Guest Editorial Preface

Special Issue on Disruptive Technologies for Constructing Unbounded Learning Environments

Jian Chen, The University of Aizu, Japan
Yishui Zhu, Chang'an University, China
Wei Liang, Hunan University of Commerce, China
Fuhua Lin, Athabasca University, Canada

When we talk about disruptive technologies, a related concept of sustaining innovation always appears in our minds. It reminds us of a once brilliant company - Eastman Kodak. It was founded in 1881 and is famous for producing photographic film. This is a real sample of sustaining innovation which has continued to support a company for meeting our pursuit of high-quality film in the past more than 100 years (Kodak, 2019). However, the glory of photographic film has ended by digital cameras in the 21th century. Digital camera technologies have experienced decades of accumulation and eventually spread to most areas of the society in the early 21th century. They are regarded as disruptive technologies or disruptive innovation. They created a new innovation system and eventually disrupted an existing innovation system. The term of disruptive innovation was defined and first analyzed by the American scholar Clayton M. Christensen and his collaborators beginning in 1995 (Bower & Christensen, 1995).

With the rapid development of information technology, the disruptive technologies for constructing unbounded learning environments are also brought about the change of learning models with the times. Many research works have tried to combine several computational algorithms to realize the symbiosis of human-computers-things, ranging from artificial intelligence, information technology, user modeling, virtual reality, and robotics. These technologies are continuously changing our educational experience in e-learning environments. Along with the popularity of online learning, such as massive online open courses (MOOCs), different from the traditional learning model, learning under an environment of no restriction on time and place has drawn increasing attentions. Specifically, these disruptive technologies for constructing unbounded learning environments focus on providing an efficient means based on combining the new theories and technologies with the traditional theories and technologies to help people improving their learning efficiency.

In those early distance education systems, distance education suppliers tended to convert traditional learning contents into the types which are suitable for distance education. The limitation of this approach is that although the instruction model may be suitable for the learners in school, it may be not a good choice for distance learners. An analysis results show that the dropout predication in Edx MOOCs (Massively Open Online Courses) is more than a half (Liang, Yang, Wu, Li, & Zheng, 2016). Therefore, we think that traditional learning contents suit generalized education, and the role of teacher supervision can compensate for the lack of personalization in school education. If we regard the development of traditional education as a sustaining innovation process, we can consider using disruptive technologies to create a supervised mechanism in personalized education. Furthermore,

we can construct an unbounded learning environment based on disruptive technologies, in order to help learners to find suitable learning contents in the mass distance learning resources.

Based on the above-mentioned viewpoint, we selected four papers from submissions for this special issue. These four papers describe their approaches for supporting personalized learning from respective perspectives.

Shi et al. describe a system framework which uses a topological tree to analyze cognitive manifolds, and automatically collect data based on human computer interaction (HCI) principles. Based on the framework, the status of learning information is automatically formatted according to the cognitive structure, and then, the system can detect the learning status of learners. Furthermore, the detected results can be used for supporting personalized learning. This approach can be used as a role of the teacher to automatically know learners' status in a distance education system.

Xiao et al. provide an augmented reality (AR) enhanced courseware to improve the learning and education efficiency in real classroom. In details, AR technology is used to build a starry sky environment, in which, learners can investigate the stars from a visual angle of themselves. Similarity, this technology can be used for the other courses, such as physics, chemistry etc. which can compensate for the lack of teaching resources in remote mountainous areas.

Saito and Watanobe focus on constructing learning path from submission history of learners by a trial-and-error process. In details, an ability chart of learners is used as an indicator of their current knowledge, which consists of a sequence of submission history of learners. The submission history includes a data set which can be used to infer the relation of learning object and learning status, and then, the relations can be used to recommend a suitable learning object according to a corresponding learning status of leaners. Neural Network technology is used in this study, which is used to train a set of history data and find corresponding patterns.

Similar to the above study related to learning path, Shen et al. regard that a learning path consists of a sequence of learning units. In details, this study focuses on a new learning style named micro-learning, and the learning units are some contents which can be learned completely in a short period. In order to find the relations from a large of learning units, an association rules algorithm is proposed based on Bayesian Network, in which, a set of successful learning paths are extracted from learning history of reference learner group. Different to the traditional association rules algorithms, the proposed algorithm not only considers the associativity of items, but also considers the time sequence of items.

From this special issue, we find some new research trends that relate to disruptive technologies, which are used to develop distance education environments, such as advanced human computing interface principles, augmented reality, and neural networks. Furthermore, traditional Bayesian Network is used in this new field. We do believe that "Disruptive Technologies for Constructing Unbounded Learning Environment" is an important topic in the field of distance education and hope that this special issue can contribute to the application of disruptive technologies for constructing unbounded learning environment.

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Jian Chen
Yishui Zhu
Wei Liang
Fuhua Lin
Guest Editors
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