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# Educational Technologies in Medical and Health Sciences Education

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## BOOK REVIEW

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## Introduction

*Educational Technologies in Medical and Health Sciences,* edited by Susan Bridges, Lap Ki Chan, and Cindy E. Hmelo-Silver, is Volume 5 of the series Advances in Medical Education (published by Springer; series editors are Susanne Lajoie and Yvonne Steinert). This evidence-based volume focuses on educational technologies as a growing trend in problem-based learning (PBL), with a special emphasis in medical and health science education. Educational technologies are defined by the editors as learning in physical and virtual spaces, the installation of hardware (infrastructure), the development of software, and using blended synchronous and/or asynchronous approaches. The book presents current theoretical and research-based studies that use educational technologies in situated and contextual learning, highlighting knowledge building in PBL and applied learning in clinical contexts. Key to each study is the understanding of authentic learning and practical implications regarding the use of educational technologies related to deep learning and student engagement.

Valuing multiple methodologies, this book includes studies that use various approaches in exploring educational technologies and student learning. This purposeful emphasis on selecting studies using various methods leads to diverse analysis procedures and a much broader understanding of how educational technologies are used in PBL, the situated and contextual factors involved in learning, and enhancements related to student learning in different courses and programs. The chapters of this volume individually and collectively present innovative and cutting-edge research in PBL and clinical learning with a shared goal of understanding the potential of educational technologies to support student learning in complex contextual situations and providing a greater understanding of how using and embedding educational technologies can be accomplished successfully in an authentic learning context.

## Book Organization

Beginning with a brief introduction by the editors regarding the theory and practice of situated learning and educational technologies, where they emphasize the importance of the authentic learning context and its relationship to educational technologies, the book is then organized into two parts. Part 1 includes six chapters focused on educational technologies and how they support context, space, communication, and resources in online and face-to-face PBL. Part 2 includes five chapters focused on educational technologies and how they support learners in the clinical context and care of patients. Both parts of the book include high quality, independent, and new studies that build on prior research. The diversity and arrangement of the chapters are creatively balanced. Overall, this collection of studies is informative and innovative, presenting the opportunity for understanding technology in situated learning (Lave & Wenger, 1991).

## Part 1: Educational Technologies in PBL Contexts (Chapters 2–7)

Part 1 (chapter 2) begins with a narrative literature review focused on understanding how e-learning (learning facilitated by using information and communication technology) can

support PBL groups, either face-to-face or online. Specifically, it explores the settings and reasons that support e-learning in PBL groups as well as the ways e-learning is used to support PBL principles and processes. Rich descriptive data were collected (Appendix A of the book is the form used to collect this data) with results indicating that a wide variety of tools are being used to support PBL. The data suggests that contextual learning and collaborative learning are supported using e-learning tools, which supports PBL students and their interactions. The remaining chapters in part 1 focus on specific tools (e.g., interactive whiteboards, Second Life virtual world, smart phones, tablets) used to explore PBL activities.

Using an ongoing interactional ethnography framework to examine video data over time and a comparative analysis, chapter 3 focuses on the technology of interactive whiteboards in group processes in PBL tutorials. The study concentrates on thinking and knowledge acquisition in group work and the role technology plays in a socially situated activity. The comparative analysis examined a non-interactive whiteboard PBL group versus an interactive whiteboard PBL group, building a chain of logic over time from the data collected. Results indicate a positive effect in using interactive whiteboards to scaffold a PBL scenario, with the technology mediating collaborative processes among the students. The collaborative context supports knowledge moving from individual to group understanding, with cultural tools and technology contributing. This is a fascinating chapter, as it builds on research about interactive whiteboards (Curwood, 2009) and their use in the context in PBL.

Chapter 4 offers a proof-of-concept study, where video is used as the context and mechanism to deliver problems and infuse theoretical understanding with practice in culturally competent communication. A special element of this chapter is the community of inquiry framework (Garrison, Anderson, & Archer, 2000) that the authors extend to include cultural overlays. The chapter presents a case study in online medical learning using the extended framework and PBL videos. Like other chapters in this book, the results include information about shared or collaborative knowledge (specifically here about culture). PBL researchers might find this chapter interesting because the results highlight the effectiveness and efficiency of using video and how well it fits with PBL and the community of inquiry and culture framework.

Continuing with another technology, chapter 5 focuses on problem-based learning in virtual worlds, specifically Second Life. The authors show the progression of PBL from face-to-face courses, to online PBL, to PBL in virtual worlds and the advantages found there with practicing a wide range of skills and scenarios that are less efficient in the real world. As a result of this work, new developments for PBL and pedagogically driven scenarios emerged, including chat bots (artificially intelligent avatars), machinima (additional video scenarios created

in the world, in real time), and a holodeck feature for a dynamic virtual space. These provided enhanced pedagogically driven scenarios in the virtual world. Using an illuminative evaluation approach, data was collected about the virtual world and the scenarios with three themes emerging: (1) technological and pedagogical challenges, (2) usability and avatar identity, and (3) collaboration and interaction. This chapter might be of interest to PBL and virtual world researchers because the results indicate that students enjoyed the scenarios in the virtual world, providing immersion and realism through the technology for a very authentic and collaborative experience.

Chapter 6 focuses on student actions with their mobile devices while in a problem-based learning activity as a resource for gathering information and knowledge building. For this survey study, a mobile device included a laptop, notebook computer, smartphone, tablet, or e-book reader. The most interesting part of this chapter is the recommendations on student use of mobile devices in PBL. These recommendations are important for anyone planning and conducting PBL activities, as well as for the PBL facilitator's awareness. The recommendations include elements such as students choosing the type of device they use, devices should only be used for searching for facts, PBL tutorial time should emphasize discussion and not be time for searching for information, and encouraging students to use cloud-based services for collaborative activities. A previous recommendation by Miller (2012) encourages collaboration through mobile devices. As learning with mobile devices seems inevitable in education and learning, this study contributes essential information about mobile technology use in a PBL environment that can be implemented easily and should be effective.

As the previous chapter on mobile learning touched on the idea of resources in PBL, the last chapter in part 1 focuses on analyzing Wikipedia articles about the nervous system and using a modified version of the DISCERN instrument (also available in appendix C of the book) to evaluate the quality and accuracy of online learning resources. As PBL students search online for content, being able to assess the accuracy of the content they find is important. Although this has been extensively studied for online resources in digital libraries (Fitzgerald, Lovin, & Branch, 2003), the power behind this study is the rubric provided and encouraging students to increase their knowledge and ability to differentiate between high and low quality resources.

## Part 2: Educational Technologies in Clinical Contexts (Chapters 8–12)

Chapter 8 begins part 2 and the emphasis on clinical contexts. This chapter focuses on communication skills and the collaborative technologies of wikis and online forums, noting that

wikis are good for developing a collective product and online forums are helpful for conversations. In two separate studies, this chapter examined using wikis and online forums to develop communication skills with colleagues and patients. The interesting results from these studies are the trends in usage of different strategies for dealing with differing perspectives using a wiki or online forum.

The next chapter (9) uses a mixed-methods study to examine electronic health record (EHR) related skills training and the effectiveness of this for scaffolding patient interviews and the perception and use of a mobile electronic health records system. As electronic records and mobile units for recording information are used, this study provides rich insight for health care professionals into a learning opportunity to develop EHR skills (e.g., integration of a computer or tablet into a consultation). Results highlight how the mobile EHR system assisted students as a template to conduct a patient interview, for clarifying what patient information they should gather, identifying missing information in the patient record, and learning how to structure the patient record. This multifaceted nature of clinical learning showcases electronic record tools with mobile learning and the pedagogy involved in a bedside patient interview. The successes and barriers reported in this study in using these tools are valuable for students and professionals to understand.

Chapter 10 directly addresses the call from the literature to understand emotions and then apply that understanding in clinical training. The authors report from the research that emotions can enhance or hinder learning, motivation, and performance (Pekrun & Linnenbrink-Garcia, 2014), which has been overlooked in medical and health science education. This leaves a gap in knowledge for medical educators about the role of emotions and including this in clinical training. To address this gap, the study examined different roles and methods used to measure emotions, along with providing examples from authentic learning environments. The power of this study is the comprehensive review of measures used for collecting data about emotions (including tablets and other mobile devices), and software for analyzing data (such as eye-tracking and log files). Additionally, a critical review of commonly used data channels (self-report, behavioral, and physiological measures) identifies their advantages and disadvantages. One example of an advantage is with self-report measures: they are efficient for group comparisons in a variety of settings. A disadvantage with self-report measures is their susceptibility to cognitive and memory biases. Ongoing critical analysis of measures and tools, as is conducted in this chapter, is valuable for understanding future lines of research, but even more so for showing practitioners and instructors what is important to focus on in learning opportunities.

With the medical and health professions using high stakes activities such as simulations and natural settings (e.g., emergency rooms) for learning, chapter 11 summarizes frameworks for guiding the approach a clinician should use in a deteriorating patient situation, describes teaching approaches based on these frameworks, and shares the design of a serious game (not purely for entertainment) and other technologies aimed at supporting deliberate practice with feedback via smartphones. The chapter does include some technical explanations, but it effectively uses visuals to explain everything, and it provides support for understanding the power games have in learning (Ritterfeld, Cody, & Vorderer, 2009).

The final chapter of part 2 (chapter 12), just like the final chapter in part 1 (chapter 7), focuses on resources: specifically, the development of a learning resource and the overall effort and evolution of scope and implementation of the resource. It highlights the challenges involved with developing flexible learning resources, migrating to new platforms, and keeping up with new technologies. This powerful conclusion to the edited volume hits home the processes involved with educational technology development and evolution. It provides helpful lessons learned that anyone using and developing technology-related learning opportunities should know.

## New Contributions to the Literature

This edited book provides a current and timely examination of educational technologies in the disciplines of medical and science education, with special emphasis on problem-based learning in clinical contexts. Aligning these in one book delivers a valuable resource not just for these disciplines but for all researchers using PBL and technology in situated learning contexts. With emphasis on different technologies used (e.g., video, virtual worlds, e-learning, Wikipedia, smartphones), researchers and practitioners easily gain a broad and specific understanding of the successes and challenges that come with using technologies, in the context of situated learning. As noted in many of the chapters and in previous literature, the studies presented assert that the student-centered, collaborative learning characteristics of PBL are well aligned with blended technology (Uden & Beaumont, 2006).

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