Editorial for EAIT issue 3, 2022

Arthur Tatnall

Accepted: 26 March 2022 / Published online: 31 March 2022
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Education and Information Technologies (EAIT) is a research journal that covers the complex relationships between Information and Communication Technologies and Education. EAIT is the official journal of the International Federation for Information Processing (IFIP), Technical Committee on Education (TC3).

The research described in the first article in this issue, uses goal setting theory, to propose a new educational intervention to improve the perceptions of a Learning Management System as an organising technology and to improve the intention to continue using it. Visualising weekly learning outcomes (VWLO) and the intention to continue using a learning management system (CIU): the role of cognitive absorption and perceived learning self-regulation is by Dhuha Al-Shaikhli (University of Westminster, London, UK), Li Jin (University of Westminster, London, UK and UK Higher Education Academy, York, UK), Alan Porter and Andrzej Tarczynski (University of Westminster, London, UK). The research developed Visualised Weekly Learning Outcomes as a mechanism for exposing learners to the required learning outcomes week by week.

The role of different levels of multichannel multimodal learning experience delivery in student engagement by Jun Xiao (Shanghai Open University, China), Tzu-Han Lin and Hong-Zheng Sun-Lin (Wisdom Garden Educational Research Institute, Hong Kong, China) explores the pedagogical dimension of multichannel multimodal learning (MML) and its association with student engagement. Students from Shanghai Open University participated in the study and their behavioural, emotional and cognitive learning engagement were investigated. Although teaching in the same space, the three instructors developed different MML-integrated pedagogies and delivered different levels of MML experience.

Errors of programming and ownership of the robot concept made by trainee kindergarten teachers during an induction training by María José Seckel (Universidad Católica de la Santísima Concepción, Chile), Adriana Breda (Universitat de Barcelona, Spain), Claudia Vásquez (Pontificia Universidad Católica de Chile, Villarrica, Chile) and Marjorie Samuel (Universidad Autónoma de Chile, Talca, Chile)

Arthur Tatnall
Arthur.Tatnall@vu.edu.au

Victoria University, Melbourne, Australia
looks at computational thinking in the educational environment that they say has awakened a rising interest after being included as part of the curricula from beginning education. Programmable robots have become a valuable positive resource to develop computational thinking, demanding proper training for kindergarten teachers and trainees in order to be able to teach robotic programming. The results showed that, in general, the most frequent error appeared in problems in which movements were set in a Euclidean space of two dimensions.

Bilal Özçakır (Alanya Alaaddin Keykubat University, Antalya, Turkey) and Erdinç Çakıroğlu (Middle East Technical University, Ankara, Turkey) next discuss: Fostering spatial abilities of middle school students through augmented reality: Spatial strategies and point out that in school mathematics, representations of solid figures and three-dimensional geometric objects rely on two-dimensional representation in students’ textbooks. In learning environments, these modes create a kind of cognitive filter, which prevents students with low spatial ability comprehend and envision three-dimensional objects. Studies show that spatial ability could be improved by means of suitable concrete, and computer created models in learning settings, so fostering students’ spatial ability helps to overcome and eliminate negative effects of this cognitive filter. In this study, an intervention with an augmented reality interface to foster students’ spatial understandings was reported in terms of student invented strategies for spatial concepts. Findings revealed that while proceeding on spatial tasks, students could invent, use and modify spatial strategies.

Changing the landscape of cybersecurity education in the EU: Will the new approach produce the required cybersecurity skills? Borka Jerman Blažič (Jožef Stefan Institute, Ljubljana, Slovenia) notes that recruiting, retaining, and maintaining sufficient numbers of cybersecurity professionals in the workplace is a constant battle, not only for the technical side of cybersecurity, but also for the overlooked area of non-technical, managerial-related jobs in the cyber sector. This paper presents the results of a study with the aim to identify how much the cybersecurity education system within high-level educational institutions and the industrial sector meets the needs for graduate students to gain the required skills. The study’s findings show that there are missing topics in high-level institution’s cybersecurity programs and that there is a need to re-shape the content of the courses provided by the professional education providers.

Heather Ann Pearson and Adam Kenneth Dubé (McGill University, Montreal, Canada) next present: 3D printing as an educational technology: theoretical perspectives, learning outcomes, and recommendations for practice. They say that 3D printing is an emerging educational technology that is said to prepare learners for a more technologically designed world, and in their paper, 3D printing studies are analysed to identify dominant theoretical approaches and learning outcomes. They discuss theoretical perspectives on how 3D printing influences learning: Self-directed, Situated, and Critical. Learning outcomes attributed to 3D printing include critical thinking, creativity, design thinking, and collaboration. Given the identified, theoretical approaches, outcomes, and common barriers to use, recommendations are made for how educators approach and implement 3D printing in the classroom.

The article to follow: Impact of digital game-based learning on the social competence and behavior of preschoolers comes from Menglin Fang (Lomonosov...
Moscow State University, Moscow, Russian Federation and Minxi Vocational & Technical College, Longyan, China), Olga Tapalova and Nadezhda Zhiyenbayeva (Abai Kazakh National Pedagogical University, Almaty, Kazakhstan) and Svetlana Kozlovskaya (Russian State Social University, Moscow, Russian Federation). They point out that digital gaming has become a regular part of life for today’s pre-schoolers and so there is a need to look at integration of digital technology into preschool education. Their study examines the effect digital games have on children’s behaviour and social competence if played for an educational purpose (supervised play) and for fun (without educational aim).

Julia Yates and Anke C. Plagnol (University of London, UK) then write on: **Female computer science students: A qualitative exploration of women’s experiences studying computer science at university in the UK.** They note that under-representation of women in computer science education courses is well documented and widely recognised, but that there has been limited qualitative data to provide an in-depth understanding of existing quantitative findings. Their study explores the lived experiences of female computer science students and how they experience the male dominated learning environment. Female computer science students from eight universities were interviewed. Whilst these women have not been troubled by their sense of fit at university, a combination of stereotypical assumptions of male superiority in this field, and a masculine, agentic learning environment, has left them feeling less technologically capable and less motivated.

**An exploratory study on academic staff perception towards blended learning in higher education** was contributed by Bokolo Anthony Jnr (Norwegian University of Science and Technology, Trondheim, Norway) who suggests that higher education has moved towards implementing Blended Learning (BL) and so it is important to investigate the factors that may influence lecturers’ perceptions towards BL. This study proposes a framework based on Model of Personal Computer Utilization (MPCU) theory to examine the factors that influence lecturers’ perception of BL to improve teaching quality in higher education. The results suggest that social factors affect use, complexity, job fit, long term consequences, facilitating conditions, and IT experience, significantly influences lecturers’ perception towards using BL initiatives to improve academic activities in higher education.

**ICT enabled Almajiri education in Nigeria: Challenges and prospects** from: AbdulGafar Olawale Fahm, Adesina Lukuman Azeez, Yusuf Olayinka Imam-Fulani, Omenogo Veronica Mejabi, Nasir Faruk, Musbau Dogo Abdulrahaman, Lukman Abiodun Olawoyin, Abdulkarim Ayopo Oloyede and Nazmat Toyin Surajudeen-Bakinde (University of Ilorin, Ilorin, Nigeria) begins by pointing out that the Almajiri children in Nigeria are deserving of special interventions to reduce the life-long divide in educational achievement, social status, and economic empowerment. They suggest that one way of speedily achieving this is the use of ICT, and their study examines the prospects and challenges of using ICT in the education of these children.

Mohamed Ashmel Mohamed Hashim (Westford University College, Sharjah, United Arab Emirates), Issam Tlemsani (The Centre for International Business, Leeds, UK) and Robin Matthews (Kingston University London, Kingston upon Thames, UK and RANPA, Moscow, Russia, and LSC, London, UK) then present:
Higher education strategy in digital transformation. The authors say that digital transformation in the global higher education industry determines the future to a sustainable education management strategy. Their paper develops a qualitative model that advocates how digital transformation could be used to build competitive advantages for universities. It offers insight into changes affecting universities’ vision and how these can be turned to their advantage. They set an approach to design-develop models to integrate and regulate these changes using evolution learning mechanism and digital transformation strategy.

Alvin Prasad (The University of Fiji, Lautoka, Fiji), Kaylash Chaudhary and Bibhya Sharma (The University of the South Pacific, Suva, Fiji) then present Programming skills: Visualization, interaction, home language and problem solving. They note that learning computer programming is challenging and requires learners to be inquisitive and acquire skills to analyse problems to get to solutions critically. But unfortunately, students drop out of programming courses because they think that programming is difficult to understand. This study aimed to determine whether visualization, interactivity, affective teaching, and the use of home language would improve students’ understanding, and it found that this did enhance their critical thinking and problem-solving skills.

Analysing lecturers’ perceptions on traditional vs. distance learning: A conceptual study of emergency transferring to distance learning during COVID-19 pandemic comes from Mohd Khaled Yousef Shambour (Umm Al-Qura University, Makkah, Saudi Arabia) and Muhammad A. Abu-Hashem (King Abdulaziz University, Jeddah, Saudi Arabia) who point out that recently, due to the COVID-19 pandemic, education institutions worldwide have changed their education paradigm from a traditional to an online system. The authors investigated the general perceptions of faculty members who are teaching different courses for undergraduate students using the distance education system. Results indicate that the perceptions of instructors regarding the online teaching system generally do not change based on the studied factors.

Then comes: Effect of animated and interactive video variations on learners’ motivation in distance Education by Esra Barut Tugtekin (Inonu University, Malatya, Turkey) and Ozcan Ozgur Dursun (Anadolu University, Eskisehir, Turkey). The objective of this research was to develop and validate the Instructional Material Motivation Scale for Single Use (IMMS-SU) instrument in the Turkish context. The IMMS-SU was developed and validated in a two-phased process. It was found that animation and interactive video materials did not cause a higher level of cognitive load on the participants, but higher material motivation. In addition, it was revealed that interactive video materials caused a higher extraneous cognitive load in participants than the animation group.

(In)civility and adolescents’ moral decision making online: drawing on moral theory to advance digital citizenship education by Tom Harrison and Gianfranco Polizzi (University of Birmingham, UK) draws on moral theory to advance digital citizenship education and explore how adolescents make decisions when confronted with incivility, such as cyberbullying, on social media. Given the extent to which digital citizenship education may be approached in line with deontological (rules), utilitarian (consequences) and/or virtue ethical (character) theories, the authors
argue that it is important to know which of these underpin adolescents’ moral decision making online. This article reports findings from a survey completed by students in England. They conclude that if online incivility is to be reduced, policymakers, educators and parents should focus more on virtue- and character-based approaches to digital citizenship education.

This study presents a crisis management model of how to direct medical education during crises. It comes from Zahra Karimian (Shiraz University of Medical Sciences, Iran and Virtual University of Medical Sciences, Tehran, Iran), Nahid Zarif-sanaiey, Majid Reza Farrokhi, Manoosh Mehrabi, Mohsen Moghadami and Laleh Khojasteh (Shiraz University of Medical Sciences) and Nasim Salehi (Southern Cross University, QLD, Australia). Medical education and COVID-19 pandemic: a crisis management model towards an evolutionary pathway. They note that the COVID-19 crisis has had a profound effect on higher education, especially medical education due to its sensitive nature, dealing with people’s life and wellbeing. Four major challenges emerged regarding medical education during the pandemic including “The health and wellbeing of faculty members and students”; “Spatial constraints”; “Time constraints”, and “Access to resources”. A qualitative design was used via a focus group among medical education administrators at Shiraz University of Medical Sciences and strategies were suggested to tackle these challenges, including virtualization, technological support, empowerment, participation, sharing, helping, integration, compression, omission, flexibility and diversity, severance, protection, and monitoring. For a sustainable educational pathway in medical education, personalised approach to education via the incorporation of technology is essential.

Predictors of e-democracy applicability in Turkish K-12 schools – an article contributed by Serkan Sendag (Mersin University, Turkey), Sacip Toker (Atılım University, Ankara, Turkey), Lutfi Uredi and Omer Faruk Islam (Atılım University, Ankara, Turkey). They note that due to COVID-19, administrators and teachers have had to seek out new ways to interact, raising two questions; “What about the quality of interaction and participation in decision-making?” and “Which factors affect the level of participation in decision-making?” The reported research aimed to determine the factors that predict the applicability level of e-democracy: “reporting and declaring opinions” and “decision-making” in K-12 schools. This article reports on an associational research design used with Discriminant Function Analysis techniques to analyse the factors predicting the applicability level of e-democracy.

The next article: Flipped learning effect on classroom engagement and outcomes in university information systems class comes from Meyliana (Bina Nusantara University, Jakarta, Indonesia), Bruno Sablan (University of Florida, USA), Surjandy (Bina Nusantara University, Jakarta, Indonesia) and Achmad Nizar Hidayanto (Universitas Indonesia, Depok, Indonesia). They point out that how to improve student engagement and educational learning outcomes in the classroom have always been high on a teacher’s priority list, but that these challenges have become more pronounced in teaching Generation Z and to address this, educators are exploring new teaching methodologies such as flipped learning. The article examines the effect of flipped learning on student motivation and educational outcomes on
sophomore students from a private university in Indonesia majoring in Information Systems.

Today the increasing level of technology in education requires corresponding skills from teachers, but often they do not have them, and the study by Viktor Shurygin (Kazan Federal University, Yelabuga, Russian Federation), Roza Ryskalievya (Al-Farabi Kazakh National University, Almaty, Kazakhstan), Elena Dolzhich and Svetlana Dmitrichenkova (Peoples' Friendship University of Russia, Moscow, Russian Federation) and Alexander Ilyin (Yelabuga Institute of Kazan Federal University, Yelabuga, Russian Federation) explores this in *Transformation of teacher training in a rapidly evolving digital environment*. Their purpose was to explore the problem of digital competence of rising teachers and provide recommendations for its improvement.

**Wearables can help me learn: A survey of user perception of wearable technologies for learning in everyday life** is by Neha Rani and Sharon Lynn Chu (University of Florida, Gainesville, USA). They note that wearable devices are a popular class of portable ubiquitous technology and come in a variety of forms, ranging from smart glasses to smart rings. The fact that smart wearable devices are attached to the body makes them particularly suitable to be integrated into people’s daily lives. Wearables can thus be particularly useful to help people make sense of different kinds of information and situations in their everyday activities. Their paper presents an online survey conducted to understand users’ preferences and perceptions of how wearables may be used to support learning in their everyday life. This showed that the choice of wearable type to use for learning is associated with prior wearable experience and that perceived social influence of wearables decreases significantly with gain in the experience with a fitness tracker.

People’s day-to-day routines have changed drastically since the outbreak of the COVID-19 pandemic and one changes has been the transition to online learning. One of the factors that guide students through learning environments is their emotions. In this article: **Adolescent emotion scale for online lessons: A study from Turkey**, M. Betul Yilmaz and Feza Orhan (Yildiz Technical University, Istanbul, Turkey), and S. Gonca Zeren (Canakkale Onsekiz Mart University, Canakkale, Turkey) discuss this. The few existing scales that measure the emotions of adolescents in learning environments have been developed with consideration of face-to-face learning environments and their items do not adequately express the state of online environments. This study aimed to develop a scale which reveals the emotions of adolescents that may affect their academic success regarding this transition of learning environments.

Crystal Gasell (University of Colorado Denver, USA), Patrick R. Lowenthal, Lida J. Uribe-Flórez and Yu-Hui Ching (Boise State University, USA) next write on: **Interaction in asynchronous discussion boards: a campus-wide analysis to better understand regular and substantive interaction**. They note that discussion boards can provide a glimpse into the regular and substantive interaction required in online courses. This study used learning management system data to explore the frequency of interaction between instructors and students in discussion boards in online courses at one institution. Results suggested that there is no relationship between student satisfaction and the number of total posts in a course.
Do teachers’ educational philosophies affect their digital literacy? The mediating effect of resistance to change by Muslim Alanoglu (The General Directorate of Security, Mersin, Turkey), Serkan Aslan (Suleyman Demirel University, Isparta, Turkey) and Songul Karabatak (Firat University, Elazig, Turkey) reveals the direct and indirect effects of primary school teachers’ educational philosophies on their digital literacy through resistance to change. The study results indicated that the teachers’ traditional and contemporary educational philosophies did not directly affect their digital literacy levels, but indirectly affected their resistance to change through the level of resistance to change. They also suggest that teachers’ traditional educational philosophies had a negative effect on their digital literacy levels.

Makerspaces (collaborative work spaces) aim to revolutionise current higher education by providing a means for students to be directly involved in many scientific projects and develop various kinds of skills, say Qinglong Zhan (Tianjin University of Technology and Education, China), Xiaoyu Chen (Beijing Application Senior Technical School, China) and Elva Retnawati (Tianjin University of Technology and Education, China) in their article: Exploring a construct model for university makerspaces beyond curriculum. They argue that while researchers have made progress in understanding different makerspaces and the increase of making in education, the reality is that a specific makerspace may be rather different from many other contexts. As makerspace programs expand around universities in Tianjin, China, a robust framework and a construct model is needed to set the foundation for understanding key makerspace elements beyond curriculum. Their paper develops a construct model of influencing factors for makers in the universities applied beyond curriculum.

Assessing the performance of Turkish science pre-service teachers in a TPACK-practical course is by İdris Aktaş (Amasya University, Merkez/Amasya, Turkey) and Haluk Özmen (Trabzon University, Turkey). The reported study assesses the performance of Turkish science pre-service teachers (PSTs) in a TPACK-Practical Course that consists of the training course and lesson-plan micro-teaching stages. They found that there was a significant increase in the total score of TPACK among the PSTs after the course and a significant increase in the items guiding, providing active participations of students, making assessment and evaluation, appropriateness of chosen teaching methods, and accuracy of the given information/concepts when teaching science subjects with technology.

The next paper, from Rozita Tsoni (Hellenic Open University, Patras, Greece), Christos T. Panagiotakopoulos (University of Patras, Greece) and Vassilios S. Verykios (Hellenic Open University, Patras, Greece) proposes a multilayered methodology for analysing distance learning students’ data to gain insight into the learning progress of the students both on an individual basis and as members of a learning community. It is titled: Revealing latent traits in the social behaviour of distance learning students. Social network analysis (SNA) techniques were applied to create one-mode, undirected networks and capture important metrics originating from students’ interactions. Their results highlight the importance of academic performance, social behaviour and online participation as the main criteria for clustering that could be helpful for tutors in distance learning to closely monitor the learning process and promptly interevent when needed.
Novel extension of the UTAUT model to understand continued usage intention of learning management systems: the role of learning tradition is from Ahmad Samed Al-Adwan, Husam Yaseen, Anas Alsoud and Fayrouz Abousweilem (Al Ahliyya Amman University, Amman, Jordan) and Waleed Mugahed Al-Rahmi (King Saud University, Riyadh, Saudi Arabia and Universiti Teknologi Malaysia, Skudai, Malaysia). Their study was to reveal key factors that impact university students’ continued intentions with Learning Management Systems (LMS). Given the context-dependent nature of e-learning, the Unified Theory of Acceptance and Use of Technology (UTAUT) model was applied and extended with constructs principally related to LMSs. These include learning tradition, self-directed learning, and e-learning self-efficacy.

The next study examines the incremental validity of different ICT-related person characteristics over and above intelligence and prior achievement when predicting ICT literacy across a period of three years. ICT-related variables as predictors of ICT literacy beyond intelligence and prior achievement come from Martin Senkbeil (Leibniz Institute for Science and Mathematics Education, Kiel, Germany). In the research, relative weights analyses were performed to determine the relative contribution of each predictor towards explaining variance in ICT literacy. The research used data from the German National Educational Panel Study (NEPS) that tracks representative samples of German students across their school careers. Relative weights providing estimates of importance of each predictor showed that intelligence and prior achievement and intelligence, respectively explained most of the variance in ICT literacy, followed by ICT self-confidence, and ICT usage motives as the strongest ICT-related variables.

The following paper analyses the factors that influence the effects of MOOC-based teaching in universities to find an effective way to better the advantages of MOOCs. A new idea for the optimization of MOOC-based teaching is by Tingting Duan (Northwestern Polytechnical University, Xi’an, China). A university course is used to analyse the influence factors by using different models. Combining models can further analyse the hierarchical structure and overall relationship of influences on the teaching effect of MOOCs. Ten principal factors that affect the teaching effects of MOOC-based courses (IPE courses) were selected. An adjacency matrix was set up to clarify the basic binary relations between these factors, find the reachability matrix by exponentiation, and obtain a 5-hierarchy Interpretive Structural Model.

Google docs for higher education: Evaluating online interaction and reflective writing using content analysis approach from Sharon Jia Chian Lee and Siti Nazleen Abdul Rabu (Universiti Sains Malaysia, Gelugor, Pulau Pinang, Malaysia) explores the types of online interaction used and levels of reflection achieved by undergraduate students, including the influence of Google Docs. The study involved two groups of six students. Analysis of data revealed that each group used Clarification/Elaboration and Acknowledgement of Opinion, respectively while commenting on the platform. Though instances of Relating were reported most frequently in both groups’ individual reflections, most of the students reached the Low level of reflection.
Effects of virtual learning environments: A scoping review of literature by Laura Caprara and Cataldo Caprara (St. Francis Xavier University, Antigonish, Nova Scotia, Canada) investigate existing data and research on synchronous face-to-face visual presence of a teacher in a virtual learning environment (VLE) and if this is a significant factor in a student's ability to maintain good mental health. While research on the explicit interaction among VLE implementation and student mental health is limited, it suggests a framework for strong utilization of VLEs. Overall, their research has shown that authentic, high quality VLEs are ones that have as their primary focus the communication between students and their teachers and between students and their peers and that this communication is best generated through synchronous connections where there exists the ability to convey the student's immediate needs in real-time.

Bimal Aklesh Kumar (Fiji National University, Suva, Fiji), Bibhya Sharma (University of the South Pacific, Suva, Fiji) and Elisa Yumi Nakagawa (University of São Paulo, Brazil) then write on: Architectural Support for Context-Aware Mobile Learning Applications. These applications provide learning materials to suit the needs of individual learners, but despite several applications being developed, there is a lack of architectural support for developing these applications. This has resulted in challenges: lack of standardisation, poor quality of developed applications, and reliability. In their research, a reference architecture was designed using requirements gathered from context-aware mobile learning applications.

Recently, machine learning (ML) has evolved and finds its application in higher education (HE) for various data analysis needs say Kiran Fahd (Victoria University, Australia), Sitalakshmi Venkatraman (Melbourne Polytechnic, Australia), Shah J. Miah (The University of Newcastle, Australia) and Khandakar Ahmed (Victoria University, Australia) in their paper: Application of machine learning in higher education to assess student academic performance, at-risk, and attrition: A meta-analysis of literature. They argue that studies have shown that such an emerging field in educational technology provides meaningful insights into several dimensions of educational quality. Their paper involves a systematic review and meta-analyses of research studies that have reported on the application of ML in HE. The differentiating factors of this study are primarily vested in the meta-analyses including a specific focus on student academic performance, at-risk, and attrition in HE.

When implemented appropriately, computational thinking (CT) experiences in early childhood settings build essential literacy skills and foster initial explorations of sequencing, engineering design principles, and cause-and-effect relationships, say Kate I. McCormick and Jacob A. Hall (State University of New York, Cortland, USA) in their paper: Computational thinking learning experiences, outcomes, and research in preschool settings: a scoping review of literature. This scoping review surveys existing CT studies with preschool-age participants and maps what is known of CT learning experience design, intended educational outcomes, and CT study design. The analysis of the reviewed articles indicates that gaps exist in CT experience designs, scope of CT interventions, and CT tool research and development.

Psychomotor learning theory informing the design and evaluation of an interactive augmented reality hand hygiene training app for healthcare workers was contributed by Gerard Lacey (Trinity College Dublin, Ireland, and SureWash,
Dublin, Ireland and Maynooth University, Ireland), Lucyna Gozdzielewska (Glasgow Caledonian University, Scotland), Kareena McAloney-Kocaman (Glasgow Caledonian University, Scotland), Jonathan Ruttle (SureWash, Dublin, Ireland), Sean Cronin (Trinity College Dublin, Ireland and SureWash, Dublin, Ireland) and Lesley Price (Glasgow Caledonian University, Scotland). Hand hygiene is critical for infection control, but studies report poor transfer from training to practice. Hand hygiene training in hospitals typically involves one classroom session per year, but psychomotor skills require repetition and feedback for retention. In this article, the authors describe the design and independent evaluation of a mobile interactive augmented reality training tool for the World Health Organisation (WHO) hand hygiene technique. The design was based on a detailed analysis of the underlying educational theory relating to psychomotor skills learning.

The next study is by Jana Chi-San Ho (The Chinese University of Hong Kong, China), Yu-Sheng Hung (Hong Kong, China) and Letty Y.-Y. Kwan (The University of Macau, China). *The impact of peer competition and collaboration on gamified learning performance in educational settings: a Meta-analytical study* aims to investigate whether gamification could improve learning performance, and whether peer interaction, competition and collaboration moderated the effectiveness of gamification. They found that peer collaboration did not moderate the effectiveness of gamification as no subgroup differences were found between collaborative games and non-collaborative games. The effectiveness of games that were both competitive and collaborative did not differ from those that were only competitive.

Emotions have a great impact on motivation, reasoning, and decision making. This affects computing methods designed to understand and respond to human emotional states. These have been used in more than one field including e-learning, say Nesreen Mejbri (University of Tunis, Tunisia), Fathi Essalmi (University of Tunis and University of Jeddah, Saudi Arabia), Mohamed Jenni (University of Tunis, Tunisia) and Bader A. Alyoubi (University of Jeddah, Saudi Arabia) in their article: *Trends in the use of affective computing in e-learning environments*. The authors found out that most studies about emotion recognition use unimodal systems in which facial expressions emotion detection is the most common. For e-learning environments, the most present is conversational agents. The emotions detected or used are basic emotions, non-basic emotions, learning-centred emotions, trait emotions, or a combination of two or three of them.

Kingsley Okoye, Arturo Arrona-Palacios, Claudia Camacho-Zuñiga, Joaquín Alejandro Guerra Achem, Jose Escamilla and Samira Hosseini (Tecnologico de Monterrey, Nuevo Leon, Mexico) then write on: *Towards teaching analytics: a contextual model for analysis of students’ evaluation of teaching through text mining and machine learning classification*. Didactically, teaching analytics is one of the promising and emerging methods towards scholastic ways to make use of substantial pieces of evidence drawn from educational data to improve the teaching–learning processes. This study proposed an educational process and data mining plus machine learning model applied to contextually analyse teachers’ performances. The result of the analysis showed that for student comments which contain some kind of positive or negative sentiment and emotional valence, female students recommended
the teachers taking into account the sentiments while the males appear to be slightly borderline in terms of emotions.

**How do elementary school teachers learn coding and robotics? A case study of mediations and conflicts** comes from Tugba Boz and Martha Allexsaht-Snider (University of Georgia, Athens, USA). In this qualitative case study, they examine in-service elementary school teachers’ learning of coding and robotics in a blended professional learning course developed and delivered through the collaboration between university faculty and a school district. They focused on activity theory to understand and reveal the mediations, conflicts, and effective practices that facilitated or hindered teachers’ learning of coding and robotics. Findings showed that teacher collaboration, coding/robotics platforms employed during the professional learning course, instructional approaches, and resources in and outside the professional learning setting mediated or conflicted with the teachers’ learning of coding and robotics depending on the way that each of these elements was employed in the course.

**Playing smartphone games while studying: an experimental study on reading interruptions by a smartphone game** by Katharina Graben (Philipps-University Marburg, Germany), Bettina K. Doering and Antonia Barke (Catholic University Eichstaett-Ingolstadt, Germany) investigates whether the use of smartphone games while reading a text reduces learning performance or reading speed and whether this is affected by push notifications. In the gaming group (G), participants played a game app for 20 s at 2 min intervals while reading. In one subgroup, the game app sent push notifications (GN+); in the other subgroup, no notifications (GN−) were sent. In the control group (C), participants did not play a game.

Soumya M.D. (Ammachi Labs, Amrita Vishwavidyapeetham, Amritapuri, India) and Shivsubramani Krishnamoorthy (Amrita Vishwavidyapeetham, Amritapuri, India) note that Educational Data Mining and Learning Analytics have been used to model decision-making to improve teaching/learning ecosystems. Their paper is: **Student performance prediction, risk analysis, and feedback based on context-bound cognitive skill scores**. This paper explores the predictive power and generalisation of a context-bound cognitive skill score in estimating the likelihood of success or failure of a student in a traditional higher education course so that the appropriate intervention can be provided to help the students. To identify the students at risk in different courses, they applied classification algorithms on context bound cognitive skill scores of a student to estimate the chances of success or failure, especially failure.

**Does evaluating peer assessment accuracy and taking it into account in calculating assessor’s final score enhance online peer assessment quality?** Loc Phuoc Hoang (Quang Tri Teacher Training College, Dong Ha, Vietnam), Hieu Thanh Le (Hue University of Education, Vietnam), Hung Van Tran (University of Science and Education, Da Nang, Vietnam), Thanh Chi Phan (Quang Tri Teacher Training College, Dong Ha, Vietnam and, Ha Noi University of Science and Technology, Hanoi, Vietnam), Duc Minh Vo (Van Lang University, Minh City, Vietnam), Phuong Anh Le and Dung The Nguyen (Hue University of Education, Vietnam) and Chakrit Pong-inwong (Rajabhat Loei University, Mueang, Thailand) write that peer assessment has an important role in teaching and learning nowadays, but that existing
techniques tend to be limited due to lack of a suitable means to evaluate the accuracy of peer assessment activities and supervise peer assessment performances in an online environment. This study proposed a new approach to evaluate the accuracy of peer assessment results for enhancing the quality of peer assessment system.

International reports analysing current and future educational trends with an emphasis on technologies applied to education declare the importance of design and application of digital educational resources, say Odiel Estrada-Molina, Dieter Reynaldo Fuentes-Cancell and Anaibis Alvarez Morales (Universidad de las Ciencias Informáticas, Havana, Cuba). Their paper: The assessment of the usability of digital educational resources: An interdisciplinary analysis from two systematic reviews addresses this issue. This paper analyses empirical research to determine if convergence between educational and computational research exists on the assessment of the usability of digital educational resources. To fulfill the objective, the PRISMA protocol was used to carry out two systematic reviews and answer the two scientific questions.

Problem-solving is one of the most important twenty-first-century skills and should be acquired at an early age. The next paper: The effect of a programming tool scratch on the problem-solving skills of middle school students, by Osman Erol and Neşe Sevim Çırak (Mehmet Akif Ersoy University, Burdur, Turkey) addresses this issue. They argue that as programming is a kind of problem-solving process, it may be seen in the context of problem-solving skills development. Their study aimed to identify the effectiveness of one of the most popular programming tools “Scratch” on middle school students’ problem-solving skills. The study showed that game design activities with Scratch increased the problem-solving skills of the participants and that game design activities with coding tools can be employed with children in order to help them gain problem-solving skills at an early age.

Technologies in the education of children and teenagers with autism: evaluation and classification of apps by work areas by Carmen del Pilar Gallardo-Montes, María Jesús Caurel Cara and Antonio Rodríguez Fuentes (University of Granada, Spain) notes that mobile apps represent a resource with great potential for encouraging the development of many skills, given the high number of apps available and the quick access to them. Many professionals and families include these resources in the education and therapy of children with autism. They determined which work area each app developed, as well as which were the most multifaceted and found that the focus of most apps was on executive functions, language and entertainment, with a minority devoted to the emotional sphere or time management.

Social media have influenced millennials of ulama or Muslim scholars in fatwa production, Rusli Rusli and Nurdin Nurdin (Institut Agama Islam Negeri Palu, Indonesia) point out in: Understanding Indonesia millennia Ulama online knowledge acquisition and use in daily fatwa making habits. The scholars access and use online knowledge to make daily fatwa according to community requests, but little is known about how the millennial ulama acquire and use the knowledge. The authors carried out an interpretive case study using a theoretical lens from knowledge creation and use in an information technology context and Islamic sociology. Findings show that Indonesia’s millennial ulama have strongly acquired and trusted online
Islamic knowledge and they construct and use knowledge from online social network interaction in daily fatwa making.

Sarah Khan, Mona El Kouatly Kambris and Hamda Alfalahi (Zayed University, Abu Dhabi, United Arab Emirates) then write on: **Perspectives of University Students and Faculty on remote education experiences during COVID-19- a qualitative study.** Like many countries, owing to COVID-19 the Ministry of Education in the United Arab Emirates mandated educational institutions to shift to remote learning. In this study the perspectives on remote learning, of both students and faculty, from the Science major, in a public university in Dubai have been explored. The researchers found that participants believed that altered human interaction was a major consideration in remote learning. Students’ stances for learning were based on courses and disciplines, with a preference for synchronous lessons. Culture influenced interaction, assessments, acceptability, and accessibility of remote education.

**The effect of different usage of the educational programming language in programming education on the programming anxiety and achievement** by Faruk Demir (Anadolu Logistics Company, Balıkesir, Turkey) points out that the abstract structure, logic, negative perceptions, and anxiety of programming are seen as obstacles to novice programmers. This study aimed to investigate the effect of educational programming language integration on academic achievement and programming anxiety level. The paper concludes that educational programming languages can be used by integrating both the theory and practice of the course to increase academic success and in-class performance and reduce anxiety about computer programming.

The next paper, by Weiqi Xu and Fan Ouyang (Zhejiang University, China) is **A systematic review of AI role in the educational system based on a proposed conceptual framework.** They claim that Artificial Intelligence in Education (AIEd) is an emerging interdisciplinary field that applies artificial intelligence technologies to transform instructional design and student learning, but that most research has investigated AIEd from a technological perspective which cannot achieve a deep understand of the complex roles of AI in instructional and learning processes and its relationship with other educational elements. This article adopts a conceptual framework from complex adaptive systems theory perspective, using a systematic literature review approach to locate and summarise articles, and categorizes the roles of AI in the educational system.

**Gender differences in information and communication technology use & skills: a systematic review and meta-analysis.** Even though ICT is essential for everyday life and has gained considerable attention in education and other sectors, it also carries individual differences in its use and relevant skills. The following systematic review by Atika Qazi (Universiti Brunei Darussalam, Gadong, Brunei), Najmul Hasan (Huazhong University of Science and Technology, Wuhan, China), Olusola Abayomi-Alli (Kaunas University of Technology, Lithuania), Glenn Hardaker (Universiti Brunei Darussalam, Gadong, Brunei), Ronny Scherer (University of Oslo (CEMO), Norway), Yeahia Sarker (Rajshahi University of Engineering & Technology, Bangladesh), Sanjoy Kumar Paul (University of Technology Sydney, Australia) and Jaaifar Zubairu Maitama (Bayero University Kano, Nigeria) examines gender differences in ICT use and skills for learning through technology. A random-effects
model uncovered a small and positive, yet not significant, effect size in favour of boys.

This next study: *Diagnosing virtual patients in a technology-rich learning environment: a sequential Mining of Students’ efficiency and behavioural patterns*, examined the relationships between clinical reasoning behaviours and diagnostic efficiency in the context of diagnosing a virtual patient in BioWorld, a technology-rich environment designed for medical students to practice clinical reasoning skills. It was presented by Juan Zheng, Shan Li and Susanne P. Lajoie (McGill University, Montreal, Canada). Eighty-two medical students who correctly solved a patient case with Diabetes Mellitus were included in this study and were grouped into efficient and less efficient groups based on the time they spent diagnosing the case using k-means clustering. Results revealed that students in the less efficient group collected significantly more irrelevant evidence, ordered more lab tests, and proposed more incorrect hypotheses than efficient students.

Nooshin Pordelan (Islamic Azad University, Tehran, Iran), Sadaf Khalijian ( Ferdowsi University of Mashhad, Iran), Simin Hosseinian (Alzahra University, Tehran, Iran), Mohammad Khorrami (Islamic Azad University, Tehran Science & Research Branch, Isfahan, Iran) and Hamid Heydari (University of Isfahan, Iran) write on: *Consequences of teleworking using the internet among married working women: Educational careers investigation*. They argue that more flexibility is needed in career affairs of women according to the multiple roles that they play (mother, wife, employee). This study aimed to investigate the advantages and disadvantages of teleworking using the Internet on married working women in educational settings. It concluded that teleworking has a considerable effect on family cohesion and psychological security of women.

*Development and testing of the Draw-a-Programmer test (DAPT) to explore elementary preservice teachers’ conceptions of computational thinking* by Jeffrey Radloff and Jacob A. Hall (Childhood/Early Childhood Education Department, SUNY Cortland, USA) notes that recent US science standards conceptualise science as a set of shared multidisciplinary ideas and practices in common with engineering and computer science (CS). This portrayal requires an understanding of CS as a viable career path and set of discrete knowledge and skills, including those related to computer programming. However, research repeatedly shows in-service and preservice teachers to be unfamiliar or uncomfortable with reform-based instruction and CS-related careers. This exploratory study uses a Draw-a-Programmer Test (DAPT) instrument (adapted from the Draw-a-Scientist [DAST], Engineering [DAET], and Computer Scientist [DACST]) to investigate how preservice teachers understand and visualize computer programming. Findings revealed that participants held somewhat stereotypical, yet distinct conceptions of CS and computer programming which may provide concrete entry points into fostering computational thinking skills.

The next study examines education technologies (ET) publications and research trends in a 5-year time period from 2014 to 2018. *Collaborations, concepts, and citations in educational technology: A trend study via bibliographic mapping* comes from Salih Bardakci (Tokat Gaziosmanpaşa University, Turkey), Meryem Yılmaz Soylu (Ankara, Turkey), Buket Akkoyunlu (Cankaya University, Ankara, Turkey) and Deniz Deryakulu (Ankara University, Turkey). With a bibliographic
mapping tool (VOSviewer) three research questions were addressed relating to collaborations, concepts, and citations in educational technology studies. According to co-occurrence analysis, online learning, especially in open learning environments, was the most studied concept.

Savita Yadav and Pinaki Chakraborty (Netaji Subhas University of Technology, New Delhi, India) then present: Using Google voice search to support informal learning in four to ten year old children. They say that the Internet has evolved as an important source of information and that children like to search for interesting information on the Internet. This study assessed the interest and ability of children aged between 4 and 10 years to use Google voice search to see if it could foster informal learning. They found that the children used voice search more frequently than textual query-based search to find information related to general knowledge and to homework. They conclude that Google voice search, with parental help, can foster informal education of children aged 4 years and older.

Immersive Virtual Reality (IVR) consists of artificial computer-generated environments allowing a user to perceive the sensation of being present and interact in an ambience that convincingly replaces the physical world. Chiu-Shui Chan, Jelena Bogdanovic and Vijay Kalivarapu (Iowa State University, USA) write on this in Applying immersive virtual reality for remote teaching architectural history. They point out that when travel is restricted, such visualization power can be shared globally as an essential remote teaching tool for educational institutions. The research presented in this paper explores the use of IVR technologies for teaching architectural history and presents tangible student learning outcomes. Unlike Augmented Reality (AR), where virtual information is overlaid on physical real-world objects, this research focuses on IVR implementation and its effectiveness as a history teaching medium from exploring: the nature of VR, how IVR can be used online for teaching history, the representation of IVR for presenting history, and issues of learning outcomes.

The last paper in this issue: Expectations and realities: Examining adolescent students’ game jam experiences was offered by Riikka Aurava and Mikko Meriläinen (Tampere University, Finland). It describes the expectations and experiences of young (16—19 year) digital game jam participants who attend Finnish general upper secondary schools. Game jams are a form of game creation: events where games are made in co-operation. They are widely used in game design education and in addition, when participated voluntarily, learning has been reported as an important motivation. This article examines learning in formal education for adolescents. Their results indicate the creative side of digital game making, desire to learn new skills and make new friends to be the main motivations for participation, and the lack of confidence in technical skills to cause most anxiety before the jam event.

Articles in this issue come from researchers in: Australia, Bangladesh, Brazil, Brunei, Canada, Chile, China, Cuba, Fiji, Finland, Germany, Greece, Hong Kong, India, Indonesia, Iran, Ireland, Jordan, Kazakhstan, Lithuania, Malaysia, Mexico, Nigeria, Norway, Russian Federation, Saudi Arabia, Slovenia, Spain, Thailand, Tunisia, Turkey, UK, United Arab Emirates, USA, and Vietnam.
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