



THE APPLICATION OF QUANTITATIVE AND QUALITATIVE RESEARCH IN COMPUTER ENGLISH TEACHING

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ABSTRACT

With reference to the situation of computer teaching research in China and New Zealand and some teaching theories, this paper explores the criteria of teaching research quality from the viewpoint of quantitative and qualitative form, with many detailed examples as well as sufficient supporting theories in an effort to emphasize the importance of the combination of the two methods in a scientific way to facilitate the promotion of the more efficient and interest-stimulating teaching in the schools concerned.

Keywords: *Computer Teaching Research, Quantitative, Qualitative, Combination, Application*

1. INTRODUCTION

With the first decade elapsing in the 21st century and the ever-increasing development and use of computer-aided technology and methodology, there has been an ever-lasting interest in and call for an appropriate criterion concerning the quality of the teaching research, which involves what constitutes the quality of research and what efforts need to be made for that orientation. Researchers who have the use of quantitative methods generally agree on the criteria as regards the quality of quantitative research (Bryman & Cramer, 1990 ; Fraenkel & Wallen, 2000; Kerlins, 2002), but those with the use of qualitative methods resort to a variety of criteria depending on research paradigm (e.g. Maxwell, 1992; Guba and Lincoln, 1989). Some think that the quantitative criteria can be transformed well into qualitative research (Gilbert, 1993; Safrit & Wood, 1995; Thomas & Nelson 1996;), while others disagree, for example, LeCompte and Preissle (1993) suggest that the criteria of reliability for quantitative research may be simply unworkable for the qualitative research, which requires some sort of control and manipulation of phenomena in unnatural circumstances (Cohen, Manion, & Morrison, 2000). Although literature on criteria for either form of research has continued to grow, few studies have so far explored the possible universal criteria for both of them, in spite of how important they have always been for researchers as well as those with an interest. This study focuses on the issue of combining criteria in both forms to create a

common criterion, with the previous study summarized to its advantage. Then a deeper discussion is made into the universal criteria involving the quality of research in terms of the criteria relevant to what has been achieved in the previous study. Finally some conclusions regarding this research are to be reached with the presentation of the scientific theories and confirmed examples, with some directions for the future research briefly dealt with for the readers to have a deep insight of it.

2. A SUMMARIZATION OF THE PREVIOUS STUDY

The method of group-work at university is very important for the future success of students who will be definitely confronted with the challenges of working in a global society where organizations are increasingly creating more cooperative environments. This trend, together with the relative lack of studies on group-work in tertiary level, creates a need for more research in this area. In order to increase our understanding of group-work, we find it necessary to offer some information about the situation of group-work with a view to acquainting teachers with a better use of the method of group-work to lay a solid foundation for future pedagogical practice.

The following questions will be answered in the first place: (1) What are the main advantages and disadvantages of group-work in the eyes of the tertiary teachers and students in China and New Zealand ? (2) How can they improve the efficiency



with the application of group-work? Based on this, we have designed a semi-structured interview for them, with an involvement of outlining a set of issues. Two major reasons are involved in the use of this semi-structured interview: (1) A guide is an efficient way of statistical analysis and data collection in large amounts in terms of low cost and short period of time. (2) Interviewers need flexibility in modifying questions in line with the survey. Therefore, a structured questionnaire is offered in an effort to allow as many reviewers as possible to gather and analyze data from a potentially large number of respondents, with the 3 major reasons as follows: (1) Data analysis can be undertaken fairly rapidly in the two countries. (2) The irrelevant response can be avoided, with all relevant topics covered and all the designed questions in this interview answered by the respondents. (3) A comparison will be made regarding the different situation on the use of group-work in China and New Zealand in an effort to analyze the respective role the method of group-work plays in different educational backgrounds, which, needless to say, calls for due attention and much deliberate effort for a reasonable survey outcome.

3. UNIVERSAL CRITERIA CONCERNING QUALITY OF RESEARCH

Throughout the research, many a form of quantitative and qualitative research criteria to have some effect on the quality of research is referred to for further insight into what is being explored. In this article, we have to space to discuss all the terms in depth. Rather, the following criteria involving the previous study, in terms of samples, focus, questions, time scale and data, will be addressed: reliability, validity, generalizability and triangulation.

3.1 Definition Of Validity

Whilst Kirk & Miller (1986) suggest that validity is the extent to which it gives the correct answer, that is, the degree to which the finding is interpreted in a correct way. In the qualitative research, validity is addressed through the honesty, depth, richness and scope of the data achieved; the participants approached the extent of triangulation; and the disinterestedness or objectivity of the researcher (Cohen, L., Manion, L. & Morrison, K., 2000). In the quantitative research, validity is improved through careful sampling, appropriate instrumentation and proper statistical treatment of the data.

3.2 Internal Validity

Internal validity is to demonstrate the explanation of a particular event, issue or set of data which the research provides. Hammersley (1992) suggests that internal validity requires attention to the kinds and amounts of evidence required. The subjectivity of respondents, their opinions, attitudes and perspectives will have their part in the validity. Lincoln and Guba (1985) hold that internal validity can be addressed by member checking (respondent validation) to assess intentionality, correct factual errors, and offer respondents the opportunity to add further information or to have information on record; to provide summaries and to check the adequacy of the analysis. Upon the completion of the study, we shall go back to those under research with respect to the need of correction or elaboration on construction, hypotheses, etc. Some of those mentioned work together in the planning, conducting, and analysis of the acquired results.

3.3 Descriptive Validity

Descriptive validity refers to the use sufficient details to help readers to grasp the idiosyncrasies of the situation. In answering questions, what counts as a question depends to a large measure upon the assumptions made by the interrogator. The researcher must make every effort to get the process of the study accessible and write it in a rich, and descriptive manner. Stake (1980) believes the most effective means of facilitating the understanding is the preparation of research reports for the readers to have their understanding through words and illustrations, which accounts for our combination of descriptive validity with face validity in the study.

3.4 Maximizing Validity

Validity is demonstrated when the result is a good reflection of the variable being measured. Gronlund (1981) argues that validity should be seen as a matter of degree rather than as an absolute state. Therefore, we strive to maximize the validity under our research. (1) We have taken advantage of the comparisons with the previous literature on group-work (e.g., Brown & Thomson, 2000; Good & Brophy, 2000; Slavin, 1995; Johnson, 1989; Bishop & Glynn, 1999; Fraser, 1998; Brown, 1992) and other research data, such as archival data or recordings (video or audio), to check convergence with other sources of data. (2) We check each researcher's notes kept from the beginning to see how the data has pushed us from initial assumptions, that is, the divergence from the initial expectations.

4. THE DEFINITION OF RELIABILITY

Kirk & Miller (1986) define reliability as “the degree to which the finding is independent of accidental circumstances of the research, that is, reliability is the extent to which a measurement procedure yields the same answer however and whenever it is carried out”. We should check whether other researchers give the same data as we do or not. Reliability is defined as providing consistent measurements of a value when repeatedly applied. A measure is said to be reliable, if, upon repeated sampling, similar results are obtained. It is very possible, however, that a study or measurement can be reliable without being valid. That is, we may measure something with great repeatability, but we may not be measuring what we think we are measuring. This is particularly true in educational research. Therefore, we not only utilize multiple choice tests to measure students’ understanding, but also seven other kinds of questions. Cohen, Manion, & Morrison, (2000) suggest that “reliability makes several assumptions that instrumentation, data and findings should be controllable, predictable, consistent and replicable”. We ensure reliability in qualitative research by multiple viewings of videotape, multiple listening of audio tape and multiple transcriptions of audio tape --by the same person or different people.

4.1 Time Stability

In quantitative research, reliability as time stability is a measure of consistency over time (Cohen, L., Manion, L. & Morrison, K., 2000). Similar respondents over time yield similar data. It can be demonstrated that, if the interview and then the questionnaire on group-work are undertaken within an appropriate time span, then we can obtain similar results. In terms of time stability, great care is taken with regard to the interval between our interviews and questionnaires. We decide that one hour is an appropriate length of time --- it is not too short, so respondents will not remember what they said or did in the first situation, nor is it too long to produce no extraneous effects (e.g. outside influences on respondents) to distort the data.

4.2 Sample Stability

In quantitative research, reliability in terms of sample stability is a measure of consistency over similar samples (Cohen, L., Manion, L. & Morrison, K., 2000). This form of reliability is particularly useful in questionnaires and piloting tests.

We designed a questionnaire on group-work simultaneously for two groups--- Chinese tertiary

teachers and students and their counterparts in New Zealand. In order to get similar responses to the questionnaire, demographics about status, age range, nationality and date are included as well to ensure they are very closely matched on significant characteristics.

The theory of Chaos and complexity (Morrison, 1998) suggest minor flaws and errors are liable to escalate into huge failure at a systematical level. To ensure high reliability of performance and avoid of the failure or breakdown of the system, we choose much closely matched samples to identify problems and weaknesses in the process of the design.

4.3 Reliability As Equivalence

Reliability as equivalence can be achieved through inter-rate reliability. Because we have in our mind to carry out the study in China and New Zealand, a team of researchers are needed. As human judgment is fallible, the agreement among all researchers must be achieved through on the hypothesis that each researcher enters data in the same way. High reliability needs a systematic bias shared by multiple researchers at work in data. It is particularly important for us to conduct semi-structured interview, because each member of the team is supposed to have to agree on which data shall be entered into the relevant categories.

5. THE DEFINITION OF GENERALIZABILITY

Generalizability means the degree to which the findings can be generalized from the study sample to the entire population (Polit & Hungler, 1991). The theory generalized within specific groups or communities, situations, or circumstances that may be useful in the understanding of other similar situations.

If something occurs frequently, we expect that it will continue to keep the momentum in the future. Researchers in most cases use the same type of reasoning when generalizing about their findings.

Generalizability is common to the quantitative research. Once researchers have collected sufficient data to support a hypothesis, a premise regarding the behavior of the formulation of that data, rendering it generalizable to similar circumstances. Because qualitative research relatively lacks in objectivity and generalizability, we need to conduct the quantitative research afterwards.

5.1 Types

There are three types of generalizability. First, researchers determine whether a specific treatment



will produce the same results in different circumstances. We need a higher flexibility and adaptability for the treatment to be generalized under a greater variety of situations. For example, we design a set of questions to encourage teachers and students to consider group-work in tertiary level education. To responsibly generalize the effectiveness of that group-work, we need to test the same group-work with an exercise in a variety of educational settings at the tertiary level, with the participation of different teachers, students, and the involvement of different environments. If the same positive results are produced, the treatment is generalizable --- group-work can improve learning efficiency. The second form of generalizability focuses on measurements rather than treatments. We need the information about group-work to enable teachers outside the test group to make better use of group-work, and provide a basis for future pedagogical practice. We need the information about group-work to enable teachers outside the test group to improve their future pedagogical practice. Our findings will be more generalizable if the same results are obtained when we assess " What do Chinese and New Zealand tertiary teachers and students consider are the main advantages of group-work in school classrooms?" by interview and questionnaire. The third type of generalizability concerns the subjects of the test situation. After getting internal validity in the particular group tested, we need to apply our findings about group-work to many situations beyond that group. We need to generalize our results from a larger population in China and NZ, so it is a must for us to guarantee that our test group is large and randomly chosen.

5.2 Sampling And Generalizations

Generalizability can be acquired from representative samples. Educational research must generalize from the samples of a larger population. The applicability of the study is therefore defined by the sampling techniques used. In education research, we have never had the opportunity to select truly random samples, however, samples should be representative in both quantitative and qualitative research. Researchers should consider the fact that a tested population of over 10,000 subjects does not significantly increase generalizability (Firestone, 1993). It is clear that sample size is a matter of representative. How large the sample should be? It depends on the goal of the study and the nature of the respondents. In qualitative research, samples are small. Many researchers question the value of dependence on small samples which are incapable of generalizing

reliable conclusions. They think that too small a sample size might be unrepresentative of the total targeted population. Yin (1994) concludes that studies do not require a minimum number of cases, or randomly select cases, and he advises researchers to work with the situation that presents itself in each case in conducting the most possible study that can be adequately described in the research report.

We believe that a reasonably small sample size may be more useful in examining a situation deeply from various perspectives. In such situations, small qualitative studies can gain a more personal understanding of the phenomenon and the results can potentially contribute valuable knowledge to the community. Therefore, we generalize on small samples (30 cases) from various perspectives in depth in the pilot because we are constrained by cost---in terms of time, money, stress, administrative support, the number of researchers, and resources. We design 8 kinds of questions in questionnaire and multi-faceted questions (e.g. questions 8 and 9) in interview protocol to ensure that we can get results in depth from various perspectives.

Stake (1980) claims that single qualitative studies are not an adequate basis for generalizations. So after qualitative studies, we conduct quantitative research, and its samples are large. The larger the sample, the greater is its chance of being representative. The greater the representative, the more generalizability reflects the population value. So we investigate 500 tutors and students in China and New Zealand respectively.

5.3 Limitations

We have no absolute guarantee to get equal results in every situation outside the study. However, careful design can help overcome many of these limitations. Researchers must emphasize precision when generalizing their findings, scope and variance. In order to balance precision and generalizability, we conduct a greater number of interviews and questionnaire on group-work to increase the sample population, which heightens generalizability, and to average out the random errors between interviews and questionnaire.

6. THE DEFINITION OF TRIANGULATION

A widely accepted definition of triangulation in education research is: in order to obtain the truth about what happened in the classes and student's inner awareness, multiple data collection methods and sources, and multiple methodologies and analytical approaches are triangulated.



Triangulation is the use of two or more different methods of data collection and assessing the variables that characterize a phenomenon of interest. In our research, we use normative, and interpretive techniques (e.g. question 4 in the questionnaire), and combination of both.

A single method may distort the theories developed as a result of the nature or limitations of the method. Triangulation overcomes this problem and increases confidence in the eventual theory by using two or more methods for data gathering. In order to strengthen the weakness of each of the methods, we use a combined approach, that is, multiple methods to study group-work. Triangular techniques are suitable for our study because we seek an overall view of group-work in NZ and China.

6.1 Classes

Denzin (1970) identifies six classes of triangulation: (1) Time triangulation means similarity of data gathered by making use of cross-sectional and longitudinal approaches. We collect data on group-work from different groups at one point in time. We also collect data from the same group at different points in time sequence. (2) Space triangulation overcomes a localized view of the phenomenon by analyzing data from several geographical areas. We have a survey of teachers and students in tertiary schools from different places---lots of universities in an area or around the country, or in New Zealand or China. (3) Combined level triangulation deals with individuals, groups as well as the whole organizations. (4) Theoretical triangulation studies several alternative theories about the phenomenon of interest. (5) Investigator triangulation refers to the use of more than one observer or participant in a research setting. In the same classroom, we will use more than one independent observer to get more valid and reliable data on group-work. Researchers might see things from different angles and at different levels. The whole perspectives are far more complex than any single one. Their own perspectives and observational styles will be reflected in the subsequent data, creating divergence in the data collections. A combination of two different accounts together might result in a better understanding of the whole than the use of either one separately, even if the accounts are inconsistent. Together, the two very different accounts--reflecting low reliability--could produce even a higher validity. If data divergence is minimal, we will get more validity. If the data are significantly different, we should carry out further

survey. We have two original ideas in our study about the triangulation under survey. First, it is especially suitable for the pilot. We can modify our design of the interview and questionnaire according to the divergence and redo the pilot when we find striking differences. Second, after the pilot, we are expected to combine the triangulation with equivalent reliability. Independent checks are conducted in the former; the approaches of team research are used to ensure equivalent reliability in a team of researchers. We can therefore improve the validity and reliability simultaneously.

(6) Methodological triangulation applies different research methods, including 'within methods' and 'between methods' triangulation. Triangulation within methods is related to the replication of a study as a check on reliability and theory confirmation (Smith, 1975). Triangulation between methods involves the use of more than one method on a given objective. The tools (interview and questionnaire) we have used to measure group-work are valid only insofar as they actually measure what they are supposed to measure. It is therefore critical to carefully select measurement tools that have been shown to be both reliable and valid. We use the same questions in our interview in different universities and different countries. We also use interview and questionnaire on the same object of study--group-work.

6.2 Questions Triangulation

We know there are many critics about triangulation, and some of them are reasonable (e.g. Silverman, 1985; Denzin, 1997; Patton, 1980; Fielding, 1986; Lincoln & Guba, 1985), so we are very careful with the use of it. Here we created a new term --- questions triangulation to address that. Quantitative research is question-centered, including many closed questions. It can save cost---time, money, the number of researchers, and resources. It does not matter who the researcher is. It can give us an overview on group work. It is easy to collect and analyze the data. We designed some question-centered questions (e.g., questions 1, 2, 3, in questionnaire) to get the data. But we can not get more detailed data from the interviewee. On the other hand, qualitative research is interviewee-centered. The role of interviewee and researchers are very important. Since responses to a curriculum innovation - group-work - vary, we take into account the uniqueness, culture and setting of each individual. Agar (1993) claims that intensive personal involvement and in-depth responses of individuals help secure a sufficient level of validity. Based on this, we designed some in-depth questions



to get in-depth responses in the interview (e.g., question 6 in interview). Researcher, the key instrument of research, is part of the research world. Research methods need to be capitalized upon the natural abilities of people who are apt to experience and understand. Interviewees may openly communicate with one researcher and remain distant with others. Future researchers may not have access to the same interviewees, and if other interviewees are involved, results may differ. We design some interviewee-centered questions in the interview and questionnaire, especially, open-ended questions such as: 'Can you tell me about...' 'Why do you think that?' 'Please comment on reasons for your choice' and 'that's an interesting idea, can you explain what that means?', and we combine closed questions and open-ended questions (e.g. question 4 in questionnaire).

7. CONCLUSION

In conclusion, by addressing the criteria of validity, reliability, generalizability and triangulation as regarding the previous study, it is clear that a successful research should mingle different criteria concerning quality of both quantitative and qualitative research, rather than focus on different criteria or simple transference. Researchers should meet the relevant criteria for the research in four aspects: (1) Different kinds of criteria can be mingled. For example, we combine triangulation validity with equivalent reliability. (2) Quantitative criteria and qualitative criteria can be mingled. For example, internal validity can be applied to quantitative and qualitative research (LeCompte and Preissle, 1993). (3) Some criteria should be demonstrated throughout the research such as cultural validity, because the study of group-work happens in different cultural background and we need more opinions of the respondents, thus more questions should be asked according to the situation. (4) We can design a qualitative pilot research first, then design a quantitative research. More extensive study on universal criteria in several aspects is needed: trustworthiness, credibility, dependability, originality and robustness.

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