13th International ISAAC Congress
August 2–6, 2021 - Ghent, Belgium

Conference programme

Overview

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00–10:00	10	2,4,8,10 11,13	4,6,10,11,14 + JOINT (7,8,13)	3,6,7,8 12,14,16	1,3,6,7 8,14,16
10:00–10:30	Break	Break	Break	Break	Break
10:30–12:00	10,15	2,4,8,10 11,13,15	4,6,10,11,14,15 + JOINT (7,8,13)	3,6,7,8 12,14,16	1,3,6,7 8,14,16
12:15–13:00	**Opening**	Break	Break	Break	Break
13:00–14:00	de Hoop	Break	Break	Break	Break
14:00–15:00	De Philippis	Kaltenbacher	Kuijlaars	Jaffard	Seip
15:00–16:30	2,3,5,7,8,14	1,3,5,7 9,12,14	1,3,7,8,10,12,14	2,4,5,8,10 13,14,15	4,9,10,15
16:30–17:00	Break	Break	Break	Break	Break
17:00–19:00	2,3,5,7,8,14	1,5,7 9,12,14	1,3,7,8,10,12,14	2,4,5,8,10 13,14,15	4,10 18:30 **Closing**

All times are in time zone UTC+2.

Session 2 Challenges in STEM Education

Organizers: Ján Gunčaga and Vladimir Mityushev

	Monday	Tuesday	Wednesday	Thursday	Friday
8:30 9:00 9:30		Wijaya Putra Toiganbayeva			
10:00		Break			
10:30 11:00 11:30		Zhunussova Jancarik Ferdianova			
12:00	12:15: **Opening**	Break			
13:00	**de Hoop**	Break			
14:00	**De Philippis**	**Kaltenbacher**	**Kuijlaars**	**Jaffard**	**Seip**
15:00 15:30 16:00	Körtesi Václavíková Velichová			Sajka Zemanová Santos	
16:30	Break			Break	
17:00 17:30 18:00 18:30	Korenova Lavicza Papp			Hritonenko Hvorecky Nevřelová	**Closing**

we will demonstrate the results of a study conducted in the methodology of a pedagogical experiment, which was carried out in the context of remote learning using ICT (e.g. Tracker software) and applying physical experiments presented remotely. Literature Sajka, M., Rosiek, R. (2019). Struggling with physics and mathematics curricula based on the notion of function in the context of the educational reform in Poland, AIP Conference Proceedings 2152, 030029; doi.org/10.1063/1.5124773

Mathematical Problem Solving with Technology: a Case Study with Pre-Service Teachers

Vanda Santos

University of Aveiro (CIDTFF), Portugal
vandasantos@ua.pt

In educational environments, technology is present as a resource that facilitates teaching and learning. In the teaching and learning of mathematics, at all levels of education, it needs to integrate not only technology, but also the establishment of links with other areas of knowledge [1], namely with the sciences in general. The advantage of using technology in the teaching of mathematics and its effects on professional development, namely in basic and secondary education, it is well studied [4]. Several authors [2,3] are unanimous in stating that the teaching of mathematics, supported by activities supported by technology, favors the development of positive attitudes that will lead to better learning and a greater taste for this science. Even in higher education, modern education in science, technology, engineering and mathematics (STEM) faces fundamental challenges.
The objective of the present study is to analyse, the learning strategy with the use of technologies in mathematical activity, analyse mathematical activities and ways of thinking in Higher Education. The research methodology adopted consists of a case study, relating to a group of pre-service teachers in a public Higher Education. A qualitative approach was adopted through the interpretation of data collected through the activities on GeoGebra Classroom, brief questionnaire and conducting individual interviews, to triangular data interpretation.
It is concluded that the technologies have a significant participation in the educational environment and favour teaching and learning. The teacher, when perfecting his pedagogical practice, will be able to insert the technological tools in teaching and learning, to improve the interaction with students and favour the improvement of learning with the modelled use of technology in the classroom.
References
[1] National Council of Teachers of Mathematics (NCTM). (2000). Principles and standards for school mathematics. Reston, VA: National Council of Teachers of Mathematics.
[2] Jones, K. (2000). Providing a foundation for deductive reasoning: students' interpretations when using Dynamic Geometry software and their evolving mathematical explanations. Educational studies in mathematics, 44(1-2), 55-85.
[3] Tomaschko, M., Kocadere, S. A., & Hohenwarter, M. (2018). Opportunities for participation, productivity, and personalization through GeoGebra mathematics apps. In Handbook of Research on Mobile Devices and Smart Gadgets in K-12 Education (pp. 45-56). IGI Global.
[4] Vlasenko, K., Chumak, O., Sitak, I., Lovianova, I. & Kondratyeva, O. (2019), Training of Mathematical Disciplines Teachers for Higher Educational Institutions as a Contemporary Problem. Universal Journal of Educational Research, 7(9): 1892-1900.

Using neural networks in intelligent recognition problems of manuscripts

Nazgul Toiganbayeva

Al-Farabi Kazakh National University, Kazakhstan
bodinaz@mail.ru
Joint work with Zh. Zhunussova, Ye. Akkazin, Ye. Ashimov

One of the areas of artificial intelligence is machine learning which plays an important role in the field of IT. The amount of digital data we use in everyday life is growing, therefore there is a need for automatic analysis of smart data for further development of technological progress. The active development of machine learning has led to the widespread use of artificial neural networks. Neural networks based on the biological structure of the human brain are several times more efficient than other learning algorithms due to their high level of computational capabilities.
The application of neural networks to the problems of intelligent recognition of manuscripts in English and

French are discussed in this article. Handwriting recognition is one of the most important reports when processing documents. One of the most common machine learning methods in solving this problem is neural networks. Among the artificial neural networks, the analysis of the use of Convolution Neural Networks (CNN), LSTM (Long Short-Term Memory), MDLSTM (Multidimensional Long Short-Term Memory), MTRNN (Multidimensional Recurrent Neural Network) in intelligent recognition of manuscripts is carried out. The article describes how the IAM database was used for recognizing manuscripts in English, the RIMES database for recognizing French manuscripts. In addition, various approaches and achievements of recent years in the field of intelligent recognition of manuscripts are described, a review of the models of recognition of manuscripts related to Cyrillic graphics is conducted, and the results are analyzed.

The most common mathematical mistakes in the teaching of science subjects at secondary schools

Zuzana Václavíková

University of Ostrava, Czech Republic
zuzana.vaclavikova@osu.cz
Joint work with L. Konicek

Mathematics is one of the subjects with the greatest overlap in other fields, especially natural sciences. Unfortunately, it is still taught separately and without sufficient connection to its use, for example, in physics, chemistry, or other areas. As a secondary effect of the project focused on creating and piloting problem tasks in the field of chemistry and physics, based on inquiry-based learning, we observed the most common mathematical mistakes and errors that students make. A total of 40 problem tasks on topics: water, air, colours and temperature from the physical and chemical point of view were created in cooperation with secondary-school teachers of physics and chemistry. Each task was verified on one class of the involved secondary school. By involving teachers in the work, it was also possible to monitor whether these mistakes arise from students' misunderstandings of mathematics or whether mistakes are transmitted from their teachers by misinterpretations of mathematics and thus give room for bad habits. The paper will present the most common mistakes and errors repeated across all tasks and compare their occurrence in teachers who have or do not have mathematics as a second subject. The mistakes and errors will also be explained from the mathematical point of view and a proposal will be outlined on how to innovate the teaching of mathematics at secondary schools. This would lead to a correct understanding of these areas and elimination of errors.

Teaching Mathematics to Enginering Students - Challenge and Adventure

Daniela Velichová

Slovak University of Technology in Bratislava, Slovakia
daniela.velichova@stuba.sk

It has been proved by the everyday evidence that implementation of active learning methods in teaching increases enthusiasm for both learners and facilitators. And even more, active learning also improves learners' perception and attitude towards studied subject, strengthens their motivation and raises their interest and involvement into the entire learning process and desire to acquire new knowledge. These are all critical attitudes in establishing an active learning environment, in mathematical subjects in particular. The Fourth Industrial Revolution era with emerging 4D industry is imposing new challenges to the whole society and human activities, education at the first place. Teaching mathematics to engineering students becomes a challenge, as the roles of teachers in this new framework are changing accordingly. Universities are requested to provide their students with high scientific and soft-skill competencies needed for their future careers. Teachers must be prepared to work within international and multicultural teams practicing group collaboration, rather than work on individual basis, disconnected from everyone else in the world. Giving our students a stimulating learning experience in various different learning environments and introducing innovative ways of teaching focused on active learning is at the heart of the Education Strategy of our Age. A short analysis of the results of experiment carried out at the Faculty of Mechanical Engineering STU within the DRIVE MATH project activities will be presented in the talk. Project partners cooperated on examination of best strategies for implementation of active learning methods, innovative teaching strategies and adaptation of course curricula emphasizing the problem-based-learning approach, learning by doing (hands-on), and application of the eduScrum as pedagogical approach promoting active learning in engineering mathematics courses. The main goals of the experiment were to find out: - abilities of students to solve mathematical problems independently, and within a small stable group throughout the semester,