PRE-EXPERIMENTAL DESIGNS IN PSYCHOLOGY AND EDUCATION: 
A CONCEPTUAL REVIEW

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ABSTRACT

In this paper we analyze the names and meanings assigned to preexperimental design concept, reviewing some of the literature on this topic especially in Spanish language. Among the textbooks on methodology, there are a great number of denominations, which we have tried to classify in order to facilitate analysis and to understand the reasons why they have so many different meanings. In the frame of this communication we discuss why these designs are important today.

Key words: Experimental design, Experimental pre design, Experiment

Introduction

The pre experimental designs are often used in research in education, psychology, and generally in all the social sciences. Despite this, many researchers in the mentioned areas do not accept them as easily as a valid alternative to design their projects and/or they tend to consider them with a dismissive attitude and, therefore, justify - almost guiltily- their use. I believe that the basis on which these attitudes are based has to do with a certain level of ignorance, with what has been found in the literature that has been able to consult, as well as in the analyses performed on these designs. To discuss these issues is what interests us in this work.

A variety of designations and classifications that the authors of methodology texts (mostly experimental) have used for this concept can be found in the literature about the subject. Denominations range from those that contain qualifiers that can generate misconceptions to not trained reader (e.g. «a bad experiment» proposed by Shgaugnessy, Zechmeister & Zechmeister, 2007; or «faulty» experiments, proposed by Kerlinger & Lee, 2001), up to those denominations and definitions which denied its experimental value, and others who do not know it completely among the designs to investigate (Leon & Montero, 2002; McGuigan, 1983). It should be noted, however, that many authors do recognize its value in research applied to education, psychology and the social sciences such as, for example, Bernal (2010); Hernandez, Fernandez and Baptista (2010); McMillan and Schumacher (2010), and Van Dalen and Meyer (1971).

In 1963 Donald F. Campbell and Julian C. Stanley proposed quasi experimental designs for educational research and then in 1966 released Experimental and quasi-
experimental designs for research, text translated into various languages and reprinted until the present day, in 1973 the first edition was published in Spanish under the title Diseños experimentales y cuasiexperimentales en la investigación social and to date nine reprints have been done (Campbell & Stanley, 2005). In this work is the first reference to the analyzed construct and it is also what most authors use as a primary source.

The starting point on which the proposal of these authors is based is the finding of some problems given in the experimental research of the era and which generated unrest among the social scientists and researchers. These problems were:

a. The objects of study in the social sciences are more complex, of multiple relationships, and are not easy to subject them to control.

b. The first social researchers which applied these designs were more concerned with the use of statistical models in the data treatment that is collected, and neglected the quality of the results and the procedures to obtain them.

c. The first results of the experimental models’ application (hypothesis/statistics model/hypothesis testing/conclusions) did not have a good effect on the experimenters. They were disappointed to see that the results did not lead to the development of the theory as planned; they also didn’t serve to validate hypothesis in a stunning way (internal validity), nor to make generalizations. In short, the quality of the data was in discussion and this aspect had no resolution - at least at this time.

d. The use of uni-variable models, although it could be productive in disciplines in which the experimental designs originated, did not satisfy in the case of pedagogy and social sciences, so they were very limited and exposed to criticism.

e. Around the same time, as a result of the work carried out by Milgram about obedience, academic and professional organizations emphasized control over research ethics and the rights of the participants in research.

Currently, the rigor in the ethical review of research and its consequences is more comprehensive and generalized, that further justifies the use of these designs in the research in disciplines such as psychology, education, and other social sciences. Campbell and Stanley (2005) had a clear idea that great part of the concerned problems had no relationship with the experimental methodology properly speaking, nor with the treatment of the data itself, but with the control of the experimental situation and the data that is produced in these little controlled situations. For this reason, and taking into account the nature of the social disciplines, it was proposed the use of designs pre and quasi-experimental as alternative solutions, faced with the impossibility that in social sciences experiments to develop in situations of absolute control (which is only a saying) of the variables and the limited possibility of replicating studies in the same circumstances.

The interest of this article focuses on analyzing different definitions that of pre experimental designs that we have tracked (although the problem is actually much broader). Currently, in several texts of research methodology we find lots of information about these designs, but it so happens that many authors - even almost everyone parting from Campbell and Stanley as an original source - define and characterize the pre-experimental designs in different ways, and in some cases are contradicting themselves.

A little history and context in which the pre-experimental designs are born

In the text in which the analysis starts, Diseños experimentales y cuasiexperimentales en la investigación social (Campbell & Stanley, 2005), the authors refer to McCall who, in 1923, said that researchers were concentrated in the statistical management of data but not in the way it should be getting suitable data for such treatment. This attitude as a consequence resulted in «the transit of experimentation to the writing of essays» (Campbell & Stanley, 2005, p. 12) and to look for possibilities to develop the necessary knowledge for the time in the gestaltism or psychoanalysis.

The first experimental researchers let themselves be carried away by the belief that experimentation was a foolproof method and its application would allow the development of theories and the progress of the social
sciences, which did not correspond with the fruits of their studies, rather they gave rise to disenchantment.

Another aspect that Campbell and Stanley recognized as a problem to be resolved, had to do with the use of univariable models in the data analysis, that even though they demonstrated their usefulness in other applied fields before (physics, agronomy), they were not ideal for research in social sciences in which phenomena cannot be explained by the presence of a single variable, but several that converge at the same time.

Finally they present a list of some (eight) variables that threaten the internal validity of the research and three more that have to do with the external validity of the experiments, factors that are very difficult to handle particularly in the social sciences.

While statistics has made substantial progress in the use of models that solve most of the raised problems at the time, the limitations of the application of these designs to the study of reality remain the same or have been increased by the complexity of environments or for ethical reasons; It is quite difficult to control all the factors that threaten the internal and external validity of an experiment developed in the social sciences.

Campbell and Stanley argued that the experimental designs such as were applied to other solid and mature sciences (physics, chemistry, biological sciences and agricultural sciences), while they were the ideals of the experimental research, they were not completely applicable to the social disciplines like pedagogy, psychology, sociology, etc. Therefore they propose the pre-experimental and quasi-experimental designs as alternatives for use in the educational and social fields.

The different designations found and definitions of the pre experimental designs

Within the literature there are numerous denominations allocated to the pre-experimental designs; some of which we have been able to collect are the following:

- Designs of minimum control (Van Dalen & Meyer, 1971).
- Experimental approaches (Arnau, 1982).
- Intra-subject designs (McGuigan, 1983).
- Designs of unique case (Kazdin, 2001).
- Weak experimental designs (Kazdin, 2001).
- A bad experiment (Shgaugnessy, Zechmeister & Zechmeister, 2007).
- Defective designs (Kerlinger & Lee, 2001).
- Pre experimental or minimum control designs (Hernandez et al., 2010).
- Pilot experiments (Martin, 2005).

Obviously, these names have different meanings and connotations in the framework of the theory of methodology and research designs, a fact that complicates the understanding which may have on them and on the criteria to be used, especially among those researchers seeking information for specific reasons for their graduation thesis for undergraduate and graduate studies.

Some authors such as Shgaugnessy, Zechmeister and Zechmeister (2007), consider that a pre experiment is a «bad experiment». This denomination leads the reader to make judgments of value of the experimental pre designs. It could be said that according to this view a bad experiment could be the one that has no value, lacks utility, is inappropriate, is made or done wrong, etc. A «bad» experiment could be one who has too many errors, a study that fails because it was not well planned, in which lack of control leads to gathering unusable data for analysis, but these meanings have no relation with what defines a pre-experiment. It is true that the pre-experimental designs have many limitations and they threaten the internal and external validity but, as Pino (2006) sustains, if they are well used they can be very useful for applied research above all. Also, within this same trend Kerlinger and Lee (2001) call these designs as «defective» and «inadequate», in reason that they have a poor variable control, clarifying however that «it is not that the method lacks full value, but it scientifically lacks value» (Kerlinger & Lee, 2001, p. 423) alluding to the use given in the research in natural and applied situations.
With the precision made by Kerlinger and Lee (2001), we can understand that these designs have no scientific value because they do not guarantee the causality and from the data found theories cannot be built, but they have value in the applied research aimed at solving specific problems.

Wood (1984) considered that the pre-experimental designs are outside the field of experimentation; therefore, he argues that these are in fact «non-experimental». There are those who share the opinion of Wood, among them Martin (2005) which classifies pre-experimental known designs (a group with post test design and a group with pre- and post- test design) and the quasi-experimental as non-experimental, because none of them guarantees the internal and external validity of the findings. Referring to the pre-experiments as non-experimental designs leads to confusion insofar as the first is considered as part of a group of designs in which there is no manipulation of the experimental variable, and they are founded on the basis of survey and observation (the latter obviously not experimental as they are clearly indicated by Balluerka & Vergara, 2002; Hernandez et al., 2010; Van Dalen & Meyer, 1971), distant to all forms of experimentation.

Within this same group of authors it can be found those who considered the pre-experiments as equivalent to the designs ex post facto, an error which means that some authors like Carrasco (2006) and Hernandez et al. (2010) consider that the pre experiments do not manipulate the VI, which is contradictory with what they themselves manifest in their own text on the definition, nature, and the classification of the experiments. Kazdin (2001) says about the pre-experiments «even though the assessments may be imperfect [...] they offer advantages different than the anecdotal cases which often compete». See anecdotal cases, and from that it assumes possible and hypothetical causes, it is different to assume and to manipulate and watch something, even if there is nothing with which to contrast. The second assumes more control. This confusing way of conceptualize and classify the pre-experimental designs of static groups, the difference is in the active character of the VI in the pre-experiment, while in the ex post facto designs, the VI has already happened and it has no direct control over it.

Campbell and Stanley (2005) propose that experimental designs are composed of three large classes of experiments: pure or true experiments, quasi experiments and pre-experiments. If we take the classification proposed by them literally, we have a clear idea that the last two designs mentioned are not experimental «properly speaking», because they do not meet some of the features of the real experiment, but in both groups of experiments exists an important condition that defines whether an investigation is or isn’t experimental: direct control (manipulation) of the VI. Pino (2006) reiterates that the pre-experiments are a kind of experiments, what sets apart the three classes of experiments is the quality of the control that can be achieved; that which corresponds to the pre-experiments is a precarious control, at least; that leaves many doubts about the trust and value of the data.

Amau (1982) and Castro (1975), among others, consider that the pre-experimental designs are «approximations» to an experiment. Castro (1975, p. 33) States that «those situations of research approaching somehow true experimentation are considered in this work as pre-experimental». He then explains that the designation of these designs is due to that a formal comparison of the data can’t be produced, either from an analysis «between» or «intra-groups», but they are close to being «true» experiments. This way of defining the pre-experiments also leads to errors to the reader, since the «proximity» can be understood and is in fact understood incorrectly, that these designs are not experimental. What must be understood is an «approximation to a real experiment», an approach to a level of high demand in the control of the variables that affect the validity of the experimental data.

Another group of methodologists don’t distinguish pre-experiments from quasi-experiments. Among them we can consign Alarcon (2008), Cubo, Martin and Ramos (2011), Kazdin (2001), Leon and Montero (2002), Sommer and Sommer (2001), Zinser (1992), those who depart from the same main source (Campbell and Stanley) than the rest of the authors, but do not use the concept of pre-experimental
The pre-experimental designs are considered part of the quasi-experimental designs. Kazdin (2001) proposes that these designs can also be called «weak experimental designs». Maxim (2002) does not distinguish any classification and just uses the title of basic designs and among them considers from the simplest of the pre-experimental up to the most rigorous of true experiments.

There are also those who in our opinion are closer to the proposal of Campbell and Stanley and taking into consideration the level or the requirement of performed control classify the minimal pre-experimental control designs (Bernal, 2010; Hernandez et al., 2010; McMillan & Schumacher, 2011; Van Dalen & Meyer, 1971). These authors nest the designs by the force of the established control of the variables that affect the internal and external validity of the experiments: those who have very little or a «minimum» control are the pre-experiments; those who have a moderate control are the quasi-experiments and those who «totally» control the foreign variables, are the real experiments. Bernal, (2010, p. 146) says that the pre-experiments:

«Present the lowest control variables and don’t carry out random assignment of subjects to the experiment, and those are the ones in which the researcher has no control over the foreign or intervening variables, there is no random assignment of participating subjects in the research nor is there a control group».

Amau (1981), Leon and Montero (2002), McGuigan (1983) and other authors prefer to not use the classification proposed by Campbell and Stanley (2005) and, therefore, they also do not refer to the pre-experiments. To designate the designs which are based on comparisons of the data from the same group of subjects - as is the case of the pre-experimental designs - they use the design concepts of «intra-subject», denomination which is justified because they perform a statistical «intra-group» analysis. The same idea of intra-subject comparison is worked by other researchers who do not use statistics, or work with groups, aversely the comparison is done between data coming from the same subject, a comparison with himself. Castro (1975), Kazdin (2001), Leon and Montero (2002), among many others, call these «unique case» designs, since the analysis of the data is performed by comparing direct data from the same subject at different times of measurement (so called repeated measure designs, intra-subject, with the same subjects, etc.). The experimental analysis of behavior is based on the baseline strategy, which allows you to compare data at different times of experimentation, model that was popularized by the studies developed by B.F. Skinner, who «... has helped to sustain a totally different vision of the reasons of behavior and the way behavior should be studied as» (Salkind, 1999, p. 254). This group of authors even discusses the validation of these designs as real experiments and their value in determining causality.

Finally there are authors that limit the pre-experiments with the idea of pilot studies. Effectively, we can argue that one of the pre-experimental research modalities is the pilot study, which is a valuable tool in the real or pure experimental research development and serves as a previous study which develops with the idea of exploring a new or original idea which must become a hypothesis later. Martin (2008, p. 135) says:

«such experiment is a small-scale version of the experiment that has been planned and where it can solve almost all problems before starting. Since it does not have to make the results of this experiment public, it can break some rules of the experimentation ».

Also to test whether what it has been planned will work or not; i.e. whether or not the planned manipulation of the VI is empirically possible to do, or if the expected data (VD) is properly recruited by the used instrument, or if controlled foreign variables are those involved in the relationship VI – VD. As already stated, the pilot studies are a kind of pre-experimental research, both concepts are not synonymous, nor can be used alternatively.

Hernandez et al. (2010, p. 137) say:

«on certain occasions the pre-experimental designs serve as exploratory studies, but their results must be observed with caution ».

Why are the pre-experiments experiments?

The pre-experiments like the quasi-experiments, as we have seen, arise as one response to a first stage in which experimentation is applied to the social sciences and which does not meet the expectation that researchers had in the production of knowledge and theory in this field. In

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response to the disappointment initially produced, Campbell and Stanley (2005) proposed to consider the case of the social sciences other modalities of experimental work, in addition to the well known classic (pure experiments); they also propose the quasi-experimental designs and the pre-experiments. The pure or true experiments fulfills all the criteria of the traditionally understood experiments and serve precisely to develop knowledge, contrasting hypothesis and build theory, or contrast it with the reality; but the following two kinds of experiments are for other purposes: approach us to the theory and validate assumptions in the applied field.

As we have seen, many alternative denominations produced to these last two types of experiments and especially the pre-experiment, don’t take into account this situation and depart that the experimentation (all of it) is tied to the construction and validation of knowledge; This may explain why the pre-experiments have been called bad experiment, experimental approaches, or, not experimental. Those who have taken into account the considerations made by Campbell and Stanley (2005) about the nature of social science research and the need to adapt to this field of research, have used the denomination proposed by them (pre-experiment) or have proposed alternatives relating to the limitations on the control, then we find: minimum control experimental designs, or, weak experimental designs; They emphasize the weaknesses that they have in the control of foreign variables and lead to discuss the internal and external validity of data; for this reason it is that their application does not go to the construction of theory, but the field of knowledge application; but they do not deny its experimental character.

What distinguishes true experiments from other kinds of experiments?: the foreign variables and fundamental randomization control. The quasi-experiments and especially the pre-experiments do not develop good control of the foreign variables, so internal validity is at stake; nor are the selection of participants handled with random criteria, fact which compromises the external validity. But they share a criterion with real experiments that is fundamental and definitive to consider them as part of the experiments: they control or directly manipulate the VI, if this requirement did not exist, then definitely research would not be experimental. Some authors such as Castro (1975), Hernandez et al. (2010), Leon and Montero (2003), Montgomery (2003) among others consider that the most important and definitive criterion to classify a research as experimental or not is the manipulation of the VI. In this regard Hernandez et al. (2010, p. 121) refer that an experiment is:

«... a study in which one or more independent variables are manipulated intentionally (so-called background causes), to analyze the consequences of manipulation on one or more dependent variables (effects-consequence assumptions), within a situation of control to the researcher».

The pre-experiments, as we have argued all along this work, are a form of experiments, which have the following characteristics that limit them as causal designs, intended for the construction of the theory:

- Meet the minimum condition of an experiment: the manipulation of the VI;
- Apply only in situations in which it is impossible to manipulate more than one condition of the VI;
- Do not control the internal validity, so are not very useful in the scientific construction;
- The results are always debatable; and,
- Are useful in the applied field, emerges as a response to the problems of experimentation in education.

Usefulness of the pre-experiments

Buendia, Colas and Hernandez (1998, p. 94) tell us:

«This kind of designs are characterized by a low level of control and, therefore, low internal and external validity. The drawback of these designs is that the researcher cannot know with certainty, after carrying out its investigation, which of the effects on the dependent variable are exclusively due to the independent variable or treatment. However, such designs are the only ones applicable in certain types of educational research».

From the above and that which has been revised in much of this work, clear limitations remain that have the pre-experimental designs and that focus on the little confidence that should have the data obtained and the
limited validity thereof; so from them it is dangerous to say that a hypothesis is «true», also generalizing the results should be avoided; but the idea of this work is that as there are clear limitations, it should be also clear their importance within the applied research to the disciplines such as education and psychology primarily.

Medical researchers use it very often because they work with the own limitations that it is imposed upon them by the context in which they investigate: the hospital environments; in these, research participants are rarely chosen by chance nor are they representative of populations. In the field of education, I think that they are equally important and very useful, as many of the investigations carried out with experimentation methods, they have limitations with the selection of the participants, real experiments work with populations, from which participants have been selected in a haphazard manner; but the pre-experiments almost always have difficulties in the haphazard composition of the sample, with the composition and the equalization of the groups and in general with the foreign variables control. The teacher-researcher, educator or educational psychologist by these limitations have to resort to the pre- or quasi-experiments when they develop work with a single group of participants or when choosing two or more groups, it has no control over its formation. In the field of Psychology these designs are also useful in researching clinical environments, educational, labor organizations and other fields as sport psychology; in applied research in psychology we can find the same problems already pointed out before and add a very important factor of experimentation for all of them, the lack of repeatability of the data obtained.

The importance of these designs is increasing in the context in which ongoing experimental research in the areas of social sciences is developing and bearing in mind that the laws and rules of the ethics of research in each professional group tend to be more and more restrictive and rigorous in the defense of the rights of persons. It is the control that is exerted on the basic research with animals and humans, that many projects are non-viable and do not run or the researchers are exposed to disciplinary proceedings for ethical reasons or worse yet they could reach the judicial fields. The ethical considerations lead us to renounce the pure and rigorous experimentation and even the quasi-experiments and bet on the development of pre-experiments. The rights of research participants can condition and prevent the possibility of random selection of subjects and even them and can also prevent the formation of control groups to compare the results (an example: If we assume that an instructional program can benefit students and improve their reading comprehension, and that assumption is supported empirically and theoretically ¿How do we justify forming a control group that would not benefit only by methodological convenience?, ¿Is it ethic the decision to form a control group even with the consent of the participants of the same?, ¿Would it not be against the right of the participants in this group?). Regulations of the ethics of research - as already said - are increasingly demanding and ensure the right of people even at the expense of the theoretical construction. There are however some authors, like McGuigan (1983) that remind us that Ebbinghaus used these designs to build his theories on human memory. The alternative use of concepts as intra-subject designs or $N = 1$, is the result of this discussion. To this reference it should be added that most of the classical theories have been built with similar strategies, especially those linked to those of greater experimental tradition as is the case of learning.

The pre-experiments are also useful when researching in natural situations, in which it cannot be made an exhaustive control of the context variables, equally when characteristics of the subjects with whom you work can’t be controlled, as history, maturity, personality or other factors that are not possible to control through the techniques of equalization of groups or individuals.

**Final comments**

¿What is the origin of the confusion that exists in the issue that we raised?, I think that it is in the origin denomination that Campbell and Stanley gave prefixes (Pre- and quasi-) to describe experiments that did not meet all the conditions of an «real experiment» and those in which we have read literally such prefixes «pre» means a «before», «previous to», which has possibly led many to interpret it as equivalent to other descriptive designs, correlational, or ex post facto; but not experimental, that would explain why some authors like Hernandez et al. (2010) claim that «they do not manipulate the independent variable». Similar case
The quasi-experimental designs, «quasi» can be taken as an adverb as well as prefix, in Spanish «almost», it tells us that something resembles another, which is almost the same... alike, but that it is not completely, lacking something to be as such; it refers to something which is to be completed, but which has the value as such. As I reiterate, taken literally, these two terms more in the case of the «pre», is what has generated great conceptual confusion.

The discussion that has been carried out allows you to discover that among pre-experimental designs there are not only a large number of denominations and definitions, but also contradictions, one such contradiction that caught my attention is the one I found in an excellent text of research methodology, in it defines and characterizes experiments emphasizing the manipulation of the VI, then it classifies experiments in three groups: pre-experimental designs, quasi-experimental, and experimental designs real or pure; but when it concerns one of the pre-experimental designs and proposes its characteristics it argues that this does not manipulate the VI, which reiterating is the condition that cannot be missed on any kind of experiment. This is contradictory, A cannot be not-A at the same time. If the essential condition of an experiment is that it manipulates a VI, it is not possible to argue that in a pre experiment - previously classified as a form of experiment - is not manipulated the VI (Hernandez et al. 2010).

I believe that it is important to continue working on this issue and clarify the field and unify concepts and meanings, this will allow us to avoid the confusion now existing among researchers, teachers in the area of methodology in the social sciences and in particular between pre and postgraduate students. Above all it will allow pre-experimental designs give its exact value in field research such as psychology and pedagogy, working with humans and ethical limitations that govern research.

Once I attended the graduation of a master’s student of education in my capacity as jury, the senior presented an interesting investigation that reported the results he obtained with the use of a methodology of academic work developed in a classroom (a single group of students), the author far from recognizing that their work was an investigation clearly pre-experimental; He insisted in both the written version and more strongly in its exhibition, that it was an experiment and not a pre-experiment. As soon as he was asked to make the distinctions between both designs he reaffirmed the idea that the pre-experiments were not experiments and that its value was nil in the investigation.

On the other hand, the review that has been conducted, is limited to Hispanic literature, almost all texts have been translated from the English, and it may be that an important part of the «conceptual disorder» found is due to the effects of translations. It is known that when attempting to translate a concept that does not have a direct equivalent in the other language, translators tend to use terms that are considered close to which the translator considered that the author wants to express.

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