Editorial: A Message from the Editorial Team and an Introduction to the January-March 2016 Issue

Peter Brusilovsky and Mike Sharples

WELCOME to the ninth year of publication and the first 2016 issue of the *IEEE Transactions on Learning Technologies* (*TLT*). We start this year with bidding farewell to several editorial board members. For *TLT*, the tenure of editorial board members is limited to two terms of three years, so every year several board members retire after three or six years of service. This year, we want to thank the second large cohort of board members who have retired after distinguished service: Mordechai Ben-Ari, Tom Boyle, Rafael Calvo, Denis Gillet, Baltasar Fernandez-Manjon, Ralf Klamma, Rynson Lau, and Stefanie Lindstaedt. The work of these board members, who are leading experts in their fields, helped our journal to emerge as a top-10 publication in the field of learning technologies after just a few years since the start of publication.

We are also excited to bring in a large group of new board members who will replace the retired members while also bringing essential expertise in several new areas: Gustavo R. Alves, Tiffany Barnes, Sherry Y. Chen, Carol H.C. Chu, Hendrik Drachsler, Seiji Isotani, Euan Lindsay, Xavier Ochoa, Mykola Pechenizkiy, Ma. Mercedes Rodrigo, Cristóbal Romero, Sergey Sosnovsky, Stefaan Ternier, and Katrien Verbert. We would encourage readers to pay attention to the new board member introductions in the next section, to see range of fields that they cover and the quality level that we expect. We are bringing to the journal established researchers and rising stars across many important areas of learning technology. With their help, we intend to offer a broader coverage of topics while maintaining thorough and prompt professional reviewing. Please, join us in welcoming them aboard!

The remainder of our Introduction reviews the papers that are included in this issue. New ways to teach science, mathematics, and technology are addressed by papers in this issue, proposing novel environments for interactive tabletops, virtual worlds, augmented reality, and mobile devices.

Bertrand Schneider and Paulo Blikstein extend a previous study that found a discovery approach to learning (for the topic of pathways in the brain) promoted greater learning gains than a "tell-and-practice" method. The new study is entitled "Flipping the Flipped Classroom: A Study of the Effectiveness of Video Lectures Versus Constructivist Exploration using Tangible User Interfaces". For this, the authors taught combinatorics and probability through two methods. In the first, 12 college students explored questions on these topics by interacting in pairs with software implemented on an interactive tabletop, employing tangible objects linked with visualizations. They then watched a video lecture on probability given by a university professor. In the second condition, 12 students first watched the video lecture then engaged with the tangible learning environment. The results showed significantly greater learning gains from pre-test to post-test for the students who worked first on discovery learning with the tabletop system. The authors suggest that these students utilized their own initial knowledge to explore the visualizations which primed them for the lecture, whereas the ones who began by watching the lecture then engaged in more limited investigations to memorize, recall, and apply formulas they had seen.

In their paper "Virtual Engineering Sciences Learning Lab: Giving STEM Education a Second Life", Stephanie E. August, Michele L. Hammers, Don Brian Murphy, Allison Neyer, Penda Gueye, and Robert Thames describe an environment in Second Life to teach quantitative skills through visualization, collaborative games, and problem solving. For example, the users are set tasks to open combination locks by converting numbers from base 10 to base 2. The authors conducted evaluations during three summer workshops with university students. They found that the students experienced some problems and frustration with the interface when manipulating the components; however, the 11 students using the virtual world performed marginally better than the 20 students who were taught by traditional lecture.

Learning the principles of wireless communications involves applying theory to practical activity, including designing Wi-Fi and mobile networks and mapping signal coverage. Juan F. Valenzuela-Valdés, Pedro J. Pardo, Pablo Padilla, and Antonio José Lozano-Guerro describe a "Low Cost Ubiquitous Context-Aware Wireless Communications Laboratory for Undergraduate Students" that engages university students in measurements using mobile devices. The students were required to design and implement Wi-Fi and mobile networks, then use software applications on mobile devices to measure signal strength and data rates at various locations. Studies over two academic years with 15 to 24 students per year showed high satisfaction with the teaching methods and good exam scores, particularly for the topics that required the students to use their own devices for measurement.

The paper "Development and Evaluation of an Active Learning Support System for Context-Aware Ubiquitous Learning", by Tien-Yu Hsu, Chuang-Kai Chiou, Judy C.R. Tseng, and Gwo-Jen Hwang, discusses the ALESS system for context-aware ubiquitous learning. This employs active RFID tags located throughout a museum to indicate the distance

For information on obtaining reprints of this article, please send e-mail to: reprints@ieee.org, and reference the Digital Object Identifier below.
Digital Object Identifier no. 10.1109/TLT.2016.2537399

between learners and location-based educational materials. The learners are guided through the museum to locations based on the number of learning targets, expected learning benefit from visiting the location, the distance to the location, the time required to learn the content, and whether the location is already saturated with other visiting learners. The research team compared learning gains of two groups of learners, average age 11.8, where one group used maps on mobile devices to navigate and gain educational materials in the "Rocks and fossils" section of a museum while learners in the other group were given active guidance on mobile devices through the ALESS system. The evaluation showed superior learning profiles for guided students during the first 20 minutes of activity, but no differences in learning outcome at the end of the 40-minute visit. Most learners, in both conditions, finished within 30 minutes and the authors suggest that ALESS would be more useful for situations when time is limited. They are now working on a version of the system that includes sequencing of the curriculum topics.

María-Blanca Ibáñez, Ángela Di-Serio, Diego Villarán-Molina, and Carlos Delgado-Kloos in the paper "Support for Augmented Reality Simulation Systems: The Effects of Scaffolding on Learning Outcomes and Behavior Patterns" bring us to the domain of educational augmented reality. The authors present AR-SaBEr, an image-based augmented reality simulator for teaching basic principles of electricity to ninth-grade students. To complement freedom of exploration, which is a known feature of augmented reality systems, the authors developed a personalized guidance component that can suggest to learners the most relevant and productive tasks for exploration. A controlled study with 82 students demonstrated that personalized guidance considerably affects student behavior and leads to better learning achievements.

The paper "Investigating Engagement with In-Video Quiz Questions in a Programming Course" by Stephen Cummins, Alastair R. Beresford, and Andrew Rice from the University of Cambridge is focused on a "flipped classroom" technology: in-video quizzes for online video lectures. This technology has been made popular by MOOCs where video lectures serve as the primary presentation content and the lack of student engagement is a known problem. The study reported in the paper attempted to assess and maximize the value of in-video quizzes. The results demonstrate that this technology supports an engaging and interactive mode of content delivery.

The paper "Learning Object Recommendations for Teachers Based On Elicited ICT Competence Profiles" by Stylianos Sergis and Demetrios G. Sampson presents a novel approach to teacher-oriented educational recommender systems. This involves extended profiling of teachers to include not only traditional profiles of interest, but also professional expertise in the form of competence profiles. The authors demonstrated how such profiled could be constructed automatically by observing teachers' work in learning object repositories and then using this for generating recommendations. The benefits of the proposed approach are demonstrated in the context of three professional learning repositories.

The paper "Reducing Mistakes in Mathematics Problem Solving through Behavioral Training with a Tablet Computer" by Youngjae Kim, Cheolil Lim, Haewook Choi, and Minsoo Hahn, presents a novel tablet-based system for learning mathematics that allows students to work on solving problems using handwriting. The goal of the system is to reduce problem-solving mistakes by offering students a chance to learn from their own mistakes as well as from the work of their peers. This is done by allowing students to re-play their own solutions side by side with their peers' good problem-solving examples and, optionally, examine three important performance values. A study revealed that the ability to learn from past experience significantly improved learning and the ability to examine performance values provided further improvement.

Peter Brusilovsky, *Editor-in-Chief*
Mike Sharples, *Associate Editor-in-Chief*

Gustavo R. Alves received the MSc and PhD degrees in electrical and computer engineering from the University of Porto, Portugal, in 1995 and 1999, respectively. He has been an adjunct professor with the Department of Electrical Engineering, School of Engineering, Polytechnic of Porto, since 1994. He is responsible for the Research Group in Systems Testing which is part of the Center for Innovation in Engineering and Industrial Technology. He has published more than 160 articles in journals and international conferences with peer review. He coedited a book in the area of remote labs in 2011. His areas of interest include teaching in engineering, remote experimentation, and electronic systems debug and test. He is a member of the Institute of Electrical and Electronics Engineers (IEEE), Global Online Laboratory Consortium (GOLC), the International Society for Engineering Education (IGIP), the Portuguese Society for Engineering Education (SPEE), and the Order of Engineers (OE) in Portugal.

Tiffany Barnes received the BS and MS degrees in computer science and mathematics, and the PhD degree in computer science from North Carolina (NC) State University. She is associate professor of computer science at NC State University. A member of Phi Beta Kappa and the NC State Golden Chain Society, she has served as a chair (2008) and program chair (2009) of the Educational Data Mining conference, chair of the STARS Celebration conference (2011), program chair (2014) and program track (2009) chair for the Foundations of Digital Games conference, the ACM Special Interest Group on Computer Science Education Board (2010-2016), the board of directors for the International Educational Data Mining Society (2011-2016), associate editor for the *Journal of Educational Data Mining* (2008-2010), and guest editor for the *IEEE Computer Graphics and Applications Special Issue on Serious Games* (2009). She received an US National Science Foundation (NSF) CAREER Award for her novel work in using data and educational data mining to add intelligence to STEM learning environments. She is a coPI and current executive vice president for the STARS Computing Corps, a consortium of 53 universities that has engaged 1700+ college students in outreach (to more than 107 K K12 students), research, and service to broaden participation in computing. She is currently working on an NSF-funded project to prepare 150+ teachers to teach the new advanced placement computer science principles course. Her research focuses on educational data mining, serious games for education, health, and energy, and broadening participation in computing education and research.

Sherry Y. Chen received the PhD degree from the University of Sheffield, United Kingdom, in 2000. She is currently a chair professor at the Graduate Institute of Network Learning Technology, National Central University, Taiwan, and a visiting professor in the School of Information Systems, Computing, and Mathematics at Brunel University, United Kingdom. In May 2010, she recieved an Outstanding Scholar Award from the Foundation for the Advancement of Outstanding Scholarship. Her main research interest is to investigate how to develop an individualized information space that can accommodate users' individual differences.

Carol. H.C. Chu received the PhD degree from the Department of Information and Learning Technology at the National University of Tainan, Taiwan, in July 2009. She is an associate professor in the Department of Computer Science and Information Management, Soochow University. She serves as an editorial board member and a reviewer for more than 15 academic journals. Her research interests include mobile and ubiquitous learning, game-based learning, information technology-applied instructions, and knowledge engineering in education. She has published 90 academic papers, including 40 academic journal papers in such professional journals as *Computers & Education*, *British Journal of Educational Technology*, *Educational Technology & Society,* and *Electronic Library* among others. Owing to the innovative inventions in e-learning, she received the annual Young Scholars Outstanding Researcher Award-Ta-You Wu Memorial Award from the Ministry of Science and Technology in 2014. Moreover, she served as the guest editor of the *International Journal of Distance Education Technologies* and *Interactive Learning Environments* (SSCI) in 2013.

Hendrik Drachsler is an associate professor for personalised learning technologies at the Welten Institute of the Open University of the Netherlands. His research interests include learning analytics, personalisation technologies, recommender systems, educational data, mobile devices, and their applications in the fields of technology-enhanced learning and health 2.0. Dr. Drachsler is chairing the EATEL SIG dataTEL and the National SIG Learning Analytics of the Dutch umbrella organization SURF. He is also an elected member of the Society of Learning Analytics Research (SoLAR). In the past, he has been principal investigator and scientific coordinator of various national and EU projects (e.g., FP7 laceproject.eu <http://laceproject.eu>, patient-project.eu <http://patient-project.eu>, WP2 lead LinkedUp-project.eu <http://linkedup-project.eu>) and was responsible for a research budget of more than 2.4 Million Euro. He has regularly chaired international scientific events and is an associate editor of the *Journal of Learning Analytics*. He authored various highly cited articles on technology-enhanced learning. The most influential articles can be found on Google Scholar: https:/sol;scholar.google.nl/citations?user=v1hwiRAAAAAJ&hl.

Seiji Isotani received the BSc and MSc degrees in computer science from the University of Sao Paulo, Brazil, and the PhD degree in information engineering from Osaka University, Japan. He is an associate professor in computer science and vice-president of the International Relations Office at the Institute of Mathematics and Computer Science of the University of Sao Paulo, Brazil. Before joining the University of Sao Paulo, he was a research fellow associated with the Human-Computer Interaction Institute at Carnegie Mellon University. He was also an invited professor at the Tokyo Institute of Technology and Pompeu Fabra University. His research career has been devoted to imagine, design, develop, test, and deploy intelligent and collaborative educational systems using ontologies and other semantic technologies. His scientific and social mission converges into a single goal which is to enable the realization of AAAL: Anytime, Anywhere, Anybody Learning, by developing cutting-edge technology. He is the cofounder of two startups (MeuTutor and Linkn) that received several innovation awards in the field of education and Semantic Web. His main research interests are in the areas of open linked data, ontological engineering, Computer-Supported Collaborative Learning (CSCL), Artificial Intelligence in Education (AIED), and technology-enhanced learning. His research has received international recognition with awards from the IEEE, ACM, and IBM Research. He is a senior member of the IEEE and ACM.

Euan Lindsay is a mechatronic engineer, a discipline that integrates computers, electronics, and physical hardware. His background is in remote laboratories, investigating whether remote and simulated access alternatives to the traditional in-person laboratory experience can provide the high-quality learning outcomes for students. His work in the remote and virtual laboratory classes has shown that there are significant differences not only in students' learning outcomes but also in their perceptions of these outcomes, when they are exposed to the different access modes. These differences have powerful implications for the design of remote and virtual laboratory classes in the future, and also provide an opportunity to match alternative access modes to the intended learning outcomes that they enhance. He is the foundation professor of engineering at Charles Sturt University. His research interests include largely around online learning – the use of remote and virtual laboratories, MOOCs, and other methods for making learning asynchronous, and data analytics for promoting student learning. He was the 2010 president of the Australasian Association for Engineering Education. He is a fellow of Engineers Australia, and a fellow of the United Kingdom Higher Education Academy. He received a 2007 Carrick Award for Australian University Teaching. In 2005, he was named as one of the 30 Most Inspirational Young Engineers.

Xavier Ochoa is a principal professor at the Faculty of Electrical and Computer Engineering at Escuela Superior Politécnica del Litoral (ESPOL) in Guayaquil, Ecuador. He is the coordinator of the Research Group on Teaching and Learning Technologies (TEA). He is currently a member of the executive committee of the Society for Learning Analytics Research (SoLAR). He is also involved in the coordination of the Latin American Community on Learning Objects and Technologies (LACLO), the Latin American Open Textbook Initiative (LATIn), and other regional projects. His main research interests revolve around learning technologies, learning analytics and multimodal analysis.

Mykola Pechenizkiy received the PhD degree in computer science from the University of Jyvaskyla, Finland, in 2005. He is an associate professor in predictive analytics in the Department of Computer Science, Eindhoven University of Technology (TU/e), the Netherlands. Since June 2013, he has also been an adjunct professor in data mining for industrial applications there. His expertise and research interests are in predictive analytics and knowledge discovery from evolving data, and in their application to real-world problems in industry, commerce, medicine, and education. He develops generic frameworks and effective approaches for designing adaptive, context-aware predictive analytics systems. He has actively collaborated on this with industry. He has coauthored more than 100 peer-reviewed publications and coorganized several workshops, conferences, special issues, and tutorials in these areas. He served as the chair of the steering committee of Computer-Based Medical Systems (CBMS) conference series in 2012 to 2016. He serves now as the president of IEDMS, the International Educational Data Mining Society. As a panelist and an invited speaker, he has been advocating for the ethics-aware predictive (learning) analytics research at several recent events, including the FATML@ICML 2015 and US National Science Foundation (NSF) IRB Privacy and Big Data workshops and the EDM 2015 conference.

Ma. Mercedes T. Rodrigo received the BS degree in computer science (honorable mention) from the Ateneo in 1988, the MS degree in applied computer science from the University of Maryland Eastern Shore in 1992, and the PhD degree in computer technology in education from Nova Southeastern University in 2002. She is a professor in the Department of Information Systems and Computer Science at the Ateneo de Manila University in the Philippines. Her areas of specialization are educational technology, intelligent tutoring systems, educational data mining, and affective computing. In 2011, she established the Ateneo Laboratory for the learning sciences through a grant from the Department of Science and Technology's Engineering Research and Development for Technology program.

Cristóbal Romero (http://www.uco.es/∼in1romoc/) received the BSc and PhD degrees in computer science from the University of Granada, Spain, in 1996 and 2003, respectively. He is an associate professor in the Department of Computer Science and Numerical Analysis at the University of Córdoba in Spain and a member of the KDIS (Knowledge Discovery and Intelligent Systems) research group. He has published more than 100 papers in books, journals, and conferences, 33 of which have been published in *Thomson-Reuters Impact Factor* (IF) journals and some of them are important EDM (Educational Data Mining) surveys and reviews. He is also the coeditor of several special issues and two books regarding EDM. He has organized several conferences and workshops about EDM and AI topics as a program chair and conference chair. He has also been engaged in 10 research projects supported by the Spanish and Andalusian governments, concerning several aspects of the area of data mining and its applications. His current main research interests the application of data mining and artificial intelligence techniques in educational domain. He was a founding officer of the EDM society and he has served on the program committee of a great number of international conferences about education, personalization, data mining, AI, and EDM.

Sergey Sosnovsky received the MSc degree in information systems from Kazan State Technological University (Kazan, Russia) and the PhD degree in information sciences from the University of Pittsburgh, PA. He is a principal researcher at the Center for Learning Technologies (CeLTech), German Center for Artificial Intelligence (DFKI), and a project leader at the School of Education, Saarland University. He has coauthored more than 90 peer-reviewed publications on various topics related to adaptive and intelligent educational systems. He served on organizing and programming committees of numerous conferences and workshops related to learning technologies. His research interests lay at the intersection of technology-enhanced learning, personalization, and Semantic Web technologies.

Stefaan Ternier is an assistent professor at the Welten Institute of the Open University of The Netherlands. His current areas of research include mobile learning, metadata management, architectures for learning object repositories, and learning analytics. He was a member of the CEN/ISSS Workshop on Learning Technologies (WS/LT). At this workshop, he coordinated the developments of the Simple Publishing Interface (SPI) and contributed to several other standardization initiatives. Furthermore, he was involved in several European projects, including ProLearn, MELT, MACE, ASPECT, iCoper, Share.TEC, OpenScout, weSPOT, and ECO. Nowadays, he coordinates research and development of ARLearn, an open source platform for mobile serious games and field trips.

Katrien Verbert received the doctoral degree in computer science in 2008 from KU Leuven, Belgium. She is an assistant professor at the HCI research group of KU Leuven. She was a post-doctoral researcher of the Research Foundation – Flanders (FWO) at KU Leuven. The fellowship was interrupted for two years for assistant professor positions at TU Eindhoven, the Netherlands from 1 January 2013 to 31 December 2013 and the Vrije Universiteit Brussel, Belgium from 1 January 2014 to 31 January 2014. Her research interests include learning analytics, visualization techniques, recommender systems for learning, and digital humanities. She has been involved in several European and Flemish projects on these topics, including the EU FP7 ROLE and STELLAR projects. She was also involved in the organization of several conferences and workshops (program co-chair EC-TEL 2016, workshop co-chair EDM 2015, program co-chair LAK 2013, and program co-chair of the RecSysTEL workshop series).