

Methodological Issues in Experimental Research

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1. INTRODUCTION

As a History it is important to know that Bombay University was the first to start the M.Ed. course in 1936. Also the Bombay University was the first to introduce Ph.D. in Education in 1941 and it awarded the first Ph.D. degree in Education in 1943. The Lucknow University was the next to award Ph.D. degree in Education in 1949. Jangira and Sharma (1974) reported that the first Experimental study was conducted by Javli in 1949. Most of the Experimental studies were conducted in areas, like, Microteaching, Programmed Learning, Models of Teaching, etc. On the basis of findings of Experimental studies conducted in various Universities, it was decided to make Microteaching and Models of Teaching as part of B.Ed. curriculum. Till 2009 researchers were allowed to pursue their research to get Ph.D. degree in Education without undergoing any pre- Ph.D. course in Research Methodology. But looking to the quality of research in Education and other subjects, University Grants Commission, New Delhi made pre- Ph.D. course in Research Methodology compulsory. Now it is hoped that the quality of Research in Education and other subjects will improve. I personally feel that the quality of Research in Education on the whole is on the decline. Further even the quality of pre-Ph.D. course as well as teaching is of poor quality. There might be different reasons for this state of affairs. Some of the reasons are as follows:

- The basic understanding of Research Methodology and applied Statistics is lacking among researchers as well as teachers.
- The pre-Ph.D. course is almost what is taught at Masters level or little more.
- No where it is taught how to write Title, Objectives, and Hypotheses.
- There is no coherence in Objectives and Data Analysis as can be seen from thesis for which Ph.D. degree in Education has been awarded.
- The quantitative analysis and interpretation is of poor quality.

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- The qualitative researches in Education are far from the required quality due to the lack of proper training in Qualitative Research.

Having said all this about Research quality in general in Education, I like to focus on Methodological Issues of Experimental Researches in Education. It is being presented under headings, like, Title, Objectives, Hypotheses, Sample, Experimental Design, Data Analysis, and Interpretation of Results. The details are as follows:

2. TITLE

Irrespective of type of Research, each and every Research has to have a Title. One should understand that books, research papers and thesis do have titles but differ in terms of length and content. The reader from the title can differentiate among books, research papers and thesis. The title of a book is shorter than research paper and thesis. The thesis title may be at times little longer than research paper. Sometimes the length of title of research paper and thesis may be same but both differ in terms of information which a reader gets after reading the title. A thesis title should give information in respect of variable(s), Population and Type of Research. Let us analyse the following titles of Ph.D. thesis which have been awarded. In the following along with title, year is given. The name of the researcher and university is not disclosed due to research ethics.

1. To Prepare Programmed Learning Material and to study in what Different Ways it can be used, 1969.
2. To Develop Programmed Learning Material and study Pupils' Achievement on Programmed Learning Material in relation to some Personality Variables, 1972.
3. An Investigation into the Relative Effectiveness of Different Forms of Programmed Learning Material, 1972.
4. Classroom Behaviour Training of Teachers and its relationship with some selected measures of pupils' Criteria of Teacher Effectiveness, 1972.
5. A study of the Effects of feedback from Different Sources on the Classroom Behaviour of Student Teachers using the Technique of Interaction Analysis, 1972.
6. Relationship between Patterns of Teacher Classroom Behaviour and Pupils' Attainment in terms of Instructional Objectives, 1972.
7. An Experimental Study of a Linear Programme in Educational Statistics for B.Ed. student-teachers, 1973.

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8. To Develop Auto-Instructional Programmes in Geometry for std. IX and to find out their Effectiveness in relation to Different Variables, 1975.
 9. Effectiveness of Multimedia Programmed Materials in the teaching of Physics, 1981.
 10. A Study of the effect of step to paraextrinsic to intrinsic reinforcement and overt to covert response transformations in learner reading-material interaction on learner performance, 1992.

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From the above it is evident that titles at serial number 1, 2 and 8 are technically incorrect because the title cannot start with the word 'To'. Objectives start with the word 'To' because these are pinpointed and give direction while Ph.D. titles are narrow but not pinpointed. Ph.D. titles cited at serial number 3, 4, and 7 are without the variables while a title must have Variable(s). None of the above cited Ph.D. titles give information about the specific population from which the sample should be selected. However each above cited Ph.D. titles give information about the Type of Research. Lastly the Ph.D. titles at serial numbers 4 and 6 are not Ph.D. titles but titles of Research paper. From this it may be concluded that from the beginning titles of Ph.D. studies have been lacking and technically incorrect. So in order to improve the quality of Experimental Research and overall Research at Ph.D. level, the teachers as well as researchers should be trained in writing Titles.

3. OBJECTIVES

Objectives of any Ph.D. thesis must be pinpointed because these help researcher in deciding the sampling technique, tools, experimental design and data analysis. Let us look at some of the following Objectives of Ph.D. Thesis in Education for which the degrees have been awarded.

1. To study the relationship between the immediate achievement and retention scores on Linear and Branching programmes and some selected Personality variables, viz., Intelligence, Anxiety, Self-sufficiency and Introversion-extraversion.
2. (i) To prepare Programmed Learning Material, the topics being (a) 'Introduction to Algebra' and (b) 'Simple Equations'. (ii) To evaluate this material in terms of products of instruction, time taken to go through the programme, sequence progression, error rate, etc. (iii) To investigate the effects of student variables and method variables on maximising the performance of students, if these topics are introduced in lower grades where they are not conventionally taught.
3. (i) To examine the potentialities of the auto-instructional programmes as a practical solution to some of today's critical problems in education.

- (ii) To make the teachers conversant with the technique of preparing auto-instructional programmes.
4. To ascertain the interaction effects and main effects of styles of programming, response mode and taxonomic categories.
 5. (i) To prepare a Linear Programme in Educational Statistics using Hindi as the medium of presentation. (ii) To study the workability of the programme for various levels of qualifications, age, motivation, intelligence and for different sex. (iii) To prepare a manual for the guidance of the consumers of the programme.
 6. (i) To develop a programmed text for the course, 'Educational Testing and Techniques of Evaluation' as specified in the B.Ed. syllabus. (ii) To experimentally validate and study the effectiveness of the programme. (iii) To develop an attitude scale and measure students' attitude towards programmed learning. (iv) To study the relationship of achievement with attitude towards programmed learning, intelligence, academic motivation and English language comprehension. (v) To study the relationship of attitude towards programmed learning with intelligence and academic motivation.
 7. (i) To develop PLM in some units of Geometry of class VII. (ii) To compare the achievement in Mathematics of students having different reading abilities and learning through PLM and traditional way of teaching. (iii) To compare the achievement in Mathematics of the students having different study habits and learning through PLM and traditional way of teaching. (iv) To compare the achievement in Mathematics of the students with respect to anxiety and n-Ach when taught through PLM and traditional way of teaching.
 8. (i) To develop instructional materials for the strategy of programmed class-teaching and to study its' effectiveness. (ii) To develop programmed learning materials on light in school physics in four different styles- semi-programme, linear programme, branching programme, and hybrid programme. (iii) To develop a multimedia programme package using each style of programme in conjunction with audio-visual media. (iv) To compare the relative effectiveness of different strategies of instruction employing multimedia programmed material and programmed class-teaching on the criteria of immediate achievement, retention and delayed retention. (v) To study the interaction effects of instructional strategies, abilities and occasions (immediate learning, retention and delayed retention).
 9. (i) To study the relative efficacy of three types of programmes on the unit of 'INTEREST' in mathematics. (ii) To find whether one or the other
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type of programme was better for higher achievers or low achievers.
(iii) To find the relationship between achievement through different programmes on the one side and intelligence, numerical ability and achievement in mathematics on the other.

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10. To determine whether the training strategies affect creative problem solving skills and cerebral dominance. (ii) To study if the intelligence, personality and cognitive style affect the creative problem solving skills. (iii) To study whether intelligence, personality and cognitive style affect cerebral dominance.

Researchers should understand that Objectives are the Research Questions whose answers are to be found through research. Preparation of tools or Instructional Materials cannot be the objectives as these have to be there to find answers to the Research Questions. From the above mentioned Objectives one cannot decide the Sampling Technique, Tools, Experimental design, and Data Analysis. So from Objectives point of view, the Experimental researches and Researches on the whole conducted so far are too weak. In order to improve the quality of Experimental Researches and Researches in general, Teachers and Researchers should be trained in writing pinpointed Objectives which will help the Teachers and Researchers in deciding appropriate Sampling Technique, Tools, Experimental design, and Data Analysis.

4. HYPOTHESES

Experimental Researches cannot be without Hypotheses. It is important to understand that Hypotheses should be stated in Present Tense because there are basis for formulating Hypotheses. In the formulation of Hypotheses, significant or significance word should be used. Let us look at some of the following Hypotheses of Ph.D. Thesis for which the degrees have been awarded.

1. Different programme forms do not differ significantly in their achievement in terms of immediate scores or retention scores on the criterion test.
2. There would be significant interaction between step-size and response mode, between stem-size and taxonomic category, and between response mode and taxonomic category.
3. There will be no difference between the perceived 'actual' pre- and post- ALP ethos of a classroom receiving instruction through PLM in audio-tape format, and teaching in the traditional way
4. The hypothesis of the study was that radio and television had made a considerable impact on education.

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5. There will be no significant difference between the mean scores of students taught through Advance Organizer Model and Traditional Method of teaching in development of Conceptual Structure.
6. There is no significant difference in the attainment scores on communicative competence test between the scholars exposed to three different types of learning situations viz. EG-1, EG-2, and CG.
7. There is no significant relationship between verbal and non-verbal IQ of normal and special children separately.
8. There is no significant difference between test scores on the six programs of computer education when treated with Traditional Method and Printed Module.
9. There would be no impact of intervention of affirmation strategy, visualization strategy, communication strategy, problem-solving strategy and of goal setting strategy, separately on adolescent's Self-esteem.

The Hypotheses given at serial numbers 1, 6, 7 and 8 are stated in present tense which is correct. But others are stated in future and past tense which is technically wrong. Further Hypotheses given at serial numbers 3, 4, and 9, do not have 'Significant' word in it. In formulation of Hypothesis 'Significant' word should be used otherwise it is technically incorrect. The Hypothesis given at serial number 7 is technically correct. It indicates that majority of Teachers as well as Researchers need to be trained in formulating Hypotheses.

5. SAMPLING

Experimental Researches are conducted with a view to generalise the findings from a large number of researches. If it is not done than Theory or Law or Principle cannot be stated. For this the researchers have to select Sample using Probability Sampling Techniques. Non-Probability Sampling Techniques will not help in generalization as the Population Frame is not available. After going through large number of Experimental Researches conducted for the award of Ph.D. degrees in Education, it was found that Samples were selected using Probability Sampling Techniques. Use of robust Probability Sampling Techniques is doubtful. Appropriateness of Sampling Technique used in the research could not be ascertained because the complete information is not given in the abstract. One should understand this analysis against the background mentioned above.

6. EXPERIMENTAL DESIGN

Experimental Design is the backbone of Experimental Researches. Different Experimental Designs exist in books with different names but the layout is

the same. Campbell and Stanley (1966) classified all Experimental Designs into three categories, namely, Pre-Experimental Designs, Quasi-Experimental Designs and True Experimental Designs. Experimental Designs categorised under Pre-Experimental Designs are the weakest on the basis of Internal Validity and External Validity. Normally, in Education it is not possible to use True Experimental Designs as Random selection of subjects may not be possible. So Quasi-Experimental Designs are the most appropriate for conducting Experimental Researches in Education. From different Surveys of Research in Education it can be seen that researchers used Factorial Designs, Matched Group Design, Experimental and Control Group Design, etc. The names of Experimental Designs used by different researchers are not from the list of standard names of Experimental Designs. So it is important to understand layout of different Experimental Designs along with their Internal Validity and External Validity.

In any Experimental Research the Treatment Duration is very important. Existing Experimental Researches differ with respect to Treatment Duration. As per available abstracts in different Surveys of Research in Education, it can be noted that the Treatment Duration varies from a week to one semester at the rate of 40 to 60 minutes per day. In order to make the findings of Experimental Researches useful, it is important to have longer duration of Treatment. Many Intervening Variables enter in the process of Experimentation. In Experimental Researches in Education, it is difficult to control all potential Intervening Variables. The utility of any Experimental Research depends on ease of use. That is, less complicated the controls, more chances of using the Treatment. But no good Experimental Research can be without controlling the potential Intervening Variables.

In India, Experiments have been conducted related to Microteaching and Models of Teaching. On the basis of findings of Experimental Studies conducted in India Microteaching and Models of Teaching are part and parcel of Teacher Training programmes at different levels. Apart from these, Programmed Learning Material on Educational Evaluation by Govinda (1976), Research Methodology by Sansanwal (1978) etc. are being used by students and teachers. Thus such Experimental Researches are very useful and must be encouraged.

7. DATA ANALYSIS

In Experimental Researches the researcher gets quantitative data. Normally the Data Analysis should be as per Objectives. This can happen when the Objectives stated are pinpointed but not vague. Most of the time Objectives

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stated are not pinpointed. Thus there is no coherence between Objectives and Data Analysis. This brings down the quality of Experimental Research. One of the reasons might be that most of the Universities have weak syllabus in terms of Statistical Techniques taught to M.Ed. and M.Phil. (Education) students. Even the teachers guiding the doctoral level students do not understand the quantitative techniques used in analysing the data. Most of the time researchers try to take help from the old thesis which are weak on Data Analysis. Pre-Ph.D. course in Education must help researchers in understanding Advanced Statistical Techniques so that the quality of Experimental Researches can improve.

8. INTERPRETATION OF RESULTS

Majority of time Interpretation of Results is quite weak because at M.Ed. level only Statistical Analysis is taught but not the Interpretation of Results. Wherever it is taught, it is wrong. Because of this, the guiding teachers also do not know the correct Interpretation of Results. Thus Experimental Researches are quite weak in respect of Interpretation of Results. In order to improve the Quality of Research in Education, researchers and guiding teachers should be trained in Interpretation of Results obtained from the use of different Statistical Techniques.

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