An Introduction to the April-June 2018 Issue

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To TLT readers,

We are pleased to introduce the first regular journal issue of the year, which follows the special issue on “Innovation in Technologies for Educational Computing”. Our journal alternates regular and special issues to reflect the trends in our field, and we want to point you to the two forthcoming special issues that are open for submission: a Special Issue on Early Prediction and Supporting of Learning Performance and a Special Issue on Data Capture and Analysis to Support Learning Engagement. Please see the call for papers on the journal home page (http://ieee-edusociety.org/about/ieeetransactions-learning-technologies).

Thanks to the increased page budget, the current issue brings to your attention 11 papers.

We start the issue with a survey paper. Lal Bozgeyikli, Andrew Raij, Srinivas Katkoori, and Redwan Alqasemi present “A Survey on Virtual Reality for Individuals with Autism Spectrum Disorder: Design Considerations”. Their design guidelines have been accumulated from systematic literature reviews of research related to VR for users with Autistic Spectrum Disorder, with a focus on VR training applications. They apply a taxonomy that classifies previous work according to immersive and regular (non-immersive) VR systems and types of social, life, and safety skills that they teach.

Automation of teaching procedures—including concept tutoring, summarization, question generation, and formative feedback—is a common theme for five papers in this issue.

Jacob Whitehill and Javier Movellan address the problem of how to design efficient automated methods for teaching concepts. Their paper “Approximately Optimal Teaching of Approximately Optimal Learners” describes a new procedure to train an automated teacher by maintaining a model of the student as a rational approximately-Bayesian learner. The approach was tested with volunteers learning the meaning of foreign words from visual images. It performed better than hand-crafted teaching procedures.

An automated method to summarize lecture slides is the topic of a paper by Atsushi Shimada, Fumiya Okubo, Chengjiu Yin, and Hiroaki Ogata. “Automatic Summarization of Lecture Slides for Enhanced Student Preview—Technical Report and User Study—” describes an approach using image and text processing to select the most important slides that give students a short preview of an upcoming lecture. A study with 372 students showed that those who previewed the summarized slides achieved equivalent scores on pre-lecture quizzes compared to those who browsed the full slide set despite having spent less time with the material.

Luciana Benotti, María Cecilia Martínez, and Fernando Schapachnik describe and evaluate Chatbot, “A Tool for Introducing Computer Science with Automatic Formative Assessment”. By programming Chatbot to engage in structured conversation, students learn fundamental concepts of computer science including variables, conditionals, and finite state automata. The system provides automated formative assessment. A study with 1,454 young participants in an online competition showed that engagement by girls with Chatbot was higher than for boys, for most indicators. A classroom study in three schools showed similar indications of greater engagement by girls.

“Automatic Chinese Multiple Choice Question Generation Using Mixed Similarity Strategy” by Ming Liu, Vasile Rus, and Li Liu focuses on an important problem in the age of MOOC and online learning. One of the key challenges for automatic question generation is producing good distractors (i.e., wrong answer options). The paper explores and compares several options for generating distractors for Chinese multiple choice questions. A study with 296 primary school students demonstrated that the mixed strategy proposed by the authors outperformed baselines in terms of usefulness and discrimination power.

The motivation behind the paper “Learning Buckets: Helping Teachers Introduce Flexibility in the Management of Learning Artifacts Across Spaces” by Juan A. Muñoz-Cristóbal, Juan I. Asensio-Pérez, Alejandra Martínez-Monés, Luis P. Prieto, Iván M. Jorrín-Abellán, and Yannis Dimitriadis is to achieve a balance between teacher-centered and student-centered learning approaches in ubiquitous learning environments. That is, they should offer reasonable freedom of student exploration while putting the teacher in control of students’ actions. The authors propose a “learning bucket”, a container of positioned learning artifacts configured by teachers. To assess this idea, the authors developed the Bucket-Server, a system that implements the idea of buckets, and performed an evaluation with 30 experts. The results confirmed that “learning buckets” could achieve the desired flexibility and highlighted several positive sides of the proposed approach.

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Another common topic is the use of large volumes of learning data and different data analysis approaches to infer various information about learners or learning processes, which would be hard or impossible to obtain otherwise. The next three papers present attempts to quantify and classify such valuable characteristics as orchestration load, collaboration, and reflective thinking.

In “Orchestration Load Indicators and Patterns: In-the-Wild Studies Using Mobile Eye-Tracking”, Luis Prieto, Kshitij Sharma, Łukasz Kidzinski, and Pierre Dillenbourg attempt to quantify the orchestration load, i.e., the effort a teacher spends in coordinating multiple activities and learning processes. The paper proposes a measuring approach that combines physiological data with human-coded behavioral data and explored it in four case studies. Among other insights, the results indicated that the proposed Orchestration Load Score, a linear combination of four eye-tracking metrics, is a useful measure of orchestration load.

Sree Aurovindh Viswanathan and Kurt VanLehn present interesting attempts to classify and measure collaboration of learning pairs in their paper “Using the Tablet Gestures and Speech of Pairs of Students to Classify Their Collaboration”. The ability to measure collaboration in real-time is important to deliver timely intervention, for example by attracting the instructor’s attention to pairs that need help in collaborating effectively. To analyze collaboration in a challenging context of solving math problems with tablets, the authors considered verbal interaction and user action logs and applied machine learning to induce a range of collaboration detectors. The results show that the best detector achieves an accuracy of 96% compared to human coding.

The paper “Mining Online Discussion Data for Understanding Teachers’ Reflective Thinking” by Qingtang Liu, Si Zhang, Qiyun Wang, and Wenli Chen attempts to classify and quantify reflective thinking of teachers engaged in professional training using discussion forum data. While forums provide a wealth of data to understand the teacher’s reflective thinking, traditional manual data coding cannot handle large data volumes. To address the scalability issue, the authors explored educational data mining and machine learning. Using a sample of labelled data, they trained a classification model and applied it to a large volume of unlabelled discussion forum data to understand and visualize the balance of different types of teacher’s reflective thinking.

The remaining papers focus on different topics within the scope of TLT.

Kristian Kiili and Harri Ketamo in “Evaluating Cognitive and Affective Outcomes of a Digital Game-Based Math Test” examine the use of educational games in a novel assessment context. Using a game-based rational number research engine called Semideus, they created an assessment-oriented digital game Semideus Exam and used it to evaluate the validity and usefulness of this game as a tool for assessing sixth-graders’ knowledge of fractions. The results of the study presented in the paper confirmed the validity of a game-based assessment approach and demonstrated that it could decrease text anxiety and increase engagement.

“From Learners to Earners: Enabling MOOC Learners to Apply Their Skills and Earn Money in an Online Market Place”, by Guanliang Chen, Dan Davis, Markus Krause, Efthimia Aivaloglou, Claudia Hauff, and Geert-Jan Houben, considers the feasibility of offering MOOC participants real-world tasks from an online work market place. The authors hand-selected tasks from the Upwork platform relevant to course on Data Analysis and offered these as course exercises. They found that work tasks being offered for up to $50 can be solved accurately by a considerable percentage of the MOOC learners that attempted them.

Enjoy your reading and consider TLT for sharing the results of your exciting projects!