Digital systems supporting cognition and exploratory learning in twenty-first century: guest editorial

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Abstract Digital systems and digital technologies are globally investigated for their potential to transform learning, teaching and assessment towards offering unique learning experiences to the twenty-first century learners. This Special Issue on *Digital systems supporting cognition and exploratory learning in twenty-first century* aims to contribute to the global dialogue between the educational technology and educational psychology research community and the educational practitioners on current issues towards large scale take-up of educational technology.

Keywords Digital systems · Cognition · Collaborative problem solving · Exploratory learning · Learning communities · Remote labs · Self-regulated learning · Technology integration

Introduction

The Cognition and Exploratory Learning in the Digital Age (CELDA; <http://www.celda-conf.org>) conference is a unique international research conference that brings together educational technology and educational psychology researchers as well as instructional designers and other educational practitioners for the purpose of

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fostering and promoting ongoing dialogue between these academic and professional communities. CELDA is sponsored by the International Association for the Development of the Internet Society (IADIS; see <http://www.iadisportal.org/>). The disparate nature of these educational technology research and professional groups worldwide results in sporadic and fragmented efforts that limit the transformative potential of digital technologies in the areas of learning, teaching and assessment. This is occurring when there is a global need for improved learning and the tools to support such improvements are widely available. To this end, CELDA has created, since it was initiated in 2004, a community that actively contributes to this dialogue and has contributed to outcomes in the form of special issues published in academic journals and edited books that inform and influence academic and professional practice (Ifenthaler et al. 2011; Isaías et al. 2012; Sampson et al. 2013, 2014; Spector et al. 2010, in press).

This special issue and a forthcoming edited book based on papers presented in CELDA 2015 are the most recent outcomes of this well-established process (Ifenthaler et al. 2012a, b, 2014; Kinshuk et al. 2007, 2008, Kinshuk et al. 2009a, b, 2010; Kinshuk and Sampson 2006). It is created from the extended versions of the best papers around a core theme from the 2015 International Conference on Cognition and Exploratory Learning in the Digital Age (CELDA; see <http://www.iadisportal.org/celda-2015-proceedings>) that was held in Maynooth, Greater Dublin, Ireland in October 2015, hosted by Maynooth University. Each contribution reports an original research work in the theme of this special issue—*Digital systems supporting cognition and exploratory learning in twenty-first century*.

What follows are six papers that have been expanded from the CELDA 2015 papers: (1) “Extending the will, skill, tool model of technology integration: adding pedagogy as a new model construct” by Gerald Knezek and Rhonda Christensen, (2) “How does self-regulated learning relate to active procrastination and other learning behaviors?” by Masanori Yamada, Yoshiko Goda, Takeshi Matsuda, Hiroshi Kato, and Hiroyuki Miyazawa, (3) “The relationship between collaboration, multi-tasking and problem solving performance in shared virtual spaces” by Lin Lin, Leila A. Mills, and Dirk Ifenthaler, (4) “Comparing learner community behaviour in multiple presentations of a massive open online course” by Silvia Elena Gallagher and Timothy Savage, (5) “Postgraduate Students’ Level of Dependence on Supervisors in Coping with Academic Matters and Using Digital Tools” by Gurnam Kaur Sidhu, Sanjit Kaur, Peck Choo Lim, Yuen Fook Chan, and Leele Susana Jamian, and (6) “A study on the use of a metadata schema for characterizing school education STEM lesson plans by STEM teachers” by Panagiotis Zervas, Eleftheria Tsourlidaki, Yiwei Cao, Sofoklis Sotiriou, Demetrios Sampson, and Nils Faltn. The order is based loosely on a general to more specific sequence, with each of the papers focusing issues pertinent to planning and supporting exploratory learning in the digital age.

The special issue starts with a paper by Gerald Knezek and Rhonda Christensen that presents an expanded framework to support planning and technology integration in the digital age. Their paper includes an analysis of three sets of data to support the addition of pedagogical style to the will, skill and tools model

previously developed and published. This addition has strong implications for teacher preparation and professional development in the context of integrating technology effectively in school environments.

Masanori Yamada and colleagues present an empirical study involving 179 first-year university students engaged in a blended learning environment. The purpose was to investigate the relationships between self-regulated learning, procrastination and learning behaviors. Data collected included pre- and post-course surveys, log data, and student artifacts (e.g., short papers and reports). Their findings indicate that self-regulation and procrastination are significant factors in understanding learning behaviour. These results have implications for planning motivational and other learning support interventions for different students depending on their levels of self-regulation and tendency to procrastinate.

Lin Lin, Leila Mills, and Dirk Ifenthaler present an empirical study aimed at understanding collaborative problem solving by university students in a shared virtual space. Specific hypotheses involved (a) the relationships between multi-tasking, collaboration and problem solving, and (b) the extent to which collaboration was positively correlated with problem-solving performance. While there is research to suggest that multi-tasking generally degrades task performance, this study suggests that collaborative problem solving and multi-tasking had a positive effect on task performance. Moreover, collaboration in general tended to improve performance.

Silvia Gallagher and Timothy Savage contribute to research on massive open online courses (MOOCs) by investigating learner communication, expectations and learning behaviors in two iterations of a Futurelearn History MOOC. Retention in the course, learning behaviors, and expectations were analysed taking into account prior online experiences and a number of demographic variables. The MOOC was not changed between the two offerings so that a comparative analysis could be performed. As has been reported for many other MOOCs, many learners reported that they dropped out because they could not keep up with the pace of the course. With regard to learner behaviors, it seems that those from Western cultures are more likely to be actively engaged and make comments than those from Eastern cultures. Such findings as these can help those who plan and support MOOCs create environments that are more likely to engage a variety of learners and reduce the high MOOC drop-out rates.

Gurnam Kaur Sidhu and colleagues report an investigation of 132 postgraduate university students in Malaysia with regard to their perceptions about dependence on supervisors and major professors in relation to their use of digital tools, academic performance and motivation. They found that these students were generally more dependent on their supervisors with regard to academic matters but not really so dependent on their supervisors with regard to the use of digital tools and technologies. While the progress of these students was good when developing and implementing technology-based interventions, when it came to data collection, analysing findings and writing their progress slowed considerably as they became much more dependent on their supervisors. This further suggests that these students may be lacking sufficient autonomy for lifelong academic learning. Implications for addressing this situation in Malaysia and perhaps other cultures are then suggested.

Concluding this special issue is a paper by Panagiotis Zervas and his colleagues that presents results from a European initiative, namely, the Global Online Science Labs for Inquiry Learning at School (Go-Lab). The paper focuses on the GoLAB technical infrastructure for providing access to STEM (science, technology, engineering and mathematics) lesson plans in association with online laboratories and a study on its use by real teachers. This infrastructure involves a web-based repository where those lesson plans can be placed, and a systematic way to tag those lesson plans to facilitate retrieval and re-use. Then, the authors analyse the metadata records of lesson plans produced by more than a hundred school teachers to better understand their tagging behavior.

Overall, these six selected papers in this special issue demonstrate multiple perspectives and approaches with implications for the transformative potential of digital technologies and digital systems in planning and supporting learning, performance and instruction. We are hopeful that this special issue contributes in a substantive way to the public discourse and research with regard to advanced technologies and innovative approaches to learning and teaching.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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