



## Editorial

In this volume of the *International Journal of Research in E-learning*, authors from different countries are trying to answer the following question: what should be the university / school of the 21<sup>st</sup> century? Among other things, it should be open to innovation – not only in the world of technology, but also in relation to teaching and learning processes. Personalisation of teaching / learning should take place – a student is in the centre of the university / school of the 21<sup>st</sup> century. Another desirable feature is highly qualified staff, open and prepared for lifelong learning. One of the pillars of preparing new generation specialists should be STEM education, internationalisation of higher education, and mobility.

The present volume includes seven articles gathered in three chapters.

Chapter I – “Evolution of Innovative Educational Environment and Development of Digital STEM Competences” – includes four articles. At the beginning of this chapter, Nataliia Morze, Oksana Strutynska, and Mariia Umryk – Ukrainian experienced authors – present the article “Implementation of Robotics as a Modern Trend in STEM Education.” They state that the world revolves around innovations: new ideas, new products, new solutions to existing problems. Science, technology, engineering, and mathematics are the foundation for innovation. The development of STEM-directions in education is crucial for the development of modern society. The paper discusses implementation of STEM education in the learning process of educational institutions. The authors analyse the development of STEM education in Ukraine, determine the level of readiness of educators for understanding the principles of STEM education, and substantiate the need for introducing robotics into the educational process as a modern and important trend in STEM education. The concept of educational robotics is discussed. This makes it possible to identify the technical inclinations of students (at an early stage) and development of these inclinations, as well as formation of STEM competency in general. The study focuses on the interdisciplinary aspect of STEM education, in particular on the implementation of interdisciplinary links between STEM subjects and robotics in the conduction process of research and training projects. The authors provide examples of the implementation of robotics in the educational process based on the use of a project method. The article also delineates the project for the creation of the Juno Rover robot based on the Arduino robotic platform in

university education and gives two examples of the robotics projects in school education; one of them is implemented on an open platform with freely distributed materials for creating and using 3D printed robots. The second manuscript – “Applying QR Codes in Facilitating Mathematics and Informatics Education” – has been elaborated by Slovak researchers Lilla Koreňová and Jozef Hvorecký. They stress that QR codes are usually discussed in the context of mobile learning. In their presentation, the authors show other opportunities of their use with special focus on mathematics and informatics education and its methodology. Appropriately placed QR codes can, for example, be applied to create a feedback for both students and teachers, as an additional source of problems in a problem solver or a worksheet, or as an input gate to a didactic game. The addressees use their smartphones to read their selected QR code. The code refers to a file containing the data files predesigned and stored by their educator or the author of learning materials. The data are then used in accordance with their educator’s instruction. Similarly, a QR code can link additional information sources in a worksheet or open the student’s gate to the course/instructor evaluation. In the paper, such an approach is portrayed using examples from various fields of mathematics, statistics, and databases. Finally, the authors discuss advantages and disadvantages of this approach. The third article, “Influence of University Innovative Educational Environment on the Development of Digital STEM Competences” has been prepared by researchers from Ukraine – Nadiia Balyk, Galina Shmyger, and Yaroslav Vasylenko. The article deals with the problem of the influence of the innovative educational environment of the university on the development of digital STEM competences in the process of training teachers of the new formation. It is determined that the innovative educational environment of the university consists of organisational, educational, methodological, and technological and information resources, the purpose of which is to create conditions for the development of digital STEM competences of teachers. The main aspects of introduction and development of STEM education in different countries of the world are analysed. Particular attention is paid to the functioning of the STEM Centre, which is the basis of the innovative educational environment of the pedagogical university. The practical experience in introduction of STEM education at Ternopil Volodymyr Hnatiuk National Pedagogical University is summarised. The peculiarities of the influence of the innovative educational environment of the university on the development of digital STEM competences are explored. The last article in the chapter, “MDB as an Effective Platform of Communication between Students and Teachers: A Study of the Virtual University of Pakistan,” has been prepared by Pakistani researchers Nadia Saleem, Aisha M Din, Saba Sadiq, and Masroor Ahmed. They stress that the integration of distance learning and Information Communication technology has brought a lot of convenience for the students who were earlier facing problems in education due to time and geographical limitations. Since the concept of e-learning is comparatively new and different, the discourse on teaching methodologies and

the student–teacher relationship in an e-learning environment has brought many new dimensions under discussion. In a virtual system, the communication bonding between a student and a teacher is not so strong. Students are dependent on one-way communication in the form of recorded lectures, published announcements, and information given on a website. Bridging the communication gap between a student and a teacher through MDB (Moderate Discussion Board) is an effective step taken by the Virtual University of Pakistan in online education to address students. This research was aimed at investigating the effectiveness of MDB as an interaction platform between students and course instructors at the Virtual University of Pakistan. The effectiveness of MDBs was measured through analysing the number of MDBs posted in a certain course and the nature of questions asked in MDBs by students. It was a quantitative study in which two Mass Communication subjects were selected through purposive sampling. The collected data were analysed in percentages, and a statistical test Correlation was applied to find out if there was some relation between the strength of students and questions asked through MDB. The study found that although the number of MDBs is quite lower than that of enrolled students, it is an effective platform of communication between students and a teacher, as students can ask questions related to subject, exams, semester activities, and general concerns.

Chapter II – “Innovative Models, Methods, and Means in Electronical Education” – contains two articles. The authors of the first article, “The Multimedia Presentation of a Lecture as the Means of Perception, Comprehension, and Memorisation of Educational Information by Students,” are Svetlana Skvortsova and Maryna Haran from Ukraine. In their manuscript, the demand for teachers of Ukrainian universities to create multimedia presentations of lectures and their use in the process of teaching the course “Methodology of teaching mathematics” has been formulated as the result of the experimental research. Taking into account the specificity of the discipline and the peculiarities of the perception, comprehension, and memorisation of educational information by students, what has been determined are the requirements for visual and audio content, for the text presented on presentation slides, and for the design and navigation, and their effectiveness has been experimentally proved. In particular, it has been established that, in order to facilitate students’ perception of educational information, presentation slides should not contain large text arrays. Text slices of presentations should be executed using a certain font, with a certain font size and dominant colours of the headings and main text. To facilitate understanding and memorisation of the content of teaching, the theoretical information should be structured and presented in the form of circuits, tables, diagrams, etc. To stimulate interest in learning, a positive emotional background should be created, and thus a presentation should contain bright colour objects, photographs, and video footage of real mathematics lessons. It is emphasised that, in order to create conditions for the perception, understanding, and memorisation of educational information, presentation design

should provide a single style of design and identical compositions of components; for example, image of the same type of information should be in the form of identical elements of “SmartArt.” The second article, “The Role of Ecological Education and IT Education in Promoting Sustainable Development of a Human Being,” has been elaborated by Natalia Maria Ruman from Poland. She argues that we live in times dominated by the media, which have an impact on virtually every sphere of our lives. Nowadays, it is difficult to imagine school education without the use of modern technologies such as computers or the Internet. In the context of the ecological crisis and a number of threats associated with it which are brought by contemporary civilisation – including those of conformism or materialism – it is necessary to present a series of actions taken in education to help children and their parents oppose contemporary threats. The Internet today is becoming a good tool for exploiting information. Ruman’s article contains theoretical considerations on the important problems of modern civilisation and human education, namely issues related to ecology, the use of modern technologies, and communication. It focuses the reader’s attention on important values in education for sustainable development.

Chapter III – “Reports” – contains the paper “A Report from the International Scientific Conference DLCC2018, 15–16 October 2018, Poland” elaborated by Eugenia Smyrnova-Trybulska, devoted to the 10<sup>th</sup> edition of the International Scientific Conference *DLCC2018: Theoretical and Practical Aspects of Distance Learning* ([www.dlcc.us.edu.pl](http://www.dlcc.us.edu.pl)). The conference was held under the theme “E-learning and smart learning environment for preparing the specialists of new generation” and included reports from the IRNet project. The conference was held on 15–16 October 2018 in Wisła. It was organised by the Faculty of Ethnology and Educational Science at the University of Silesia in Cieszyn with cooperation of ten other universities and organisations. More than 90 researchers from 10 countries and from more than 20 universities participated in this conference. It is worth noting that the conference favours exchange of experiences, strengthening international cooperation, common problem solving, implementing innovative methodologies, and creating global educational space. During the conference numerous themes were discussed, such as: further directions in international cooperation, new common scientific and didactic projects, internationalisation development in the conditions of digitalisation and globalisation. More information concerning the event can be found on the website [www.dlcc.us.edu.pl](http://www.dlcc.us.edu.pl).

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