Guest Editorial

Education is about the transmission of relevant information. It is based on research, encompassing academic, creative and, last but not least, educational methodology. Engineering is a source of progress for all humankind, and the same is true for engineering education. All living and intelligent systems are based on a self-learning principle. We, university teachers, facilitate the education process based on the *credo* that education, the state of education, is the ability to reliably share the cultural context. Hence, we contribute to the sharing of relevant content by publishing and the exchange cycle moves in an upward spiral. Here we get to the mission of the WIETE.

Sustainability has been a challenge for several decades, and we are constantly responding to this challenge. But nowadays; it takes on new, unforeseen dimensions. Two years ago we could not have imagined that the sustainability of life would be connected to overcoming a pandemic. For us educators, the pandemic has brought one special effect. We found ourselves in a communication trap. We have lost the core method of sharing information - between us and the students, and with each other - the personal contact. We all have many years of experience with the e-learning method, now we have had to expand our instrumentation with new approaches. Several contributions in this issue respond to the current efforts.

The first article, *Disability and support for visually impaired students in South African engineering programmes* by Sheethal L. Tom, Noluntu Mpekoa and Arthur J. Swart is dealing with another kind of communication trap. Equality of access to education is a fundamental right. The social inclusion of people with different types of disabilities is one of the challenges for sociology, and also for the broad field of universal design. Visually impaired learners have an easier situation in disciplines where the focus of teaching is on listening to the spoken word. In engineering, we depend on the display of objects or their models as part of the communication between teacher and student. Communicating this information to visually impaired students requires not only staff commitment, but also technical readiness from the university. At first glance, hands-on and design teaching and learning seem inaccessible to the visually impaired. An overview of this issue at universities in an international environment shows that this is a globally difficult problem to solve. Nevertheless, it is absolutely essential to look for solutions. In an optimal situation, the effect of the use of human and technical resources by universities should not be measured by economic efficiency.

The basic paradigm of the future development of human civilisation is innovation; and innovation is based on the creativity of its bearers. The content of the article, *An intelligent scoring method for a creative thinking test* by Yeni Anistyasari, Ekohariadi, IGP Asto Buditjahjanto and Shintami C. Hidayati, is therefore, *a priori* topical. In education, we measure creativity at the beginning, during the process and, of course, at the end, we evaluate the degree of creativity reflected in the result. In the introduction, the authors offer a summary of known methods for evaluating creativity and point out their pitfalls. Subsequently, they present their intelligent scoring method for measuring originality and compare it with a standard expert evaluation. Adequate agreement of the results justifies the use of the proposed intelligent scoring method for testing creative thinking, and its almost incomparable time savings is an obvious advantage. In the final discussion, the authors present the limits of the validity of their method for measuring originality as one of the parameters of creative thinking. The measurement of other parameters is open for further research or remains the subject of expert evaluation.

The next article, *Structural systems in the mind of an architect - cognition through a non-linear teaching model* by Romuald Tarczewski, is a nice example of communication between the world of science and technology on the one side, and arts and humanities, on the other. The author delivers evidence that this connection might be fruitful. He raises one of the *eternal* questions of architecture - the relationship between the elements of the Vitruvian triad *utilitas, venustas, firmitas*. It focuses mainly on *firmitas* with a link to aesthetic qualities. Apparently, all schools of architecture struggle in education to address the relationship between the aesthetic and engineering aspects of architecture. The author points out the division of these segments of education related to the establishment of independent schools or faculties of architecture. The degree of this dualism varies from school to school. Excessive emphasis on arts education can create a barrier for students to accept technically oriented skills. The author analyses various educational methods that can help overcome this barrier. The result of his research is presenting a non-linear teaching model. The description of this model is convincing on its own, but the author also reinforces its perception of effectiveness by the survey results of architecture students.

Within a similar, but wider context, Jacob Vargas Arteaga and Lorenzo Zanello Riva present key issues in their article, *Information and communication technologies for the social appropriation of cultural heritage*. This article raises one of the basic problems that current civilisation is facing. A sustainable future is not a new challenge, but it is gradually increasing. Charles C. Mann offers two possible approaches in his book *The Wizard and the Prophet: Science and the Future of Our Planet*. Engineering optimism versus *soft* respect for the capacity limits of the environment. These two

options do not have to be in conflict but, in any case, the sustainability of culture must play a crucial role. The authors of the article analyse this very problem. Economic or social sustainability may be more important to the public in the first place, but history teaches us that the demise of civilisations has been very often caused by the collapse of culture. The authors examine in a broader context the possibility of using new technologies - VR, AR and, at the same time, raise the need for social understanding for strategies of cultural sustainability. They are interested not only in *higher* education, but also in educating the public. Education for understanding culture in everyday life is an excellent approach. The result can be a balance of social, economic and cultural parameters of sustainability on a local scale.

Authors Kobashen Moodley and Cecile G. Proches, in their article, *Industry preferences of future engineering leadership education in South African tertiary education institutions,* state that the engineering education system in South Africa does not offer engineering leadership education (ELE) in its curricula. It should be noted that even in the international context, we tend to register only education leading to teamwork capabilities. The content of soft skills in study programmes is also oriented in this direction. It is good that in the history of university education, we find a relevant mention already in *the Inaugural Address Delivered to the University of St. Andrews, Feb. 1st 1867* by John Stuart Mill. Today's industry sometimes suffers from being run at various levels by non-engineers. Engineering leadership is, therefore, a socially necessary requirement. Research and its projection into tertiary education study programmes offered by the authors is an excellent starting point for improving the situation. The management of all activities in the field of engineering cannot be left only to experts educated in the field of management. Leadership competency should be a *conditio sine qua non* for engineering degree programmes.

Leadership needs independent thinking, and this kind of insight is offered by Elena Yushchik, Ekaterina Savelyeva, Dmitry Zdor, Eugeniu Cozac and Zhanna Smirnova in their article, *On-line testing in computer science as an opportunity to enhance the independent work of higher education institution students*. Education for independent thinking and decision-making for personal motivation is a general, though sometimes hidden, goal of university education. The term independent and its derivatives occur frequently in some paragraphs, which is justified because it is a key word not only in the context of the article, but generally in education. If the on-line tests presented by the authors are useful in achieving the learning goals, they appear a good way to strengthen the students' potentials.

Mohammed M.U. Faiz and Mubarak S. Almutairi in their article, *Curricula comparison of electrical and electronics engineering technology and similarly named associate degree programmes*, deal with the issues that all universities must address during the accreditation process. Comparing the study programme with the accreditation standard is a matter of necessity. Accreditation institutions also prescribe comparison processes. In the presented case, it is a broader analysis linked to the generally accepted ABET methodology. The article is of benefit in view of the details of the comparison of individual benchmarks. However, on the other hand, it does not cross the borders of a wider international area. Nevertheless, the individual benchmarks appear to be converging in international terms. Thus, specific universities can obtain supporting arguments for their accreditation procedures.

Teaching mathematics seems to be a global problem, especially in terms of the interest of the young population. The topic of STEM education is rather frequent in research and publications. Authors Ilyas Yessengabylov, Shynggys Nurgozhayev, Aigul Aldabergenova, Yessengali Smagulov and Liliya Krivankova, describe the introduction of ICT into all spheres of life in Kazakhstan and pay special attention to the application of ICT in the teaching of mathematics. In their article, *Factors in the productive use of information and communication technologies by mathematics teachers*, they analyse, beside other issues, an interesting feedback related to ICT-based mathematical procedures that were applied in the teaching of mathematics. One could ask why not all mathematics teachers are productive in using ICT? The authors of the article describe the situation through data analysis with a convincing methodology. As the authors claim, the success of a teacher's potential depends essentially on understanding psychological, pedagogical and physiological characteristics of students' perception of audio-visual information. Based on observations from other disciplines, we can afford to argue that teachers' productivity and success depend on their personality charisma. However, this is a very difficult benchmark to achieve.

How to deal with an enormous amount of information, especially when working with big data? We can find several answers in *The effective use of telecommunication cloud services for the training of future computer science teachers* by Kambar Bedelov, Yessen Bidaibekov, Vadim Grinshkun, Bektas Bostanov and Svetlana Koneva. Cloud technologies are currently an essential part of the work not only for computer science teachers, but also in other professional fields within and outside academia. Cloud storage is used for fast operational communication in on-line teaching and larger data files are commonly shared. The authors analyse the *cloud computing world* and draw conclusions to support educational processes. They distinguish these technologies as a learning tool and a teaching tool. One possible drawback is the absence of comparison with the international environment of cloud technology applications in education.

Innovation needs flexibility. Although universities are inherently conservative institutions, their *modus operandi* is currently dependent on the search for new models of education. One of the possible examples is presented by Hassan Salti, Mohamad Farhat, Mohammed A. Niby and Isam Zabalawi. The essence of their article, *Towards a flexible 2+2 hands-on engineering technology curriculum*, lies in the final statement that teacher-centred education is currently unsustainable, and therefore, universities are generally moving towards the student-centred principle of learning. This, of course, implies an appropriate degree of curriculum flexibility. This is beginning to be a general requirement for local

and international accreditation requirements. Although the outlined 2+2 model does not represent a widely applied approach, it can serve as an inspiring example.

The above-mentioned mutual relationship between engineering and humanities is the subject of a future-oriented article, *Towards a long-term sustainable development vision in the self: a study with engineering students* by Manuel Fernández-López. From the very beginning, the author penetrates philosophical thinking and ethics, and their interweaving with engineering education. The concept of possible selves is crucial for moving towards a real sustainability. In essence, it contains Kant's categorical imperative with a philosophical extrapolation into the programmed future. The presented research explores the philosophical aspect in a cursory way; however, its connection with engineering education is sufficiently outlined. Hence, we can also ask questions about the form of possible selves; for example ... what will my position be as an engineer in the context of circular economy?

The big data phenomenon has gradually caught us uncompromisingly in its network. It requires basic philosophical analyses and interpretations, especially a consistent ethical approach. The article, *Optimal organisation of a big data training course: big data processing with BigQuery and setting up a Dataproc Hadoop framework* by Meruert Serik, Gulmira Nurbekova and Meiramgul Mukhambetova analyses the technical and IT side of this phenomenon. The study programme presented in the article is optimal in itself. It responds to the requirements of practice and the offer of available services and platforms. However, a brief reflection on the philosophy and ethics of gathering, and using big data is conspicuously absent in this rather practice-oriented article.

Dear colleagues, one of the beautiful aspects of engineering and technology education is that we can recall older, past teaching methods and enrich them with new approaches. We can still stand in front of a blackboard with chalk in hand and the lecture can be transmitted by current sophisticated technologies. Or we can connect our minds with artificial intelligence and become part of the global educational network of the 21 Century. In each case, let us enjoy what we are doing.

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