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# Editorial for EAIT issue 1, 2023

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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.

Due to the journal's popularity, Springer has approved publication of twelve issues this year (up from nine in 2022). There are currently 377 articles waiting in Online First and the aim is to reduce this number. (The acceptance rate will not change.)

To begin this issue is: ***Negotiating scientific knowledge in the development of an eHealth MOOC*** from Heidi Gilstad (NTNU-Norwegian University of Science and Technology, Trondheim, Norway and St. Olavs University Hospital, Trondheim, Norway), Martha Skogen (NTNU, Trondheim, Norway), Pieter Toussaint (NTNU, Trondheim, Norway and SINTEF, Trondheim, Norway), Cathrin B. Larsen (NTNU-Norwegian University of Science and Technology, Trondheim, Norway) and Arild Faxvaag (St. Olavs University Hospital, Trondheim, Norway and NTNU, Trondheim, Norway). They point out that interdisciplinary team communication in eHealth development is challenging because all disciplines have unique, intrinsic discursive practices, theories and artefacts. Through a centred focus, members can benefit individually, inspire one another, and ultimately reach a timely delivery of their common pedagogical goal(s). Using the lens of dialogism, this paper aims to identify the conceptual considerations that arose during the development of a Massive Open Online Course (MOOC) for higher education in eHealth.

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The next article is by Siri Sollied Madsen, Helge Habbestad and Iris H. Borch (UiT the Arctic University of Norway, Tromsø, Norway): ***Valuable unintended learning outcomes when practicum for student teachers in kindergartens is carried out online***. The authors present a study of an educational experiment conducted at the early childhood education programme at UiT, the Arctic University of Norway. As COVID-19 made social distancing an issue, the traditional practicum in kindergartens was moved to online platforms. Constructive alignment was used as an analytical framework to investigate the possibilities and limitations of student teachers' learning outcomes in a collaborative online learning activity. This study broadens understanding of how collaborative online learning can facilitate unintended valuable learning outcomes and critically debates the limitations related to emphasising a too-strong focus on intended learning outcomes as a premise for constructive alignment in education.

***Does a flipped classroom model work in mathematics education? A meta-analysis*** was contributed by Mustafa Güler and Mehmet Kokoç (Trabzon University, Turkey) and Suphi Önder Bütüner (Yozgat Bozok University, Turkey). The design of the flipped classroom (FC) as a pedagogical approach is becoming increasingly prevalent in mathematics education. However, although many studies have been conducted on whether FCs are more effective in improving mathematics achievement compared to traditional lectures, the results are not consistent. To address this issue, this meta-analysis examined the overall effect of flipped mathematics classrooms on student achievement, in addition to a set of moderating variables.

Hatice Okyar (Necmettin Erbakan University, Konya, Turkey) then offer: ***University-level EFL students' views on learning English online: a qualitative study***. The article aims to determine Turkish EFL (English as a foreign language) students' perceptions about learning English through distance education (DE) during the COVID-19 pandemic. The results of the analysis showed that most of the students prefer face-to-face English education in a classroom setting rather than online education. Despite some positive comments about DE, like it being more comfortable for shy students, students' attitudes toward DE were found to be mostly negative because of the challenges they faced, like technical problems, health and focus issues, a lack of interaction and speaking practice in the target language, feelings of anxiety and isolation and low motivation, and DE not addressing all learning styles effectively.

Collaborative design approaches have been increasingly adopted in the design of learning technologies since they contribute to developing pedagogically inclusive and appropriate learning designs, say Eva Durall Gazulla (University of Oulu, Finland), Ludmila Martins (Universitat de Barcelona, Spain) and Maite FernándezFerrer (Universitat Oberta de Catalunya, Barcelona, Spain) in their article: ***Designing learning technology collaboratively: Analysis of a chatbot codesign***. Despite the positive reception of collaborative design strategies in technology-enhanced learning, little attention has been dedicated to analysing the challenges faced in design processes using a collaborative approach. In this paper, they explain the collaborative design of a chatbot for self-regulated learning in higher education using an action research approach. They analyse the design process of EDUguia chatbot, which includes evidence from questionnaires and workshops with students and lecturers, as well as intermediary design objects.

The next paper: ***Computer games and the study of terminology: An application to national accounts***, by Elias MelchorFerrer (University of Granada, Spain) and Maria Angeles DaviaRodriguez (University of Castilla - La Mancha, Spain), introduces a computer application, based on The Alphabet Game, designed to assist students of all disciplines understand the key academic concepts used in their respective fields, with specific application to economics and the study of national accounts. They point out that this approach offers a valuable contribution, in view of the difficulties often encountered in presenting key national accounting concepts in a dynamic and appealing manner. To assess the game's impact on enhancing learning, students of national accounts in economics were asked to assess their participation by means of an attitudinal survey focusing on motivation, quality of learning, and the effective use of time.

***Systematic literature review and bibliometric analysis on virtual reality and education*** describes research by: Mario A. RojasSánchez (Costa Rica Institute of Technology, Cartago, Costa Rica), Pedro R. PalosSánchez (University of Sevilla, Spain, and University of Beira Interior, Portugal) and José A. FolgadoFernández (Universidad de Extremadura, España). Its objective was to identify and analyse the scientific literature with a bibliometric analysis to find the main topics, authors, sources, most cited articles, and countries in the literature on virtual reality in education, to understand the conceptual, intellectual, and social structure of the literature on the subject and identify the knowledge base of the use of VR in education and whether it is commonly used and integrated into teaching–learning processes.

Coding games are widely used to teach computational thinking (CT), and studies have broadly investigated the role of coding games in support of CT learning in formal classroom contexts, but there has been limited exploration of their use in informal home-based settings. The next paper: ***Playing coding games to learn computational thinking: What motivates students to use this tool at home?*** tackles this. It is by Shuhan Zhang and Gary K. W. Wong (The University of Hong Kong, China) and Peter C. F. Chan (NetDragon, Hong Kong, China). This study investigated the factors that motivated students to use a coding game called Coding Galaxy in a home-based setting and explored the connections between the students' perceptions of and usage of the tool.

Tingting Gao (Chang'an University, Xi'an, China) then offers: ***College education: Problemsolving creativity in an interactive learning environment***. This research studied the effectiveness of using the specialised interactive environment Revit Architecture for creativity development. The Torrance Tests of Creative Thinking (TTCT) facilitated the identification of the creative thinking development level among participants. This paper also seeks to determine if there is a connection between creative thinking and design training program effectiveness in architecture education (null hypothesis).

***Investigating the Experiences of Online Instructors while engaging and empowering non-traditional learners in eCampus*** was contributed by Xinyue Ren (Ohio University, Athens, United States and Auburn University at Montgomery, United States). The purpose of this qualitative study was to investigate instructors' experiences of engaging non-traditional learners in eCampus. Despite the growth of online education, a high attrition rate could negatively impact student success. Research findings showed that engagement was a significant factor to increase students' online

retention. The study's findings showed that instructors faced both challenges and opportunities with increasing engagement among non-traditional learners in online programs.

Yulin Chen (Yuan Ze University, Taiwan) next presents: ***The effect of using a gamebased translation learning app on enhancing college EFL learners' motivation and learning experience***. This study investigated the motivation of Taiwanese undergraduate EFL students in learning English-to-Chinese translation and the intention to use a digital game-based learning app called CHEN-slate. The app involved, consisting of a learning zone, practice zone, and competition zone and including translation skills needed for actual translation practice, was developed as a supportive learning tool to equip students with the necessary translation skills and to enhance their translation experiences. The findings of the study indicated that students have positive attitudes toward the adoption of CHEN-slate and have intentions to use the app to facilitate their learning process.

Fahima Djelil (IMT Atlantique, Brest, France) and Eric Sanchez (University of Geneva, Switzerland) write on: ***Game design and didactic transposition of knowledge. The case of Progo, a game dedicated to learning objectoriented programming***. They point out that game-based learning has been widely promoted to overcome the difficulties encountered by beginners to learn programming, but there are many issues to address for the implementation of game-based learning. They indicate that game-based learning is not limited to adding game elements such as rewards to a learning situation, but that it consists of transforming the learning situation so that it becomes playful. They designed a novel environment dedicated to learning object-oriented programming for beginners called Progo, based on a metaphor of a three-dimensional (3D) construction and animation game.

The next study, by Aisha Salim Ali Al-Harthi and Wajeha Thabit Al Ani (Sultan Qaboos University, Muscat, Sultanate of Oman) investigates the level of readiness for massive open online courses (MOOCs) of students in Oman. Titled: ***Learner readiness for MOOCs in Omani higher education institutions: disparities between projections and reality*** it compares the readiness of ordinary students in the Omani higher education institutions (HEIs) and those outside HEIs who took a MOOC from the larger Omani society and tests for the differences between their levels of readiness, as well as for the best predictor for future participation in MOOCs. In this study, readiness is defined as the possession of three sets of skills: technological, metacognitive, and motivational. Binary regression results indicate that comfort with eLearning is the best predictor for future participation in MOOCs.

***Framework for the adaptation of an autonomous academic recommendation system as a serviceoriented architecture*** comes from Julian MonsalvePulido (Universidad Santo Tomás Seccional Tunja, Boyacá, Colombia, and Universidad Pedagógica y Tecnológica de Colombia, Tunja, Colombia), Jose Aguilar (Universidad EAFIT, GIDITIC, Medellin, Colombia, Universidad de Los Andes, Mérida, Venezuela, and Universidad de Alcala, Dpto Automatica, Alcala de Henares, Spain). The adaptation of traditional systems to service-oriented architectures is very frequent, due to the increase in technologies for this type of architecture. This has led to the construction of frameworks or methodologies for adapting computational projects to service-oriented architecture (SOA) technology. In this work, a framework for adap-

tation to SOA in an educational organisation is presented, through a specific case of adaptation of an autonomous recommendation system.

The article following examines the effect of having a tracking technology in a learning management system (LMS) that reports the effect of perceiving other students' interactions, on a learner's intention to keep using LMS in the future. ***The effect of the tracking technology on students' perceptions of their continuing intention to use a learning management system*** is by Dhuha AlShaikhli (University of Westminster in Computer Science Engineering, London, UK). The main underlying theory is herd behaviour theory which argues that crowd behaviour affects the perceptions of the observers. This paper found that tracking technology will affect a learner's perceptions of cognitive absorption and that perception of self-regulation from using an LMS. These perceptions are found to influence the learner's intention to keep using the LMS in the future positively.

Wilk Oliveira (Tampere University, Finland and University of São Paulo, Brazil), Juho Hamari (Tampere University, Finland), Lei Shi (Durham University, UK), Armando M. Toda (University of São Paulo, Brazil and Durham University, UK), Luiz Rodrigues, Paula T. Palomino and Seiji Isotani (University of São Paulo, Brazil) next present: ***Tailored gamification in education: A literature review and future agenda***. They note that gamification has been widely used to design better educational systems aiming to increase students' concentration, motivation, engagement, flow experience, and other positive experiences. With advances in research on gamification in education over the past few years, many studies have highlighted the need to tailor the gamification design properties to match individual students' needs, characteristics and preferences. To provide a complete understanding of this research domain, they conducted a systematic literature review to summarize the results and discussions on studies that cover the field of tailored gamified education.

***Projectfirst approach to programming in K–12: Tracking the development of novice programmers in technologydeprived environments*** by Ndudi O. Ezeamuzie (University of Hong Kong, China) points out that there are several instructional approaches that have been advanced for learning programming, but that effective ways of engaging beginners in programming in K–12 is still unclear, especially among low socioeconomic status learners in technology-deprived learning environments. Understanding the learning path of novice programmers will bridge this gap and explain what constitutes an effective learning path for novices. The research findings showed that the students' programming ability increased on the first day, remained stable throughout the intervention, and was not affected by either semantics or syntax of the Python programming language.

***The influence of social education level on cybersecurity awareness and behaviour: a comparative study of university students and working graduates*** is by Wilson Cheong Hin Hong (Macao Institute for Tourism Studies, China), ChunYang Chi (Editorial Department of Journal, Wenzhou Polytechnic, China), Jia Liu (Zunyi Medical University Zhuhai Campus, China), YunFeng Zhang (Macau Polytechnic University, China), Vivian NganLin Lei (Macao Polytechnic University, China) and XiaoShu Xu (Wenzhou University, China). A multitude of studies have suggested potential factors that influence internet security awareness (ISA). Some, for example, used GDP and nationality to explain different ISA levels in other countries but yielded

inconsistent results. This study proposed an extended knowledge-attitude-behaviour (KAB) model, which postulates an influence of the education level of society at large is a moderator to the relationship between knowledge and attitude.

Hatice YILDIZ DURAK (Bartin University, Turkey) next offers: ***Conversational agent-based guidance: examining the effect of chatbot usage frequency and satisfaction on visual design self-efficacy, engagement, satisfaction, and learner autonomy***. Chatbots are tools that have the potential to effectively support interpersonal communication and interaction, the author points out. The use of chatbots in education can be used to employ interactive methods, to provide learners information and different types of info, and to guide learners. The purpose of this study was to apply chatbot technology as a guidance tool in educational environments and to model its effects on visual design self-efficacy, engagement, satisfaction, and learner autonomy at the end of the process.

***Datadriven decisionmaking in emergency remote teaching*** by Maya Botvin (Tel Aviv University, Israel), Arnon Hershkovitz (Tel Aviv University, Israel) and Alona ForkoshBaruch (Tel Aviv University, Israel and Levinsky College of Education, Tel Aviv, Israel) explores data-driven decision-making processes of K-12 teachers at times of emergency remote teaching, as experienced during the COVID-19 pandemic outbreak in Israel. Decision-making is key for teaching, with informed decisions important for students and teachers. In their research they studied how teachers' data use had changed during COVID-19 days, and which data they would like to receive for improving their decision-making. Overall, they found a decline in data use, regardless of age or teaching experience.

Online teaching has globally become a part of the learning process and has been more well-established in developed countries, say Mahdi SofKarim, Ahmed Omar Bali and Kardo Rached (University of Human Development, Sulaymaniyah, Iraq) in their article: ***Online education via media platforms and applications as an innovative teaching method***. In developing countries, online teaching or e-Learning is not practiced or recognized officially by educational organisations and policymakers. This study analyses and interprets the challenges and potentials of implementing online learning by surveying through an online questionnaire using 'Google Forms' with responses from high school and primary school English teachers.

Zibo Liang, Lan Mu and Jie Chen (Wuhan University of Technology, China) and Qing Xie (Wuhan University of Technology and Chongqing Research Institute of WHUT. China) note that in recent years, online learning methods have gradually been accepted by more and more people. In their article: ***Graph path fusion and reinforcement reasoning for recommendation in MOOCs*** they note that many online teaching courses and other resources (MOOCs) have also followed. To attract students' interest in learning, many scholars have built recommendation systems for MOOCs. The authors propose a resource recommendation method called Multi-path Embedding and User-centric Reasoning (MEUR), which embeds multiple paths and searches with users as the centre, innovatively combining the advantages of graph convolution network and reinforcement learning, ultimately shows the path of the knowledge graph.

***Evaluating students' experiences in selfregulated smart learning environment*** points out that the increasing development in smart and mobile technologies trans-

forms a learning environment into a smart learning environment that can support diverse learning styles and skills development. It is by Yusufu Gambo and Muhammad Zeeshan Shakir (University of the West of Scotland, UK). They argue that an online learner needs to be supported for an engaging and active learning experience, and that to understand students' experiences, there is a need to evaluate a mobile app. There is a lack of investigation of students' experiences in terms of usability, challenges, and factors influencing satisfaction to inform a decision regarding future implementation. This study attempts to fill these gaps by exploring these experiences for sustainable future implementation.

***Indian government initiatives on cyberbullying: A case study on cyberbullying in Indian higher education institutions*** by Manpreet Kaur and Munish Saini (Guru Nanak Dev University, India) notes that in the digitally empowered society, increased internet utilisation leads to potential harm to the youth through cyberbullying on various social networking platforms. The cyberbullying stats keep on rising each year, leading to detrimental consequences and in response to this online threat, the Indian Government launched different helplines, especially for the children and women who need assistance, various complaint boxes, cyber cells, and made strict legal provisions to curb online offenses. This research evaluates the relevant initiatives.

The application of augmented reality games (ARG) as an emerging innovative technology has become a significant component of instructional learning contexts in recent years. ARG-based education as a form of student-centred learning situates students in a learning environment that integrates virtual elements with physical environments through three-dimensional pictures and videos on mobile devices for educational purposes, says Farzaneh Khodabandeh (Payame Noor University, Tehran, Iran). ***Exploring the viability of augmented reality game enhanced education in WhatsApp flipped and blended classes versus the facetoface classes*** argues the need to connect the use of digital tools into the language classrooms and allow learners to view the real world. This study examines the viability of ARG-enhanced education on English foreign language (EFL) learners' giving and asking for directions in flipped and blended contexts.

***Organization of Student-Centred learning within the Professional Training of a future teacher in a Digital Environment***. Ulzharkyn Abdigapbarova (Abai Kazakh National Pedagogical University, Almaty, Kazakhstan) and Nadezhda Zhiyenbayeva (Abai Kazakh National Pedagogical University, Almaty, Kazakhstan) remind us that in recent years, student-centred learning has undergone significant changes influenced by the introduction of the competency-based approach to the digital learning environment. They point out that this approach places a teacher at the centre of the educational process taking into account professional competencies and personal interests of educators to foster the improvements of methodological, organisational, and technological support of personalised learning. Their study into this matter revealed a background of discomfort with the current system of education – about half of the respondents experience psychological and emotional stress due to the current education format.

Blanka Klimova and Marcel Pikhart (University of Hradec Kralove, Czech Republic), Alice Delorme Benites and Caroline Lehr (Zurich University of Applied Sciences, Switzerland) and Christina Sanchez-Stockhammer (Chemnitz University

of Technology, Germany) then write on ***Neural machine translation in foreign language teaching and learning: a systematic review***. They note that today, hardly anyone working in the field of foreign language teaching and learning can imagine life without machine translation (MT) tools, and thanks to the rapid development of artificial intelligence, MT now most widely assumes a new form, the so-called Neural Machine Translation (NMT), which offers the potential for a wide application in foreign language learning (FLL).

Serdal Poçan (Bingöl University, Turkey), Bilal Altay and Cihat Yaşaroğlu (İnönü University, Turkey) next offer: ***The Effects of Mobile Technology on Learning Performance and Motivation in Mathematics Education*** and point out that, due to rapid developments, mobile technologies play an essential role in designing seamless learning environments. Their study aimed to assess mobile-assisted seamless learning environments' effects on students' success and motivation in the secondary school 7th grade mathematics class algebra unit and student opinions about the application.

***Leadership role and professional development of technology*** is from Afam Uzorka and Ademola Olatide Olaniyan (Kampala International University Uganda, Kampala, Uganda). They remind us that the COVID-19 pandemic has driven educational technology to the next higher level, especially in faculty teaching and research. To become conversant with the technologies, educators need opportunities for professional development. And to continue to be involved with new and evolving technologies in education, faculty members seek leadership and support. This study was carried out to investigate the leadership role in the professional development of technology in the educational delivery system of Nigerian universities. The leadership role of faculty members, technology specialists, policy, support, and infrastructure are discussed.

Guohua Shen (Nanjing University of Aeronautics and Astronautics, China, and Collaborative Innovation Centre of Novel Software Technology and Industrialization, Nanjing, China and Ministry of Industry and Information Technology, Nanjing, China), Sien Yang (Nanjing University of Aeronautics and Astronautics, China), Zhiqiu Huang (Nanjing University of Aeronautics and Astronautics, China, and Collaborative Innovation Centre of Novel Software Technology and Industrialization, Nanjing, China and Ministry of Industry and Information Technology, Nanjing, China), Yaoshen Yu (Nanjing University of Aeronautics and Astronautics, Nanjing China) and Xin Li (Nanjing University of Aeronautics and Astronautics, China, and Collaborative Innovation Centre of Novel Software Technology and Industrialization, Nanjing, China and Ministry of Industry and Information Technology, Nanjing, China) then write on ***The prediction of programming performance using student profiles***. Due to the growing demand for information technology skills, programming education has received increasing attention. Predicting students' programming performance helps teachers provide support for students. This paper proposed a student profiles model to describe students' characteristics, which contains coded information and uses this as input to a deep neural network to predict the programming performance.

The following study aims to explore the significant variables affecting online knowledge-sharing and the hierarchical structure, from the perspective of online learners. ***Significance and hierarchy of variables affecting online knowledgesharing using an integrated logitISM analysis*** comes from Jihe Chen (Guangxi Nor-

mal University, Guilin, China and New Century School, Guangdong, China), Ying Zhou (Guangxi Normal University, Guilin, China), and Litian Lv (Guangxi Normal University, Guilin, China). To comprehensively discuss the relationship between these variables, binary logit regression and interpretative structural model (ISM) was used. Thirteen significant variables were obtained using the Logit model of SPSS 22, with an 8-layer ISM program established by MATLAB 2017 A software. The results showed that six of the thirteen variables had positive effects on online knowledge-sharing behaviour, with the remaining seven having a negative impact.

Automated writing evaluation (AWE) systems are developed based on interdisciplinary research and technological advances such as natural language processing, computer sciences, and latent semantic analysis, and Shi Huawei and Vahid Aryadoust (Nanyang Technological University, Singapore) examine this in their article: ***A systematic review of automated writing evaluation systems***. Despite a steady increase in research publications in this area, the results of AWE investigations are often mixed, and their validity may be questionable. To yield a deeper understanding of the validity of AWE systems, they conducted a systematic review of the empirical AWE research. Implications and directions for future research are also discussed.

Student feedback is crucial for evaluating the performance of teachers and the quality of teaching, and Ping Ren, Liu Yang and Fang Luo (Beijing Normal University, Beijing, China) examine this in: ***Automatic scoring of student feedback for teaching evaluation based on aspect-level sentiment analysis***. Free-form text comments obtained from open-ended questions are seldom analysed comprehensively since it is difficult to interpret and score compared to standardized rating scales, and to solve this, their study employed aspect-level sentiment analysis using deep learning and dictionary-based approaches to automatically calculate the emotion orientation of text-based feedback.

***Examining factors that influence teachers to adopt information and Communication Technology in rural secondary schools: an empirical study*** describes research by Rekai Zenda and Reuben Dlamini (University of the Witwatersrand, Johannesburg, South Africa). They point out that ICT undoubtedly forms an important channel for improving student learning through continuous access to information and knowledge development, but that teachers in rural secondary schools are still unclear about how to use technology appropriately to facilitate particular approaches to educational practice. Quantitative research method and the modified Unified Theory for Acceptance and Use of Technology (UTAUT) model were used to investigate factors that influence teachers to adopt ICT in rural secondary schools.

Neila Chettaoui (University of Sfax, Tunisia), Ayman Atia (Helwan University, Helwan, Egypt and University of Sfax, Tunisia) and Med Salim Bouhlel (University of Sfax, Tunisia) then write on ***Student Performance Prediction with Eye-Gaze Data in Embodied Educational Context***. Recent advances in sensor technology, including eye-gaze tracking, have introduced the opportunity to incorporate gaze into student modelling within an embodied learning context they say. The produced multimodal data is used to uncover cognitive, behavioural, and affective processes during the embodied learning activity. This paper explores the integration of eye-gaze features to predict students' learning performance during an embodied activity.

***Digital technologies: students' expectations and experiences during their transition from high school to university*** describes research by Therese Keane (Swinburne University of Technology, Hawthorn, Australia), Tanya Linden (The University of Melbourne, Parkville, Australia), Paul Hernandez-Martinez, Andreea Molnar and Aaron Blicblau (Swinburne University of Technology, Hawthorn, Australia). University students' expectations of digital technologies in their studies are greatly influenced by their previous exposure both within the secondary school classroom and in their private lives they point out, and these expectations often play a powerful role in their approaches and learning strategies in their first-year university classes. In this work, they investigated students' expectations and utilisation of digital technologies in their transition from high school to tertiary studies.

Orit Baruth and Anat Cohen (Tel Aviv University, Israel) then offer ***Personality and satisfaction with online courses: The relation between the Big Five personality traits and satisfaction with online learning activities***. Online courses, they note, have become widespread in higher education, but despite their prevalence, they do not suit all learners, as personality influences learner satisfaction and affects learning experience. This study explores the relation between personality traits (using Costa & McCare's Big-Five model) and student satisfaction with various of learning activities offered in online courses, called Techno-Pedagogical Learning Solutions (TPLS). The tested TPLS were discussion groups, digital books, online assignments, surveys/polls and media.

***Educational data mining to predict students' academic performance: A survey study*** is work from Saba Batool (COMSATS University Islamabad, Pakistan), Junaid Rashid (Kongju National University, South Korea), Muhammad Wasif Nisar (COMSATS University Islamabad, Pakistan), Jungeun Kim (Kongju National University, South Korea), HyukYoon Kwon (Seoul National University of Science and Technology, South Korea) and Amir Hussain (Edinburgh Napier University, UK). Educational data mining is an emerging interdisciplinary research area involving both education and informatics, they note. In this paper they discuss understanding of student performance prediction and compare studies in the last 20 years. They look at: major factors highly affecting student performance prediction, kinds of data mining techniques including prediction and feature selection algorithms, and frequently used data mining tools.

Chatbots hold the promise of revolutionising education by engaging learners, personalising learning activities, supporting educators, and developing deep insight into learners' behaviour, say Mohammad Amin Kuhail (Zayed University, Abu Dhabi, United Arab Emirates), Nazik Alturki and Salwa Alramlawi (Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia) and Kholood Alhejori (Independent Scholar, Saudi Arabia) in their article: ***Interacting with educational chatbots: A systematic review***. This study presents a systematic review of 36 papers to understand, compare, and reflect on recent attempts to utilize chatbots in education using seven dimensions: educational field, platform, design principles, the role of chatbots, interaction styles, evidence, and limitations.

***Early warning mechanism of interactive learning process based on temporal memory enhancement model***. The authors, Xiaona Xia and Wanxue Qi (Qufu Normal University, Shandong, China) explain that interactive learning is a two-way learning method by learners independently using computer and network technolo-

gies. This study firstly mines the temporal series of learning behaviour features, and the corresponding data is collected from one online learning platform of The UK Open University. They also designed an early warning mechanism based on temporal memory enhancement model. This method should be useful to the analysis of learning behaviour features.

Artificial intelligence (AI) education for K-12 students is an emerging necessity, owing to the rapid advancement and deployment of AI technologies, say King Woon Yau, C. S. CHAI, Thomas K. F. Chiu, Helen Meng, Irwin King and Yeung Yam (The Chinese University of Hong Kong, Shatin, NT, Hong Kong SAR, China). In their article: ***A phenomenographic approach on teacher conceptions of teaching Artificial Intelligence (AI) in K-12 schools*** they argue that it is essential to take teachers' perspectives into account when creating ecologically valid AI education programmes for K-12 settings. In this study, phenomenography is an empirical research method that was used to understand teacher's interpretive understanding of new phenomenon such as the teaching of AI in secondary school.

Edna Nwanyiuzor Ogwu, Ngozi Ugonma Emelogu, Richard Ojinnakaeze Azor and Fredrick Amunabo Okwo (University of Nigeria, Nsukka, Nigeria) then write on: ***Educational Technology Adoption in Instructional Delivery in the New Global reality***. They point out that although educational technology is a discipline that has a lot of roles to play in the global education system, its services had been neglected over the years in Nigeria. Using the diffusion theory of innovation, this paper argues that necessity calls for compulsory adoption of innovation in the Nigerian education system, and that educational practitioners need in-service training to be part of these changes.

***Explainable AI and machine learning: performance evaluation and explainability of classifiers on educational data mining inspired career counselling*** is from Pratiyush Guleria (National Institute of Electronics and Information Technology (NIELIT), Shimla, India) and Manu Sood (Himachal Pradesh University, Shimla, India) who point out that machine learning concepts come from experiences, inferences and conceived complex queries. They point out that machine learning techniques can be used to develop the educational framework which understands the inputs from students, parents and with intelligence generates the result. In this paper, they propose a framework for career counselling of students using Machine Learning (ML) and AI techniques.

Tzu-Chi Yang and Chung-Yuan Chang (National Yang Ming Chiao Tung University, Taiwan) then write: ***Using Institutional data and messages on Social Media to Predict the Career decisions of University Students – A Data-Driven Approach***. They point out that enabling college graduates to achieve career success is increasingly considered a major responsibility of universities, and many studies have developed models of predicting students' career decisions and sought to provide appropriate treatments or early support for students to achieve this goal. Their study proposes a data-driven approach that considers both institutional data and social media news for predicting students' career decisions.

With the advent of technology and digitization, the use of Information and Communication Technology and its tools for the imperative dissemination of information to learners are gaining more ground say Munish Saini, Vaibhav Arora, Madanjit Singh, Jaswinder Singh and Sulaimon Oyeniyi Adebayo (Guru Nanak Dev Univer-

sity, Amritsar, India) in the article: ***Artificial intelligence inspired multilanguage framework for notetaking and qualitative contentbased analysis of lectures***. During the process of the conveyance of lectures, students (learners) are supposed to take notes of the subject matter being delivered to them, but disturbance (noise) from the environment, learner's lack of interest, problems with the tutor's voice, and pronunciation, may hinder the practice of preparing (or taking) lecture notes effectively. To tackle this, they propose an artificial intelligence-inspired multilanguage framework for the generation of the lecture script (complete) and minutes (only important contents) of the lecture (or speech).

***Measuring the effect of social media on student academic performance using a social media influence factor model***. With the advent of smartphones and fourth generation mobile technologies, the effect of social media on society has stirred up some debate and researchers across various disciplines have drawn different conclusions, say the authors: Mohammed Nurudeen, Siddique AbdulSamad, Emmanuel OwusuOware, Godfred Yaw KoiAkrof and Hannah Ayaba Tanye (University of Professional Studies, Ghana). Social media provides university students with a convenient platform to create and share educational content, but it may have an addictive effect that may lead to poor health, poor concentration in class, poor time management and consequently poor academic performance. This paper presents a social media influence factor (SMIF) model for measuring the effect of social media on student academic performance.

The last paper in this issue: ***The usability evaluation on mobile learning apps with gamification for middle-aged women*** is by Syahida Mohtar (Universiti Teknikal Malaysia Melaka Hang Tuah Jaya, Durian Tunggal, Melaka, Malaysia), Nazean Jomhari, Nor Azyra Omar, Mumtaz Begum Peer Mustafa and Zulkifi Mohd Yusof (Universiti Malaya, Kuala Lumpur, Malaysia). Mobile learning and gamification are becoming increasingly popular, and research suggests that mobile learning apps with gamification can improve student learning. The aim of this study was to propose a new mobile learning app with gamification aspects for the use of middle-aged women in memorizing Arabic words. The results from using the Kahoot! game for this showed that participants enjoy learning and can memorize Arabic words effectively, indicating that gamification can motivate learning among middle-aged women.

As usual, this issue has work by researchers in many counties around the world. From: Australia, Brazil, China, Colombia, Costa Rica, Czech Republic, Egypt, Finland, France, Germany, Ghana, Hong Kong (China), India, Iran, Iraq, Israel, Kazakhstan, Malaysia, Nigeria, Norway, Pakistan, Portugal, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Sultanate of Oman, Switzerland, Taiwan, Tunisia, Turkey, Uganda, UK, United Arab Emirates, United States and Venezuela.

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