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A Call for Dynamic Research in Information Technology in Education

Leping Liu
University of Nevada- Reno

This article issues a call for dynamic research in the field of using information technology in education. I have (a) reviewed the quality of current publications in the field, (b) summarized the progress of research in educational information technology in terms of three stages of research along with three stages of technology integration, (c) discussed some factors related to the progress with respect to research design and research ideas in the field, and (d) proposed a dynamic research model in relation to a set of dynamic factors in current research that can be used to systematically generate meaningful research ideas.

Keywords: Information Technology in Education, Quality of Publication, Dynamic Research

INTRODUCTION

When a new academic journal appears, scholars and researchers in the field, especially those junior faculty who are just starting to develop some new research ideas, may feel curious and excited: curious about whether this journal will provide any new research agenda or any new directions in practice; and excited about the additional opportunity to write and publish.

The new online journal *International Journal of Technology in Teaching and Learning* (IJTTL) aims to reflect the excellence of current research and practice in the field of using information technology in education on a global level. As the editor of this new journal, I realize that we are confronted with the challenge of maintaining the academic quality of the journal. The *we* in the previous sentence includes the editor, the editorial team, and the potential authors. The most important part of this group is the authors. The quality of their manuscripts contributes the most to the quality of the journal.

To discuss the quality of publications, in this article I will first (a) review the quality of current publications in the field, (b) summarize the progress of research in educational information technology in terms of three stages of research along with three stages of technology integration; and (c) discuss some factors related to the progress with respect to research design and research ideas in the field.

Second, I also want to take this opportunity to issue a call for *Dynamic Research* in the field of information technology in education. *Dynamic Research* is defined by a dynamic research model. I will describe this research model in relation to a set of dynamic factors summarized from current research. The model can be used to systematically generate meaningful research ideas, and to develop a research agenda to deal with the rapid changes of technology.

Leping Liu is an Associate Professor at the University of Nevada-Reno. Please contact her at the University of Nevada-Reno, MS 281, Reno, NV 89557. E-mail: liu@unr.edu.

QUALITY PUBLICATIONS

Quality of articles is a concern for all academic journals. Statistics from the National Technology Leadership Summit shows that as much as 85% of research submitted for publication in the field of educational technology does not meet the test of peer review (NTLS, 2005). Recently, from a review of the submissions to an international journal in the field of information technology in education (I will refer to this review as the "journal-submission-review" in later sections), I found that (a) over a six-year period from 1998 to 2004, the acceptance rate of the journal was approximately 48%; and (b) up to 96% of published papers did not initially meet the criteria for publication, and 99% of published research papers required several revisions.

Summarized from the review, in general, quality publications are those: (a) that clearly address current issues, trends, progresses, or innovations; (b) from which educators can learn something new or obtain guidance for their practice; (c) from which other researchers can generate new ideas for further research; and (d) that contribute to theory and literature in the field. Specifically, Liu and Johnson (1999) developed a logistic prediction model and identified a set of factors that significantly affect the quality of research, the quality of manuscripts, and the possibility of a manuscript being published. Those factors include an innovative research idea, an appropriate research design, validated instruments, meaningful findings, sufficient literature, and professional writing.

Obviously, published research should provide clues about what an educator *should or should not do* in practice. It should reflect what does works and what does not work. However, before educators figure out what they *should or should not do*, they may spend a great deal of time *wandering* (Maddux, 2003; Maddux & Cummings, 2004) due to factors such as weak influence of research on education (Maddux, 2003), lack of connection between educators' knowledge about research and their practice in schools (Maddux & Cummings, 2004), misguided practice by people's different perception or understanding about theories (Willis, 2003), or inefficient efforts made without analyzing the needs (Liu & Velasquez-Bryant, 2003). Consequently, this *wandering* may have a negative influence on the quality of their research and publications.

The literature review in the next section has identified *what went wrong* in the field, which may be of interest to potential authors who intend to conduct research to determine what educators *should or should not do*,

SLOW PROGRESS IN RESEARCH

Over decades, researchers have published thousands of studies in the field of information technology in education. Today, a Google search using the key words "research, information technology in education" can produce 550,000,000 items. An EBSCO online journal-database search using "educational technology" locates more than 1000 recent articles in three seconds. Does this quantity indicate appropriate pace and direction of research progress in the field?

THE GAP BETWEEN RESEARCH AND PRACTICE

Literature has identified three stages of research in information technology in education (Maddux, 2003) and three stages of technology integration practice (Johnson & Liu, 1997, 2000; Johnson, Maddux & Liu, 2000) as shown in Table 1. When research progress parallels with the stages of technology integration, it is likely that research and practice will affect each other positively and move toward a *should-be* focus (Liu & Johnson, 1999).

The first stage of research, *Exposure to Computers*, focused on computer literacy and the debate on whether using computers will benefit education. Most publications at this stage were position papers, qualitative case studies, and descriptive research (Maddux, 1993). This took place from the middle 70s to middle 80s during the first stage of technology integration known as *Learning Technology* (Johnson & Liu, 2000; Johnson et al., 2000).

Table 1. Stages of Research and Technology Integration

Stages of Research	*Stages of Technology Integration*
1. Exposure to Computers	1. Learning Technology
2. Computer Education	2. Using Technology
3. Learning-Treatment Interaction	3. Learning/Teaching with Technology

The second stage of research, *Computer Education*, focused on the "use of specific computing applications and the attempt to assess their effects" on teaching and learning (Maddux, 2003, p. 39). At this stage, researchers attempted to conduct qualitative studies to explore the applications (Willis, 1999), or to use control groups to examine the effects (Maddux, 2003). This was common from the middle to late 80s in the second stage of technology integration – *Using Technology* (Johnson & Liu, 2000; Johnson et al., 2000).

At the third stage of research, *Learning-Treatment Interaction*, the focus should be on "specific applications in the context of learner/treatment interactions" (Maddux, 2003, p. 40), which requires thorough experimental research designs. Research at this stage should yield results that identify what works, and how/why it works. It should provide guidance to educators' practice in the third stage of technology integration, *Learning and Teaching WITH Technology*, which began in the early nineties (Johnson & Liu, 1997, 2000; Johnson et al., 2000). However, the third research stage never fully arrived. As Maddux (2003) suggested, during the past 10 years research has stalled between the second and third stages.

This pause has resulted in a gap between research and practice. Research has failed to furnish appropriate guidance to help educators improve their practice in technology integration, or to provide lessons from unsuccessful experiences to prevent educators from making ineffective efforts (Liu & Velasquez-Bryant, 2003). As the gap continued and enlarged, many of the same mistakes were repeated. Educators have wandered a very long way. Consequently, in the past two decades, "article after article, and report after report have concluded that the effect of information technology on teaching and learning has been disappointingly minimal" (Maddux, 2003, p. 37). The following is an example of how a missing area in research relates to the quality of practice and progress in technology integration.

An Example: Adding or Integrating?

According to a series of learning theories (Ausubel, 1963; Eggen, Kauchak, & Harder, 1979; Gunter, Estes, & Scheab, 1999), cognitive theories (Driscoll, 2000), and design theories (Burch, 1992; Kemp, Morrison, & Ross, 1998; Smith & Ragan, 1993), successful technology integration will not occur without a careful design. However, in the literature of technology integration from the early 80s to the early years of this new century, the *design of integration* is a missing area (Liu & Velasquez-Bryant, 2003).

During that period, technology was *added* but *not integrated* into teaching and learning. Teachers simply used technology in classrooms without systematically going through the four major phases of integration design: "planning integration, designing integration, implementing integration, and evaluating integration" (Liu & Velasquez-Bryant, 2003, p. 97); or the five stages of technology adoption: "entry, adoption, adaptation, appropriation, and innovation" (Lengel & Lengel, 2006, p. 15). The use of technology (e.g., the Internet or educational software) was simply *added* into lessons or class activities; with the absence of carefully designed procedures and tasks under each phase or stage.

It appears that just as teachers are about to reach the core integration design, usually after many practice attempts, new technology is released. Unfortunately, it is very easy to be sidetracked by new technology. Thus, time is spent on learning the new technology and trying to use it in the classroom. Again, the *design of integration* is missing. Because current research does not provide guidance, teachers tend to repeat this faulty cycle. As a result, the major phases of integration design are never fully completed.

Consistent with many other cases in the literature (Johnson & Liu, 2000; Liu & Johnson, 1999; Maddux, 2004), this example shows that when there is a missing area in research, there is a missing area

in practice. Additionally, when research does not keep up with the pace of practice, effective practice hardly occurs.

Again, a critical problem in current research and practice is that educators' practice is presently at the third stage of technology integration, *Learning and Teaching with Technology*, but research has not truly reached the corresponding stage, *Learning-Treatment Interaction*.

FACTORS RELATED TO THE SLOW RESEARCH PROGRESS

There may be a number of factors related to this problem. As this article focuses on the quality of research and publication, I would like to discuss issues related to two major components of research, (a) research design, and (b) research ideas and why they have affected the progress of research in the field.

RESEARCH DESIGN: LACK OF QUANTITATIVE RESEARCH

In the field of information technology in education, there has been a long-term debate regarding appropriate use of *quantitative* or *qualitative* design (Maddux, 2003; Willis, 1999, 2003). As we all know, any decision about design must be based on the purpose of research. To discuss the appropriate design for research in the third stage, we should first look at the specific and overall purposes of research in this stage.

The third stage of research, *learner/treatment interaction*, specifically focuses on investigations to determine *what are the best ways* to use the most appropriate technology tools to achieve the *most effective learning and teaching.* This requires a focus on the best *ways*, the most appropriate technology *tools*, *learners* and *learning/environment, instructors* and *teaching/subjects*, and *effectiveness.* Under each part, there is an entire field with numerous items to study. The specific purpose of a particular study in this stage can be the investigation of a combination of item(s) from each part. The overall goal of research in this stage is to generate *what works* and provide guidance to educators.

Based on the overall goal of research in the third stage, research design at this stage must ensure that findings from successful experiences can be generalized to a large population to ensure the external validity of the study. As discussed in many statistics and research design textbooks and articles (e.g., Hinkle, Wirsma & Jurs, 2003; Onwuegbuzie & Daniel, 2003; Wiersma, 2000), well designed experimental quantitative studies will most likely achieve this goal.

Qualitative research experts have also considered external validity and developed some means of "validation of findings" (Berg, 2001, p. 5). However, the external validity of qualitative studies is achieved by leaving the decision of generalizability of the study up to the readers, allowing the readers to find the similarities between their own situation and the context of the study, and then translate or adjust the findings for their situation (Merriam, 1998, p. 207). Obviously, because of the nature of qualitative research, and interpreted from these qualitative experts' explanation (Berg, 2001; Merriam, 1998), external validity is not assumed even from well designed qualitative research.

Well-designed qualitative studies are definitely necessary in the field. As discussed in the previous section, qualitative design is an appropriate method, especially in the first two stages of research (*Exposure to Computers*, and *Computer Education*). However, at the time to advance research to the third stage (*learner/treatment interaction*), after those qualitative studies, quantitative studies must be conducted to examine the findings from qualitative studies, and to determine whether the findings can be generalized to a larger population of educators.

As Berg (2001) described, journals tend to publish quantitative research rather than qualitative research. The proportion of quantitative publications has been very low over the past two decades. Results from the "journal-submission-review" show that among over 200 submissions, only 19.4% are quantitative research, among which 49.3% are published.

In summary, well-designed quantitative research is critical and necessary to advancing research to the third stage. However, there is a scarcity of quantitative studies in the field. Therefore, research in the field has progressed slower than it should have, pausing between the second and third stages.

Suggestions

The root of the lack of quantitative studies in the field of education can be traced back to doctoral level research (Maddux, 2003). Many professors in the field of education see themselves as *qualitative* researchers, and they direct their students to do qualitative research only, which to a certain extent limits our students' *thinking* about research. A scholar will not label him/herself as a *quantitative* or *qualitative* researcher. In stead, he/she may focus on one or the other but realize the value of both. Therefore, I want to encourage our doctoral students to take more advanced statistics courses, and courses in both quantitative and qualitative research design.

RESEARCH IDEA: LACK OF CURRENTLY MEANINGFUL RESEARCH IDEAS

Lack of currently meaningful research ideas is another possible factor related to slow progress in research. To advance research to the third stage, research should focus on *current* issues and themes. Specifically it must focus on *Learning-Treatment Interaction* to determine the best ways of using technology to improve learning. The focus should switch from *whether to use* to *how to use*. Topics that should be considered include comparing the effectiveness of using different methods to integrate a certain technology, or testing the use of a new technology and its impact on learning. In the same journal-submission-review, the themes of 61.1% of the submissions are considered "not current" (to the period when the manuscript was submitted), and 66.7% of the rejected manuscripts do not present a current theme. If those dated themes are studied repeatedly, research will never move to the advanced stage.

Next, to advance research to the third stage, research should focus on *meaningful* ideas. Only meaningful research ideas can result in meaningful findings, providing guidance or lessons for educators' practice. A meaningful research idea should aim directly at the issues to be explored, focus on the critical perspectives of the issue, and provide a careful plan to examine the factors directly related to the questions. The most important, meaningful research ideas would logically yield important findings. If a researcher conducts a study in which data are collected from over 2000 participants, but then simply calculates the percentage of students using that technology; or if after a four-year observation the only thing the researcher can report is the procedure used for the observations, such research ideas are neither *meaningful*, nor *currently meaningful*.

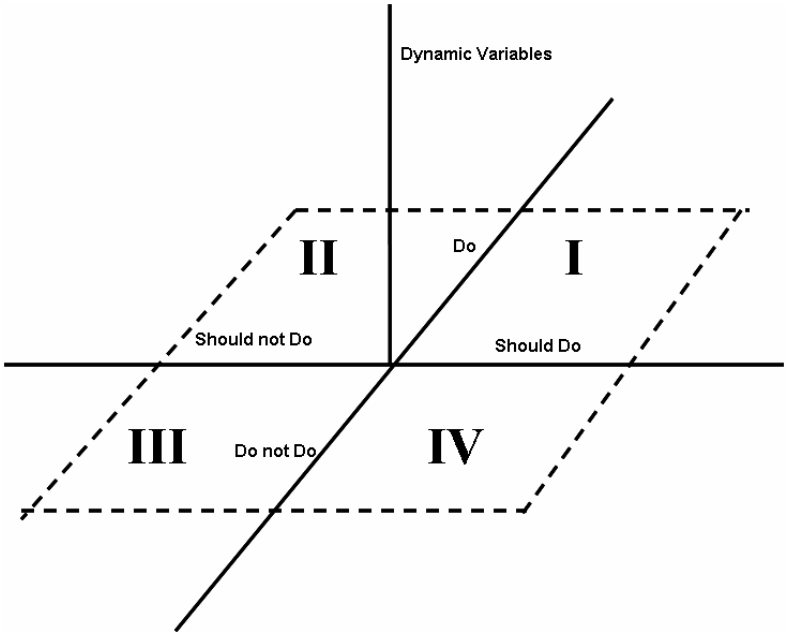
However, where do meaningful ideas come from? How does a researcher formulate a research agenda to deal with the rapid changes of technology? To answer these questions, I will propose a dynamic model of research.

A DYNAMIC MODEL OF RESEARCH

The research model promotes a new way of *research thinking*, and it is a *dynamic* model because it can be used to constantly generate different meaningful research ideas. The conceptual framework of this model is derived from a term in the field of political science – *public policy*, which is defined as "whatever government ought or ought not do, does or does not do" (Simon, 2006, p. 1). Similar to this definition, research in the field of information technology in education should determine what educators *should or should not do*, by examining what they *do or do not do*.

Based on this framework, the proposed dynamic research model consists of three major components: (a) what educators should or should not do, (b) what educators do or do not do, and (c) a set of dynamic variables. As shown in Figure 1, they are the three dimensions of the model. A more understandable method to explain this model is that proposed by the famous ancient Chinese philosopher, Lao Tsu, who states, "the biggest problem in the world could have been solved when it was small" (cited in Liu & Cummings, 1997, p.102). Let us look at each component (dimension) of this model, and I will explain them as simply as possible.

Figure 1. A Dynamic Model of Research



SHOULD OR SHOULD NOT DO

In this model, the dimension of *should or should not do* represents research results. What educators *should or should not do* is determined by the research results of what *does or does not work*. If the results indicate positive outcomes or effectiveness under certain conditions (e.g., the uses of different methods, tools, design), they fall into the *should-do* side. Otherwise, they will fall into the *should-not-do* side.

DO OR DO NOT DO

In general, the dimension of *do or do not do* indicate educators' practice. In a particular research design, it specifies the treatments. Experiences with certain treatments fall into the *do-* side; and those without the treatment will fall into the *do-not-do* side.

DYNAMIC VARIABLES

This dimension is the dynamic portion of the model; and it is the core of the model where dynamic research ideas are generated to study *learner/treatment interaction* (the focus of the third stage of research). Dynamic variables could include the following:

- Technology tools
- Methods of using the tools
- Learners/learning styles
- Instructors/teaching styles
- Learning contents
- Learning environment/community
- Theoretical approaches
- Design of educational applications
- Time
- Any other variables related to the studies in the field

These are some very common variables that have been studied for years in the field. In this model, they are proposed as dynamic variables because each of them consists of a number of attributes (or levels of the variable), and the *dynamic* feature is that a researcher can focus on different combinations of the variables/attributes in numerous ways, for example, under different learning environments, at different times, with different methods, to different learners, or using different technology tools.

APPLY THE MODEL: TO FORMULATE RESEARCH IDEAS

The process of using this model to generate research idea can be summarized into three steps. In the first step, the goals/purposes of the research are determined. The second step focuses on the dimension of *dynamic variables*. In this step, variables related to the goals and the attributes under each variable (levels of the variable) are carefully chosen. The selection of the variables determines (a) the range of the study, (b) the interactions among the variables to be explored, and (c) the extent to which the findings can accurately link back to the research purposes. It is in this step that different combinations of variables and attributes of the variables are formulated. It is in this step that a researcher can constantly generate new ideas. The third step emphasizes the dimension of *do or do not do*. That is, to determine the treatments. This is another dynamic feature of the model. For different research goals, treatments are different. For different variables, treatments are different.

After these three steps, a research design is completed. The key point of using this research model is to think about research in a dynamic way.

APPLY THE MODEL: TO GENERATE RESEARCH FINDINGS

This model also can be used to generate research findings. As in Figure 1, the two dimensions (*do or do not do* – treatments, and *should or should not do*—research results) have defined four areas. Each area presents one type of possible finding from a study.

- **Area I** [do – should do]: If the treatment on the studied variables yields positive outcomes, findings fall into Area I, indicating *what works* or *what we should do.*
- **Area II** [do – should not do]: If the treatment on the studied variables yields negative outcomes, findings fall into Area II, indicating *what does not work* or *what we should not do*.
- **Area III [**do not do – should not do]: If the absence of treatment yields negative outcomes, findings fall into Area III, indicating *what does not work* or *what we should not do*.
- **Area IV** [do not do – should do]: If the absence of treatment yields positive outcomes, findings fall into Area IV, indicating *what works* or *what we should do*.

The areas illustrate the four types of possible findings from a study, either guidance to educators' practice as in Areas I and IV, or lessons educators should learn as in Areas II and III. Research producing such findings is needed to advance research to the third stage. Theoretically, studies designed with the dynamic research model will yield important findings that will be meaningful to future research and to educators' practice.

A CALL FOR DYNAMIC RESEARCH

In summary, I have reviewed the quality of current publications in the field, summarized the progress of research in educational information technology, discussed factors related to the progress, and proposed a dynamic research model. I prefer to name the research derived from this model as *Dynamic Research*. I also want to take this opportunity, as our new journal begins, to issue a call for *Dynamic Research* in the field of information technology in education. As described above, dynamic research promotes ongoing studies that reflect the most current issues. We encourage our authors to think about research using a dynamic approach, and to conduct research in a dynamic fashion. We expect our authors to develop research agendas on any topics under the scope of this journal, and submit quality manuscripts that will result.

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