Book Review

Emerging Tools and Applications of Virtual Reality in Education

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Emerging Tools and Applications of Virtual Reality in Education
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As the use of digital technologies continues to proliferate, the impact of its wide array of applications for educational purposes is of interest to educational practitioners and researchers around globe. Visual, auditory, and interactive stimuli have been blended into virtual reality (VR) learning environments delivered as effective venues to deepen student engagement so as to meet the cognitive needs of the digital generation of students (Jones & Warren, 2011). Central to the theme of the book, as sketched in the preface of the book, are the understanding of VR applications in education underpinned by ever-expanding exploration of virtual technologies, the developing interest in the usability of VR across grade levels and disciplines, and emerging VR technologies as catalysts for further pedagogical evolutions and research developments.

Organized thematically, the book consists of 13 chapters grouped into three sections. The first section comprising four chapters sets the scene of the book by depicting the promise of realizing VR for learning and teaching in diverse disciplines. As depicted in Chapter 1, pedagogical potential of VR use in education is demonstrated in its applications across varying disciplines, including chemical engineering, medical education, multicultural education, mathematics and information technology, to name a few. Avatar interaction within 3D virtual environment is made possible with

advancement of technologies exemplified by a scientific and collaborative visualization tool named Second Life. Chapter 2 contains a systematic meta-analytic review of research targeting on the applications of Three Dimensional Virtual Worlds (3DVW) in institutions of higher education. Up to 164 studies were extracted and documented based on the parameters of major categories of 3DVW application areas, 3DVW platforms adopted for teaching and learning, and virtual and 3D environments blended into learning for divergent educational purposes. Methods and approaches that empower faculty to measure content quality of 3-D virtual learning environments and assess student outcomes are introduced in Chapter 3, followed by Chapter 4 on a pilot study which sketches the implementation of the Second Life virtual world environment to encourage college student engagement in learning.

The second section of the book, containing five chapters, addresses the immense effort for embedding different tools, platforms, and technologies as an integral part of learning/teaching for knowledge acquisition and skill development in fields ranging from teacher preparation, economics, foreign language, mathematics and tourism marketing. The potential of VR-based learning can be observed when looking into its blurring usage in a wide variety of disciplines and its provision of ubiquitous access to information which can be actively applied to real-world situation. Significant benefits for student learning in the VR landscape include improved motivation and retention of student learning, high level of interactivity and collaboration for interpersonal development, the promotion of active and experiential learning, and leveraged exposure to practical skills to deal with real world demands, to name a few.

Chapter 5 continues with the pedagogical merits of Second Life for creating active and situated learning environment applied to a case study on teacher education. To maximize learning in VR-based learning environment, Chapter 6 provides a general axiom broken down into four procedural steps in the integration of VR into a well-organized and informative course. Aside from the benefits taken into account, the transition from the traditional classroom to VR-based learning has its limitations and challenges. In a meta-analytic review of 15 studies on VR applications in the ESL/EFL teaching/learning context (Chapter 6), a number of limitations identified include inappropriate virtual activities for lower language proficiency learners, as well as technical and classroom management problems that impeded the learning process. Chapters 7 and 8 on the inclusion of augmented reality (AR) into tourism market education and VR into mathematics education highlight that strong demands for content-driven, pedagogical and technological knowledge are key challenges remained to be addressed in the transition from traditional instructional approach to VR-based learning.

The final section of the book containing four chapters provides a fresh perspective to emerging technology to be accounted for as new opportunities to enhance the teaching-learning process. Given the potential of pedagogical agents for situated learning, Chapter 9 begins with a case study on the integration of Second Life into mathematics education for homeschool children and community college students. Mathematical

conceptions are broken down into procedural steps for guiding experiential explorations into sequential mastery of the required skills. Chapter 10 showcases new scenarios of human-like pedagogical intelligence in the new educational paradigm. Alongside diverse research findings in relation to the robust effects of incorporating pedagogical agents into learning, potentialities and capabilities of intelligent agents are examined within the socio-cognitive framework in terms of the agent's role of and its use in broader domains of science, mathematics, and the humanity education.

The potential of AR use in education, as posited in Chapter 11, represents a new wave in educational practices. This chapter gives a deep insight into types of AR in education, advantages of AR in education, limitations of AR in education, AR resources for higher educational institutions and a focused discussion of AR Book use in education. Difficulties maintaining information and system, students' attention to virtuality, student cognitive overload and intrusive technology were among some of the top factors which would impede AR application in education. AR technology, driving the next generation of learning in virtual environment, has come a long way but still has some distance to go before it is widely accepted and implemented for educational purposes.

Chapter 12 summarizes a stream of research aimed at addressing ethical issues associated with research in the realm of VR education, including but limited to ethical issues for using human subjects, concerns about public and private spaces on the Internet and online communities, issues raised about military's use of virtual world for research, ethical considerations for K-12 related research, and concerns over standards, guidelines and policies provided by Second Life. With the increasing concerns over technology use standards for the research community, it is essential for further research undertaken on the communication and enactment of the necessary research ethics in the context of VR educational research.

As a concluding remark, Chapter 13 looks into the complexity of technology, pedagogy and content knowledge interwoven in the process of adopting and implementing VR-based teaching/learning. Pedagogical merits, if sound VR-based learning is implemented, are manifested in connection with students' development of problem-solving and critical thinking in a collaborative community. Professional development of teachers are discussed alongside the enhancement of technology infusion competency and self-efficacy, targeting at dealing with challenges and grasping the opportunities in adopting VR technologies to the teaching and learning curriculum. New VR artefacts, such as GemInGame, Oculus Rift, Scalable Game Design and Mobility of Virtual Reality, are paving the way to scrutinizing the future outlook for an enriched VR learning environment.

One of the major limitations of the book comes from the lack of compelling empirical evidence to verify that VR environment causes motivation and learning increases under any conditions. Further research could expand the scope of the book by developing the foundations of quantitative inquiry for understanding many facets of factors involved in the effectiveness of a given VR teaching/learning approach to each intended outcome. The classical Clark and Kozma debate regarding "whether

and the extent to which the media influences learning" is still relevant to VR learning research (Liao & Chen, 2007). With the ever-lasting development of technology use in education, another area for future research, therefore, would be the investigation of interchangeable effects of VR technology, teacher's adoption of such innovation and students' motivation/ needs on learning outcomes. As stated throughout the literature, if learning occurs as a result of exposure to any VR learning environment, the learning is caused by the instructional method embedded in the VR presentation. Educators and researchers of the net generation have a responsibility to bridge the digital divide and prepare students with the skills and competences needed to be successful in a globalized digital society.

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