Editorial for EAIT issue 6, 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 journal is embedded in the research and practice of professionals and is accepted into the Social Science Citation Index (SSCI) in the category ‘Education & Educational Research’, with an Impact Factor (2021) of 3.666. EAIT is now in the top quartile (Q1) of journals in Education & Educational Research.

To begin this issue, Catherine Audrin (University of Teacher Education, Lausanne, Switzerland) and Bertrand Audrin (University of Fribourg, Switzerland) offer: Key factors in digital literacy in learning and education: a systematic literature review using text mining. Six key factors that define the literature are: information literacy, developing digital literacy, digital learning, ICT, social media, and twenty-first century digital skills. These factors can be grouped into three main streams: (1) digital literacy, (2) digital learning and (3) twenty-first century digital skills. These streams are supported by informational and technological foundations.

Adolescents’ credibility justifications when evaluating online texts by Carita Kiili (Tampere University, Finland), Ivar Bråten (University of Oslo, Norway), Helge I. Strømsø (University of Oslo, Norway), Michelle Schira Hagerman (University of Ottawa, Canada), Eija Räikkönen (University of Jyväskylä, Finland) and Anne Jyrkiäinen (Tampere University, Finland) follows. This study examined students’ abilities to justify the credibility of online texts from different perspectives, thus providing a more nuanced understanding of students’ credibility evaluation ability. They examined how upper secondary school students evaluated author expertise, author intention, and the publication venue.

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Nihal Dulkadir Yaman (Alparslan University, Muş, Turkey) and Işıl Kabakçı Yurdakul (Anadolu University, Eskişehir, Turkey) next write on: *Exploring Parental Mediation of Internet Use Through Young Children’s Perspective*. The authors developed a Parental Mediation Scale and found that parental mediation of internet use did not differ based on the age of children, child’s level of education, the gender of children, number of children in the family, parents’ level of education, and family’s income level.

Determining the perceptions of pre-service teachers on technology-based learning during the Covid-19 process: a latent class analysis approach was contributed by: Bülent BAŞARAN and Murat YALMAN (Dicle University, Diyarbakır, Turkey). They found that pre-service teachers who are older and are using the Internet for more than 8 h a day, have advanced computer skills and have advanced technology-based learning experience are less likely to be in Class-2 (Low-Level Technology Perception). In addition, in the study, while self-directed learning with technology was associated with preservice teachers’ attitudes towards online teaching in the COVID-19 period and class membership, the fear of COVID-19 was not associated with latent class membership.

Writing on: *Personalized and Adaptive Context-Aware Mobile Learning: Review, challenges and future directions* Chandra Prakash Gumbheer and Kavi Kumar Khedo (University of Mauritius, Mauritius) and Anjali Bungaleea (Ministry of Social Integration and Economic Empowerment, Mauritius) point out that due to the outbreak of COVID 19, digital learning has become the most efficient learning and teaching technique adopted across the world. They note that pervasiveness of Personalized and Adaptive Context-Aware Mobile Learning (PACAML) technologies is improving the academic performances of learners by providing an efficient learning platform that supports social interactivity, context sensitivity, connectivity, and individuality in a ubiquitous manner.

Students’ collaboration in technology-enhanced reciprocal peer tutoring as an approach towards learning mathematics is from: Riitta Maarit Oikarinen (University of Eastern Finland, Kuopio, Finland), Juho Kaleva Oikarinen (Upper secondary school of Kuopio Lyseo, Kuopio, Finland), Sari HavuNuutinen (University of Eastern Finland, Kuopio, Finland) and Susanna Pöntinen (University of Eastern Finland, Kuopio, Finland). Technology-enhanced Reciprocal Peer Tutoring (RPT) was carried out with Finnish, nine-to-ten year-old primary school students. The RPT as a method of paired mathematics placed specific emphasis on electrical mathematical writing and drawing. Little is known about the important area of implementing digital mathematical skills at the primary level. The contribution of this study was to address the research gap in implementing Technological Pedagogical Content Knowledge (TPACK) into primary school students’ digital mathematics learning.

In distance learning, recommendation systems (RS) aim to generate personalized recommendations to learners, which allows them an easy access to various contents at any time. This paper: *ERSDO: E-learning Recommender System based on Dynamic Ontology*, by Meryem Amane, Karima Aissaoui and Mohammed Berrada (Sidi Mohammed Ben Abdellah University, Fez, Morocco) discusses the main RSs employed in E-learning and identifies new research directions to overcome their weaknesses. The objective of this study was to propose an E-learning Recommender
System based on Dynamic Ontology. Existing RSs such as content-based, collaborative filtering-based and knowledge-based recommendations reveal significant softness due to their incapacity to collect accurate information about learners, especially new ones which is identified as cold start problem.

Humanoid robots are being used in some schools, however, research on the use of these robots is relatively new. In this three-year study: Humanoid robots go to school, Christina Chalmers (Queensland University of Technology, Brisbane, Australia), Therese Keane (Swinburne University of Technology, Melbourne, Australia) and Marie Boden (Association of Independent Schools of South Australia, Unley, Australia) study humanoid robots that were deployed in 10 schools, involving 29 teachers across early childhood to Year 10. Their study aimed to ascertain teachers’ perceptions of the benefits and challenges, the pedagogical practices that helped with student engagement, and where the robots fitted in the curriculum.

The performance status of higher educational institutions: A transfer of knowledge perspective by: Shabana Gul, Waseef Jamal (Institute of Management Sciences, Peshawar, Pakistan) and Muhammad Naeem (Institute of Management Sciences, Peshawar, Pakistan and Virtual University of Pakistan, Lahore, Pakistan) presents an empirical application of Gul and Jamal’s Transfer of Knowledge Index and presents the ranking of 17 public sector higher educational institutions HEI by categorising them into High, Medium, and Low transfer of knowledge activity HEI. In the process of ranking the HEI based on the transfer of knowledge, the study also highlights several issues that hinder the recording of transfer of knowledge activity thus leading to the substandard performance of HEI on the given index.

Anja Garone, Bram Bruggeman and Brent Philipsen (Vrije Universiteit Brussel, Belgium), Bram Pynoo (VIVES University of Applied Sciences, Belgium), Jo Ton-deur (Vrije Universiteit Brussel, Belgium) and Katrien Struyven (Vrije Universiteit Brussel, Belgium and Universiteit Hasselt, Belgium) then write on: Evaluating professional development for blended learning in higher education: a synthesis of qualitative evidence. Successful implementation of blended learning initiatives requires careful planning and consideration of multidimensional factors and focusing on evaluation and accountability for the design of professional development initiatives (PDIs) is the next step towards creating efficient and effective PDIs. The purpose of this research was to synthesise how professional development initiatives for blended learning in higher education institutions can be evaluated.

Virtual Chemistry Laboratories (VCLs) are used as an alternative to the physical laboratories, where users can enhance their performance for hands-on chemistry experiments, but cognitive load and other issues make the VCLs impractical say Numan Ali (University of Malakand, Pakistan and University Islamabad, Pakistan), Sehat Ullah (University of Malakand, Pakistan) and Dawar Khan (University of Haripur, Pakistan) in their article: Minimization of students’ cognitive load in a virtual chemistry laboratory via contents optimization and arrow textual aids. The issue of cognitive load arises due to the complexity of the environment by displaying a number of chemicals, glass wares, and other lab equipment in the VCL. In this paper, the authors question field experts about the practical use of the VCLs and then propose a Purpose-built Virtual Chemistry Laboratory (PbVCL) with arrow textual aids to minimize the cognitive load and improve the learning efficiency.
Accelerated HE digitalisation: Exploring staff and student experiences of the COVID-19 rapid online-learning transfer describes research by Laura Louise Nicklin, Luke Wilsdon, Darren Chadwick, Laura Rhoden, David Ormerod, Deborah Allen, Gemma Witton and Joanne Lloyd (University of Wolverhampton, UK). In the UK, the first ‘lockdown’ of the COVID-19 pandemic necessitated a rapid shift to online learning and digital technologies in Higher Education (HE). While the ‘lockdown’ due to the COVID-19 pandemic situation was unprecedented, extant literature on online learning suggested there would be challenges, opportunities, and benefits to this transition, and the authors sought to understand these via a case study of one UK HEI department at this time.

Video conferencing in the elearning context: explaining learning outcome with the technology acceptance model is from Daniel R. Bailey (Konkuk University’s Glocal Campus, Chungju, South Korea), Norah Almusharraf (Prince Sultan University, Riyadh, Kingdom of Saudi Arabia) and Asma Almusharraf (Imam Mohammad Ibn Saud Islamic University, Riyadh, Kingdom of Saudi Arabia). Their results revealed that perceived ease of use with Zoom strongly affected perceived usefulness (PU) and actual use. In addition, PU with Zoom predicted intentions to use Zoom in the future but failed to influence perceived learning outcomes.

Therese Keane and William F. Keane (Swinburne University of Technology, Melbourne, Australia) then present: The missing link: The parental voice in Bring Your Own Device (BYOD) programs. Their paper reports on the parental perspective on one school’s implementation of a Bring Your Own Device (BYOD) Program to ensure students had access to a personalised computer. Often studies of one computer to one student (1:1) programs focus on students and or teachers while parent compliance in the program is assumed. The aim of this study was to document the parental voice in the implementation of one such BYOD program.

Solving word problems involving ‘Time’ is an important skill but poor mastery of the skill among elementary students has often been reported in the literature say Huan Chin and Cheng Meng Chew (Universiti Sains Malaysia, Penang, Malaysia) in their article: Online Cognitive Diagnostic Assessment with Ordered Multiple-Choice Items for Word Problems involving ‘Time’. They write on development of an online problem solving Cognitive Diagnostic Assessment (CDA) with Ordered Multiple-Choice (OMC) items as a web application with automated scoring features to increase the efficiency in assessing Grade Five students’ mastery level of word problem-solving attributes involving the topic of Time. This was developed based on the principled assessment design which comprised four building blocks: (i) construct map, (ii) item design, (iii) outcome space, and (iv) measurement model.

Yuzhi Lai and Nadira Saab (Leiden University, The Netherlands) and Wilfried Admiraal (Oslo Metropolitan University, Norway) then give us: Learning Strategies in Selfdirected Language Learning Using Mobile Technology in Higher Education: A Systematic Scoping Review. Language learners in higher education increasingly use out-of-class self-directed learning facilitated by mobile technology. In order to make informed educational decisions, this study sets out to provide an overview of empirical research into learning strategies that self-directed learners use with the support of mobile technology in language learning.
A self-determination theory into the psychological needs of CALL: Probing EFL teachers’ autobiographical narratives comes from Hussein Meihami and Fateme Huseini (Imam Khomeini International University, Qazvin, Iran). Addressing psychological needs in computer-assisted language learning (CALL) has a critical role in developing learners’ motivation to use CALL-related materials. Taking a self-determination theory into the psychological needs of CALL, the primary purpose of this study was to explore to what extent English as a foreign language (EFL) teachers address the psychological needs when they attempt to introduce CALL materials to their learners.

Ali Mugahed AlRahmi (Universiti Tun Hussein Onn Malaysia), Waleed Mugahed AlRahmi (Universiti Teknologi Malaysia, Johor, Malaysia), Uthman Alturki, Ahmed Aldraiwieesh and Sultan Almutairy (King Saud University, Riyadh, Saudi Arabia) and Ahmad Samed AlAdwan (Al-Ahliyya Amman University, Jordan) then write on: Acceptance of mobile technologies and Mlearning by university students: An empirical investigation in higher education. Mobile-learning (M-learning) apps have grown in popularity and demand in recent years and have become a typical occurrence in modern educational systems, particularly with the deployment of M-learning initiatives. The objective of this study was to reveal the key factors that impact university students’ behavioural intention and actual use of mobile learning in their education.

Emotional outcomes of elearning adoption during compulsory online education describes research by Ferhan Şahin (Ağrı İbrahim Çeçen University, Turkey), Ezgi Doğan (Van Yüzüncü Yıl University, Van, Turkey), Muhammet Recep Okur (Anadolu University, Eskişehir, Turkey) and Yusuf Levent Şahin (Anadolu University, Eskişehir, Turkey). The aim of the study was to identify the factors that influence university students’ intention to continue using e-learning systems and to examine the emotional outcomes of the continuance intention. The core constructs of the Technology Acceptance Model formed the basis of the proposed model, and the model was extended with a framework of emotions (challenge, achievement, deterrence, loss) and external variables.

Exploring technology readiness and practices of kindergarten student-teachers in Saudi Arabia: A mixed methods study is by Jawaher Alghamdi, Fatma Mostafa and Aisha Abubshait (Imam Abdulrahman Bin Faisal University, Jubail, Saudi Arabia). This study aimed to explore kindergarten student teachers’ readiness to integrate technology into their future classrooms, and factors affect their integration. They found that three main factors are involved: technological resources, school infrastructure, and the number of students in their classrooms. It is recommended to improve teacher preparation program to develop teacher technology readiness.

The next study describes an innovative methodology for teaching natural and mathematical sciences in the context of distance learning using modern technological solutions and based on the concepts of active social learning that involves constructivist, problem-oriented, project and research approaches. Improving teaching in different disciplines of natural science and mathematics with innovative technologies is from Umitzhan Kossybayeva (E.A. Buketov Karaganda University, Karaganda, Kazakhstan), Bagit Shaldykov (Rudny Industrial Institute, Kazakhstan), Danna
Akhmanova (E.A. Buketov Karaganda University, Karaganda, Kazakhstan) and Svetlana Kulanina (Kazan Federal University, Elabuga, Russian Federation). Fan Ouyang, Luyi Zheng and Pengcheng Jiao (Zhejiang University, China) then write on:  
**Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020.** They point out that as online learning has been widely adopted in higher education in recent years, artificial intelligence (AI) has brought new ways for improving instruction and learning in online higher education, but that there is a lack of literature reviews that focuses on the functions, effects, and implications of applying AI in the online higher education context. The literature review presented examines the functions of AI in empirical research, the algorithms used and the effects and implications generated.

The rushed introduction of online education for universities because of the current COVID-19 health crisis, has affected the quality of education for millions of students around the world, write Luis Laurens-Arredondo (Universidad Católica del Maule, Talca, Chile) in the article:  
**Mobile augmented reality adapted to the ARCS model of motivation: a case study during the COVID-19 pandemic.** This pandemic has emphasized the need to improve the teaching process through use of innovating educational tools, such as mobile augmented reality (mAR). This pilot study evaluates the relationship between motivation and meaningful learning for university students through mAR.

**Perception of online feedback and its impact on cognitive and emotional engagement with feedback** was contributed by: Rosa M. Mayordomo, Anna Espasa, Teresa Guasch andMontserrat Martínez-Melo (Universitat Oberta de Catalunya, Barcelona, Spain). Online feedback plays a key role in learning, but this requires that students engage with it. To measure the effect that perceived feedback has upon engagement with feedback, a study was carried out between two groups of master’s students: one in which students had the possibility to resubmit an assignment after feedback and another in which students only received feedback at the end of the assignment. Results showed there were no significant differences between the groups regarding the perception of the feedback.

**Does learning happen? A mixed study of online chat data as an indicator of student participation in an online English course** reports research by Qiang Huang (Guangdong University of Foreign Studies, China). This research sought to explore student participation by drawing on text data from the chat box of an online learning platform. The two main research questions concern the main types of student participation indicated by the online chat data as well as how extensively and frequently students had participated online in class.

**The effectiveness of unplugged activities and programming exercises in computational thinking education: A Meta-analysis** is from Feng Li and Xi Wang (East China Normal University, Shanghai, People’s Republic of China), Xiaona He (Beijing Normal University, People’s Republic of China), Liang Cheng and Yiyu Wang (East China Normal University, Shanghai, People’s Republic of China). This study explored computational thinking (CT) education and found that both unplugged activities (UA) and programming exercises (PE) teaching approaches are useful in cultivating students’ CT. Also, the effect of the PE teaching approach is better than the UA teaching approach in CT education.
The effectiveness of web-based Mathematics instruction (WBMI) on K-16 students’ mathematics learning: a meta-analytic research comes from Ayça Akın (Anadolu University, Turkey). Web-based mathematics environments have been increasingly widely used, and the COVID-19 pandemic has led to an urgent transition from traditional mathematics instruction (TMI) to web-based mathematics instruction (WBMI) at all levels of mathematics education. This paper scrutinizes the effects of WBMI on K-16 students’ mathematics learning. The most notable result of this research is that WBMI is significantly more effective on students’ mathematics learning than TMI, while even in the context of WBMI, traditional paper-pencil assessment is significantly more effective than online assessment.

The next article: Implementing technology-enhanced collaborative writing in second and foreign language learning: A review of practices, technology and challenges comes from Ruofei Zhang, Di Zou and Gary Cheng and Haoran Xie (The Education University of Hong Kong, Hong Kong SAR, China). Technology-enhanced collaborative writing (TECW) for second language development is receiving increasing research attention from educators and teachers, but there have been few review studies investigating how teachers implement this activity, how they use technology for the implementation, and what challenges they have. Their article addresses this issue.

Artificial intelligence (AI)-based voice assistants have become an essential part of our daily lives, say Jawaher Hamad Al Shamsi, Mostafa Al-Emran and Khaled Shaalan (The British University in Dubai, UAE) in their article: Understanding key drivers affecting students’ use of artificial intelligence-based voice assistants. Little is, however, known concerning what motivates students to use them in educational activities. This research develops a theoretical model by extending the technology acceptance model (TAM) with subjective norm, enjoyment, facilitating conditions, trust, and security to examine students’ use of AI-based voice assistants for instructional purposes.

Sandra Baroudi (Zayed University, UAE) and Nessrin Shaya (American University in the Emirates, UAE) write on: Exploring predictors of teachers’ self-efficacy for online teaching in the Arab world amid COVID-19. Literature suggests that many teachers do not feel confident enough or lack perceived capability in teaching using advanced technologies in classrooms, and do not have positive self-efficacy beliefs towards their online teaching. The purpose of this mixed-method study was to investigate teachers’ self-efficacy (TSE) in online learning environments amid COVID-19.

Students have mixed views about remote learning, say Lawrence Meda (Zayed University, Dubai, UAE) and Zayd Waghid (Cape Peninsula University of Technology, South Africa), but the global pandemic of COVID-19 forced institutions of higher learning to implement emergency remote learning and to change pedagogical approaches to enhance access and success for all students. The purpose of their study: Exploring special need students’ perceptions of remote learning using the multimodal model of online education, was to examine special educational needs and disabled students’ perspectives of remote learning in the United Arab Emirates.

Student learning performance in online collaborative learning describes research by Peggy M. L. Ng and Jason K. Y. Chan (The Hong Kong Polytechnic Uni-
versity, Kowloon, Hong Kong) and Kam Kong Lit (The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong). Online collaborative learning (OCL) has received significant attention, but the ultimate goal of adopting OCL is often neglected, especially in the higher education context. To bridge the research gap, their study applied OCL theory integrating with cognitive development to evaluate the effectiveness of student learning performance through OCL.

The efficacy of a computer-adaptive reading program on grade 5 students’ reading achievement scores was written by Laurie O. Campbell (University of Central Florida, Orlando, United States), Cassandra Howard (Florida State University, Tallahassee, United States), Glenn W. Lambie and Xueying Gao (University of Central Florida, Orlando, United States). Reading in upper-elementary grades includes comprehending complex texts and learning disciplinary-specific vocabulary and this study aimed to determine the effects of a computer-adaptive supplementary reading program on fifth-grade students’ reading achievement. Their findings support the use of a supplemental computer adaptive reading program for improving overall reading, and reading comprehension outcomes among these fifth-grade students.

There has been increasing use of interactive technologies in the classroom today and a rising popularity of employing virtual environments as a means to engage students in sensorially rich contexts for more embodied forms of experiential learning. Note Marcus Cheng Chye Tan, Stefanie Yen Leng Chye and Kylin Shu Min Teng (National Institute of Education, Nanyang Technological University, Singapore) as they write: “In the shoes of another”: immersive technology for social and emotional learning. In particular, virtual reality (VR) or immersive virtual environments (IVEs) facilitated by head-mounted displays have been used in the teaching of subject content such as history, geography and science. This article presents the findings of an exploratory study of immersive technology, specifically immersive virtual environments (IVES), for the purpose of social and emotional learning (SEL), in the context of Character and Citizenship lessons in the Singapore classroom.

Abdullah S Alghamdi, Abdullrhman A Alharbi, Atif A Alshehri and Mustafa A Alzhrani (King Saud bin Abdulaziz University for Health Sciences and King Abdullah International Medical Research Centre, Jeddah, Saudi Arabia), Sinan Keskin (Van Yuzuncu Yil University, Turkey), Muhittin Şahin (Ege University, Izmir, Turkey) and Alaa M Althubaiti (King Saud bin Abdulaziz University for Health Sciences and King Abdullah International Medical Research Centre, Jeddah, Saudi Arabia) then offer: Social anxiety in E-Learning: Scale validation and sociodemographic correlation study. They point out that during the ongoing coronavirus pandemic, over 1.5 billion students worldwide have been deprived of access to traditional learning. This situation has necessitated the use of social distancing-based educational methods and consequently a tremendous shift towards e-learning has been observed. This study assesses medical students’ social anxiety levels in e-learning environments.

Factors influencing younger adolescents’ intention to use game-based programming learning: A multigroup analysis by Yue Hu (Hangzhou Normal University, China), ChienYuan Su (National University of Tainan, Taiwan) and Anna Fu (Hangzhou Qiushi Educational Group, China) begins by point out that in recent years, increased attention has been given to programming instruction for primary and secondary students, with game-based programming learning platforms, such as Code.
org, Lightbot, and Run Marco, created to offer enticing, enjoyable, and visualizable programming learning conditions that facilitate student interest and engagement in learning programming. The study uses a technology acceptance model to investigate the intentions of younger adolescents regarding the use of game-based programming learning supported by Code.org and to analyse the moderating influence of gender and grade level.

The next article presents findings from a study of pre-service teachers’ design discourses that identified how Technological Pedagogical and Content Knowledge (TPACK) elements were used during their collaborative design of technology-enhanced lessons. The discourse of design: Patterns of TPACK Contribution during preservice teacher learning design conversations is by Giang N. H. Nguyen (Hanoi University, Vietnam), Matt Bower (Macquarie University, Sydney, Australia) and Michael Stevenson (New South Wales Department of Education, Parramatta, Australia and Macquarie University, Sydney, Australia).

Looking at MOOC discussion data to uncover the relationship between discussion pacings, learners’ cognitive presence and learning achievements was written by Zhi Liu, Xi Kong, Sannyuya Liu, Zongkai Yang and Cuishuang Zhang (Central China Normal University, Wuhan, Hubei, China). This paper describes a study conducted in the context of an introductory astronomy course on the Chinese MOOCs (Massive Open Online Courses) platform, examining the relationship between discussion pacing (i.e., instructor-paced or learner-paced discussion), cognitive presence, and learning achievements.

Computational thinking – the ability to reformulate and solve problems in ways that can be undertaken by computers – has been heralded as a foundational capability for the 21st Century say Kay-Dennis Boom (University of Hamburg, Germany), Matt Bower (Macquarie University, Sydney, Australia), Jens Siemon (University of Hamburg, Germany) and Amaël Arguel (University of Toulouse, France) in their article: Relationships between computational thinking and the quality of computer programs. This study examines the relationship between different forms of computational thinking and two different measures of programming quality for a group of preservice teachers. General computational thinking capabilities were measured using Bebras tests, while applied computational thinking processes were measured using a Computational Thinking Behavioural Scheme.

Modelling online community constructs through interaction data: A learning analytics based Approach comes from Ünal Çakiroğlu and Sefa Kahyar (Trabzon University, Turkey). This study used Learning Management System (LMS) log data to suggest a way to understand Community of Inquiry (CoI) constructs. Students’ interactions in Moodle components were weighted for indicators of cognitive, teaching and social presences. The results indicated that, cognitive presence is at the centre of the CoI constructs, and student-content interaction, is found is more prominent than other interactions in terms of its relation to cognitive presence.

A study aimed to compare female and male students’ attitudes and achievements within different learning settings determined by e-learning and in-classroom learning modalities, collaborative (CL), and traditional (TL) learning pedagogies and investigated the effect of single-gender (SG) and mixed-gender (MG) grouping in an undergraduate biology course reports the work of Firas Almasri (University of Warwick,
Coventry, UK and Gulf University for Science and Technology, Hawally, Kuwait). The impact of elearning, gendergroupings and learning pedagogies in biology undergraduate female and male students’ attitudes and achievement. The study helps to understand the most suitable learning settings for female and male students to decrease gender disparities, reduce the negative influences of stereotypical threats in different socio-cultural environments, and develop learning strategies to further equalize opportunities for females and male students, promoting students’ attitudes and achievement in undergraduate biology education.

Zh. E. Temirbekova and A. Yu. Pyrkova (AlFarabi Kazakh national university, Almaty, Kazakhstan) then give us: Improving teachers’ skills to integrate the microcontroller technology in computer engineering education. The study of microcontroller and microcircuits by students is becoming very important and in demand when acquiring competencies in the computer engineering educational program. This article discusses technologies of fully homomorphic encryption that allow performing operations on encrypted data without disclosing them, so they have a huge potential for use in solving problems of storing and processing personal data.

Fakhroddin Noorbehbahani, Azadeh Mohammadi and Mohammad Aminazadeh (University of Isfahan, Iran) write on: A systematic review of research on cheating in online exams from 2010 to 2021, saying that one of the most challenging aspects of online education is student assessment since academic integrity could be violated due to various cheating behaviours in online examinations. This study is a review of 58 publications about online cheating, published from January 2010 to February 2021.

Multitechnique comparative analysis of machine learning algorithms for improving the prediction of teams’ performance is from Filippos Giannakas, Christos Troussas, Akrivi Krouska, Cleo Sgouropoulou and Ioannis Voyiatzis (University of West Attica, Athens, Greece). Working in groups is an important collaboration activity in the educational context, where a variety of factors can influence the prediction of the teams’ performance, they note. This research assesses 28 different machine learning models, including a Deep Neural Network (DNN) which is structured by four hidden layers, for predicting teams’ performance. Both data analysis and optimization of input data are also explored for their effectiveness in the improvement of the models’ performance.

Mekuriaw Genanew Asratie, Yibeltal Tadele Aylet and Metages Gebeyehu Alegbachew (Injibara University, Injibara, Ethiopia) describe research to identify attitudes and practices to improve English language skills for secondary school teachers. Attitudes and practices to improve English language skills through mobile applications: in the case of secondary schools’ English language teachers Avi zone, Amhara Region, Ethiopia. They argue that it is good to build an attitude and engage in tasks to progress English language skills using Mobile Applications (MA), Their research outcome showed that English language teachers (ELT) have positive attitudes, but they sometimes practice developing their English language skills through MA.

A mobile augmented reality system to conduct electrical machines laboratory for undergraduate engineering students during the COVID pandemic by Yih Bing Chu (UCSI University, Kuala Lumpur, Malaysia) reports on an Augmented Reality (AR)
based teaching method adopted during the movement control period for undergraduate engineering students to perform in an electrical machine laboratory. In this work, Unity 3D development platform and Vuforia Engine software development kit are applied to create the AR system.

Yih Bing Chu (University, Kuala Lumpur, Malaysia) reports on: *A mobile augmented reality system to conduct electrical machines laboratory for undergraduate engineering students during the COVID pandemic*. Unity 3D development platform and Vuforia Engine software development kit were applied to create the Augmented Reality (AR) system. The content of the practical component is projected onto the mobile display mimicking the actual machine setup from the physical laboratory in real life. Investigation of the effectiveness of the AR tools on delivering the coursework component has been conducted and evaluated.

*ScratchThAI: A conversationbased learning support framework for computational thinking development* comes from Kantinee Katchapakirin and Chutiporn Anutariya (Asian Institute of Technology, Pathum Thani, Thailand) and Thepchai Supnithi (National Science and Technology Development Agency, Pathum Thani, Thailand). Computational Thinking (CT) has been formally incorporated into the National Curriculum of Thailand since 2017, where Scratch, a block-based visual programming language, has been widely adopted as CT learning environment for primary-level students. Conducting hands-on coding activities in a classroom has, however, caused substantial challenges including mixed-ability students in the same class, high student-teacher ratio and learning-hour limitation. This research proposes and develops ScratchThAI as a conversation-based learning support framework for computational thinking development to support both students and teachers.

In order to successfully implement learning analytics (LA), we need a better understanding of student expectations of such services say Olga Viberg and Linda Engström (KTH Royal Institute of Technology, Sweden), Mohammed Saqr (University of Eastern Finland, Joensuu, Finland) and Stefan Hrastinski (KTH Royal Institute of Technology, Sweden) in their article: *Exploring students’ expectations of learning analytics: A person-centred approach*. This study examines students’ ideal (i.e., representing their wanted outcomes) and predicted expectations (i.e., unveiling what they realistically expect the LA service is most likely to be) of LA by employing a person-centred approach that allows exploring the heterogeneity that may be found in student expectations.

*Indicators to assess preservice teachers’ digital competence in security: A systematic review* comes from Norma TorresHernández and María Jesús GallegoArrufat (University of Granada, Spain). The goal of this review was to analyse the state of inquiry in the field of digital competence in security in initial teacher education, via indicators to assess preservice teachers’ digital competence in security, to help find opportunities to improve their competence level. Following the parameters defined in the PRISMA declaration, the review uses a bibliographic research methodology to explore the Web of Science, Scopus and ERIC databases.

Mengrong Liu, Weiguo Pang, Jiajun Guo and Yiwen Zhang (East China Normal University, Shanghai, China) then present: *A Metaanalysis of the Effect of Multimedia Technology on Creative Performance*. Creativity is essential for the sustainable development of both individuals and organisations they note, and the constant
permeation of technology into everyday life is expected to facilitate the cultivation of creativity. To date, no consistent answer has been reached regarding the effect of technology on creativity and this study explored this question.

A metaanalysis of the Effect of Multimedia Technology on Creative Performance was offered by Mengrong Liu, Weiguo Pang, Jiajun Guo and Yiwen Zhang (East China Normal University, Shanghai, China) who point out that creativity is essential for the sustainable development of both individuals and organisations and the constant permeation of technology into everyday life is expected to facilitate the cultivation of creativity. This study explores this question. Their findings confirmed the positive effect of technology on creativity, providing practical implications for creativity educators and researchers.

With the increase in Technology Enhanced Learning, the effective retrieval and availability of Learning Objects (LOs) for course designers is a significant concern say Sidra Tahir, Yaser Hafeez, Muhammad Azeem Abbas, Asif Nawaz and Bushra Hamid (PMAS- Arid Agriculture University, Rawalpindi, Pakistan) in their article: Smart Learning Objects Retrieval for E-Learning with Contextual Recommendation based on Collaborative Filtering. Text-based LOs can be accessed from structured LO repositories (LOR) and unstructured sources. Their research aimed to provide an innovative Machine Learning and filter-based context-aware LO recommender System for the designing of courses. The proposed model helps to easily search and access diversified and semantically related LOs.

Sebiha Balci, Jonathan M. Secaur and Bradley J. Morris (Kent State University, OH, USA) next write on: Comparing the effectiveness of badges and leaderboards on academic performance and motivation of students in fully versus partially gamified online physics classes. Gamification, or the intentional use of gaming elements in non-game contexts, has been touted as a promising tool to improve educational outcomes in online education, yet the evidence regarding its effectiveness is inconclusive they point out. One reason is that previous research has often included several gamification tools together, neglecting that each gamification tool can vary in effectiveness. In order to evaluate their relative impact, two frequently used gamification tools, badges (i.e., digital credentials given for achievements) and leaderboards (i.e., digital rankings based on performance), were compared for their effectiveness on the academic performance and motivation of students.

Wenhui Zhao (Fuyang Normal University, China) next offers: An empirical study on blended learning in higher education in “internet+” era. To investigate the overall cognition of blended learning, the researcher made a questionnaire survey and interviews with students and teachers of 10 universities and colleges in Anhui Province in China and designed a blended learning model which fully utilises the modern network technology and mobile terminals to closely link pre-class and after-class learning to classroom teaching by using Wechat terminal.

Influencing factors on students’ learning effectiveness of AI-based technology application: Mediation variable of the human-computer interaction experience by ChunMei Chou, TsuChi Shen, TsuChuan Shen (National Yunlin University of Science & Technology, Yunlin, Taiwan) and ChienHua Shen (Transworld Institute of Technology, Yunlin, Taiwan) investigated the correlation between university students learning effectiveness of artificial intelligence (AI) technology applications and its
influencing factors. Their aim was to provide a reference for school planning and application of AI in information and communications technology teaching.

Understanding the factors related to teacher burnout can support school administrators and teachers in optimising the direction of school development and reducing teacher burnout, and Min Chen, Chi Zhou, Yiming Wang and Yating Li (Central China Normal University, Wuhan, Hubei, China) discuss this in: *The role of school ICT construction and teacher information literacy in reducing teacher burnout: Based on SEM and fsQCA*. This study investigated the impact of school information and communication technology construction and teacher information literacy on teacher burnout and explored the combined effects of the above factors by using a structural equation model and fuzzy-set qualitative comparative analysis.

**Using the educational tablet: An evaluation study of teachers’ and pupils’ views in Egyptian primary schools** is by Mustafa Ahmed Abdullah (South Valley University, Qena, Egypt). This study investigates the perceptions of primary school pupils and teachers by answering the research question: what are the teachers’ and pupils’ perceptions about the advantages and disadvantages of integrating the educational tablet in primary schools? The findings indicate that pupils have a positive attitude towards using tablets.

**Exploring secondary school teachers’ TPACK for video-based flipped learning: the role of pedagogical beliefs** by YingTien Wu (National Central University, Taoyuan City, Taiwan), ChingSing Chai (The Chinese University of Hong Kong, Hong Kong) and LiJen Wang (National Yang Ming Chiao Tung University, Hsinchu city, Taiwan), points out that Video-based flipped learning (VFL) has become a popular form of flipped learning. Teachers’ technological pedagogical content knowledge (TPACK) for video-based flipped learning is still, however, under-explored. A TPACK-VFL questionnaire for assessing teachers’ TPACK for VFL was developed and validated with both exploratory factor analysis and confirmatory factor analysis in this study to fill the research gap. The results showed that the secondary school teachers in this study generally expressed sufficient confidence in their TPACK for VFL.

Merliyani Putri Anggraini, Bambang Yudi Cahyono, Mirjam Anugerahwati and Francisca Maria Ivone (Universitas Negeri Malang, Indonesia) next bring: *The interaction effects of reading proficiency and personality types on EFL university students’ online reading strategy use*. This research aimed to discover the most frequently used reading strategies of EFL university students across their reading proficiency and personality types and examine the interaction between the predictive factors in using the strategies when reading English online texts. Based on the results, it can be claimed that students with different reading proficiency and personality types use different strategies for comprehending English online texts.

**Student’s performance prediction model and affecting factors using classification techniques** comes from Asif Hussain (Virtual University, Lahore, Pakistan), Muzammil Khan and Kifayat Ullah (University of Swat, Mingora, Pakistan). Educational institutions are creating a considerable amount of data regarding students and faculty. This is an essential asset as it has valuable insights, knowledge and intelligence for the policymakers. This paper adopted a hybrid classification model using
Decision tree and support vector machine algorithms to predict students’ academic performance.

Eleni Dermentzi (Northumbria University, Newcastle Upon Tyne, UK), Maria Zotou, Efthimios Tambouris and Konstantinos Tarabanis (University of Macedonia, Thessaloniki, Greece) write on: Using the problem-based learning method and educational technologies to teach open data: A design-based research approach. With Open Data becoming more popular and more public bodies publishing their datasets, the need for educating prospective graduates on how they can use them has become prominent. This study examines the use of the Problem Based Learning (PBL) method and educational technologies to support the development of Open Data skills in university students. Findings suggest that while the PBL method is suitable for Open Data education, special care should be taken to ensure that the potential of educational technologies is fully realised.

The last article in this issue: The mediating role of personality traits on the relationship between academic self-efficacy and digital addiction is by İzzet Parmaksız (Niğde Ömer Halisdemir University, Turkey). The reported study was to examine whether personality traits had a mediator role on the relationship between university students’ digital addiction behaviour and academic self-efficacy. Results of the study indicate that personality traits fully mediate this relationship.

Articles in this issue come from researchers in: Australia, Belgium, Canada, Chile, China, Egypt, Ethiopia, Finland, France, Germany, Greece, Hong Kong, Indonesia, Iran, Jordan, Kazakhstan, Kuwait, Malaysia, Mauritius, Morocco, Norway, Pakistan, Russian Federation, Saudi Arabia, Singapore, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, The Netherlands, Turkey, UAE, UK, USA and Vietnam.

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