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THE STRENGTHS AND WEAKNESSES IN THE EXPERIMENTAL APPROACH IN THE EDUCATIONAL RESEARCH - PURPOSES AND CIRCUMSTANCES OF A RESEARCH

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Abstract:
Educational research literature seems to highlight the use of different research methods, but there appear to be three main research strategies widely used and discussed. These are experiments, surveys and case studies. This paper concentrates on the experimental approach, which could be deemed for this paper to be of the "quantitative tradition". The three strategies differ, then in two respects: (1) in how many cases are studied and, (2) in how these are selected. Strategies may be used to investigate any particular research topic, their strengths and weaknesses will have varying significance, depending on the purposes and circumstances of the research. The overall picture that emerges is that the experimental approach is based on multiple and varied sources of evidence and it must attend to process as well as to the outcome, it is better when it is theory-driven and it leads ultimately to multiple analyses that attempt to consolidate the program effect within some reasonable range. One theme that underlies the other research strategies namely, the case study and survey method, and that illustrate the increasing awareness of the tentativeness and frailty of the experimental approach concerns the importance of human judgement in research. Evidence bearing a causal relationship emerges and it is not a trivial matter to integrate or resolve conflicts and constraints.

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1. The Aim of the Study

The aim of the study is to reflect on strengths and weaknesses in the experimental approach in educational research. The aim of the study, thus, is to examine the experimental approach, which could be deemed for this paper to be of the "quantitative tradition". There appear to be three main research strategies widely used and discussed. These are experiments, the survey and case studies, the study will be guided by the following key research question:

The three strategies differ, then in two respects: (1) in how many cases are studied and, (2) in how these are selected. Strategies may be used to investigate any particular research topic, their strengths and weaknesses will have varying significance, depending on the purposes and circumstances of the research.

1.1 Significate of the Study

The importance of this research stands in its originality, where it is its experimental approach appeases to have strengths and weaknesses reflect on the educational research. It does appear that they are interrelated. It is, additionally, the first to focus that is a strong point could be a weakness and vice versa. The continuing need to plan in an experimental approach arises because things change continually. The objective of an experimental study is a very speculative one. The experimental study can be used in effectively in the natural sciences such as physics and botany. This method is also used in the social sciences by sociologists and psychologists.

2. Methodology of the Research

In order to provide a general review of the availability of educational research; By examining the experimental approach to investigating the relationship between them appears to be three main research strategies widely used content are experiments, surveys and case studies. General reviews will utilize the educational research divided into the three main research strategies widely used and ability to reconstructed at research. In addition, the literature was reviewed to analyse the experimental approach document for the educational research. This review is the result of this extensive literature survey.

2.1 Introduction

Educational research is about people. It is apparent that changes in education are occurring at an exponential rate. Hence, it is difficult to predict the knowledge, skills and understanding the present classroom student will be using in the next decade and what these students would need by their mid-career.

It can be argued that one of the failings of education in some countries is that educators, planners, government administrators are most made aware of diversities of societies and cultures of which there are members. In other meaning, they work hard to present their societies through their work to the world. But it is the school that is expected to cultivate students' abilities to understand society and develop their abilities to be active participants in the "real world".

It must be remembered that education is the only public service where the law requires a place to be provided for every member of its group so far, at least, as the provision of schools is concerned.

According to Suchan and Brewer (2000, p. 147) *"the goal of researchers, whether employing quantitative or qualitative methods, is to produce credible and useful results"*. Writers, such as, Patton (1990) and Creswell (1994) notes that the "quantitative tradition" seems to be labelled at methods considered to be traditional, positivist, hypothesis-based, experimental or empiricist. By contrast, "qualitative tradition" is deemed constructivist, naturalistic, interpretative or phenomenological.

Patton (1990) and Miles and Huberman (1994) have stated that quantitative and qualitative approaches require data acquisitions, organisation, summary, analysis, interpretation and presentation of findings.

Experimentation is one of the fundamental activities of educational research (Robson 1993; Cohen and Manion 1994). This is one research methodology in which planning is essential in all its various aspects and at all levels of operation. Careful planning in an experimental approach can be created. That is, within an experimental approach exist a procedural or step by step process to guarantee success. It must be borne in mind that nothing in life is static and no research methodology is effective, efficient and even sufficient for all time. The continuing need to plan in an experimental approach arises because things change continually. The objective of an experimental study is a very speculative one. The experimental study can be used in effectively in the natural sciences such as physics and botany. This method is also used in the social sciences by sociologists and psychologists.

A critique of schools has been the role of educational research, with an emphasis on the merits and demerits of the experimental approach in the "process of learning".

The experimental approach appeases to have strengths and weaknesses in educational research. It does appear that they are interrelated. That is a strong point that could be a weakness and vice versa. It is apparent that there is a thin line between these two as in one situation something may be considered a strong point whereas in another it may be a weakness. In another way, a point in experimentation could be a strength if we control the variables at the same time if we could not control them in terms to be a weakness. The educational researcher must maintain strict control of any variables in the experiment. They have the task of training and at times retraining children.

In order to present what this writer understand to be the strengths and the weaknesses involved in the experimental process in educational research, it is first of all

necessary to look at the dynamics of this approach - the major sources and causes of change.

2.2 Definition of Terms

2.2.1 Education

It is really necessary for any researcher to know what the use of education mean in his or her research. In the public word, education has a positivist meaning (Bassey, 1999). *"Thus Tony Blair, Prime Minister, announced in 1997 that his policy was 'Education, education, education': do we all give the same meaning to each of these three words? Clearly not. For example, some see it as acquiring useful and skills in order to achieve a high quality of life, some as developing personally and socially as good people, and others as about creating wealth in order to increase the gross national product".* (Bassey 1999, p. 38).

The concept of the word education which is used by R. S. Peters in 'Ethics and Education' (1966) views education as:

- *"first, the experience and nurture of personal and social development towards worthwhile living;*
- *second, the acquisition, development, transmission, conservation, discovery and renewal of worthwhile culture".* (Bassey 1999, p. 38).

And I think these two concepts of the word education as R. S. Peters are really put the word education in the right situation.

2.2.2 Research

Cohen and Manion (1996, p. 40) explained that *"research itself may take on a range of meanings and thereby be legitimately applied to a variety of contexts from, say, an investigation into the techniques of Dutch painters of the seventeenth century to the problem of finding more efficient means of improving traffic flow in major city centres".* This view has highlighted the complex nature of the research. But other authors have attempted to provide a definition of research. Best (1970, p. 9) viewed research as *"a more systematic activity duelled towards discovery and the development of an organised body of knowledge. It is based on critical analysis of hypothetical propositions for the purpose of establishing cause-effect relationships, which must be tested against objective reality".*

Another expression of research is highlighted by Tuckman (1994, p. 4) as *"a systematic attempt to provide answers. Such answers may be abstract and general as is often the case in basic research, or they may be highly concrete and specific as is often the case in a demonstration or applied research. In both kinds, the investigator uncovers facts and then formulated generalisation based or the interpretation of those facts".* Bassey (1999, p. 38) has defined this concept simply by stating *"research is a systematic, critical and self-critical enquiry which aims to contribute to the advancement of knowledge and wisdom".*

So, these definitions show that research is an organised, logical, and objective effort to collect new data or to make use of existing information for a specific and new purpose. The definitions are also indicating that the reason why research is undertaken

is not to collect information about some problem but to help with the process of developing theories (Dyer1995, p. 30).

Research, therefore, should be a process that helps the education researcher better understand the present, the past and the individual's place in the scheme of things. This should be the goal of all research, no matter how broad or limited the initial itch that starts the process.

2.2.3 Educational Research

McIntyre (1997) says that it is impossible to provide a definition of educational research that would be acceptable simply because **"**educational**"** has been given plenty of meanings. For instance, Bassey (1999, p. 39) said that *"educational research is a systematic, critical and self-critical enquiry which aims to contribute to the advancement of knowledge and wisdom about the experience and nurture of personal and social development, transmission, conservation, discovery and renewal of worthwhile culture".*

Another perspective is presented by Broadfoot (1988, p. 6) who claims that *"educational research occupies an uneasy conceptual and methodological middle ground between natural science …and interpretive disciplines such as history…indeed it can and should build in the strengths of both as appropriate*". These definitions highlight the breadth and depth of these authors notions at definitions.

However, other writers provide simpler versions of educational research. Beveridge (1998, p. 94) noted that *"educational research tends to find problems rather than solutions…"* while Griffiths (1997, p. 192) regard educational research as *"…[aiming} to improve the education of children".*

From my point of view, the common thread in the definitions is that a change in certain conditions should produce a change in some aspect of a pupil teaching-learning.

2.2.4 Experimental Approach

The experimental approach according to Underwood 1957 (as cited in Robson 1993) is concerned with the manipulation of variables, random sampling, different conditions and strict control of variables.

Kerlinger's 1970 description of the experimental approach as (Robson 1994, p. 164): *"if x, then y, if frustration, then aggression…the researcher uses some method to measure x and then observes y to see if concomitant variation occurs".* For this paper, the working definition of an experiment *"is a method of research in which the researcher deliberately intervenes in order to introduce changes into a situation, with the intention of observing the effects of those changes on the process being studied"* (Dyer 1995, p. 194).

This definition seems to suggest that there are two important aspects when dealing with the experimental approach. Firstly, an experiment has to be designed in such a way that its result will logically confirm or disprove the predicted effects of the variables. Secondly, the experimental approach appears to be a means of collecting evidence to show the effect of one variable upon another.

The definitions of the various keywords seem to be suggesting that educational researchers should be concerned with the objective testing of some sort of prediction about the teaching-learning situations and this could be achieved through the experimental approach.

Probably an example of an experiment would give a clearer picture. In the ideal case, the educational researcher manipulates the Y, holds all other variables constant, and then, observe the changes in A. In this hypothetical perfect experiment, any changes in Y must be caused by the manipulation of A. Suppose, for example, the researcher has a theory that predicts that the lack of sleep causes an increase in pupil's reflexes to sound. Given the cooperation of a group of students, we would test this prediction experimentally. Half of the pupils would be deprived of sleep for one night while the remaining half were allowed to sleep normally. The next morning the researcher would measure the reflex time to sound of each pupil and see whether the sleep-deprived group had noticeable longer reflexes to sound. If they had and provided that the two groups were similar in all other respects, we would be justified in concluding that sleep deprivation causes a slowing of reflexes. This procedure qualifies as an experiment because the researcher has manipulated the independent variable (amount of sleep) and observed the consequential changes in the dependent variable (reflexes to sound). In this example, the independent variable takes on only two values or levels (no sleep – normal sleep).

From this example, it could be seen that the main characteristic of an experiment lies in the notion of intervention – the idea that the researcher acts to produce certain changes in a situation.

2.2.5 Other Research Strategies

Though the concentration of this paper is on the experimental approach, it is necessary to highlight some important aspects of the other two research strategies, namely the survey and case study, mentioned in the introduction as a means of providing a context, while at the same time, hopefully, highlighting the apparent overlap between the quantitative and qualitative traditions.

2.2.6 The Case Study

The case study is a valuable method of research, with distinctive characteristics that make it ideal for many types of investigations (Hammerseley 1992; Yin 1994). There are several examples of the use of case study methodology in the literature. Yin (1994) listed several examples along with the appropriate research design in each case. Its use and reliability should make it a more widely used methodology.

Hammersley (1992, p. 184) in his definition of case study said: *"the phenomenon (located in space/time) about which data are collected and/or analysed and that corresponds to the type of phenomena to which the main claims of the study relate. Examples of cases range from the macro to the micro, all the way from an individual person through a particular event, social situation, organisation or institution, to a national society international social system".*

The definition of a case study according to Hammersley (1992) is highly inclusive, allowing it to traverse a wide range of social phenomena and allow the application of a range of research tools.

Yin (1994) made the point that a case study can be either single or multiple-case designs. Single cases are used to confirm or challenge a theory, or to represent a unique or extreme case. Single-case studies are also ideal for revelatory cases where an observer may have access to a phenomenon that was previously inaccessible. Multiple-case studies follow a replication logic. This is not to be confused with sampling logic where a selection is made out of a population, for inclusion in the study. This type of sample selection is improper in the case study (Yin 1994: Kenny and Grotelscheun 1984).

Advantages of the case study include:

- The case study is capable of being designed around naturalistic methods of inquiry;
- It is highly amenable to the use of both structured and non-structures forms of data collection and a range of sampling strategies;
- It is capable of capturing complex relationships descriptively and/or explanatory;
- It can contextualise and 'bring to life' meaning and issues that are being investigated (Loxley 1999).

Disadvantages of the case study:

- It is context and time-bound;
- It is highly time-consuming;
- The incorporation of different methods can make data analysis problematic (Loxley 1999).

2.2.7 The Survey Methods

The survey is a non-experimental, descriptive research method (Kidder et al. 1986). Surveys can be useful when a researcher wants to collect on phenomena that cannot be directly observed (such as on library services). A survey also could be a way of going from observations to theory validation.

Data are usually collected through the use of questionnaires, although sometimes researchers directly interview subjects. The survey can use qualitative (e.g. ask open-ended questions) or quantitative (e.g. use forced-choice questions) measures. There are two basic types of surveys: cross-sectional surveys and longitudinal surveys (Robson 1993). The cross-sectional survey is used to gather information on a population at a single point in time. Longitudinal surveys gather data over a period of time.

Overall, the survey approach can be seen to have the following advantages and disadvantages. Advantages of the survey:

- Survey is easy to administer;
- Survey is simple to score and code;
- Survey can help confirm and quantify the finding of qualitative research;
- Survey can be reused easily, and provide an objective way of comparing responses over different groups time, and places (Loxley 1999).

Disadvantages of the survey:

- Survey is just a snapshot of behaviour at one place and time;
- One must be careful about assuming they are valid in different contexts (Loxley 1999).

In particular, different cultures may produce different results. Some writers have provided a good example of this by showing the effect of cultural differences in the measurement of survey methods.

Comparing the survey with the case study, other things being equal, the first will provide a sounder basis for empirical generalisation, whereas the second will provide more and more detailed data on each case studied, as well as allowing more scope for checking the validity of these data (Hammerseley 1992; Bryman 1995). Usually, the more case studied the more confident the educational researcher can be in generalising about findings. However, given fixed time and resources the more cases studied the less detailed the data that can be collected on each and the less time is a variable of these data (Yin 1994; Robson 1993; Dyer 1995). If we compare the experiment and case study, we find that the former allows for more rigorous testing of theories than does the latter (Bryman 1995). On the other hand, writers such as, (Campbell and Stanley (1963, 1966); Kidder et al. (1986)), have claimed that experiments involve some level of reactivity, in that the individuals participating will usually be aware that they are taking part in an experiment and may therefore act in a different way from normal. This can result in the findings being defective in terms of the educational researcher's ability to draw inferences about what happens in non-experimental situations. Conversely, a case study typically involves a lower level of reactivity, but even where comparison of several cases is carried out it is not usually possible to come to judgements about what caused what with as high a level of justifiable confidence as in experimental research (Kenny and Grotelscheum 1984; Yin 1994).

3. Principles of The Experimental Approach

Dyer (1995); Robson (1993); and Cohen and Manion (1994) have made the distinction between the 'true' experiment, the 'quasi' experiment and field experiments. This distinction appears to be important in ensuring that the results of experiments are correctly interpreted. As an example, to qualify as a 'true' experiment the following are required. Firstly, the research participants should be randomly selected and assigned to each of the conditions in the experiment (Dyer 1995). This should ensure that the conditions are equal to each before the experiment begins. This random selection and assignment provide the necessary condition for making *"causal inferences about the relation between the independent variable and dependent variable"* (Dyer 1995, p. 125).

Secondly, the treatment of participants in the experiment should be equal in every way except in relation to the variable being investigated as the independent variable (Robson 1993). That is, in the experiment, participants are treated differently in different conditions in respect of only one variable and the different treatment gave them in the

conditions constitute the different levels or values of the independent variable (May 1998).

According to Dyer (1995); Robson (1993); Lewis (1968) the first step towards an experiment is to limit to two the variables with which the researcher is to be principally concerned. Those two variables are usually referred to as (1) an independent variable which is usually a possible cause of a phenomenon being investigated.

Bryman (1995, p. 20) shows the typical structure of an experimental approach (see Figure 1). All steps must be followed in consecutive order for the experimental approach to be seen as been valid and reliable. The figure shows a linear appearance of this particular method. Once a stage is omitted the experiment is considered invalid.

Theory → Hypothesis → Data Collection → Data Analysis → Findings

Figure 1: Typical structure of experimental approach

The experimental methodology of the study involves the manipulation of variables, random sampling of different conditions and strict control of variables.

So, it does appear that the experimental approach has been the accepted norm, the apparently legal way to gain insights into knowledge and understanding. Inherent in this dominance was the belief that research should be able to be quantified, parts of it controlled and it is analysed through some statistical technique.

Robson (1993), Bryman (1995), Creswell (1994), Patton (1990) and Silverman (1998) through their books are saying that the experimental approach, at times referred to as the "*quantitative tradition*" (see page 1) is grounded on testing hypothesis through which the researcher seeks to confirm or challenge previous theory. The hypothesis is tested by selecting variables, measuring and analysing with statistical procedures; probability sampling, and the use of methods, such as surveys, case studies and controlled experiments. An example of a controlled experiment was provided on page 2.

Suchan and Brewer (2000, p. 147) have remarked that *"[experimental approach] emphasise the measurement and analysis of causal relationships between variables. Such research starts out with a fixed and limited set of variables, and the researcher looks for precise relationships between these categories".*

In addition, Patton (1990) and Denzin and Lincoln (1994) are of the opinion that the [experimental approach] capture issues of distribution and generalisation when the patterns of thoughts or actions across a population are of central interest, and when research questions give an unambiguous response.

It seems that part of the importance enjoyed by the experimental approach has to do with the perception generally held with numbers. Somehow numbers are treated with respect. The fact that the experimental approach tends to analyse using data with numbers, causes a reluctance by persons to question the truth of the numbers.

The formulation of a hypothesis is critical to a successful experiment (Bryman 1995; Silverman 1998). Hence there is a need to provide more insights into this concept. According to (Vogt's Dictionary of Research Methods and Statistics 1993; Silverman 1998) a hypothesis is *"a statement of the relationships among the variables that a researcher intends to study"*. This definition brings out two important ideas. First, hypotheses are assertions about how two or more variables are related to or associated with each other. For example, assume that the researcher is interested in studying why students are not interested in higher education. One possible hypothesis is: students are not interested in higher education because they cannot afford to pay the high costs.

This hypothesis posits that higher education and finances are related, and suggests that those who can't afford the costs will not pursue higher education. It is testable because we could see if students can't afford the cost (versus higher education for other reasons). Hypotheses should both say what we expect to find in our research and be testable.

The second concept illustrated is the idea that hypotheses are formulated for variables that we intend to study. That is, the hypotheses are formulated before we do our research. It seems improper to do the research, poke around in the data, and then write up a hypothesis that "fits" what we found. Hypotheses should be based on theory and what the previous researcher have found; they are not just made up *"off the cuff"*. Hypotheses are scientifically reasonable predictions. It is also testable and makes specific predictions about what the researchers expect to find in his/her research.

The experimental approach is not without its strengths and weaknesses. A closer examination of academic literature and the examples in this paper has highlighted weaknesses in sampling, inaccuracy in measurements, the effects of the experimenter per se and misconceptions between the participants. On the other hand, strengths could be seen as the process of the experiment design, and ethically aware approach, and the notion of a pilot study as a dress rehearsal for the main experiment.

4. Weaknesses of the Experimental Approach

The educational researcher can never be certain whether the independent variable measured is actually the one that produces changes in the dependent variable.

Many variables the researcher would like to investigate cannot be brought under experimental control. The researcher cannot manipulate a pupil's personal characteristics: his age, sex, social status, intelligence, personality, religious belief, social attitude and so on. The researcher would not interfere with critical aspects of a child physiological and emotional state, even though in principle it may be possible.

It is possible for inaccuracies to arise out of the failure of the sampling procedure to generate a sample that is representative of the population of interest. It does seem that the only way in which any inaccuracies from this source could be avoided is when every member of the population is included in the sample. In all experiments, some degree of sampling inaccuracy is inevitable, and it is left to the educational researcher and his/her

tactic in trying to maintain its effect as much as possible. It should be noted that the random sampling procedure is the common way of determining a scientific sample, however, it is difficult to achieve a random sample.

The actual participants involved in an experiment present some concerns.

These concerns arise from the existence of uncontrolled differences between the experimental participants themselves, which confounds the independent variable in some way. Such differences include sex, educational attainments, age, temperament and so on. Not all differences need to be controlled in any one experiment. It must be borne in mind that individuals who participate in an experiment may differ one from another in all kinds of ways, only some of the possible differences are likely to be capable of influencing the dependent variable, and will be a source of wrongs.

Ideally, the process of measuring changes to the dependent variables should be accurate and reliable in order to register precisely all changes which may occur, no matter how small. However, no matter how carefully an experiment may be approached, the measurement process in an experiment may be the source of misconceptions.

Another weakness of the experimental approach arises out of a failure to control all the variables in an actual experimental situation that are capable of exerting some influence on the performance of participants. It seems that a way to control this is the standardisation to ensure that the experience of all participants is as far as possible identical, with the sole exception of the differences between the experimental and control condition.

At times the educational researcher that engages in an experimental approach, unconsciously introduces, often in the form of non-verbal cues and signs, into the research situation. The problem is not because of any negative behaviour on the part of the researcher. It has been shown that the educational researcher can have an effect on any experiment by their personal characteristics, such as sex and age, as well as the perceived competence and authority of the researcher. It is possible for the educational researcher in attempting the use of the experimental approach to become 'complacent' because of the fact that in designing an experiment and collecting some data this data must eventually 'throw some light' or 'add value' to the research question.

6. Strengths of the Experimental Approach

Perhaps one of the strengths of the experimental approach is the process of experimental design. It seems, at least from reading the literature, that designing a successful experiment is not a difficult process. It is apparent that the main quality that is necessary is to be prepared for *"a systematic and careful approach to the task"* (Dyer 1995, p. 162). Somehow, it is the amount of care and thought with which the experimental design is approached because this is the essential ingredient to be able to draw valid inferences from the data gathered.

Once the research question has meaning, the amount of useful information which can be extracted from a set of data is determined solely by the extent to which the research

has been able to anticipate and solve the problems involved in measuring the effects of an independent variable on a dependent variable. The scientific experiment is a classic example of a strategy for controlling variables. It is often said to involve physical control of variables since it entails actual alternation of the independent variable of interest and the holding constant or minimising of other factors likely to affect the dependent variable (Hammersley and Comm and Woods 1994, p. 93).

Another strength of the experimental approach is the run of a pilot study. Robson (1993), Dyer (1995), Cohen and Manion (1999) have viewed the pilot study as a dress rehearsal for the main experiment. This pilot study involves implementing all experimental procedures and gathering data exactly as the educational researcher would in the main experiment, only with a small number of participants rather than from a full-scale sample.

The purpose of the pilot is to check that an experiment is near as perfect as it is can be and this has two functions. Firstly, it enables the procedures of the experiment to be tried out in a *"'real' but not 'crucial' situation"* (Dyer 1995, p. 166), so that anything which might prevent the main experiment from running smoothly can be identified. Secondly, the pilot provides information on the kind of data values the educational researcher may expect to find when conducting the min study. If the data obtained in the pilot are different from what is expected, then that may be a broad hint that the basic design of the experiment needs to be looked at again.

A further strength of the experimental approach is provided by Hammersley and Comm and Woods (1994) who are contends that *"the things which make the experiment distinctive is that the researcher constructs the cases to be studied. This is achieved by stabilising in which it is possible to manipulate the variable that is the focus of the researcher and the controls at least some of them relevant extraneous variable"* (Hammersley and Comm and Woods 1994, p.132).

"Experiments typically involve a high level of reactivity in that subjects will usually be aware that they are taking part in an experiment and may therefor act in a different way from normal; as a result, the findings may be defective in terms of our ability to draw inferences about what happens in non-experimental situations" (Hammersley and Comm and Woods 1994, p.133).

7. Conclusion

The discourse thus far points to an increasingly realistic and complicated life of the educational researcher using the experimental approach. Though many educational researchers from the academic literature tend to favour the case study and the survey methods, it is obvious that the experimental approach should be utilised even more than the other research strategies.

The experimental approach at times hailed as the most 'rigorous' of all research designs or, the 'gold standard' against which all other approaches outlined in this paper are judged. In one sense, it probably is. In fact, if the educational researcher can

implement an experimental design well then, the experiment is probably the strongest design with respect to validity and reliability. In other words, if the educational researcher wants to determine whether some program or treatment *causes* some outcome or outcomes to occur, then the researcher is interested in having strong internal validity.

The key to the success of the experimental approach is the random assignment. The reality is that even with the random assignment it is difficult that groups the educational researcher create will be exactly the same. It must be borne in mind that groups are made up of different people. So, if we randomly assign people to two groups as seen in the example on page 2, and there are enough people in the study to achieve the desired equivalent within known probabilistic ranges, then the educational researcher may consider the experiment to be strong in internal validity and there is a strong inclination at assessing whether the program causes the outcome(s). In other words, the experimental approach requires a control group not exposed to a stimulus and the major characteristic is that it gives precise measurements.

As with other research strategies, the educational researcher must be aware that things can go wrong. For example, the sample may not be large enough or people may refuse to participate in the study or drop out partway through. Other problems include the resistance from the staff in an experimental study who would like some of their 'favourite' people to get the program or the researcher may be challenged on ethnic grounds, after all in order to use this approach, the researcher has to deny the program to some people who might be equally deserving of it as others.

Obviously, the number of cases studied can vary from one to a very large number, with many mid-way points. Similarly, the amount of control exerted over variables can vary considerably. There are mid-points between the laboratory experiment, on the one hand, in which maximal physical control over variables is exercised, and the survey and case study, on the other, where no physical control is exerted. Field experiments and quasi-experiments fall between these extremes.

The experimental approach is definitely a fairly complex subject in its own rights. The bottom line here is that the experimental approach is intrusive and difficult to carry out in most real-world contexts. Further, because an experiment is often an intrusion, the educational researcher is to some extent setting up an artificial situation in order to assess the causal relationship.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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