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Analysis Of The Paradigm Of The Principles Of Overcoming The Problems Of Productivity Of Researchers Conducting Research In The Field Of Physical Culture

Umarov Abdusamat Abdumalikovich

Kokand State Pedagogical Institute Department of Methods of Physical Culture, Ph.D., Professor e-mail: abdusamatumarov@gmail.com

Annotation. The results of the study in the field of Physical Culture are associated with the ratio to certain laws and estimates. Knowing the basic assumptions is essential to carry out, analyze and present high-quality research in this area. In this article, we will provide the information needed to understand the assumptions that lead to a quantitative research paradigm that includes hypothesis testing and sampling logic. In addition, we describe the main aspects of real and quasi-experimental research designs, which are widely used in quantitative research.

Keywords: dialectics, hypothesis, formal procedure, statistical hypotheses, research hypothesis, experimental research, correlational data.

Introduction

Research paradigms are undergirded by a set of assumptions (e.g., epistemology and ontology) that influence researchers' decisions and actions. Assumptions can be defined as a set of beliefs that guide the way in which researchers approach their investigations described assumptions as being "related to the views they [researchers] hold concerning the nature of reality, the relationship of the research to that which he or she is studying, the role of values in a study, and the process of research itself". Assumptions then guide the research endeavor, including the methods used and the questions asked. Emerging professionals such as upper level undergraduate and graduate students interested in research pertaining to physical education for individuals with and without disabilities should understand the basic assumptions of the quantitative paradigm for conducting, analyzing, and presenting research of high quality. This paper will serve as a convenient resource that can be distributed to emerging professionals to provide introductory research content. It is a userfriendly guide to unlock the mystery of many research methods textbooks and courses. Therefore, there were two purposes of this paper. The first purpose was to provide readers with information essential to understanding the assumptions undergirding the quantitative research paradigm including the logic of hypothesis testing and sampling. The second purpose was to describe key aspects of true and quasi-experimental research designs.

Basic assumptions

The basic assumptions for each research paradigm are related to the philosophy under which the paradigm is situated. The quantitative research paradigm is based on the philosophy of positivism. Positivism is supported by an external realist ontology, in which it is assumed that a hard reality exists. The philosophy of positivism has influenced the quantitative research paradigm by providing several assumptions that guide researchers' actions. There are eight main assumptions of quantitative research in Science (see Table 1). Researchers need to take into account each assumption when designing research using a quantitative paradigm.

Table 1 Major Assumptions of Quantitative Research

1	A hard reality exists, and it is the task of science to discover the na- ture of reality and how it works.
2	Research investigations can result in accurate statements about the way the world really is.
3	Researchers may remove themselves from what is being researched.
4	Facts are independent of the knower (the person with the knowledge) and can be known in an unbiased way.
5	Facts and values are distinct from one another.
6	Proper research designs can lead to accurate conclusions about the nature of the world.
7	The purpose of research is to explain and predict relationships.
8	The goal of research is to develop laws that make prediction possible.

In basic terms, a positivist's view of the role of science is to dis- cover the nature of this reality and determine how it works. Furthermore, a positivist epistemology claims to be free of value and not influenced by social context. Positivists believe their understanding of knowledge can be generalized to other individuals across different environments and time. Positivism states the world is deterministic, meaning all events that occur in the world are a result of a cause-and-effect relationship. An essential aspect of this paradigm is the logic of hypothesis testing.

The Logic of Hypothesis Testing

Hypothesis testing is the formal procedure used by researchers utilizing the group design research paradigm to accept or reject statistical hypotheses. Hypothesis testing is based on the mathematic concept of probability, which represents the likelihood of an event occurring. A research hypothesis is the predicted outcome or the expected results from a study. This anticipated result may be derived from previous literature, a theoretical framework, or a researcher's previous experiences. The formulation of a research hypothesis is critical to the beginning of the research process, as every aspect of a study is affected by the hypothesis including the participants selected, design of the study, and data analysis strategy. In contrast to the research hypothesis, the null hypothesis states there was no change in the participants' behavior after the researcher introduced the intervention. In null hypothesis testing, the researcher uses deductive reasoning to ensure the truth of conclusions is irrefutable. A critical feature of a research hypothesis and null hypothesis is they must be testable, pro- viding a way the claim can be either supported or refuted.

To further illustrate the difference between the study and zero hypotheses, consider a study by scientists that sought to determine the effect of a post-school program based on social cognitive theory on the participation of adolescents with impaired vision in their physical activity in free time. For this study, a research hypothesis may state the expected results of the study would be that adolescents with visual impairments exhibit more leisure-time physical activity participation when introduced to a social cognitive theory-based after-school program. On the contrary, the null hypothesis would indicate adolescents with visual impairments do not exhibit a change in leisure-time physical activity participation when introduced to a social cognitive theory–based after-school program.

Several misconceptions exist about hypothesis testing. One common misconception about hypothesis testing is that researchers seek to determine whether a research hypothesis is accurate. Statistics cannot prove a research hypothesis is correct. Rather, researchers seek to determine whether the hypothesis is supported by data. Another common misconception is that researchers test their research hypothesis. Instead, it is always the null hypothesis that is tested. All that statistics do is inform the researcher to either reject or fail to reject the null hypothesis.

After the research and null hypotheses are stated, the researcher will then test the null hypothesis to assess the probability of the sample result if the null hypothesis were true. In other words, the researcher looks to determine the probability of whether the data obtained through the study could exist if the null hypothesis were true. To do so, researchers decide what statistics are relevant for the particular data set and specific hypothesis. Using the statistical procedure(s) chosen, researchers analyze the data to determine the probability of obtaining the sample results if the null hypothesis were true. The last step in hypothesis testing is to either accept or reject the null hypothesis. Researchers base this decision on the level of significance of the result. If the probability of obtaining the sample results with the null hypothesis being true is small, the null hypothesis is rejected. If the probability of obtaining the sample results with the null hypothesis being true is large, the research hypothesis is not supported. But what is a large or small probability?

Simple Random Sampling

Simple random sampling is a random sampling procedure in which each individual in the population has an equal chance of being included in the sample. Suggested simple random sampling may be the best method to obtain a representative sample of the population, especially for large samples. In this strategy, a table of random numbers is used to ensure every member has an equal and independent chance to be included. A table of random numbers can be a large list of numbers with no predetermined order or pattern. The table can be used in several ways to select participants. Suggested creating a series of random six digit numbers. From there, they would use the first few digits from each number to decide on the identified individuals within a population for the sample. For example, a researcher needs to choose 50 participants from a population of 500. The researcher would assign numbers to each participant (i.e., 1 to 500) and then go through the table of random numbers and use the first three digits of each number to choose the participants. If a number was 324053, participant 324 would be included in the study. If numbers were too high (i.e., 650), the re- searcher would skip to the next number.

Once again, the purpose of simple random sampling is to select a random sample that represents the larger population. This strategy has a few disadvantages. First, it is not an easy sampling strategy to use because each member of the population must be identified. In large populations (e.g., inhabitants of states), this is not possible. Second, although school-based research is essential to physical education research, randomly selecting participants in schools is typically problematic. It is not likely school administrators will allow researchers to break apart classes in the name of scientific inquiry. Third, simple random sampling should not be used if researchers wish to be sure that certain demographic groups are included in the sample in the same proportion as they are in the population. This can be an issue with small sample sizes. For this objective, researchers should use stratified random sampling or purposive sampling.

Stratified Random

Stratified random sampling is a sampling procedure in which the population is divided based on a chosen characteristic prior to sampling. Participants who are included in a specified demography, or strata, are selected in the same proportion as they exist in the population, or the desired proportion for a study. The following steps would be used in stratified random sampling. First, the researcher identifies the target population. Second, the researcher determines what characteristic he or she wants to stratify the sample based on and determine what percentage of that characteristic is present in the population. Next, the researcher creates a table of random numbers, which will include strata of each de- sired characteristic. Finally, the researcher uses the table of random numbers to select the sample, being sure to include a predetermined percentage of participants from each of the desired strata.

Layered random sampling can be particularly useful in research studies, as researchers usually want to find a large representative sample. For example, in an online survey, scientists conducted a differentiated national random sample of 3,000 public schools across six geographic regions (two states were randomly selected in each region) of 233 general physical education teachers across 12 general physical education teachers in the United States.

The layers were states across the regions. Advantages of stratified random sampling are it increases the likelihood of obtaining a representative sample and almost ensures important attributes of individuals are included in the same proportion as they naturally exist. Perhaps the biggest disadvantage of stratified random sampling is the amount of effort it takes the researcher to perform stratified random sampling correctly.

Systematic selection

Systematic sampling is categorized as a nonrandom sampling method because all members of the population do not have an equal chance to be selected. This method can be used when the population from which the researcher is sampling is too large and assigning a numeric identification number would be too time consuming. Using systematic sampling methods, the researcher would select every nth (e.g., 12th, 7th, 122nd) individual in a list of potential participants. A method that is typically paired with systematic sampling is using a random start. A random start includes randomly selecting a starting point in the first few participants and then selecting every nth participant from there.

Several other terms are associated with systematic sampling. First, a sampling interval is the distance in a list between each of the participants selected for the sample. If a researcher chooses a participant every 10th person, the sampling interval would be 10. Second, a sampling ratio is the proportion of the population that is included in the sample. If the population is 1,000 individuals and the researcher chooses 100 participants (one out of every 10th person), the ratio would be 10.

A benefit of systematic sampling is the selection process is simple. However, it is important for the researcher to inspect the list of potential participants carefully prior to sampling using a systematic sampling technique. If researchers are in an educational setting, it may not be uncommon to receive lists in order of grade point average (GPA), homeroom, or seat order in classes. Researchers should inspect the list for any pattern that could accidentally coincide with the sampling interval. This type of bias is called periodicity.

Experimental Research Designs

The objective of experimental research is to establish cause-and- effect relationships. To do so, the researcher manipulates the independent variable to judge its effect on the de- pendent variable. This action allows experimental researchers to go beyond descriptive and correlational information and determine what causes the phenomenon to occur. To establish a cause and effect relationship (a) the cause must precede the effect in time, (b) the cause and effect must be correlated with each other, and (c) the relationship between cause and effect cannot be explained by another variable. Another characteristic of experimental designs is they typically involve at least two groups of participants. One group acts as the experimental group, who receives the intervention, and the other group acts as the comparison group (may receive an alternative intervention) or as the control group, who does not receive the intervention.

In experimental research, one of the most important concepts is the control, or elimination or minimization, of threats to the validity of the results. Threats to validity can effect both internal validity (i.e., the degree to which observed differences on the dependent variable can be attributed directly to the independent variable) and external validity (i.e., the degree to which results are generalizable). To gain high internal validity, the researchers must control for all variables to eliminate other explanations for change. When the researcher does this, though, the study will lose degrees of external validity because of the lack of ecological resemblance. Common threats to internal validity include (a) history, (b) maturation of participants, (c) testing effects, (d) instrumentation, (e) statistical regression, (f) selection bias, (g) experimental mortality, (h) selection-maturation interaction, and (i) expectancy. One way to control for threats to internal validity is through randomization, which is discussed briefly in the next section on true experimental research. Placebos, blind, and double-blind studies are also strategies useful in controlling for threats to internal validity, but are not commonly used in physical education research. Some threats to internal validity, such as experimental mortality, are un- controllable.

As with internal validity, external validity has several threats that can affect the ability for researchers to generalize results to other participants or settings. External validity threats include (a) reactive or interactive effects of testing, (b) interaction of selection bias and the experimental treatment, (c) reactive effects of experimental arrangements, and (d) multiple treatment interference (Thomas et al., 2005). External validity is typically controlled by selecting a sample of participants who provide an equitable representation of the larger population.

The way in which researchers choose to control variables and which variables they value in controlling affect the research designs they use. In experimental research, two broad categories are true experimental designs and quasi-experimental designs. In the following sections, we describe essential components of true experimental and quasi-experimental research designs.

True Experimental Research

Research designs are typically considered to be true experimental whenever they include randomly formed experimental and comparison or control groups, which allow the researcher to assume they were equivalent at the outset of the study. Key aspects of random assignment include (a) it must occur prior to the experiment; (b) it must be a process of assigning individuals to groups, not an outcome of distribution; and (c) the groups that are formed are different only from chance. The power of random assignment is that it controls for extraneous variables of which the researcher is or is not aware. Random assignment controls for threats to validity including history, maturation, testing, statistical regression, selection bias, and selection–maturation interaction (Thomas et al., 2005).

Although true experimental research may be viewed as the most powerful style of group design research, it is not common in physical education research settings. One reason for this is researchers cannot randomize participants in an applied setting. In addition, the chance of providing a harmful treatment, or withholding a powerful treatment, causes ethical concerns in school-based settings. A third reason, pertaining more specifically to the education of individuals with disabilities, is the difficulty in acquiring a large enough sample of homogeneous participants with a specific diagnosis to conduct a study. These reasons lean more support for the use of quasi-experimental research (or single-subject designs) to evaluate treatments for students in schools.

Quasi-Experimental Research

The prefix quasi means" similarity to what is given." Based on this definition, quasi-experimental research is similar to actual experimental research. According to the theory of science, not all Group design studies clearly fit into the category of real experimental design. In quasi-experimental designs, the design of a study is fit into the set- tings more likely to resemble real-world applications and as many threats to validity as possible are still being controlled.

Because most real-world applications (e.g., physical education classes, schools in general) do not allow researchers to assign participants to groups randomly, randomization is usually the aspect of true experimental designs that is lost in quasi-experimental designs. When random assignment is not possible, researchers must rely on other techniques for controlling threats to validity. One such quasi-experimental design is the nonequivalent control group design. This design is similar to the experimental pretest–posttest design. However, rather than randomly assigning individuals to groups, researchers assign intact groups to different treatments. When assigning intact groups to different treatments, researchers should remember the appropriate unit of analysis is almost always the group, rather than the individual participants. Therefore, a larger number of groups may be needed to obtain sufficient power while analyzing data. Other examples of quasi-experimental designs include counterbalanced, ex post facto, time series, and matching-only designs. The researcher may never control for internal validity as well in quasi-experimental designs as in true experimental designs, but quasi-experimental designs allow researchers to conduct investigations when true experimental designs are not feasible.

However, because the control and treatment groups may be different in unknowable ways, several alternative hypotheses may be stated to explain observed results in addition to experimental manipulation.

Summary and Implications

To conduct, analyze, and present research of high quality in the quantitative paradigm, researchers must have an understanding of basic assumptions. Therefore, it is essential for emerging professionals who have an interest in research pertaining to physical education for individuals with and without disabilities to be able to access this knowledge. In this tutorial, we have provided readers with basic information for understanding the quantitative research paradigm. This information has included the logic of hypothesis testing and sampling and key aspects of true and quasi-experimental research designs commonly used in quantitative studies. In addition, we have provided relevant examples of the use of these components from the physical education and adapted physical education literature. This tutorial should help readers better understand basic concepts and principles of quantitative research methodology for the conduct of school-based research in physical education.