Smart Learning Environments - Lecture Notes in Educational Technology
(Book review)

Xiaojing Weng, Morris S.Y. Jong, and Thomas K.F. Chiu

Abstract—The technological advancements and educational changes in the new era have made educational technology a popular research topic. Particularly, the topic of smart learning environments is attracting the attention of educational researchers. While the feasibility and effectiveness of smart learning environments have been popularly explored, there is a crucial need to further gain in-depth understandings of designing, implementing, and evaluating smart learning environments in the 21st century educational contexts. Smart Learning Environments - Lecture Notes in Educational Technology is a book that collects research examples related to the learning, pedagogical, and technological aspects of digital learning applications. It gathers a variety of empirical evidence on smart learning environments and presents the ways of how technological products are adopted in various educational contexts to facilitate learning. The book provides significant insights for both the educational technology development and technology-assisted pedagogical design in multi-disciplinary domains. Furthermore, it helps readers to critically reflect on different smart learning approaches. In this article, we will review the content of the book and discuss the interconnection between the chapters therein.

Index Terms—Smart learning environments, educational technology, learning analytics, ambient design, pedagogy, book review

I. INTRODUCTION

Smart technologies are generally characterized by certain features, including being intelligent and innovative, providing knowledge support, assisting users in accomplishing difficult tasks, and giving appropriate and effective responses [1]. In the book entitled Smart Learning Environments - Lecture Notes in Educational Technology edited by Maiga Chang and Yanyan Li, the term “smart” has been adopted to modify different learning environments. A smart learning environment refers to a technology-enhanced learning environment [2], featured with knowledge, task support, learner sensitivity, context-sensitivity, reflection, and feedback [1].

It is necessary to understand different users’ perspectives while designing smart learning environments [3]. For instance, teachers commented on digital applications from a pedagogical view (e.g., Chapter 5, Chapter 8, and Chapter 11), while students focused on their learning experience or performance with educational technologies (e.g., Chapter 2, Chapter 7, Chapter 10, and Chapter 11). This book aims to “gather the newest research results of smart learning environments” and “provide readers with evidence and experiments that account for users’ experiences and perceptions related to knowledge and concepts acquisition through these smart learning approaches” [4].

II. BOOK OVERVIEW

The content arrangement of the chapters is well balanced. It begins with a foreword by Alfried Essa and a preface by the two editors on the themes of the chapters. The significance of smart learning environments and its applications in learning analytics, ambient design, and smart pedagogy have been stressed. The book is then organized into three parts with eleven chapters in total. Each part of the book includes quality and independent studies. Generally, the collected studies are informative and innovative, which guides readers to have a better understanding of smart learning environments.

Part 1 is composed of four chapters on the theme of learning analytics in smart learning environments. The corresponding framework (e.g., Chapter 1) and data mining practices (e.g., Chapter 2 to Chapter 4) are illustrated. Modeling is an important mechanism for learning analytics in smart learning environments. For example, Chapter 1 explored how student modeling and context modeling can assist the smart learning system in the recommended courses for students. Chapter 3 and 4 proposed new methods for topic modeling in online learning platforms.

Part 2 includes three chapters on the theme of ambient design. It reports the empirical studies on how different educational technologies (e.g., EagleEye mobile application in Chapter 5 and clicker system in Chapter 7) can facilitate teaching and learning. With conventional resources, researchers yielded some perspectives on the design of smart learning environments. For instance, Chapter 5 mapped out four existing problems in students’ traditional field trip activities and proposed to use digital platforms to solve these problems. Also, Chapter 6 identified the features and influence factors of notetaking in printed textbooks to provide insights for the notetaking function design of e-textbooks.

While Part 2 advocates learning from the past, Part 3 embraces the future of education by addressing on the theme of smart pedagogy in four chapters that discuss a variety of advanced educational technologies, including artificial intelligence (Chapter 8), game design (Chapter 9), virtual environment (Chapter 10), and augmented reality (Chapter 11). The pedagogical feasibilities of these digital learning systems (e.g., to help teachers give feedback, to improve K-12 students’ cognitive skills, and to facilitate senior adults’ fitness training) were tested by different user groups. These studies revealed the unlimited potential of educational technologies to meet wide-ranging learning demands.

III. READING REFLECTIONS

While reading the book, readers will first be impressed by the
breadth and diversity of the contributors and educational domains involved in this edited volume. It is a collective work and effort by educational researchers from Canada, China, Egypt, Brazil, India, Hong Kong, Taiwan, Japan, and Germany. The mixture of different cultural backgrounds and education contexts enriches and broadens the landscape of smart learning environments and attracts international readers. The studies in the book were categorized by different disciplines, including Computer programming, Geography, Chinese, Biology, Mathematics, Fitness, and Science. This wide range of subject domains implies the significance of subject-specific smart learning environments. The diversity of the education contexts and disciplines elucidates the book’s multifaceted and in-depth research on smart learning environments.

This book reports not only the positive outcomes of using educational technology, but also honestly discusses the obstacles, so that readers will be given a whole picture of this field. While the adopted technological applications in most of the chapters received positive comments or learning outcomes from their users (e.g., Chapter 2, Chapter 5, and Chapter 7 to Chapter 11), some were perceived unfavorably. For instance, in Chapter 5, EagleEye was not regarded as effective enough for developing student collaboration. In Chapter 7, students achieved a higher cognitive level in the non-digital study group. In Chapter 8, students preferred to use pencils and paper than a computer system while dealing with mathematical problems. In Chapter 11, students regarded that the legibility of the standard AR outperformed the proposed AR X-ray version. By investigating the authentic cases of educational technology development, this book helps readers establish a more comprehensive understanding of the design and application of smart learning environments.

Personalization is one of the common features of most book chapters. For instance, Chapter 1 aims to propose approaches to provide personalized support for learners. Chapter 2 promotes the study of personalized interactions. Chapter 4 takes learners’ individual learning demands into consideration while providing recommendations for them. Chapter 5 designs a learning system for field trips that can facilitate learners’ different time spending preferences. Chapter 6 identifies that students will use personalized symbols in their notetaking. Chapter 8 highlights the significance of teachers to provide personalized feedback for students in the learning management system. Chapter 9 suggests a fitness system to adjust the motion recognition based on users’ individual differences. When students are learning, they tend to absorb information from their own preferred ways, which are decided by their hereditary equipment, life experience and the environment demands [5]. Based on these preference differences, learners can be categorized by different learning styles, such as visual learners, auditory learners, reading/writing learners, and kinesthetic learners [6]. Though there is no one-fit-all instrument for all users, researchers are trying to make the learning environment as smart as possible to serve learners with different needs.

Despite the comprehensive and useful content of this book, readers may come across some difficulties. Firstly, since the book covers a wide spectrum of subjects, readers should expect some challenges when reading something they are not familiar with. For example, the mathematical formulas shown in Chapter 1, 3 and 4 explaining the modeling algorithm of the systems may frustrate readers who do not have relevant knowledge. Readers are advised to grasp the main idea of the chapter instead of understanding it verbatim. Besides, the studies in this book are not at the same quality level. Some of the chapters have weaknesses in their research designs. For instance, the sample sizes of Chapter 9 (n= 13) and Chapter 10 (n=18) are relatively small. Nevertheless, the quantitative analysis of these two studies can be a complement to their qualitative investigations, readers can still gain valuable insights from these chapters.

This book provides both theoretical and practical insights for educational researchers, policy makers, teachers, students, technology developers, and the ones who are interested in smart learning environments. New technological applications and tools will emerge over time; however, the theoretical bases and student-centered educational paradigms underpinning the design, implementation and evaluation of various promising constructivist technology-enhanced learning strategies are everlasting [7] [8]. Therefore, this book can always gain readership in educational technology, regardless of the changing environments. In the near future, the editors may consider compiling another book to discuss the new learning and teaching opportunities unleashing by the educational potential of artificial intelligence (e.g., [9]), digital gamification (e.g., [10]), seamless ambience-awareness (e.g., [11]), mixed reality (e.g., [12]), as well as other web 4.0 and industry 4.0 technologies (e.g., [13]). While this book covers a large number of educational innovations, including LMS, intelligent tutoring systems, game design, virtual environments and augmented reality, the next book can deepen these studies by riding on emerging technologies.

REFERENCES

Xiaojing Weng is currently a PhD student in the Department of Curriculum and Instruction, The Chinese University of Hong Kong. She has obtained the Master of Science in education technology from the University of Hong Kong. Before joined CUHK, she was a research assistant under the ITF project entitled “The Techniques and Applications for Fuzzy Talent Assessment Based on Educational Big Data” in the information technology in The department of mathematics and Education University of Hong Kong. Her research focuses on the STEM education, educational technology, and computational thinking.

Morris S. Y. Jong is the Director of the Centre for Learning Sciences and Technologies, and an Associate Professor of Department of Curriculum and Instruction, The Chinese University of Hong Kong. Currently, he is also in the capacity of Co-Chair of the IEEE Education Society Technical Committee on Learning Sciences, Vice-President of the China Association for Educational Technology Professional Committee on Game-based Learning, Associate Editor of IEEE Transactions on Learning Technologies, as well as Honourary Research Fellow of the Learning Sciences Lab, Peking University. His research interests include learning sciences, gamification, educational VR, context-aware mobile learning, and teacher facilitation in technology-enhanced learning environments.

Thomas Chiu is Assistant Professor in Curriculum and Instruction at The Chinese University of Hong Kong. Thomas has expertise in quantitative research in digital and STEM education and design-based research methodologies. His specializations include educational technology, and motivation and learning. Currently, He is a Self-determination theory international scholar, and sits on the editorial board of Frontiers in STEM Education and Journal of Education and Training Studies. He served as a co-chair of the international conference International Mobile Learning Festival. He is an award-winning educator and School-University Partnership Director, from his time with the University of Hong Kong. He recently proposed a model of student engagement for online learning. See tchiu for more detail.