarily the same;
  (*ii*)   Content of the questioning;
 (*iii*)   The question which can be defined as the verbal stimulus to which the respondent will be exposed;
  (*iv*)   The provision for answering which refers to the response the respondent will be.

(*v*) The way in which the response will be recorded, which refers to variation like writing or speaking or recording;

(*vi*) The nature of the researcher respondent interaction, which considers whether researcher respondent interaction, which considers whether researcher and respondent actually meets face to face or whether they communicate impersonally.

Preparing and Administering the Questionnaire

1. Get all the help that you can in planning and constructing your questionnaire. Study other questionnaire and submit your items for criticism to other member of your class or your faulty, especially to those who have had experience in questionnaire construction.

2. Try out your questionnaire on a few friends and questionnaires when you do this personally, you may find that a number of your items are ambiguous.

3. Choose respondents carefully. It is an important that questionnaire be sent only to those who possess the desired information or those who are likely to be sufficiently interested to respond conscientiously and objectively. A preliminary card, asking whether or not the individual would be willing to participate in the proposed study, is recommended by research authorities.

   In a study on questionnaire returns see (1) discovered that a greater proportions of returns was obtained when the original request was sent to the administrative head of an organization, rather than directly to the person who had the desired information. It is possible then when a superior officer turns over a questionnaire to a staff member to fill out, there is implied some feeling of obligation.

4. If schedules or questionnaires are planned for use in a public school, asking for the responses of teachers or pupils, it is essential that approval of the project be secured from the principal, who may, then, wish to secure approval from the superintendents of schools.

5. If the desired information is delicate or intimate in nature, consider the possibility of proving for anonymous responses. The anonymous instrument is most likely to produce objective responses. There are occasions, however, for purposes of classification, when the identify of the respondent is necessary. If a signature is needed it is essential to convince the respondent that his responses will be held in strict confidence, and that his answer will in no way jeopardize the status and security of his position.

6. Try to get the aid of sponsorship. Recipients are more likely to answer if a person, organization, or institution for prestige has endorsed the project.

7. Be sure to include a courteous, carefully constructed cover letter to explain the purpose of the study. The letter should promise some sort of Inducement to the respondent for compliance with the request.

   The cover letter should assure the respondent that delicate information will be held in strict confidence. The explanation sponsorship might well be mentioned, of course, a stamped addressed return envelope should be included. To omit this courtesy would be practically to guarantee that many of the questionnaires would go into the waste paper basket. It has been suggested that two copies of the questionnaires be sent, one to be returned when completed and the other for respondent's own life.

8. Recipients are often slow to return completed questionnaire to increase the number of returns, a vigorous follow up procedure may be necessary. A courteous postcard reminding the recipient that the completed questionnaire has not been received will bring in some additional

responses. This reminder will be effective with those who have just put in the follow up process may involve a personal letter or reminder. In extreme cases a telegram, phone call, or personal visit may bring additional responses.

It is difficult to estimate, in the abstract, what percentage of questionnaire responses is to be considered adequate or satisfactory. The importance of the project, the quality of questionnaire, the case used in selecting recipients, the time of year, and many other factors may be significant in determining the proportion of responses. Needless to say, the smaller the percentage of responses, the smaller the degree of confidence one may place in the adequacy of the data collected. However, objectivity of reporting requires that the proportion of responses received should always be included in the research report.

Choosing the Questions

Stage in a question is to define the problem precisely. It is desirable also to define at an early stage the population to whom the question is to be directed and to decide the nature of the sample to be drawn, as this may influence the drafting of the question. The definition of the problem should set out one by one the aspects of the problem to be explored and stage, II, follows on from this with construction of questions or items to deal with each aspect in turn. The question should be compiled with definite hypotheses or theories in mind. Each question should contribute clear information on a specific aspect to be explored or else the question should be discarded ruthlessly.

If the investigation is on a small scale and the investigator himself will classify all the responses, it may not be necessary to put all questions into a multiple choice pattern. Multiple choice can be tiresome, especially if the alternatives offered for choice do not express adequately the response a subject wishes to express opinion questions if they are included must not be too general or they will be unclassifiable and should be restricted to fairly straightforward topics where answers can easily be coded subsequently.

It may be necessary to choose questions and to specify possible answers in such a way as to facilitate coding. The art of drafting a question consists of being able to do this without forcing your respondents into an uneasy choice a difficulty which they can too easily resolve by giving up altogether.

The questionnaire should start with simple factual questions, so that the person completing it gets off to a good start. Complex or awkward topics should come towards the end. An open ended- general question at the end will allow expression of points which the responder thinks important, though they are not covered by the questionnaire.

A questionnaire need not to be restricted to questions attitude scales ratings and check lists may be included, providing they are brief and straight forward and the instructions are kept simple. Similarity and brevity are cardinal virtues.

The distinctions between a leading question and a neutral question is sometimes difficult to decide. For example, which of following is a neutral wording.

1. Are you in favour of abolishing corporal punishment?
2. Should corporal punishment be abolished?
3. Should corporal punishment be retained etc.?

The questionnaire is not a scientific instrument. It is a cheap, easy and rapid method of obtaining information and non- information one never knows which he points the weaknesses of both questionnaire and interview-the tested-validity of the responses. Questionnaires show what people say, not what do or are. Any form of questionnaire implies a certain frame of reference and thereby influences the answer given.

Try out of the Questionnaire

It is very helpful to obtain criticism of qualified persons about the questionnaire before the final form is got printed and mailed out. The investigator may request some of his friends to look over the items critically with the idea of discovering possible misinterpretations. A few copies may then be got typed and sent or administered personally to a random sample of the respondents. Their responses must be carefully examined to see if they suggest any modifications of the questionnaire before it is used on a large sample or for study purpose. This presetting of all the measuring tools is essential to ascertain the workability of the tool. Different persons will differently interpret the same lines. A preliminary form of the questionnaire used in this way will require revision and improvement by eliminating some of the items. It may also suggest addition of some more items. The result of the try out should also be analysed in a preliminary way to determine whether they lead to certain conclusions for the significant purpose of the study. The presetting of a questionnaire indicate the following things:

- Relative effectiveness and costs of alternative questions instruments and procedures.
- Acceptability and intelligibility of the questions from the respondents point of view.
- Completeness of questions for correct coding and interpretation.
- Response rates and estimates of mean and variance.

Improving Questionnaire Items

The questionnaire maker must depend on words alone. It is apparent that he can not be too careful in phrasing questions to insure their clarity of purpose. While there are no certain ways of producing full proof questions, there are principles that might be employed to make items more precise. A few are suggested with the hope that students constructing questionnaires will become critical of their first efforts and strive to make each question as clear as possible.

1. Define or qualify terms that could easily be a misinterpreted. "What is the value of your horse? The meaning of the term value is not clear. These values may differ considerably. It is essential to frame specific questions such as, "what is the present market value of your horse?"
2. Be careful in using descriptive adjectives and adverbs that have no agreed-upon-meaning. This fault is frequently found in rating scales as well as questionnaire.
3. Beware of double negatives (1) Federal aid should not granted for those states in which education' is not equal regardless of race, creed, or colour.
4. Be careful of inadequate alternatives (1) Married? Yes/No.
5. Avoid the double barreled question.
   Example: Do you believe that gifted students should be placed in separate groups for instructional purposes and assigned to special schools?
6. Underline the word if you wish to indicate special emphasis. Example
7. Should all schools offer modern foreign language?
8. When asking for ratings or comparisons a point of reference is necessary.
   Example: How would you rate this student teacher's class room teaching? Superior Average-Below Average.

Phrase questions so that they are appropriate for all respondents. Design questions that will give a complete response. Such questions which as answer "Yes or no" would not reveal much information about the reading habits of the respondents.

There must be a provision for the systematic quantification of response. One type of question that asks respondents to check a number of items from a list is difficult to summarize especially all respondents do not check the same number. The students should bear in mind that these suggestions are used in constructing questionnaire items.

Scope of Questionnaire

In descriptive studies where the sources are varied and widely scattered, the questionnaire is a major instrument for gathering data. It is very handy in cases, where one cannot conveniently see personally all the people from whom the responses are required. This technique finds favour in determination of present status in certain aspects of education-current practice in schools, financial aspects service conditions of teachers, etc. It can be used over extensive range of territory-national and international. "As research techniques are becoming more and more refined day after day, it is hoped that this wayward child of the science of education will soon curb its unruly disposition and also mend its unseemly ways".

Characteristics of a Good Questionnaire

The following are the characteristics of a good questionnaire

1. The covering letter of the questionnaire is drafted in a befriending tone and indicates its importance to the respondents.
2. The questionnaire contains directions which are clear and complete. Important items are clearly defined and each question deals with a single idea defined in unambiguous terms.
3. It is reasonable short, through comprehensive enough to secure all relevant information.
4. It does not seek information which may be obtainable from other sources such as school records and University results.
5. It is attractive in appearance, neatly arranged, clearly duplicated and free from typographical errors.
6. It avoids annoying or embracing questions, which arouse hostility in the respondent.
7. Items are arranged in categories which ensure easy and accurate responses.
8. Questions do not contain leading suggestions for the respondents and are objective in nature.
9. They are arranged in good order. Simple and general questions should precede the specific and complex ones. Questions that create favourable atmosphere should precede those that are personal and touch delicate points.
10. They are so worded, that it is easy to tabulate and interpret the responses. It is always advisable to base them upon a preconceived tabulation sheet.

Suggestions for Construction of a Good Questionnaire

1. The first thing to consider is the psychology of the respondents. His willingness, honesty and ability to answer questions are of utmost importance. He is usually a stranger, who is neither interested in the investigator nor in his project. He may be a very busy person, and his administrative responsibility may be making heavy demands on his time. The investigator must put himself in the respondents position to see how his attention, sympathy and cooperation can be secured. He should also try to minimize the demands on his time.
2. One can make the responses simple by providing a variety of possible answer and requiring the respondents to put a check mark against the correct one.

3. One should not undertake a questionnaire study, unless the problem is really important from the point of view of others. It should appear to be worth investigation to the respondents. It should always be accompanied by a brief introductory letter which will explain the purpose of investigation and show how the respondent's cooperation will benefit him or a noble cause. It should also contain suitable instructions for filling in it.

4. Efforts should be made eliminated irrelevant items, which may not be helpful in interpretation of results. Weeding out of unnecessary and trivial questions for making the questionnaire as brief as possible is very important. Experience shows that in this way the number of questions can in certain cases be reduced to one half.

5. In framing the questionnaire the situation in which the average respondent works should be taken into average respondent works should be taken into consideration. It is frequently noticed that questionnaires are prepared with reference to institutions of smaller size or with reference to institutions which are financially or otherwise more happily placed and these are institutions of smaller size where those conditions do not prevail. Thus the responses are irrelevant and useless.

6. The importance of each question i.e. what is actually required must be clear to the maker as well as the recipient. All the items must be free from technical and ambiguous terms so that the recipients can give their responses without consulting others. If any technical terms have to be used they must be explained in the body of the questionnaire.

7. As far as possible the response should be of such a nature as can be easily summarized in some form. However, they need not necessarily be quantitative or of yes or no character, or check mark type. These are preferable; because they are easier to summarize.

8. Questions eliciting opinion should be avoided unless opinion is worth getting. Questions permitting subjective responses should be minimized.

9. Where the responses are too large to be counted, it is always advisable to resort to coding symbols, which can be punched and weighed for summarizing purposes.

10. The group to whom a questionnaire is administered must be judiciously selected. One must carefully avoid asking people questions, they do not know or about which they have strongly coloured convictions. Sometimes the respondents may possess the information required, but he may not be free or willing to divulge it. Asking people working in denominational institutions on the eve of vacation whether they would return to work after vacation, may not beget truthful replies. In such cases asking respondents not to append their signatures would be helpful in getting frank responses.

    If there is any doubt that correct information about certain items will not be forthcoming from all the respondents questions about such items should not be asked if the investigator wants to avoid landing himself in difficulties at the interpretation stage.

11. A good questionnaire will arouse the curiosity as regards results and will stimulate them to make supplementary inquiries and promise them a copy of the published results.

12. It should be so organized as to avoid overlapping of items in different sections.

13. Evidently respondents will not like to incur expenditure on postage for returning the questionnaire. The investigator should therefore see that it accompanied by self-addressed stamped envelope, in case, it is to be returned by post.

Limitations of the Questionnaire Technique

In this technique, a research worker has to depend on several hundred persons from whom response is expected and it is not an easy job to get active and willing cooperation of all the respondents. One may be very diligent and sincere about his work but one can not be sure that the responses would be forthcoming. Some of the respondents may hold back their replies because they are skeptical about the value of research, others may not respond for want of time, or because they do not feel interested in the problem in hand or because they have not been sufficiently motivated by the introductory letter. The research worker may therefore remain in a state of expectancy and his work may be delayed.

1. Even when he gets back a sufficiently large number of questionnaires, he may find that all of them have not been completely filled in Omissions in some cases may be such as will materially vitiate the results and significantly affect the interpretations.

2. If the questionnaire is sent to different areas or to people of different categories and one set of respondents deliberately with holds its responses, the inquiry would be affected adversely. Suppose there is a judicial inquiry on discrimination against a minority and section of the minority concerned refuses to cooperate as a protest, evidently the results of the inquiry will not present a true picture.

3. Sometimes the respondents fill in their responses very indifferently, without bothering about their correctness and sometimes they deliberately give wrong information.

2. SCHEDULE

Scheduling is defined as the translation of the developed plan a time table, showing the calendar date for the start and completion of work. The scheduled start and end of each activity or work package as well as the total project is emphasized. The schedule helps to determine the operating is emphasized. The schedule helps to determine the operating budget for the project and permits us to allocate resources to' the activities.

It is within the scheduling process that we become concerned with competition for one or more of the resources that may exist in an organization. In establishing a schedule for the project, we are concerned not only with the time to do a job but also with the exact data that the office involved may be able to do our work, having considered all the other projects in the organization that will utilize this same resources. The planned schedule, which is generated as an output of the scheduling process, enable the project director to judge event progress and forecast a data of completion. The scheduling' process also enables the project director to inform various organizational units of the schedules that they must maintain for their particular task.

Some Scheduling Constraints

On the surface, the process of scheduling appears relatively simple. Several constraints, however, make the process somewhat difficult and often lead to the development of less than an ideal or optimum schedule. Some constraints are given in the following list:

1. The availability of particular resources during specific calendar periods.
2. The general sequence of the work in the project plan.
3. Consideration of resource requirements of other present or future projects.
4. Different or conflicting demands on the same resource.

5. A desire to avoid peak load for particular skills.
6. The available local capacity to do a particular task.
7. Limitations and requirements imposed by funding agencies.
8. Desire to minimize overtime and idle time.
9. Necessary integration with other plans or projects using the same resources.
10. The manager's judgement of a reasonable time for performing activities of an uncertain nature.
11. Technical constraints such as uncertainties which may require extra time.
12. Local personnel policies concerning work practices (vacations, sick leave, etc.)
13. National, states, and local laws governing work practices.
14. Difficulties inherent in scheduling far in advance.
15. The varying number of working days in a month and their translation into calendar dates.

Many of these constraints relate to project scheduling in the business-military complex, but have some application to the educational situation. The educational situation, in contrast, has some unique constraints which can affect schedules. Notable among these is the nine to ten month period in which educational personnel operate.

Characteristics of a Good Schedule

Unfortunately, an Ideal or optimum schedule rarely can be prepared in a practical situation. Instead, the project manager must generate a "reasonable' schedule. In doing so, he must form the criterion of reasonableness. Some possible criteria are: (1) to complete the project in a minimum amount of time: (2) To complete the project with a minimum amount of cost: (3) to maximize performance in the project. A further criterion might be to "level" the utilization of resources over a period of time. A schedule that is developed for only one of these criteria probably will not meet the needs of the criterion.

The most typical criterion is the one associated with the least cost, i.e. schedules are prepared to minimize the costs that are associated with the resources used in the project.

Scheduling Steps

Designing a schedule begins with the individual activities and work package. Giving consideration to the resource availability, a scheduled elapsed time may be shorter/longer that the estimated time for the activity. A schedule end date can be determined for the terminal event, if a schedule start date has been provided. Forward and backward time calculations can be used to establish the earliest schedule completion dates and the latest schedule completion dates for each event, as we did in the time estimating phase.

If, upon completion of this step, the total time exceeds the time available or the total costs are exceeded, readjustments will have to be made, using the procedure of paralleling activities, eliminating tasks, redefining work scope, and adjusting resources. The adjustment continues until a schedule is devised that meets the criterion established by the manager.

In developing the schedule, the manager should realize the slackness existing on the pathways, in the work flow. If the manager is aware of how much and where slackness activities on non-critical paths can be moved until resources are available; their duration can be extended in order to reduce resource utilization during a given period of time, or even possibly split into segments for different

scheduled periods. Splitting into segments can only be done when it is possible to complete the task in segments. The activities on the critical path are not changed unless it is absolutely necessary.

Rescheduling

Once the project is initiated and operations are begun, the project will need to be rescheduled from time to time. The project manager should not assume that the initial schedule will be maintained throughout the life of the project. This condition could be desirable but schedules can be disrupted for many reasons. A change in the major or supporting objective of a project may lead to a rescheduling of the project internally.

Another factor that may cause rescheduling might be change in the work flow necessary to achieve an objective. The schedule may have to be changed because of certain slippages which have occured because of unusual delays in completing an activity, or because of increase in slack time due to the early completion of an activity. Another cause of rescheduling may be change in funding. The funding may go higher or lower. In either case, a different schedule may have to be generated.

Problems in Scheduling

There are four different problems associated with the scheduling process. Several general problems appear to give the most concern to project directors these four problems have been the object of research and study. Each of them will now be discussed briefly.

1. *The Fixed Duration Time of Problem*

This scheduling problem arises when there is a constrain upon the total project duration time. That is there is a fixed time by which the project must be completed. This situation usually arises and others have pointed out, when the project manager has produced sufficient resources to carry out the project but wishes to carry them at a constant rate, making the most effective use of them. This concept is often referred to as "manpower leveling".

2. *The Fixed Resources Problem*

This scheduling problem arises when a project managed has a pool of resources which can not be exceeded. His objective is to schedule the activities in a way that minimizes any possible increase in the total project time. He should realize that, because of the limitations on resources, the project will have to be extended by some small amount, but this increase must be kept to a minimum.

The solution of this problem lies in the following steps; Activities on non-critical pathways throughout the project are delayed until the manpower needed for them is available. Activities on the various slack pathways or non-critical paths are also lengthened. Instead of taking one week to do the job, perhaps two weeks are scheduled with the resources in effect for half of that activity. If the resource requirement is still excessive after these two procedures have been employed the critical path should be examined to determine the greatest reduction in resource requirements per unit of time increase in the project duration.

3. *The Time/Cost Trade off concept Problem*

Scheduling can become a major problem if either time or resources are constrained to certain limits. Some of the specific scheduling models do not take into account limited resources. Therefore, they do not as useful as scheduling techniques. If there are no constraints on either resources or time, the problem becomes at time/cost trade off. The concept has limited value in education research and development situations. Its greatest application has been made in the construction industry and other trades where there is enough data accumulated about the time and cost associated with a particular job.

4. *Multi-Project Scheduling Problem*

We have been discussing scheduling as it relates to a single project directed by one project manager. In many organizations, several projects go on simultaneously under different project managers. These projects draw upon several common resources of the organization. consequently conflicts arise about the utilization of the resources. The employment of the previous procedures makes the work flow for a particular department more even and insures that the work of the projects will be accomplished according to the schedule.

Limitations of a Schedule

The following are the main disadvantages of a schedule:

1. It is very time consuming and costly instrument in administering to the subject personally.
2. Sometimes some subjects have several time queries about the schedule and difficult to explain and satisfy them.
3. Some subjects are to be conducted to get-data.
4. Some of the subjects e.g. principals administrators are not easily approachable and get appointment for administering tool.
5. Sometimes subjects are more alert or intelligent than the researcher. Researcher has the difficulty to administer the tools.
6. On a large sample of subjects this tool can not be used effectively and easily.

3. RATING SCALES

Rating is the term applied to the expression of opinion or judgement regarding some situations, object, person etc. These opinions are usually expressed on a scale or by categories of values, either quantitatively or qualitatively. For example, a teacher in assigning a mark or a grade to a pupil is applying a rating scale of proficiency of some sort to that pupil, or an individual in filling out a recommendation form for another person for a teacher's placement. Rating scales are probably one of the more commonly used scaling traits and attributes.

The rating scale in values qualitative description of a limited number of aspects of a thing or of traits of a person. The classification may be set up in five or seven categories in such terms as:

1	2	3	4	5
(*a*) Superior	Above Average	Average	Fair	Inferior
(*b*) Excellent	Good	Average Below	Average	Poor
(*c*) Always	Frequently	Occasionally	Rarely	Never

"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."   – *Good and Scates*

"Rating is an essence, directly observation",   – *Ruth Strang*

A rating scale ascertains the degree, intensity, or frequency of a variable."   – *Von Dallen*

"Rating is a term applied to expression of opinion or judgement regarding some situation, object or character. Opinions are usually expressed on a scale of values, rating techniques are devices by which such judgments may be quantified." *– A.S. Barr*

A rating scale is a method by which we systematize the expression of opinion concerning a trait. The ratings are done by parents, teachers, a board of interviewers and judges and by the self as well.

There are two characteristics of a rating scale:

1. Description of the characteristics to be rated, and
2. Some methods by which the quality, frequency or importance of each item to be rated may be given.

These rating scales give an idea of the personality of an individual.

Advantages of Rating Scales

The following are the main advantages of rating scales:

1. Helpful in writing reports to parents.
2. Helpful in filling out admission blanks for colleges.
3. Helpful in finding out students' needs.
4. Helpful in making recommendations to employers.
5. Helpful in supplementing other sources of undertakings about the child.
6. Helpful in their stimulating effect upon the individuals who are rated.

Limitations of Rating scales

The following are the disadvantages of the rating scales:

1. People differ markedly in their ability to make ratings.
2. People differ in their reliability as subjects for ratings. Some are easier to rate than others. It appears that poor employers tend to be better analysed than are good ones.
3. Raters having one form of contact with the individual being rated (teachers of the same school subject) tend to agree more closely than do raters with more diversified contacts. By the same taken rating obtained from persons having predominantly one type of contact are much less useful outside that specific field.
4. The average or medium rating of a number of judges is superior to that a single judge, provided there not great differences in the capability of judges.
5. Immediate emotional reactions affect ratings.
6. Self-rating tend to be too high on desirable traits and too low on undesirable traits.
7. One tends to rate one's own sex higher than the opposite sex on desirable traits.
8. While close associates are likely to rate more reliably than are casual associates, long and intimate friendship bring marked decreases in the reliability of ratings. Persons tend to over-rate intimate friends all desirable traits and under-rate less desirable traits.
9. 'General all round value' is frequently more reliably rated than are some of the more specific qualities involved.
10. Raters are frequently unable to justify ratings, or, are apt to give absurd rationalizations.

"The design of the rating technique must always take into account the existence of three elements; the judges who will do the rating, the phenomena to be rated, and the continuum along which they will be rated. If the design does not adequately define all three, as well as assure that (1) the judges, (2) The subjects, and (3) the continuum are logically related, them only unreliable and invalid results can be expected. All three components must be very carefully selected. According to Goode and Hatt".

Traverse Suggests the Following Rules for the Rating Process

1. Define several points on each scale with as great precision as possible.
2. Restrict each rating scale to a narrow range of behaviour that can be well defined.
3. Change the ends of the scale so that the 'good' end is not always at the top or always at the bottom of the scale.
4. Avoid words such as average in the middle range of the scale. The rater who does not wish to give too much effort to the rating procedure is likely to class too many as 'average'.
5. In the directions, indicate the need for honest rating, and wherever possible, state that low rating will not have only consequence for the person rated, either direct or indirect.
6. Assure the rater that his anonymity will be safeguarded.

Principles Governing Rating Scales

1. The specific trait or mode of behaviour must be defined properly. For example, if we want to rate a child's originality in performing a task, first of all we must formulate a definition of 'originality' in behaviourable terms and then try to rate it.
2. The scale should be clearly defined i.e. we are rating at a three; or five-points scale.
3. The trait to be rated should be readily observable.
4. Uniform standards of rating scale should be observed.
5. The rater should observe the rates indifferent situations involving the trait to be rated. This will bring reliability to the Judgement of the rater.
6. The number of characteristics to be rated should be limited.
7. In the rating scale card, some space may be provided for the rater to write some supplementary material.
8. The directions of using the rating scales should be clear and comprehensive.
9. Several judges may be employed to increase the reliability of any rating scale.
10. Well informed and experienced persons should be selected for rating.

Errors in Rating

(*a*) *Generosity Error*

Sometimes raters would not like to run down their own people by giving them mow ratings. The result is that high ratings are given in almost all cases such an error is known as generosity error.

(*b*) *Stringency Error*

The opposite of generosity error may be called stringency error. Some raters have a tendency to rate all individuals low.

(*c*) The Halo Error

'Halo' means a tendency to rate in terms of general impressions about the rate formed on the basis of some previous performance.

(*d*) The Error of Central Tendency

There is a tendency in some observers to rate all or most of the rates near the midpoint of the scale. They would like to put most of the rates as 'Average' etc.

(*e*) The Logical Error

Such an error occurs when the characteristics or the trait to be rated is misunderstood.

Types of Rating Scales

The following are the main types of rating scales:

1. *Descriptive Rating*

The rater puts a check (Ö) in the blank before the characteristic or trait which is described in word or phrase.
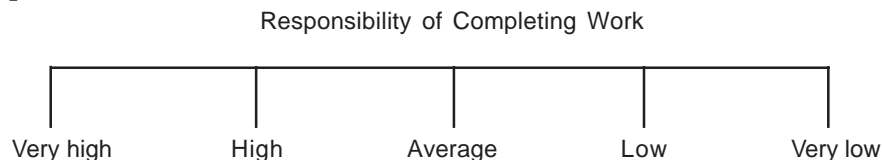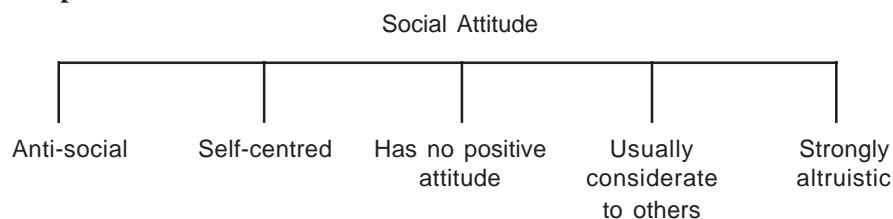
Example:

Has this pupil initiative?

. . . . Shows marked originality.

. . . . Willing to take initiative.

. . . . Quite inventive.

. . . . On the whole unenterprising.

. . . . Very dependent on others.

2. *Numerical Scale*

Here numbers are assigned to each trait. If it is a seven-point scale, the number 7 represents the maximum amount of that trait in the individuals, 4 represents the average amount.

3. *The Graphic Scale*

This is similar to the descriptive scale and the difference lies only in the way it is written. This is also called "Behavioural Statement Scale." These are of two types:

(*a*) Simple Scale
Example:

Responsibility of Completing Work

| Very high | High | Average | Low | Very low |

(*a*) Example:

Social Attitude

| Anti-social | Self-centred | Has no positive attitude | Usually considerate to others | Strongly altruistic |

4. The Percentage of Group Scale

Here the rater is asked to give the percentage of the group that possesses the trait on which the individual is rated. For example, for rating the self-confidence of an individual, the rater may check one of the following:

> . . . . . . Falls in the top 1 per cent.
> . . . . . . Falls in the top 10 per cent, but not in the top one per cent.
> . . . . . . In the top 25 per cent but not in the top 10 per cent.
> . . . . . . In the top 5 but per cent not in the top 25 per cent.
> . . . . .. In the lower half, but not in the bottom 25 per cent.
> . . . . . . In the bottom 25% but not in the bottom 10%.
> . . . . . . In the bottom 10% but not in the bottom 1%.
> . . . . . . In the bottom 1 per cent.

5. Man To Man Scale

An individual is asked to rate the ratee by comparing him to the person mentioned on the scale and assuming the ratee his position. For example, ABCDE are the persons who have been already rated is very persistent. Every one not easily stops, works quite steadily, somewhat changeable, and gives up easily.

> **Example:** Is he generally a persistent person?

> A   B   C   D   E
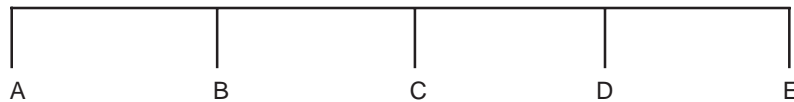
> Because of subjectivity element, the use of this type is very limited.

The Score Card

This is similar to the rating scales and usually provides for the appraisal of a relatively large number of aspects in numerical terms. It yields a total weighted score as the presence of each characteristic of aspect, or the rating assigned to each, has a predetermined point value. The rater is provided with a general standard of criteria in detail and he is asked to rate only a single unit of the total situation at a time. The general practice is to employ a number of rates and their scores combined and averaged.

Scaled Specimens

Certain standards of performances are evaluated through specimens. A number of graded samples are provided by Thorndike's hand-writing scales to which one may compare the handwriting to be evaluated. These are various intelligence test scoring manuals which provide scaled specimens for determining the mental age of children as revealed by their drawings.

The Opinion or Attitude Scales

Purpose: Attitude scales have been designed to measure attitudes of an individual or group of people towards issues, institutions and group of people (such as capital punishment, teacher training, religious education in schools, etc.).

Difference between 'Attitude' and 'Opinion'

The terms opinion and attitude are not synonymous though they are allied terms.

Attitude is what a person feels or believes in. In fact it is the inner feelings of an individual which is difficult, if not impossible to describe.

Opinion is what a person says about his attitudes towards some phenomenon the research work must depend upon what the individual says to his beliefs and feelings. We obtain a sample of the opinion of an individual through the use of questions or by getting an individual's expressed reaction to statements of opinion.

Limitations

The following are the limitations:

1. An individual may express socially acceptable opinions and conceal his real attitude.
2. An individual himself may not be clearly aware of his real attitude.
3. An individual may never have been confronted with a real situation to discover what is real attitude towards a specific phenomenon was.
4. Attitudes are revealed through the behaviour of an individual. But behaviour itself is not always a true indication of attitude. Observation of behaviour may not always be possible when a large sample is under study.
5. Social custom or the desire for social approval may make many kinds of behaviour mere formalities which are quite unrelated to the inner feelings of an individual.

However, psychologists and sociologists, under the assumption that description and measurement of opinion is closely related, to the real feelings or attitudes of an individual, have devised several methods:

1. An individual is directly asked how he feels about a subject. Techniques employed for this purpose are a schedule, a questionnaire or the interview process.
2. An individual is asked to indicate his degree of agreement or disagreement with a series of statements about a controversial topic.
3. An individual is asked to check the statements in a list with which he is in agreement.
4. The attitude of an individual is inferred from his reaction to projective devices through which he reveal his attitude unconsciously.

Thurstone's Method and Likert's Method

The two most frequently used methods for the measurement of social attitude. 'The method of summated ratings' developed by Likert.

The first method since it appearance in monograph published by Thurstone and Chave in 1929 and until 1932, when the Likert method appeared, had almost a perfect over other techniques in this field.

Thurstone's Rating Scale or the Method, of Equal Appearing Intervals.

A variety of statements expressing various points of view towards a particular issue are collected, screened and edited in accordance with certain informal criteria to omit the confusing and number of judges (fifty or more) who are asked to sort them into a number of categories usually eleven to represent a scale rating form extremely favourable through neutral to extremely unfavourable expressions of opinion about the issue in question. It may be noted that the judges are asked not to express their

opinion but sort them at their face value. Tabulations are made which indicate the number of judges who placed each item in each category. The next steps consists of calculating cumulated proportions for each item and olives are constructed. Scales values of item are read from the olives, the values of each item being that point along the base line, in terms of scale value units above and below which 50 per cent of the judges placed the item.

Q values provide the statistical criterion for the ambiguity of items. 20 to 22 items are selected for the final test on the basis of the scale and a values retaining Iowa values and with scale values falling at relatively equally spaced distances along the continuum. This enables us to construct two comparable forms of the scale in terms of the scale and a values. A new groups is asked to check the statement In the form with which they agree. The score of the individual is the mean or medium scale value of the items, which he has checked for agreement. Reliability of the scale, is found by correlating scores on the two forms of the scale.

The Likert Method of Summated Ratings

This method does away with the necessity of submitting items to the judges. After editing the items are given to a group of subjects for responding to each one in terms of their agreement or disagreement. the number of favourable and unfavourable statements should be approximately equal. Usually a 1-5 scale of response is used. A score is given for each item depending upon the response made, a sum of these scores gives the individual score. Final selection of items is done on the criterion of internal consistency.

Usually Two Methods are Adopted to Analyse these Scales

    (*i*)   A simple way is to indicate the percentage of responses on each time.

   (*ii*) The actual Likert Scaling Technique has a five point scale position being assigned to a scale value. All favourable statements are scored from maximum to minimum as:

Statement	*Scale Value*
(*a*) Agree	5
(*b*) Tend to agree	4
(*c*) Cannot say	3
(*d*) Tend to disagree	2
(*e*) Disagree	1

For statement opposing the position, the items would be scored out in the opposite order as 1, 2, 3, 4, 5.

In an opinionnaire consisting of 30 items the following score values would be revealing.

Most favourable response possible, $30 \times 5 = 150$.

A neutral attitude, $30 \times 3 = 90$ and so on.

Thus, the score of any individual would fall between 30 and 150.

Relative Merits of the Two methods

The Likert method succeeded the Thurstone method and was considered an improvement over the latter. Justifying the need for devising a new method Murphy and Likert point out "A number of

statistical assumptions are made in the application of his (Thurstone's) attitude scale e.g. that the scale values of the statements are independent of the attitude distribution of the readers who sort the statements assumptions which as Thurstone points out, cannot always be verified. The method is more over laborious. It seems legitimate to Enquirer whether it actually does its work better than the simple scales which may be employed and the same breath to ask also whether it is not possible to construct equally reliable scales without making unnecessary statistical assumptions."

The main contention of Murphy and Likert regarding the method of summated rating seems to be:

1. "It avoids the difficulties encountered using the judging group to construct a scale."
2. "The construction of an attitude scale by the sigma method (later replaced by the even simpler 1-6 method) is much easier than by using a judging group to place the statement in piles from the scale values must be calculated."
3. "It yields reliabilities as high as those obtained by other techniques with fewer items."
4. "It gives results which are comparable to those obtained by the Thurstone method."

There seems to be agreement on the simplicity of the Likert method and the time needed for its construction. It is less laborious than that developed by Thurstone.

Bird objects to such a proposition. In his opinion if the total work is taken into consideration Likert Scales with more than 25 items taken as much time as Thurstone in finding the scores. Moreover, according to him, time is no factor to be considered when it is question of the refining of the tool.

Hints on Making Opinionnaire Items

1. A careful study may be made of the list of statement prepared and used for measuring attitude by investigators in related areas of research.
2. Available literature may be surveyed thoroughly.
3. Various individuals may be requested to express their opinions about the phenomenon orally or in writing.
4. Favourable and unfavourable statements may be collected from these sources. The research worker should avoid inventing statements.
5. It is better to collect a large number of statements that are needed for the research worker for preparing an attitude scale.
6. The following types of statements should be selected :
    (*i*) Statements presenting as wide a variety of situation as possible.
   (*ii*) Statements which prevent the individual from detecting the nature of attitude which Is being evaluated.
   (*iii*) Statements which have provided to be unambiguous in their meanings through a pilot study.
7. Statements should be arranged in a random system irrespective of their favourable or unfavourable indications.
8. Approximately an equal number of favourable and unfavourable statements may be kept.

4. TESTS

In educational research achievement tests are most commonly used. These tests are of two types: Norm-referenced tests and Criterion-referenced tests. A brief description has been given here:

Criterion Referenced Tests

In the 1960s a new term entered in the vocabularies of measurement specialists, criterion-referenced test. It referred to a particular kind of test and on unconventional approach to the measurement of educational achievement. Tests of this kind were also referred to as objective-referenced or domain-referenced and were contrasted with the more conventional standardized or teacher-made tests, which are referred to as norm-referenced tests.

Strong advocates of the new tests, who were usually rather critical of conventional tests, claimed that criterion-referenced tests constituted a significant and generally applicable improvement in conception and methodology of achievement testing. They suggested that norm-referenced tests be abandoned as quickly as possible in favour of the new type. An alternative view, which we support, is that neither type is superior to the other for all measurement purposes. Each has special characteristics that make it uniquely well suited to particular situation and uses.

One way of becoming familiar with the characteristics of criterion-referenced tests is to consider some of the ways in which they differ from, or are similar to, norm-referenced tests. Comparisons of this kind are bound to involve some over simplifications and in accuracies, since there are many different forms of each type of test. Never the less, the forms have enough features in common to. make the comparisons useful, even if not always completely accurate.

Difference Between Criterion and Norms Referenced tests

One difference is in the kind of information they are intended to provide. Criterion-referenced tests are used to determine which of certain specified objectives of instruction a particular pupil has attended. Norm-referenced tests are used to determine how much overall knowledge of some subject a particular pupil has achieved. The basic report of results from a criterion-referenced test is a basic report for a norm-referenced test is a count of the number of test questions that were answered correctly.

A second difference is in the basic for interpreting the information provided the criterion in a criterion-referenced test is the attainment of all instructional objectives. The excellence or deficiency of a particular student's achievement in learning is judged by the proportion of the prescribed objectives the student has attained. The 'norm' in a normal referenced test. The excellence or deficiency of a particular student's achievement in learning is judged by the student's standing among those in the specified group.

A third difference is in the distribution of terms over the domain of achievement sampled by the test. The items in a criterion-referenced test cluster around a limited number of specific objectives. For example a criterion-referenced test might focus on 20 distinct objectives, using five items for each objective in order to determine whether or not the student had attained it. The result would be a 100 items criterion-referenced test. The items in a norm-referenced test would be diffused more widely across the domain of learning. Each of the 100 items would involve a separate aspect of achievement.

A fourth difference is in the use made of the test information. The purpose of norm-referenced test score is simply to indicate a student's degree of success in learning of criterion-referenced test, on the other hand, is after used with instructional procedures intended to ensure that certain things will be learned.

Despite these major differences, there are substantial similarities between criterion-referenced and norm-referenced tests. Both have essentially the some job to do, that is, to measure achievement in learning. Elements of quality are essentially the some for both. The individual test questions used in the two are indistinguishable.

In general, criterion-referenced test are best to assist in categorical pass-fail decisions with respect to separate specific terms or competencies.

The norm-referenced form is useful in measuring a person's general level of knowledge or understanding of a subject. While categorical decisions are sometimes made on the basis of scores on norm-referenced tests, as in the case of certification examination.

Proponents of criterion-referenced tests have performed a valuable service in emphasizing the importance of clearly defining test goods.

Proponents of criterion-referenced tests sometimes criticize standardized test (norm-referenced) for their leave of specific relevance to what is being taught in a particular unit of study in a given local school system.

The norm-referenced from is useful in measuring a person's general level of knowledge or understanding of a subject.

EXERCISES

1. Why do we need tools of research? Enumerate the various types of research tools used in educational research.

2. "Questionnaire is most frequently or commonly used research tool but misused in the field of education." Comment on this statement.

3. Describe the various steps which are used in designing a questionnaire. Indicate its advantages and limitations.

4. What do you understand by standardized tool of research? Differentiate between criterion-referenced tests and norm-referenced tests.

5. Differentiate between questionnaire and schedule. Indicate problems in which these tools are required.

6. Define the "Rating Scales." Enumerate types of rating scale. Describe the steps for developing Likert type rating scale.