Editorial for EAIT issue 4, 2020

Arthur Tatnall¹

Published online: 23 June 2020

© Springer Science+Business Media, LLC, part of Springer Nature 2020

Education and Information Technologies (EAIT) is the official journal of the Technical Committee on Education (TC3) of the International Federation for Information Processing (IFIP). It covers the complex relationships between information and communication technologies and education, from the micro of specific applications or instances of use in classrooms to macro concerns of national policies and major projects; from classes of five year olds to adults in tertiary institutions; from teachers and administrators, to researchers and designers; from institutions to open, distance and lifelong learning. The journal's breadth of coverage allows EAIT to examine fundamental issues at all levels, discuss specific instances and cases, draw inference and probe theory. This journal is embedded in the research and practice of professionals.

To begin this issue Jie He (Baoji Vocational & Technical College, China) offers a paper entitled: ***Research and practice of flipped classroom teaching mode based on guidance case***. This paper investigates a group of students as subjects for a flipped classroom experiment using an experimental and a control class. The research results showed that before the experiment both students from each class lacked interest in English learning, did not prepare lessons before class and did not perform autonomous learning. After the experiment, however, it was found that the scores of the experimental class were significantly higher than the control class. This suggests that the flipped classroom teaching mode can effectively stimulate students' interest in learning English, develop their autonomous and cooperative learning abilities and enhance their English learning proficiency.

Preservice teachers' views about the twenty-first century skills: A qualitative survey study in Turkey and Sweden comes from Ferit Karakoyun (Dicle University, Diyarbakır, Turkey) and Ola J. Lindberg (Umea University, Sweden). Their study aimed to investigate the views of preservice teachers from Turkey and Sweden about twenty-first century skills. The findings indicate that within the context of daily life, the preservice teachers from both countries associated twenty-first century skills mostly with technology, digital citizenship, communication, and information literacy. Within the context of education, a majority of the preservice teachers from Turkey associated

✉ Arthur Tatnall
Arthur.Tatnall@vu.edu.au

¹ Victoria University, Melbourne, Australia

twenty-first century skills with information literacy and technology, while those from Sweden associated twenty-first century skills mostly with technology, distance learning and communication.

Integrating scientific communication into middle school lessons: A curriculum design research by Nihal Menzi Çetin (Adana Alparslan Türkeş Science and Technology University, Turkey) and Buket Akkoyunlu (Çankaya University, Turkey) reports on the design of a Scientific Communication Curriculum (SCC) for middle school students and teachers to equip them with scientific communication (SC) skills which were integrated into the middle school lessons. Within the framework of the Curriculum Design Research (CDR), designing the SCC and integrating into it lessons was conducted in two cycles each consisted of four stages; analysis, design, implementation, and evaluation. As a part of the design process, the Teacher Training Program was organized to equip all middle school teachers with scientific communication skills and to help them how to teach and how to integrate the SC skills. Furthermore the TTP served as a professional development component of the CDR framework.

Lilian Anthonysamy, Ah Choo Koo and Soon Hin Hew (Multimedia University, Persiaran Multimedia, Malaysia) next report on ***Self-regulated learning strategies in higher education: Fostering digital literacy for sustainable lifelong learning***. Their paper examines how self-regulated learning strategies (SRLS) can foster the enhancement of digital literacy in digital learning to increase efficiencies in human capital for sustainable development in lifelong learning. Digital disruption in the education sector is unavoidable and the authors suggest that the results of this study will be useful for educators and students to establish guidelines on how to utilize SRLS to enhance digital literacy competence and hence lifelong learning as developing human capital for the future workplace is crucial.

For many young children in developed countries, family and community life is mediated by digital technology, and Karen Daniels, Kim Bower, Cathy Burnett, Hugh Escott, Amanda Hatton, Ester Ehiyazaryan-White and Jemma Monkhouse (Sheffield Hallam University, UK) discuss this in: ***Early years teachers and digital literacies: Navigating a kaleidoscope of discourses***. In an attempt to gain insights from early years teachers, they draw on semi-structured interview data from ten practising teachers which explored their perspectives on digital technologies within their personal and professional lives, and of children's use of digital technologies within and outside educational settings. They assert that narrow conceptualized notions of literacy, compounded by national imperatives to raise print literacy standards, add another layer of discursive complexity that comes to the fore when teachers are asked to provide a rationale for the promotion of digital literacies in early years classrooms.

Effect of social media on academic engagement and performance: Perspective of graduate students is by Rouhollah Mahdiuon (Azarbaijan Shahid Madani University, Tabriz, Iran), Ghasem Salimi and Laleh Raeisy (Shiraz University, Iran). This study examines the effect of the adoption of Telegram on academic engagement and performance of graduate students in two Iranian universities. The results showed that there was a positive and significant relationship between educational use of Telegram and student engagement and that educational use of Telegram affected academic performance in a mediating role of student engagement which has been significantly related to academic performance.

Based on a case study of Sri Lanka's ICT in education experiences, the next paper discusses how countries in the Global South could take up the opportunities of ICT for access to quality education. Cher Ping Lim (Hong Kong S.A.R., China), Sungsup Ra (Asian Development Bank, Philippines), Brian Chin (Asian Development Bank, Philippines) and Tianchong Wang (Hong Kong S.A.R., China) offer: ***Information and communication technologies (ICT) for access to quality education in the global south: A case study of Sri Lanka***. Sri Lanka is at the emerging state of using ICT in education with a relatively high access to education and ranked high on achievements in education. Beginning with an overview on the potential and current challenges of harnessing ICT for access to quality education, a case study of Sri Lanka identifies and analyses the key factors that facilitate or hinder the realisation of the opportunities.

Konstantinos Lavidas, Anthi Achriani, Stavros Athanassopoulos, Ioannis Messinis and Sotiris Kotsiantis (University of Patras, Greece) next offer: ***University students' intention to use search engines for research purposes: A structural equation modeling approach***. The aim of their study was to examine undergraduate students' acceptance of technology through their intention to adopt and use a specific search engine – "Google Scholar" for research purposes. The study was based on TAM (Technology Acceptance Model), reinforced by four external determinants (perceived self-efficacy, subjective norms, facilitating conditions and technological complexity), that contributed to the indirect prediction of the behavioural intention to use the particular search engine. The results of their survey confirmed that the main factors of TAM, perceived ease of use and perceived usefulness are significant determinants of students' behavioural intention to use Google Scholar. Perceived self-efficacy, subjective norms, facilitating conditions and technological complexity have an indirect significant effect on behavioural intention. All these factors explained almost 60% of students' behavioural intention to use this search engine.

Various studies have widely examined mixed reality (MR) in primary and secondary (K-12) education, but there has been little systematic review of the educational benefits of MR technology for the development of learning environments. Nikolaos Pellas (University of Western Macedonia, Greece), Ioannis Kazanidis (International Hellenic University, Greece) and George Palaigeorgiou (University of Western Macedonia, Greece) address this in: ***A systematic literature review of mixed reality environments in K-12 education***. The systematic literature review presented describes the current state of knowledge and practices using MR in K-12 education and provides guidance for educators and scholars focusing on instructional design contexts by critically appraising and summarizing the existing research. Implications for practice and research are discussed in detail as MR has the potential to influence students' engagement, participation, skill acquisition, and embodied learning experience for knowledge transfer within well-structured instructional design contexts.

Assessment of open educational resources (OER) developed in interactive learning environments by Thahomina Jahan Nipa and Sharareh Kermanshachi (University of Texas at Arlington, USA) notes that when students are unable to purchase a textbook because of rising prices and/or are unwilling to carry heavy textbooks, their education is compromised. Open educational resources (OERs) are gaining in popularity because they solve these problems by providing free study materials in electronic formats, but students from different backgrounds and situations are impacted by OER in different ways and their paper analyzes the usefulness of OER materials for students who are

majoring in engineering, as well as those whose majors are in other (non-engineering) fields. The study concluded that students majoring in engineering and students with financial constraints had a significantly more positive attitude towards the implementation of electronic OER materials.

Opinion mining technique for developing student feedback analysis system using lexicon-based approach (OMFeedback) by Muslihah Wook, Noor Afiza Mat Razali, Suzaimah Ramli, Norshahriah Abdul Wahab, Nor Asiakin Hasbullah, Norulzahrah Mohd Zainudin and Muhamad Lazim Talib (Universiti Pertahanan Nasional Malaysia) notes that online assessment systems are increasingly utilised as an evaluation tool for measuring the performance of lecturers in Institutions of Higher Learning. These systems usually involve questionnaires comprised of quantitative and qualitative questions, but most online lecturer teaching assessment systems are focused on the quantitative part of the questionnaire as this is easy to analyse. The qualitative part, however, which requires students' opinions, is often omitted and neglected, and the level of opinion results are excluded. This is because students' opinions are usually in the form of unstructured texts, which makes it hard to manually analyse all the feedback. To address this problem, a system that could automatically analyse students' feedback (known as OMFeedback) was developed.

Traditional printed textbooks have represented a static medium of knowledge transfer for many years and the next article: **Blending printed texts with digital resources through augmented reality interaction** contributed by Samer Y. Al-Imamy (Prince Mohammad Bin Fahd University, Saudi Arabia) looks at how technology has introduced digital material that encourage educational institutions to plan for the transfer to e-book and other related digital media. This article introduces a way to blend both through the augmentation of printed textbooks with interactive entries to digital media and to guide learners into the digital world recommended by expert educators.

The next article, by Filiz Kalelioglu (Baskent University, Turkey) and Sue Sentence (King's College London and Raspberry Pi Foundation, Cambridge, UK) points out that many physical devices supporting the learning of programming and digital making are now available and that these have the potential to make learning fun, accessible and creative for children and young adults. **Teaching with physical computing in school: the case of the micro:bit** addresses this topic. The advent of this technology necessitates research to inform pedagogical approaches that work in the classroom, and this article reports on a study which explored the pedagogy around the use of the physical devices for programming, drawing on teachers' experiences of teaching and assessment. The device used was the micro:bit, but the findings are applicable to use with any similar device in school. The study revealed that the most commonly used teaching methods with this physical computing device were live coding demonstrations, pair programming, discussion, collaborative work and tinkering.

The flipped classroom in ESL teacher education: An example from CALL deals with data collected from students in a Computer-Assisted Language Learning (CALL) course. It comes from YuYen Lee and Katherine I. Martin (Southern Illinois University Carbondale, USA). The flipped classroom is one of many technology-enhanced teaching strategies where students are responsible for initial learning at home (often via instructional videos) and class time is used for problem-solving and activities to deepen understanding. The reported study examined the flipped classroom through the eyes of

pre-service language teachers to reveal what hinders them from or encourages them to adopt this approach. Four challenges emerged: learners' technology access and technical ability, technical support for instructors, ambiguous student responsibility, and an inability to provide immediate clarification. Three additional notable themes emerged: heightened awareness of peers in the classroom, different reactions to content-oriented versus technically-oriented instructional videos, and student workload.

Shristi Shakya Khanal, P.W.C. Prasad, Abeer Alsadoon and Angelika Maag (Charles Sturt University, Australia) developed a taxonomy that accounts for components required to develop an effective recommendation system and this is described in their article: *A systematic review: machine learning based recommendation systems for e-learning*. They note that the constantly growing offering of online learning materials to students is making it more difficult to locate specific information from data pools and personalisation systems attempt to reduce this complexity through adaptive e-learning and recommendation systems. The recommendation systems are generally based on machine learning techniques and algorithms and there has been progress in their development. Challenges however remain in the form of data-scarcity, cold-start, scalability, time consumption and accuracy.

The article to follow: *Decolonising technological pedagogical content knowledge of first year mathematics students* was contributed by Simon Bheki Khoza and Audrey Thabile Biyela (University of KwaZulu-Natal, South Africa). They argue that decolonising students' knowledge of technology, pedagogy, and mathematics content is important because it helps students understand their learning needs. Decolonisation is a process of critiquing and renewing the curriculum and learning needs are circumstances that demand individuals' actions in order to address professional, personal, and/or social needs. Their article explores and decolonises students' knowledge of technology, pedagogy, and content in the learning of first year Bachelor of Education mathematics. The concepts were learning needs, content, goals, activities, time, environment, community, assessment, and GeoGebra resources. The study concluded that, although technological and content knowledge dominated learning in other cases of the module, the pedagogical knowledge which was a result of their self-reflection to understand their identities, drove the module all the time.

Next comes: *Factors affecting trainee teachers' intention to use technology: A structural equation modelling approach* from Fuad Ali Ahmed Eksail (Bahrain Teachers College, University of Bahrain) and Ernest Afari (Bahrain Teachers College, University of Bahrain and Curtin University, Australia). They point out that it is becoming necessary for trainee teachers to willingly accept technology as a tool for learning, effective teaching and assessment and the aim of their study was to measure trainee teachers' perceived usefulness, perceived ease of use, subjective norm, facilitating conditions, attitude towards technology use and behavioural intention to use technology. Results from structural equation modelling analyses suggested that perceived ease of use was a moderate predictor of perceived usefulness and attitude towards use and perceived usefulness strong predictors of behavioural intention to use technology.

LearnSmart: A framework for integrating internet of things functionalities in learning management systems comes from Khaleel Merashad, Abdulhadi Damaj, Pilar Wakim and Ali Hamieh (Arts, Sciences, and Technology University in Lebanon (AUL), Lebanon) who note that a breakthrough in the development of online learning

occurred with the utilization of Learning Management Systems (LMS) as a tool for creating, distributing, tracking, and managing various types of educational and training material. Major technological enhancements transformed the LMS into powerful software for providing rich-content courseware, assessment, and dynamic collaboration, but the most important technology that is expected to transform many future aspects is the Internet of Things (IoT). In this paper, the authors explain the detailed implementation of two LMS applications that exploit IoT tools and devices in order to bring new experiences and opportunities to the educational system.

Some educational organisations have multi-education paths such as engineering and medicine colleges in which the behaviour of the student in the preparatory year determines which education path they will join in the future and in this paper an adaptive recommendation system is proposed for predicting a suitable education path(s) for a student in college preparatory year. Contributed by Mohamed Ezz (Jouf University, Saudi Arabia and AL-Azhar University, Egypt) and Ayman Elshenawy (AL-Azhar University, Egypt), the article is titled: ***Adaptive recommendation system using machine learning algorithms for predicting student's best academic program***. The adaptability is achieved by automatically applying different data mining techniques for extracting relevant features and building a tailor-made model for each education path. The problem is formulated as a multi-label multi-class binary classification problem and the dataset automatically translated into one-versus-all (for binary classification). The relevant set of features for each department is then selected and a machine learning algorithm with the best performance is selected for the recommendation process of each department.

PyDiophantus maze game: Play it to learn mathematics or implement it to learn game programming in Python by Dimitra Koupritzioti and Stelios Xinogalos (University of Macedonia, Greece) notes that serious or educational games have attracted interest from instructors and researchers for several years. In education, serious games are used for motivating students, attracting their interest in cognitively demanding fields and making the teaching and learning process more fun. The study presented in this article aimed to investigate whether it is feasible to learn programming concepts, as well as game programming concepts, through implementing a game in Python. More specifically, the study presented has the following goals: firstly, to review and comparatively analyze existing game engines and libraries that can be used by novice programmers for implementing simple games in Python; secondly, to investigate whether it is feasible to implement a simple but yet meaningful game that can be used as a prototype for learning programming concepts and game programming concepts in Python. The PyDiophantus Maze game that was implemented can be used for teaching and learning game programming in Python, but also for learning mathematics.

Examination of using monoscopic three-dimensional (M3D) and stereoscopic three-dimensional (S3D) animation on students addresses research by Mehmet Burak Taştı and Ümmühan Avcı (Başkent University, Turkey). The study reported in this article examined the effect of using this animation on students' achievement and perceptions. Ninth-grade students participated in this Explanatory Sequential Mixed Design study which began with an academic achievement test and after with this same academic achievement test plus an animation opinion scale, an animation rubric, and a structured interview form. The results showed a significant difference in the post-test scores in favour of the students using the S3D animation. Both groups of students

provided positive feedback concerning the use of animations in their course; however, they highlighted that S3D animations were more effective and enjoyable.

The next article: *The perceived effectiveness regarding Immersive Virtual Reality learning environments changes by the prior knowledge of learners* from Zeynep Taçgın (Marmara University, Turkey and Charles Sturt University, Australia). The purpose of this research was to investigate the features of an immersive virtual reality learning environment (IVRLE) and to evaluate its perceived simulation effectiveness under the learning, attitude, and confidence sub-concepts. This study designed an IVRLE using gesture interaction for teaching preoperative surgical procedures and concepts to undergraduate nursing students. The results of this research emphasise that IVRLEs should be designed considering the desired learning outcomes, abilities, and expectations of the learners and that well targeted and well-designed IVRLE help to improve the confidence of learners in practical skills.

Nani Amalina Zulkainain, Suraya Miskon and Norris Syed Abdullah (Universiti Teknologi Malaysia) next present: *An adapted pedagogical framework in utilizing WhatsApp for learning purpose*. They explain that WhatsApp is one of the most popular and widely used communication platforms today, but in a few subject areas this mobile app can be distractive and cause users to lose their focus as it attracts and promotes social interaction among learning communities. In this study, observation method was used for the main experiment to gain a deeper understanding of students' responses on WhatsApp, then, a Community of Inquiry (COI) framework was selected and applied followed by an adapted pedagogical COI framework utilising WhatsApp for learning purposes. The findings showed that the framework positively supports the use of WhatsApp for learning purposes.

Fresh perspectives on TPACK: pre-service teachers' own appraisal of their challenging and confident TPACK areas by Teemu Valtonen (University of Eastern Finland), Ulla Leppänen (University of Eastern Finland), Mareena Hyypiä (University of Eastern Finland), Erkko Sointu, Windesheim University of Applied Sciences, Netherlands, Anneke Smits (Windesheim University of Applied Sciences, Netherlands) and Jo Tondeur (Vrije Universiteit Brussel, Belgium) is an extension of studies that measure pre-service teachers' Technological Pedagogical Content Knowledge (TPACK) confidence. The article provides new perspectives on pre-service teachers' TPACK by shifting the focus to concrete concerns and strengths indicated by pre-service teachers. Four TPACK areas were found confident, challenging or both confident and challenging for students. For these first-year pre-service teachers, pedagogical knowledge played the most important role, and the outcomes concretise specific aspects of pedagogical knowledge that can be addressed to develop TPACK in teacher education. The results provide important perspectives on pre-service-teachers' development of TPACK, revealing the important position of pedagogical knowledge and detailed perspectives on how pre-service teachers view their readiness to use ICT in education.

Construction and validation of Mobile Social Network Sites Utility Perceptions Inventory (MUPI) and exploration of English as foreign language teachers' perceptions of MSNSs for language teaching and learning comes from: Saeedeh Kavoshian (University of Isfahan, Iran), Saeed Ketabi (University of Isfahan, Iran), Mansoor Tavakoli (University of Isfahan, Iran) and Thomas Koehler (Technical University of Dresden, Germany). The purpose of this study was three-fold: first, it aimed to develop

a scale to shed light on English as Foreign Language (EFL) teachers' perceptions of using Mobile Social Network Sites (MSNSs) in language teaching and learning, secondly to attempt to investigate the construct validity and reliability of the MUPI through collecting data from Iranian EFL teachers and thirdly to explore EFL teachers' perceptions of MSNSs use by analysing the results of the administered scale. Their findings showed that teachers put more emphasis on factor one (Advantages of MSNSs for Teaching and Learning) and factor three (Barriers to Using MSNSs for Teaching and Learning).

Massive Open Online Courses (MOOCs) are confronted with several problems among which the most important is the lack of participants' interactivity in the platform and the dropout of participants. The next article from Hamada El Kabtane, Mohamed El Adnani, Mohamed Sadgal and Youssef Mourdi (University Cadi Ayyad, Morocco): ***Virtual reality and augmented reality at the service of increasing interactivity in MOOCs*** addresses this matter. These challenges need to be resolved to ensure better engagement and to encourage the participants to complete the training by improving their understanding-level and this paper focuses on the proposition of a solution that helps to solve the lack of the participants' interaction with the platform and to decrease the dropout rate. To do this the article proposes a module of virtual manipulations creation (virtual simulations and practical activities).

Mostafa Al-Emran (Ton Duc Thang University, Vietnam), Ibrahim Arpaci (Tokat Gaziosmanpasa University, Turkey) and Said A. Salloum (University of Sharjah, UAE) next write on: ***An empirical examination of continuous intention to use m-learning: An integrated model***. Although research has been conducted into mobile learning (m-learning) adoption or acceptance, examining its continued use is not as often researched. The reported study develops an integrated model through three different theoretical models, namely technology acceptance model (TAM), theory of planned behaviour (TPB), and expectation-confirmation model (ECM). Their empirical results indicated that perceived ease of use, attitude, perceived behavioural control, and subjective norms are significant predictors to explain the continued use of m-learning, but that perceived usefulness and satisfaction were insignificant determinants of continuous intention.

M-learning technology in Arab Gulf countries: A systematic review of progress and recommendations is an article by Ahmed Alsswey (Al-Zaytoonah University of Jordan), Hosam Al-Samarraie (Coventry University, UK), Fuad Ali El-Qirem (Al-Zaytoonah University of Jordan) and Fahed Zaqout (Higher Colleges of Technology, UAE). With the recent development in mobile devices and mobile services, mobile learning (m-learning) has become one of the most common research topics across Arab Gulf countries, but literature showed an inconsistent usage in these countries. This paper examines the progress of m-learning use there, offering recommendations to improve its adoption success. It was noted that lack of research on leadership and policy practices may lead to technology failure.

Does ICT familiarity always help promote educational outcomes? Empirical evidence from PISA-Thailand. In this article Kitisak Srijamdee and Piriya Pholphirul (National Institute of Development Administration, Thailand) note that facility in the use of information and communication technology, which can help complement, enrich, and transform education, should be promoted among students. They then ask: does a higher level of ICT familiarity always help promote learning skills and

educational outcome? Their empirical research paper investigates the impacts of ICT familiarity on educational outcomes in developing countries where access to ICT infrastructure is limited. Their results show that using ICT for educational proposes can help improve Thai students' PISA scores but that using ICT that is not tailored to educational proposes was found to have an insignificant effect on educational outcomes.

In the next article Hadeel S. Alenezi and Maha H. Faisal (Kuwait University, Kuwait) point out that learning continues to be a vital developing field since it is the key measure of the world's civilization and evolution with its enormous effect on both individuals and societies. ***Utilizing crowdsourcing and machine learning in education: Literature review*** notes that one of the crucial activities in education is the assessment method because it is the primary way used to evaluate the student during their studies. The purpose of this review was to examine existing learning and e-learning approaches that use crowdsourcing, machine learning or both in their proposed solutions. This study presents a systematic literature review of IEEE and ACM databases. They found that crowdsourcing is utilized in 48% of the investigated learning activities, while each of the machine learning and the hybrid solutions were utilised in 26%. It was found that using either crowdsourcing or machine learning in the online courses will enhance the interactions between the students.

Digitizing distance learning materials: Measuring students' readiness and intended challenges by Emmanuel Arthur-Nyarko ((University of Cape Coast, Ghana), Douglas Darko Agyei (University of Cape Coast, Ghana) and Justice Kofi Armah (University of Johannesburg, South Africa) reports on a study that sought to explore distance education students' readiness to use digital learning materials from a College of Distance Education programme which was in the process of transforming the face-to-face approach of delivery to a more digitized one in Ghana. Their results showed that the majority of students affirmed their readiness to use digital learning materials. While respondents did not report high access levels of some digital technologies such as tablets/iPad, desktop computers and laptops, the majority had personal access to smartphones with internet capabilities.

Jérémy Castéra (Aix-Marseille Université, France), Claire Coiffard Marre (Aix-Marseille Université, France), Margaret Chan Kit Yok (Universiti Teknologi MARA Sarawak Branch, Malaysia), Kezang Sherab (Royal University of Bhutan), Maria Antonietta Impedovo (Aix-Marseille Université, France), Tago Sarapuu (Tallinn University, Estonia), Alice Delserieys Pedregosa (Aix-Marseille Université, France), Sufiana Khatoon Malik (National University of Modern Languages, Pakistan) and Hélène Armand (Aix-Marseille Université, France) next offer an article titled: ***Self-reported TPACK of teacher educators across six countries in Asia and Europe***. They point out that the initial technological pedagogical and content knowledge (TPACK) model was theorised on seven clearly identified factors, but that many studies have failed to empirically identify these. Thus elements influencing TPACK level, such as national context, gender and age remain unclear. The study is focused on teacher educators' TPACK as one of the most important elements in schoolteacher training. The study showed four major results: a relative stability of the seven-factor model structure across countries; the relative differences of university teachers' TPACK perceptions across six countries in Europe and Asia; the dependence of age and TPACK factors; and an independence of gender/academic level and TPACK.

The emergence of new technological innovations in the classroom has brought about greater changes in pedagogy especially in concepts related to abstraction such as Geography say Nigeria Nafisat A. Adedokun-Shittu (University of Ilorin, Nigeria), Adedeji Hammed Ajani (University of Ilorin, Nigeria), Kehinde Muritala Nuhu (University of Ilorin, Nigeria) and AbdulJaleel Kehinde Shittu (Fountain University, Nigeria) in their article: ***Augmented reality instructional tool in enhancing geography learners academic performance and retention in Osun state***. Geography teaching and learning, particularly elements of physical Geography, is mostly approached in a conventional pedagogical manner even as the concept consist of abstractions. Their study engaged a visualisation technology; Augmented Reality Instructional Tool (ARIT) to examine Geography learners' performance and retention when they are exposed to its use in learning Physical Geography concepts. The study concluded that the teaching and learning of Geography can be enhanced with the use of ARIT.

Development of heutagogy approach in M-learning for sustainability education reports on research by: Nurul Aisyah Kamrozzaman, Jamaludin Badusah and Wan Muna Ruzanna (University of Malaysia). Lifelong education is increasingly popular among Malaysians in accordance with the formation of a stable economy. The reported study identified the elements that the education student needs throughout the development of m-learning for lifelong education. The six heutagogy elements that explore, create, connect, share, reflect and collaborate have reached unity, however the sharing elements have the highest position in the development of modules for lifelong education. They conclude that the development of modules for these lifelong educational students should be incorporated with the elements of heutagogy according to the position in the expert consensus.

Defining student learning experience through blended learning comes from Frederique Bouilheres (University of Nottingham, UK), Le Thi Viet Ha Le (RMIT University Vietnam), Scott McDonald (RMIT University Vietnam), Clara Nkhoma (RMIT University Vietnam) and Lilibeth Jandug-Montera (RMIT University Vietnam). This paper explores the benefits of Blended Learning towards students' learning experiences at an offshore campus of an Australian university located in Ho Chi Minh City, Vietnam where the Blended Learning practice in use is the displacement of content. This refers to a portion of the learning content and activities for a course being delivered online via a Learning Management System. The focus of this research was its usefulness and effectiveness in promoting interactions between students and their peers, their teachers and course materials. Clear factor structure across survey questions represented four dimensions of benefits: Engagement, Flexibility of learning, Online learning experience, and Self-confidence.

The next article describes research by: Hossein Saadabadi Motlagh (Islamic Azad University, Iran), Halimeh Khafaie (Savitribai Phule Pune University, India), Ali Asghar Arastoo (Ahvaz Jundishapur University of Medical Sciences, Iran), Maria Cheraghi (Ahvaz Jundishapur University of Medical Sciences, Iran) and Morteza Abdullatif Khafaie (Ahvaz Jundishapur University of Medical Sciences, Iran). ***Application of social network in traditional sciences education on the vocabulary acquisition of secondary English learner students*** suggests that learning vocabulary is probably the most challenging and time-consuming part of learning a foreign language and researchers argue that social media could affect learners' vocabulary acquisition. The authors hypothesized that teaching science concepts could accompany vocabulary

acquisition and investigated the possible role of social networks (i.e. Telegram) in the improvement of vocabulary knowledge among undergraduate students from the Iranian University of Medical Sciences. Their study showed that online collaborative learning (i.e. using Telegram) as an assistance tool in education can increase the communication between teaching faculty and students resulting in significant improvement in the vocabulary score of SLL.

Investigating the main determinants of mobile cloud computing adoption in university campus reports on research by: Mohammed Amin Almaiah (King Faisal University, Saudi Arabia) and Ahmad Al-Khasawneh (The Hashemite University of Jordan, Saudi Arabia). The adoption of mobile cloud computing technology in universities is still at an early stage of implementation in Saudi Arabia and the reported research aimed to fill this gap by investigating the main factors that influence the decision to adopt mobile cloud computing in the university campus. The research proposed an integrated model, incorporating seven key technological factors derived from previous research, along with new factors (such as quality of service and relative advantage) that have not been previously addressed. The most influential determinants of mobile cloud adoption were found to be quality of service, perceived usefulness, perceived ease of use, relative advantage and trust. The results also showed security and privacy concerns still prevent mobile cloud adoption in Saudi universities.

Omiros Iatrellis (University of Thessaly, Greece), Ilias K. Savvas (University of Thessaly, Greece), Achilles Kameas Hellenic Open University, Greece) and Panos Fitsilis (University of Thessaly, Greece) next offer: ***Integrated learning pathways in higher education: A framework enhanced with machine learning and semantics***. In their paper they propose development of an integrated framework for personalisation and parameterisation of learning pathways, aiming at optimising the quality of the offered services in Higher Education. The study presents a case study in relation to tertiary education in Greece, with a particular focus on Computer Science programs. Data clustering is specifically applied to find potential insights pertaining to student characteristics, education factors and outcomes. Generally, the framework is conceived to provide a systematic approach for developing tertiary policies that help optimize the quality and cost of education.

The following article presents a mixed-methods study reporting the findings of the integration of Web 2.0 tools in a one-semester extensive reading project. ***Extensive reading and web 2.0 tools in tandem: a mixed-methods study*** is from Arif Bakla (Ankara Yıldırım Beyazıt University, Turkey and Yıldırım Beyazıt Üniversitesi Merkez Külliyesi Esenboğa, Turkey). Turkish learners of English read graded readers based on their proficiency, identified using a level test. They were asked to use various Web 2.0 tools to prepare a post-reading activity for each book and share it on a self-hosted blog. Results indicated that the participation in the activity and interaction on the blog were poor, and the learners mostly prepared less time-consuming and cognitively less demanding activities. It was also found that most participants were not accustomed to working with Web 2.0 tools and suffered from lower motivation and some did not think these tools promoted their creativity. This suggests that such tools might not boost learners' motivation unless they are trained to use them.

Teacher implementation profiles for integrating computational thinking into elementary mathematics and science instruction by Kathryn M. Rich, Aman Yadav and Rachel A. Larimore (Michigan State University College of Education, USA)

suggests that incorporating computational thinking (CT) ideas into core subjects, such as mathematics and science, is one way of bringing early computer science education into elementary school. In their research they analysed how eight elementary teachers created opportunities for their students to engage in four CT practices (abstraction, decomposition, debugging, and patterns) during unplugged mathematics and science activities, identifying three strategies used to create CT opportunities for their students: framing, prompting, and inviting reflection. The implications of these results for professional development and student experiences are discussed.

A framework for heuristic evaluation of mobile learning applications describes work by Bimal Aklesh Kumar, Munil Shiva Goundar and Sailesh Saras Chand (Fiji National University) in which they note that heuristic evaluation is a fast and cheap method that can be used to identify usability flaws in mobile learning applications. In their paper they proposed such a framework to ensure that best practices are followed, hence saving time and effort in conducting a heuristic evaluation. Ten case studies on heuristic evaluation of mobile learning applications were selected, and an analysis was conducted to identify the best practices that were later incorporated into a framework. Results indicated that this provides clear guidance, and that it is fast and easy to conduct heuristic evaluation.

Technological evolution involves a challenge for teachers and higher education institutions to achieve e-learning success say Sonia San-Martín, Nadia Jiménez, Paula Rodríguez-Torrico and Irati Piñeiro-Ibarra (Universidad de Burgos, Spain) in their article: *The determinants of teachers' continuance commitment to e-learning in higher education*. Their article addresses this issue from the teachers' perspective and examines the characteristics of the e-learning system that affect teachers' continued commitment and to the increase and permanence of e-learning programmes. It investigated possible relationships among intrinsic and extrinsic variables (self-efficacy beliefs, system quality and organisational impact) and teachers' continuance commitment. Based on previous information systems and e-learning research literature, this study presents an extended version of the Information System Success Model. Results show that having a well-established learning management system in the institution reinforces the instructors' commitment.

Evaluating the impact of prior required scaffolding items on the improvement of student performance prediction follows. In their article Amal ASSELMAN, Mohamed KHALDI and Souhaib AAMMOU (Abdelmalek Essaadi University, Morocco) note that tracking student behaviour has become a very important phase for constructing adaptive educational systems. Several researchers have developed various methods based on machine learning for better tracing students' knowledge. Most of these have shown an effective estimation of student features and an accurate prediction of future performance, but these methods recognise certain limitations since they use only the correctness of prior student responses to make predictions without paying attention to many other important student behaviours. The purpose of their research was to conduct an experiment that aimed to evaluate how best to use data about the prior required scaffolding items to predict future student performance.

Students' perceptions about the use the videogames in secondary education was written by Verónica Marín-Díaz (University of Cordoba, Spain), Begoña E. Sampedro-Requena (University of Cordoba, Spain) and Magdalena López-Pérez (University of Extremadura, Spain). They point out that working with videogames in class is

becoming a normal reality which truly depends on the vision that the teacher possesses about it, but ask what receptive students really think about education mediated by videogames. They present a line of study that links vision of the videogames and the type of school in which they are studied as this, among other things, is determined by the family purchasing power. The main result obtained shows that students from this educational level are more given to the usage of videogames for their curricular development and that there are significant differences in the use of video games in favour of men.

Informal multimedia biodiversity awareness event as a digital ecology for promoting culture of science by Natercia Valle, Pavlo Antonenko, Pamela S. Soltis, Douglas E. Soltis, Ryan A. Folk, Robert P. Guralnick, James C. Oliverio, Timothy T Difato, Zhen Xu⁷ and Li Cheng (University of Florida, USA) investigates the influence of a multimedia-enhanced informal biodiversity awareness event on the evolving culture of science and internal and external motivation to take environmental action among the members of a small community in south-eastern USA. The event was hosted by a local life and science museum and featured three main components: opening session by experts in biodiversity; animated video about biodiversity; and follow-up conversation with scientists. Motivation for Environmental Action survey was used to examine public motivation to take action to protect biodiversity prior to and upon finishing the event. Interestingly, the increase in internal motivation was larger for students than for non-students, suggesting that even a relatively short informal biodiversity awareness event can impact community's motivation, especially among those who were not particularly motivated to take actions to protect biodiversity prior to the event.

Smart education research has been rapidly developed for transforming education systems to engage and empower students, educators and administrators more effectively say Harpreet Singh and Shah J. Miah (Victoria University, Melbourne, Australia) in their article: ***Smart education literature: A theoretical analysis***. The aim of their paper is to describe the current state of smart education research as a theoretical approach for introducing an initial innovative approach called Students' Career Assistance System (SCAS). Adoption of new technologies to improve education systems is criticised for lacking appropriate theoretical and technological bases and so the article involves a systematic literature review to capture insights to establish the initial solution design understanding. Key findings suggest that smart education is a rapidly evolving research field that complements applications of a range of latest technologies and a new innovative framework of smart education artefacts is introduced as a case demonstration.

Tony Yeigh (Southern Cross University, Australia), David Lynch (Southern Cross University, Australia), David Turner (Queensland Association of State School Principals, Australia), Paul Fradale (Aoba International School, Japan), Royce Willis (Southern Cross University, Australia), Ken Sell (Aoba International School, Japan) and Ed Lawless (Aoba International School, Japan) next present: ***Using blended learning to support whole-of-school improvement: The need for contextualisation***. This article reports on findings from the application of blended learning to a school improvement project involving two K-12 international schools in Japan. The implications of their findings are that successful blended learning implementation requires an involved and consistent leadership team, specific teacher training to build confidence, a means of

directing the repurposing elements of teaching and learning, being able to evaluate alignment between the implementation of blended learning and school improvement, dedicated achievement measures for student learning and some way of being able to position the purpose and function of applied blended learning in relation to the Knowledge Economy.

Comparing German and American students' cognitive strategies and affective attributes toward online inquiry is an article by S. Michael Putman (University of North Carolina at Charlotte, USA), Chuang Wang (University of Macau, China), Bob Rickelman (University of North Carolina at Charlotte, USA), Antony Crossley (Pädagogische Hochschule Ludwigsburg, Germany) and Waldemar Mittag (Pädagogische Hochschule Ludwigsburg, Germany). They remark that competent use of the Internet to locate information is an important skill for today's youth, but many lack the knowledge and dispositions to engage in the processes necessary to effectively and efficiently find such information. The purpose of their research was two-fold: to examine the measurement invariance of a German-language version of the Survey of Online Reading Attitudes and Behaviours (SORAB) across a sample of participants from Germany and to compare the results with students from United States who completed the English-version of SORAB.

The use of head mounted displays (HMDs) to experience virtual realities (VR) has become increasingly common and Göran Fransson, Jörgen Holmberg and Claes Westelius (University of Gävle, Sweden) examine this in: ***The challenges of using head mounted virtual reality in K-12 schools from a teacher perspective***. This article aims to inform the process of implementing HMD VR in K-12 contexts by researching the preconditions and challenges of use from a teacher perspective. It analyses organisational, institutional, contextual and practical challenges and opportunities in the implementation of HMD VR in K-12 school contexts. The main findings are related to: economy and technology; initial learning barriers; organisation and practical enactment for teaching and learning; curricula; syllabuses and expected learning outcomes; and teachers' competences, professional development and trust.

The final article in this issue: ***Towards a serious games design framework for people with intellectual disability or autism spectrum disorder***, was contributed by Stavros Tsikinas and Stelios Xinogalos (University of Macedonia, Greece). They point out that designing serious games (SGs) for people with intellectual disability (ID) and autism spectrum disorder (ASD), requires proper planning and decision making, and in their article they propose a serious games design framework (GDF) that aims to assist designers and special education teachers and professionals develop successful SGs for people with ID and people with ASD. The proposed design guidelines and the conclusions of the comparative analysis of existing general purpose GDFs were used as a tool to design a computer-based SG that aims to improve independent living skills of people with ID and people with ASD. Based on this previous work the proposed GDF that is analysed in this article was devised.

EAIT is a popular major international journal with articles in this issue from researchers in the following countries: China, Turkey, Sweden, Malaysia, UK, Iran, Philippines, Hong Kong (S.A.R., China), Greece, USA, Saudi Arabia, Australia, South Africa, Bahrain, Lebanon, Egypt, Finland, Netherlands, Belgium, Germany, Morocco, Vietnam, UAE, Jordan, Thailand, Kuwait, Ghana, France, Bhutan, Estonia, Pakistan, Nigeria, Fiji, Spain, Japan and Macau (China).

Arthur Tatnall

Editor-in-Chief

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.