

Conflicts in Pedagogical and Technical Knowledge: Pre-service Teachers' Understanding and Misconception of Integrating Technology into PBL Lessons

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Abstract: Fifty-one pre-service teachers' understandings and misconceptions of Information and Communications Technology (ICT) and Problem-based Learning (PBL) integration were examined in this study. Data from questionnaire and student projects were analyzed to identify the conceptual and practical difficulties integrating ICT tools into PBL lessons. While participants showed good theoretical understandings of PBL approaches, their lesson designs showed a mismatch between ICT tools and learning objectives, indicating conflicts in translating pedagogical knowledge into technology-integrated lessons.

Introduction

In order to prepare pre-service teachers to effectively integrate technology into their future classrooms, teacher development programs have implemented a variety of technology integration courses. However, one critical problem in various technology courses is that they have not adequately prepared future teachers to understand how to integrate pedagogical and technology knowledge (Moursund & Bielefeldt, 1999; Vannatta & Beyerbach, 2000). For instance, although stand-alone technology courses have exposed pre-service teachers to a variety of technology to some extent and have provided them with the opportunity to learn and practice technical skills, it has been criticized that exposing to a number of technical tools does not necessarily mean that pre-service teachers can learn an ability to design effective technology-integrated lessons. Conversely, focusing solely on pedagogical issues without teaching foundational technical skills can create frustrations in designing and delivering technology-integrated instruction (Mehlinger & Powers, 2002).

Indeed, there is a need to understand how teacher development programs should provide pre-services teachers with a balance between pedagogical and technical knowledge. To meet this need, it is important for learning sciences researchers to identify pre-service teachers' conceptual understandings and practical difficulties in integrating pedagogical and technical knowledge. The main purpose of this research, therefore, was to examine how pre-service teachers integrated their knowledge of information and communications technology (ICT) tools into the design of pedagogically-sound lessons for teaching high-order skills. The pedagogical knowledge, specifically examined in this study, was problem-based learning (PBL).

Methods

Data Collection and Analysis

Participants were 51 pre-service elementary teachers in Singapore. Thirty-nine students were females while 12 students were males. Their average age was 26.6 with approximately 7 months of contract-teaching experiences in schools. Participants took a twelve-week module on the ICT integration for teaching and learning. One of the assignments that pre-service teachers worked on was to designing a PBL lesson with the integration of ICT tools. Regarding previous exposure to PBL, 31 students indicated that they had learned PBL in other modules such as educational psychology and mathematics. A questionnaire with 5 demographic items and 5 open-ended items was developed to identify participants' understandings, misconceptions, and difficulties on the integration of ICT and PBL. Two coders identified types and frequencies of common themes emerged from student responses. In addition to self-reported data from the questionnaire, student projects on the ICT-based PBL lessons were analyzed to further understand how pre-service teachers applied their knowledge of PBL and ICT integration into designing lessons on various topics in elementary education.

Results

Overall, participants showed good theoretical understandings on PBL. Student teachers listed a) authentic problems (n=20), b) student-centered approach (n=17), c) teacher's role as a facilitator (n=16), and d) collaborative learning (n=13) as important characteristics of PBL. Next, the two areas that participants had the most difficulties with designing PBL lessons were a) generating problem statements (n=19) and b) integrating ICT tools and resources (n=18). Participants expressed that they were not sure about what components should constitute problem statements and how to make problems concise, interesting, and authentic. Additionally, a number of the participants reported that they had no or lack of experiences using ICT tools, and they had difficulties selecting appropriate tools and resources.

Results from the analysis of ICT-based PBL lessons revealed pre-service teachers' lack of understanding on two major areas: a) technology integration to better support students' PBL and b) teachers' role as a facilitator. First, student teachers tended to use technology as a mere delivery medium rather than an instructional tool supporting cognitive activities. For example, several pre-service teachers' PBL lessons simply consisted of a presentation of problem statements and a collection of websites. Secondly, lack of understanding on teachers' roles confused pre-service teachers about how much and what kinds of scaffolding strategies they needed to design ahead in their PBL lessons. For instance, while some of pre-service teachers pre-specified all of the learning activities with the belief that teachers needed to scaffold the entire learning process, some pre-service teachers provided little scaffolding since PBL lessons was meant to be independent and discovery learning where students had to find their own resources and answers.

Conclusions and Implications

An important question to ask based on data in this research is "why student teachers have difficulties translating their theoretical knowledge of PBL and ICT integration to designing technology-integrated lessons." Overall, the analysis of student teachers' projects showed that there was a mismatch between the use of ICT tools and the learning goals specified in their lessons. One possible explanation about this problem is related to the *complexity* of designing a lesson for teaching high-order thinking skills. Designing a PBL lesson is challenging to pre-service teachers who have little previous exposure to such student-centered and independent types of learning. When technology is added to this challenge, designing a lesson becomes even more complicated. Thus, many pre-service teachers ended up *adding* technology, instead of *integrating* it into their lessons.

This study has implications to the current practices in teacher training education. In order to resolve conflicts in pedagogical and technical knowledge, pre-service teachers should be *continuously* exposed to new and innovative teaching practices throughout their teacher training. Previous studies have shown that teachers' understanding and implementation of new teaching practices are affected by their epistemological beliefs and prior knowledge (Schraw & Olafson, 2002). Considering that most student teachers come to the teacher training programs with little previous exposure to student-centered and technology-integrated learning, teacher education should be structured in a way that allows pre-service teachers to change their limited thinking within exiting models of teaching and learning. Designing a series of integrated modules, providing student teachers with situated practice for formative feedback and epistemological reflection, and presenting various examples of technology integrated lessons with their impacts on student learning would be possible ways to help pre-service teachers achieve deeper connections between pedagogical and technical knowledge.

References

- Mehlinger, H. D., & Powers, S. M. (2002). *Technology and teacher education: A guide for educators and policymakers*. Boston: Houghton Mifflin.
- Moursund, D., & Bielefeldt, T. (1999). Will new teachers be prepared to teach in a digital age?: A national survey on information technology in teacher education. Milken family foundation. Retrieved June 14, 2003, from <http://www.mff.org/pubs/ME154.pdf>
- Schraw, G., & Olafson, L. (2002). Teachers' epistemological worldviews and educational practices. *Issues in Education*, 8(2), 99-148.
- Vannatta, R. A., & Beyerbach, B. (2000). Facilitating a constructivist vision of technology integration among education faculty and pre-service teachers. *Journal of Research on Computing in Education*, 33(2), 132-148.