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A Study of Research Method

Sawako Kato*

Abstract

In this working paper, the types of research design and the skills necessary in developing and organizing research studies in institutional settings are examined referring to the book, *Applying Educational Research*. In Section I, a quantitative research report, which follows a standard outline and is organized similarly, and the role of statistics in educational research are discussed. In Section II, the advantages and disadvantages of qualitative and quantitative research are examined. In Section III, evaluation and action research methods are studied and circumstances when each of these research methods would be useful and appropriate in educational research are discussed.

Key Words：qualitative research, quantitative research

和文要旨

小論では，Walter R. Borg, Joyce P. Gall and Meredith D. Gall 共著の *Applying Educational Research—A Practical Guide* を参考にし，教育研究調査を進める上での様々なリサーチ・メソッドを研究した。［Ⅰ］では，標準的な構成法に従った量的研究と教育研究における統計の役割について［II］では，量的研究と質的研究のメリットとディメリットを考察，議論した。［III］では，エバルエーション・リサーチ，アクション・リサーチを考察し，それぞれのリサーチ法が教育研究において有

リサーチ・メソッドの一考察

＊加藤　佐和子

Correspondence Address：Faculty of Business Administration, Bunkyo Gakuin University, 1196 Kamekubo, Oimachi, Iruma-Gun, Saitama 356-8533, Japan.

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益かつ適切な環境を検討した。

[I]

A quantitative research report

Quantitative research is an approach to scientific inquire in Education whose characteristics are "epistemological beliefs in an objective reality, the analysis of reality into measurable variable, the study of samples that represent a defined population, and a reliance on statistical methods to analyze data" (J.P. Gall, M.D. Gall & W.R. Borg : 1999: 120). Generally quantitative research reports are impersonal and objective. Most reports of quantitative research studies are organized similarly following the style guidelines in the *Publication Manual of the American Psychological Association* : it consists of five sections, Abstract, Introduction, Methods, Results, and Discussion.

In this section, the organization of the quantitative research report is examined and several points we should note in the research report are discussed referring to its technical features.

The organization of the quantitative research report

Abstract Section : An idea of the purpose of the study, the method of inquiry that was used, and the major findings should be given in this section. Abstract is to be a brief summary which makes the readers understand the contents of the report.

Introductory Section : In this section, the purpose and the process of the study should be described. Especially, how variables are defined and measured should be explained clearly. Variables, quantitative expression of a construct, are generally measured in terms of scores on a measure such as an achievement test or attitude scale.

Methods Section : The research design that was used to obtain the data needed to test the research hypotheses, answer the research questions, or achieve the research objectives should be described in this section referring to sampling procedures and types of measure.

Results Section : This section introduces the results of the statistical analyses of the data conducted by the research.

Discussion Section : The final section presents the meaning and implications of the results with a personal perspective.

Technical features and the points to note

In the quantitative research report, formulating hypotheses, questions or objectives is one of the first steps to take in its planning. Hypotheses usually are formulated on the basis of theory and previous research findings. A research hypothesis makes a specific prediction before data are collected. Before collecting data, we have to predict a result of the research. After formulating a hypothesis, researchers collect data to test it and then examine the data to decide if it's valid or not.

At the same time, the variable, which means a structure or process that is inferred from observed phenomena, should be clearly planned and determined. Variables usually are measured in terms of scores on a measure, such as an achievement test or attitude scale. Variables also can take the form of categories. As researchers are limited to studying a sample of individuals who represent that population, we have to select the one from various sampling procedures to make their findings be generalized. The most common techniques are simple random sampling and stratified random sampling. Simple random sampling is most feasible in sure research.

Usually educational research is conducted with nonrandom samples comprised of volunteers. To establish population validity, the researchers must show how the sample, the accessible population or the target population is similar on variables that are relevant to their research problem.

We have to select the types of measure among Paper-and-Pencil Tests and Scales, Questionnaires, Interviews, or Direct Observation to accord with the purpose of the research.

It is difficult to develop a measure that is perfectly reliable, meaning that it is completely free of error, because a variety of factors can create error. We need to check how reliable a measure is before we reach conclusions about findings based on its use.

We can sometimes determine the reliability or validity of their measure by using evidence from other studies. After showing the reliability of the measure, we have to present the result of the statistical analysis of the data. In the discussion section, the impersonal and objective result should be shown and then the personal perspective should be given.

The role of statistics in educational research

〈The purpose of statistics〉

Statistics are used to summarize data that can be expressed in numerical form in the purpose of generating it. Various statistical analyses can be used in educational research.

We need to determine an appropriate statistic for a research study.

First, you should start by determining what type of score was used in each analysis. Three types of scores are computed in educational research studies: **continuous scores, gain scores,** and **categorical scores.**

Continuous Scores

Continuous scores are "values of a measure that has an indefinite number of ordered points" (J.P. Gall, M.D. Gall & W.R.Borg : 1999 : 146). Most achievement and aptitude tests, attitude scales, and personality measures yield scores of this type. One type of continuous score is the raw score, which simply the total score is obtained by following the test developers' scoring procedures. Researchers often report derived scores in addition to raw scores. Derived scores provide a quantitative comparison of each individual's performance relative to a comparison group. There are five types of derived scores : Age Equivalents, Grade Equivalents, Percentile Scores, Standard Scores and Rank Scores.

Gain Scores

A Gain score is "simply the difference in an individual's score on the measure from one time to the next" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 : 148).

Categorical Scores

"Categories are variables that yield values that are discrete and nonordered when measured" (J.P. Gall, M.D. Gall & W.R.Borg: 1999: 148). So they must be analyzed by different statistical techniques than continuous or rank scores.

〈An overview of the various types of statistics and the purpose of each statistical procedure〉

Descriptive Statistics

"Descriptive statistics serve a useful purpose by summarizing all the data in the form of a few simple numerical expressions, called *statistic*. A statistic is a number that describes the characteristic of a sample's scores on a measure" (J.P. Gall, M.D. Gall & W.R. Borg: 1999 : 149).

Inferential Statistics

Inferential statistics assist in the process of making inferences. "Inferential statistics enable researchers to make inferences about a population based on the descriptive statistics that are calculated on data from a sample that represents this population" (J.P. Gall, M.D. Gall & W.R.Borg : 1999 : 156).

The t Test

"The *t* Test is used to determine whether an observed difference between the mean

scores of two groups on a measure is likely to have occurred by chance or whether it reflects a true difference in the mean scores of the populations represented by the two groups" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 : 160).

Analysis of Variance

As the *t* test can compare only two means at a time, another test of statistical significance, analysis of variance, must be used. The Analysis of Variance test "determines the likelihood that the differences between the three mean scores occurred by chance, in other words, that they are chance values generated by drawing repeated samples from three populations having identical scores" (J.P. Gall, M.D. Gall & W.R.Borg : 1999 : 161).

Analysis of Covariance

As gain scores have several limitations, and so they are rarely used to analyze, an analysis of covariance is applied on the pretest in order to make the groups equivalent.

The Chi-Square Test

The chi-square test is the appropriate test in inferential statistics.

Parametric versus Nonparametric Tests

"These tests make several assumptions about the measures being used and the populations that are represented by the research samples. These assumptions are that there are equal intervals between the scores on the measure, that the scores are normally distributed about the mean score, and that the scores of the different comparison groups have equal variance" (J.P. Gall, M.D. Gall & W.R.Borg : 1999 : 167).

Discussion

When we use statistics to summarize numerical data in a research study, it is important to learn how to use statistics in our research. In determining the type of statistic, we should explore relationships among variables, and check the validity of inferences based on data from a sample of a large population. Statistical significance should not be confused with practical significance. We have to judge if the result probably occurred by chance or not. If not, one can generalize from the sample of the population that it represents.

Also, we should notice that the calculation of inferential statistics is affected by the sample size. We should take into account the affection of the sample size. After all, the practical significance of statistical results is a matter of judgment.

The condition which causal-comparative research is most appropriate

In casual-comparative research, a variable that is hypothesized to cause an observed difference is called an independent variable. The variable in which the difference is

observed is called the dependent variable. In reviewing casual-comparative studies, we should examine whether there is any evidence that the two groups are similar except for the independent variable on which they are being compared. We would have to select groups with similar aptitude.

The casual-comparative research design permits study of the effects of variables that are difficult to manipulate experimentally with human research participants. Casual-comparative studies determine relationships by examining whether groups that differ in specific characteristics also differ on other characteristics.

Casual-comparative research is generally used, mainly in the behavioral sciences. In education, because it is impossible or impracticable to manipulate such variables as aptitude, intelligence, personality traits, cultural deprivation, teacher competence, and some variables that might present an unacceptable threat to human beings, this method is used. However, there are some limitations : 1. The independent variable cannot be manipulated. 2. Subjects cannot be randomly, or otherwise, assigned to treatment groups. 3. Causes are often multiple and complex rather than single and simple.

[II]

Qualitative Research in Education

The advantages and disadvantages of qualitative and quantitative research

<Qualitative research>

Much of qualitative research currently being conducted is based on an interpretative epistemology. The researchers use methods such as participant observation or case studies.

The advantages:

We adopt these research methods when we want to describe, explain, or evaluate particular social phenomena. As the research reflects the nature of reality, we can deepen our understanding of educational practice. Also, we can develop more understanding of a complex phenomenon because we can view the phenomenon from the viewpoint of both the researcher and the participant. In collecting data about same phenomenon such as observation, interview, document and media analysis, we can understand the phenomenon from various aspects. Comparing to the quantitative research, we might get information beyond what we expected from its result. We can get more than the figure or data.

The disadvantages:

There is some unsteadiness about qualitative research. First is the unsteadiness of sampling. We have to select the individuals who have special knowledge or information for the research. How far the participant can respect the researchers' purposes is also unstable. All these procedures depend on the researcher's point of view and findings influenced by participants' attitudes toward the research. As a result, findings tend to be influenced by the condition of the research. Second, there is another problem for the researcher when we analyze it. As the analysis is also very subjective, we have to put clear criteria for findings. Putting clear criteria also depends on each researcher's point of view. Thus, qualitative research relies to a great degree on the researcher's attitude or idea which may cause unsteadiness in the research. It can be said that being subjective in the research produces some unsteadiness in the findings. To make it objective, we have to use the statistical methods of quantitative research to some extent. Third, qualitative research is time consuming. Qualitative research will take more time than quantitative research.

〈Quantitative research〉

Quantitative research is based upon positivism by nature. The researchers use the methods allowing for the measurement of variables within a collection of individuals or groups and ensuing in numerical data by statistical analysis.

The advantages:

Quantitative research is much more impersonal and objective than qualitative research because it uses variables which can be measured. Aside from the discussion as to whether the findings are true or not, the findings resulting in numerical data subject to statistical analysis are objective and have considerable persuasive power.

The disadvantages:

Even though quantitative research is objective, it becomes subjective in the process of determining the variables or the ways of sampling. If we wrongly select the population, the findings will not be valid for generalization. Unless researchers carefully and ingeniously consider how each of the variables is defined and measured, the research report will not be applicable. Another point is the problem of analyzing the research. We should not be deceived by figures or numbers of the research result : We tend to believe the figures of the statistics because they are concrete. We should realize that a completely reliable measure does not exist because a variety of factors can cause error.

‹Discussion›

In both research methods, qualitative and quantitative, which are different approaches to scientific analysis in education, what we should take in is that the rsearch results they produce are not completely truthful because one analysis or observation does not apply to all cases. But it is a fact that piling the facts would be gradually near to a truth. Therefore the best method for getting the data which is useful in educational practice is to use the good points from both qualitative and quantitative research.

Ethnographic, Critical-theory research, and Historical research

‹Ethnographic research›

Ethnography "can be defined as the attempt to describe culture or aspects of culture" (J. P. Gall., M.D. Gall & W.R.Borg : 1999 : 329). It focuses on a particular human society or the process of making such a study. This research helps us understand the hidden meanings in patterns of language, behavior and arrangement of physical space that are characteristic of different groups or types of people.

We can get a means to explore cultural factors which deeply affect teaching and learning in various ways. On the other hand, when we read ethnographic research reports, we have to be critical. We need to be skeptical of their credibility, trustworthiness, or applicability. This method is appropriate in the present situation of English teaching. Now in Japan more foreign students come to study in Japan and more foreign teachers are teaching here than ever. We may sometimes have cultural conflict between them and us. It is useful to know other cultures not only for us but for foreign students and teachers.

‹Critical-theory research›

"Critical theory represents a broad school of thought that involves uncovering the nature of power relationship in a culture, and that also seeks through its inquiries to help emancipate members of the culture from the many forms of oppression that operate within it" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 : 361). Critical theory puts stress on the value of theory in explaining society and in contributing to the emancipation of its participants. When we are interested in the directions in which education is moving, or question its capacity to foster the learning of all students, the ideas and findings of critical theory can be very helpful. For instance, when we teach students, we can't motivate them unless we know the nature of the students, what they think, how they were brought up or on what they value. To be educationally fruitful, it should be interactive and in that case we should know the students. Critical-theory research will be helpful for us to know our students.

〈Historical research〉

"Historical research is the process of systematically searching for data to answer questions about a past phenomenon, in order to better understand the phenomenon and its likely causes and consequences" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 : 391).

The roles of history in education are as follows:

1. It could be a subject in the curriculum : By knowing the history of their country and the world, children will be well-informed, contributing citizens as adults.
2. It provides a foundation for the theoretical and knowledge base of educators. Educational researchers must reflect on past findings and methods of investigation in order to get a profitable idea about what to study and to decide whether new methods of investigation need to be developed.
3. It becomes a tool in planning the future: When we learn the history of educational phenomena, it can help us to imagine what the future of those phenomena will be.

Historical sources are very important in the point that they are authentic and contain accurate information. Adopting historical research provides a unique perspective of the current state of educational beliefs, values, and practices by identifying their roots in the past. We can develop a new educational method supported by the fact in the past, which will lead to the actual practice. For instance, when we make a new curriculum or new school system, we can see the advantages and disadvantages from the past.

[III]

Applications of Research Methodology

〈Evaluation method〉

Educational evaluation is "the process of making judgment about the merit, value, or worth of any component of education" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 : 433). A good evaluation study is important because it helps educators and policy makers consider a wider range of factors that are appropriate to make major decisions. According to Walter R. Borg, Joyce P. Gall and Meredith D. Gall, there are three types of evaluation research studies—needs assessment, cost-benefit analysis, and educational research and development.

Needs Assessment

Needs assessment is "a set of procedures for identifying and prioritizing needs related to societal, organizational and human performance" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 :

439). It can involve perceptions of needs or observations of actual performance. When needs are carefully analyzed, proposed solutions are more likely to address the real needs of program participants.

Cost-Benefit Analysis

Cost-benefit analysis means "an attempt to maximize the difference between the benefits (B) and costs (C) of a program (that is, B minus C)" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 : 440). It is used to determine whether educational programs in operation would produce benefits that justify their costs.

Educational Research and Development

Evaluation is "central to the educational research and development process, which is a systematic process involving the development and refinement of educational programs and materials" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 : 441).

Quantitative and qualitative approaches to evaluation research

Quantitative Approaches

"Quantitative approaches to evaluation usually focus on the extent to which an educational program or method helps students achieve the intended learning objectives associated with it" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 : 443).

Qualitative Approaches

"Qualitative approaches to evaluation are based on the assumption that judgments of worth depend heavily on the values and perspective of the individuals doing the judging" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 : 444).

Discussion

There are some circumstances when evaluation methods would be useful and appropriate in educational research. For example, many educators have to select instructional program methods and materials and decide how to allocate limited funds. If they have new evaluation information, they can clarify many factors that bear on such decision. Or, when a teacher has an evaluation of the course by the students, it will help him/her to improve the instruction or teaching material using the result of evaluation for the next term.

<Action Research Method>

Action research "enables teachers, administrators, school counselors, and other education practitioners to investigate and improve their performance in systematic, personally

meaningful ways" (J.P. Gall, M.D. Gall & W.R. Borg : 1999: 467).

Action research is a type of systematic investigation conducted by using scientific techniques. It would require considerable training to master any of the types of research.

According to W.R. Borg, J.P. Gall and M.D. Gall, action research has at least five advantages for educational professionals:

First, action research "contributes to the theory and knowledge base needed for enhancing practice." Second, it "supports the professional development of practioners by helping them become more competent in understanding and applying research findings, and in carrying out research themselves when appropriate." Third, it "can build a collegial networking system." Fourth, it "helps practitioners identify problems and seek solutions in a systematic fashion." Fifth, it "has the advantage that it can be used at all levels and in all areas of education. It can be carried out in specific class rooms or departments, throughout an educational institution, or at the regional or national level" (J.P. Gall, M.D. Gall & W.R. Borg : 1999 : 469).

Discussion

There are some circumstances when action research would be successful and appropriate in educational research. Action research would be appropriate when we have read the research literature and couldn't get a certain solution to a problem that occurred in our work, and we want to put the solution into practice. When we use action research, we can collect our own evidence of the solution's effectiveness. Or when we have not found a satisfactory solution to the problem in the research literature, we might develop a tentative solution and test it by conducting an action research project.

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