MEFANET 2023

16th international conference of medical and healthcare academic institutions in Czechia and Slovakia

7–8 November 2023, Košice, Slovakia

Cooperation on the effective use of technology in medical and healthcare education reflecting on the challenges of today

editors

DANIEL SCHWARZ
JAROSLAV MAJERNÍK
MARTIN KOMENDA

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WELCOME WORD

Dear esteemed colleagues and students,

Welcome to the 16th year of the MEFANET conference, a testament to our shared commitment to enhancing the effective use of technology in medical and healthcare education. This year promises a fusion of tradition and innovation. We are particularly excited about our keynote sessions: Baba Sheba's insights on generative AI in medical education and Radko Hudák's exploration of 3D printing in medicine. Further enriching our agenda are pivotal discussions on medical simulation, AI, and contemporary pedagogy, reflecting our community's dynamic nature.

A heartfelt acknowledgment to Jaroslav Majerník. His dedication and meticulous organisation have been instrumental in bringing this edition of the conference to life.

Thank you for joining us in this enlightening journey!

DANIEL SCHWARZ & MARTIN KOMENDA

Dear participants of the 16th conference of medical and health care faculties in Czechia and Slovakia!

MEFANET 2023 opens its fourth five-year period and this year it is a first time our friendly and inspirational conference with international participation moves from Czechia to Slovakia. The patronage of the conference was taken over by the Dean of the Faculty of Medicine at Pavol Jozef Šafárik University in Košice prof. MUDr. Peter Jarčuška, PhD. and we all hope that you will have a beautiful time in the most eastern part of MEFANET network. Kosice, the second largest city in Slovakia, has reach history as well as promising future due to its business, cultural and educational opportunities. This European city of sport, art and culture witnessed several important events in 2023, including the hundredth year of the International Peace Marathon or the seventy-fifth anniversary of the Faculty of Medicine in Košice. We are aware of the great responsibility that is needed to maintain both the quality as well as the attractivity of all previous editions of the MEFANET conference. These standards were set thanks to the perfect organisation and activities mainly of the team from Masaryk University in Brno. Following the established tradition of previous years and with the aim of maintaining recent trends affecting medical education, we have therefore prepared a program for you that include invited lectures as well as practical workshop, moderated poster section and short communications. Except of other, you will have opportunities to follow and discuss the very recent topics of artificial intelligence, practice with online simulator based on USG principles, see the advance in 3D printing for medical applications and many others. Of course, a positive atmosphere cannot be achieved without participants like you who are interested in presented topics or who want to share their experiences. Therefore, we wish you all to feel like full members of the MEFANET community during these two days and return back to your institutions full of new ideas and contacts.

Welcome to Košice, the city of tolerance and peace and enjoy the conference and discussions with participants that will hopefully lead to further fruitful cooperation.

JAROSLAV MAJERNÍK

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Faculty of Medicine, Pavol Jozef Šafárik University in Košice
Faculty of Medicine, Masaryk University
Institute of Biostatistics and Analyses, Ltd., a spin-off company of the Masaryk University

GENERAL INFORMATION

Conference venue

TUESDAY – Congress Hotel Centrum, Košice, Slovakia

WEDNESDAY – Congress Hotel Centrum, Košice, Slovakia

Catering

Lunch is included in the registration fee and will be served in the congress centre restaurant to all conference participants for both days.

Registration of participants at the conference venue

7 November 2023 from 11:00 to 16:30
8 November 2023 from 08:00 to 13:00

Information for authors

- A data projector, PC connected to the internet, laser pointer and microphone are available for the lecture.
- All equipment is available for testing before the conference or during breaks.
- Technical support will be available for the whole time of the conference in the congress hall.
- Your presentation file will be uploaded to the PC at a registration desk.
- It will be also possible to upload your presentation directly to the PC in the congress hall; however, we do not recommend this due to time issues.
- Create your presentation; we recommend pptx format, eventually export to pdf.
- Duration of a standard lecture (including discussion) should not exceed 15 min.
- Authors of posters will receive information on poster presentation at a registration desk.
- Official languages of the conference are Czech, Slovak, and English.
- Poster dimensions: from A3 to A0 format.

We kindly ask lecturers to stay within the time limit for their presentations.

Tuesday
7 November 2023

11^{00}–16^{30}	////////	Registration
12^{30}	////////	Lunch

Afternoon session

13^{30}	////////	Conference opening
14^{00}	////////	Keynote: Generative AI in Medical Education: Beyond Tools to Strategy
14^{45}	////////	Workshop: High fidelity WAZO ultrasound clinical simulator: Demonstration, access and use
16^{15}	////////	Coffee Break
16^{30}	////////	Short Communications: Medical Simulation and Virtual Reality
18^{00}	////////	MEFANET Coordination Committee: Open Meeting
19^{00}	////////	Welcome Reception

Wednesday
8 November 2023

Morning session

08^{00}–13^{30}	Registration
09^{00}	Posters: Guided Tour
10^{30}	Keynote: 3D Printing in Medicine
11^{00}	Coffee Break
11^{15}	AI4MedEd Symposium: What AI brings to Medical Education?
12^{30}	Lunch

Afternoon session

13^{30}	Short Communications: Bridging Medical Physics and Anatomy
14^{30}	Coffee Break
14^{45}	Short Communications: Blending Technology, Assessment, and Creativity
16^{30}	Conference Closure, Farewell

ABSTRACTS

KEYNOTE LECTURE I

14^{00}–14^{45} TUESDAY

GENERATIVE AI IN MEDICAL EDUCATION: BEYOND TOOLS TO STRATEGY

Baba Sheba
St George's University of London

Baba comes with a background in higher education leadership and digital transformation and serves as the Director of Digital Education with responsibility for all aspects of planning, implementing and resourcing the University strategy for digital education, including leadership of the Centre for Technology in Education (CTiE) and the Professional Education Centre (PEC). Baba is a Reader in Educational Technology and Business Strategy. Prior to St George's, he held academic leadership roles in private higher education and consultancy.

WORKSHOP

14^{45}–16^{15} TUESDAY

HIGH FIDELITY WAZO ULTRASOUND CLINICAL SIMULATOR: DEMONSTRATION, ACCESS AND USE

Samuel Fernández-Carnero, Kristina Rybosova
WAZO Technologies Lab S.L

Teaching innovation through the use of high-fidelity simulators has shown very positive results in the known scientific evidence in areas such as surgery, CPR, or triage. In the education and training for the use of ultrasound scanners, no tool enabled a real clinical immersion with proven scientific evidence, but WAZO has developed in the last 7 years a highfidelity online simulator that opens this possibility. During the lecture, these aspects will be discussed and after that, the workshop will offer the attendees exclusive access to use this software from their computers. The aim of providing access to attendees will be to explore the training it can provide.

SHORT COMMUNICATIONS: MEDICAL SIMULATION AND VIRTUAL REALITY

16^{30}–18^{00} TUESDAY

COMPARISON OF SIMULATION AND VIRTUAL REALITY EMERGENCY TRAINING ON THE EXAMPLE OF PARAMEDICS

Alena Lochmannová, Klára Gillernová, Stanislava Reichertová
Faculty of Health Care Studies at University of West Bohemia

Based on the development of a car crash module primarily designed for paramedics to practice METHANE, START (and JumpSTART) and initial pre-hospital patient treatment, research was conducted to compare an identical scenario in a simulation concept in a simulation centre and in virtual reality. This presentation will present the main outcomes from the comparison of performance and different types of subjectively perceived stress in the case of the implemented experiment.

Both general scientific methods and specific scientific methods were used in the implementation of the research study. In terms of general scientific methods, the methods of analysis, synthesis, abstraction, concretization, induction, deduction, and comparison were specifically used, as well as creative methods and the systems approach. In addition to general scientific methods, specific scientific methods were also used. Quite specifically, these include experiment, questionnaire survey, semi-structured interview and statistical evaluation methods.

The virtual environment represents an environment for the trainee that by its very nature can be described as safe. It is not the author's intention to highlight this environment or to privilege it over conventional training. The author's aim was to focus on the comparison of these two environments and, based on the data found, to propose a methodology for making the training of employees using virtual reality more effective, which is why virtual reality has been perceived from the beginning as a sub-component of this training, albeit, for example, a dominant one, but not the only one, and not completely replacing the conventional type of training in which contact with the figurant occurs. This contact and direct interaction, especially for the specific work of the paramedic, remains very important to some extent indispensable. Although the thesis was focused on the employed profession of paramedic, the proposed methodology can be used as a model in principle and with appropriate modification applied across other disciplines, as it includes a didactic level in addition to the organizational and technical one. At the same time, the relevant research and its outputs demonstrate the appropriate application of a multidisciplinary approach in the education of medical personnel.

The presentation provides interesting and practically verified input data. It also generally provides insight into the emic perspective of the trainee in virtual reality. Thus, it can be taken as a basis in an extension study of all the variables validated, without dependence on the paramedic and pre-hospital emergency care setting.

SIMULATION CENTRE / TRAINING HOSPITAL (SIMLEK). WORKPLACE USED IN TEACHING MEDICAL AND NON-MEDICAL HEALTHCARE DISCIPLINES.

Ilona Plevová, Peter Ihnát, Marcela Dabrowská, Jan Němčanský, Jakub Wrona, Barbara Kredbová, Ivona Závacká
Faculty of Medicine at University of Ostrava in Ostrava

The Simulation Centre of the OU Faculty of Medicine (SIMLEK) was designed primarily for undergraduate education. However, with the expansion of simulation medicine into many healthcare disciplines, education at SIMLEK is also oriented towards postgraduate education in medical and non-medical healthcare disciplines.

Presentation of types of education within the SIMLEK simulation centre of the Faculty of Medicine of the OU.

The Simulation Centre is fully prepared to effectively translate the studied theory into practice and avoid mistakes in patient care due to a lack of theoretical knowledge and subsequent practical skills acquired during the study. The opportunity to simulate real, but also rare cases from practice allows students to practice and rehearse basic and advanced diagnostic and therapeutic procedures in a safe environment where error is desirable - or is an integral part of the learning process individually, but also collaboratively as a team. This paper provides an overview of selected medical specialties through the OU Faculty of Medicine curricula taught through simulation medicine at the centre. Using state-of-the-art highly sophisticated simulators, real instruments and cutting-edge IT technology, it is possible to simulate situations that students may commonly encounter in real practice. Almost all the rooms are equipped with a camera and audio recording, as the necessary feedback or debriefing is an integral part of the training.

Through the use of simulation medicine methods, the SIMLEK Simulation Centre enhances the skills of students and improves the output profiles of medical graduates. It is an integral part of the practical training that precedes or accompanies the clinical practice of individual health professions.

SIMLEK SIMULATION CENTRE - WORKPLACE USED IN TEACHING NON-MEDICAL MEDICAL PROGRAMMES

Veronika Ženčuchová, Miroslava Kachlová, Kateřina Greplová, Katka Bobčíková, Ivona Závacká
Faculty of Medicine at University of Ostrava in Ostrava

The Simulation Centre, abbreviated as SIMLEK, is used for repeated practice of not only individual skills for the majority of non-medical health professions trained at the Faculty of Medicine of the OU. The study programmes falling under the Department of Nursing and Midwifery are General Nursing, Paediatric Nursing and Midwifery – and each of these disciplines, which is very specific, has its own realistic simulation area with modern simulators where students encounter complex nursing care in their field. For example, there is a delivery room with one state-of-the-art manikin - a simulator for physiological and high-risk births.

Presentation of types of training within the SIMLEK simulation centre of the Faculty of Medicine of the OU.

Students, while working in SIMLEK, practically demonstrate the already acquired theoretical knowledge in practice in the presence of a lecturer, who can either be physically present with the student or can observe the student through special software, which SIMLEK is equipped with. This process of observation by means of video and audio recording is also used by other students to analyse the correctness of the procedures in all its sub-steps. This essential feedback is a teaching

method in its own right, where the almost instantaneous analysis of the steps in a given process helps students to realise where their weak points are and lecturers to focus more on when teaching. Teaching can also be designed through pre-designed scenarios, where the tutor creates realistic situations in special software, as well as possible complications that may arise during patient care. All this is done in order to gain more confidence during the procedures performed, as well as the possibility of repeating individual sub-steps or even the whole process.

During training, students encounter not only routine situations but also rare cases and a range of complications where adequate student response, provision of correct intervention and the ability to respond to changes in the patient's condition within a short period of time is required. The SIMLEK simulation centre, through its simulation environment and methods, improves student skills and graduate output profiles through non-medical health programmes. While working in the simulation centre, students also improve their teamwork and communication skills, assess their strengths and weaknesses, and have the opportunity to continue to work on themselves and continuously improve with this knowledge.

FEEDBACK ON SIMULATION AS AN APPLIED EDUCATIONAL METHOD: PILOT STUDY

Lucia Dimunová, Beáta Grešš Halász, Gabriela Štefková, Jaroslav Majerník
Faculty of Medicine, Pavol Jozef Šafárik University

Simulations allow students to practice their skills repeatedly, learning at their own pace in a safe environment, leading to increased decision-making skills, clinical reasoning, and critical thinking development.

The aim was to evaluate and describe the effectiveness of simulation as an educational method using vital signs assessment scenario. This is a first time simulation experience followed up with evaluating the effectiveness of simulation. The Sussi high- fidelity model was used within this scenario. This quantitative descriptive study questioned 33 nursing students experiencing simulation. For data collection we used the Simulation Effectiveness Tool Modified (SET-M). We used descriptive statistic and correlation.

Simulation effectiveness total score was M = 43.06 (SD ± 0.93). In domains, the highest score was in prebriefing (M = 4.97; SD ± 0.14), followed by debriefing (M = 12.64; SD ± 0.34), then confidence (M = 13.45; SD ± 0.43), and the lowest rated was learning (M = 12.00; SD ± 0.34). High positive correlations were found between prebriefing and learning (Pearson corr. 0.430; p= 0.014), and learning and confidence (Pearson corr. 0.546; p= 0.001). The effectiveness of the provided simulation was found to be positive in every dimension.

However, as this study can be considered as a pilot, the results cannot be generalized. Simulations are an effective method in education. Prebriefing positively influences learning, and subsequently learning positively influences learners' confidence.

This work was supported by the national grant KEGA 003UPJŠ-4/2023, Innovation of the teaching process in medical and non-medical study programs using medical simulation tools and virtual reality.

OUR EXPERIENCE WITH SIMULATION TEACHING IN INTENSIVE CARE MEDICINE

Vladimír Hudák, Andrea Kačmariková, Judita Capková, Jozef Firment
Faculty of Medicine, Pavol Jozef Šafárik University, 1st Department of Anaesthesiology and Intensive Medicine, Department of Medical Informatics and Simulator Medicine

In the experienced and modern education world, simulation in the teaching of intensive care medicine is an integral and mandatory part of the educational process of medical professionals. In our centre, we started active simulation teaching of the subject of anaesthesiology and intensive care medicine in the school year 2021–2022.

In this presentation we want share the first experiences with the simulator teaching technique for students of the fifth year of general medicine. And we want to express our agreement that simulator teaching on manikin is one of the best methods how to teach and practise non-technical skills in managing team care about acutely ill unstable patient.

Positive factors in the successful implementation of the new teaching method for us were the new simulation centre, the enthusiasm of the simulation centre employees and lecturers from anaesthesiology department, the expectations of students and finally, personal practical experience with simulation teaching techniques abroad. On the side of negative factors, there are mainly the usual habits of conservative teaching techniques and the inexperience of the entire teaching team. It was also necessary to overcome some challenges, which mainly included: the will to change old habits and convenience, the lack of teachers, the lack of time space in the timetable of teaching lessons and finally the large amount of time needed to prepare and introduce specific simulation scenarios into practical teaching. An important decision was also which students in which teaching programs to start with simulation teaching and which health topics within our department will benefit the most from the advantages of this type of teaching. We decided to begin by teaching non-technical skills in critical situations in the management of an acutely ill unstable patient in the 5th year of general medicine.

After two years of teaching on the simulation manikin, we can state a great success both on the part of the students and on the part of the lecturers, realizing how important it is to teach and train complex team management of an acutely ill and unstable patient with an emphasis not only on the theoretical knowledge and practical experience of the students but also on non-technical skills in the process of team patient care. Based on positive experiences, we are looking forward to further developing simulation teaching techniques in our centre by developing additional simulation scenarios and recruiting additional lecturers and teachers who would actively cooperate with the Centre for Simulator and Virtual Medicine UPJŠ LF in Košice.

This work was supported by the national grant KEGA 003UPJŠ-4/2023, Innovation of the teaching process in medical and non-medical study programs using medical simulation tools and virtual reality.

THE BENEFIT OF INTRODUCING SIMULATORS INTO DENTISTRY TEACHING AT THE UNIVERSITY PAVOL JOZEF ŠAFARIK, FACULTY OF MEDICINE IN KOŠICE

Zuzana Schwartzová[1], Vladimíra Schwartzová[1], Jakub Jánošík[2], Jaroslav Majernik[2], Peter Kizek[1]
[1]Faculty of Medicine, Pavol Jozef Šafárik University, Department of Stomatology and Maxilofacial surgery, [2]Faculty of Medicine, Pavol Jozef Šafárik University, Center of Simulator and Virtual Medicine

The Center of Simulator and Virtual Medicine represents the era of interactive teaching of medical and non-medical fields and brings a completely new perspective on modern solutions in the teaching process. At the same time, it provides opportunities for students to supplement their theoretical knowledge with practical training on the most realistic simulators. Center of Simulator and Virtual Medicine, Faculty of Medicine, Pavol Jozef Šafarik University in Košice has more than 30 simulators, and with equipment represents the largest simulator center in Slovakia. Recently, four simulators for teaching Dentistry have become the part of the simulator center, which was appreciated mainly by our students, but also by teachers. In this center students can find simulators for teaching pre-clinical and clinical subjects. The practical part of the education is an essential part for future dentist. A graduate of Dentistry must master both theoretical and practical training. After graduation, he should be able to work independently. The practical part due to the material and technical difficulty and also work with patient who should pay for the procedures, is limited and also brings risk of the transmission of infection. For these reasons, the introduction of simulators into the teaching of dentistry is a great benefit. The Center has several simulators for various branches of Dentistry for the teaching. On these simulators, students can improve their skills in the fields of Conservative and Prosthetic Dentistry. As part of pre-clinical teaching, students can try preparations of different types of dental decays, endodontic treatments of single-rooted and multi-rooted teeth and prosthetic preparations of different types of teeth. The simulator is imitating work with rotary instruments and examination tools. Students of simulator medicine can visit the Center during practical training with their teacher, but very often, they also visit this center individually for the skills that this simulator allows them to acquire. Pre-clinical teaching on these simulators can prepare the student for a real situation, which he will encounter in work with the patient in higher grades. Even the students of higher grades welcome the possibilities of this virtual reality, which is a significant step forward for them, and based on their answers, it is clear that a large part of the students appreciated this possibility. We can conclude that the introduction of simulators into dental education will improve the readiness of dental students for practice, reduce the risk of transmission of possible infections, and it can also be assumed that the financial burden of the faculties for providing practical teaching in the field of Dentistry will be reduced.

This work was supported by the national grant KEGA 003UPJŠ-4/2023, Innovation of the teaching process in medical and non-medical study programs using medical simulation tools and virtual reality.

POSTER SESSION

9^{00}–10^{30} WEDNESDAY

PREPARATION OF PROTOCOLS FOR PHYSICAL MEASUREMENTS FOR THE COURSE OF MEDICAL BIOPHYSICS AT COMENIUS UNIVERSITY IN BRATISLAVA

Andrea Kačmariková[1], Zuzana Pella[1], Jaroslav Majerník[1], Csilla Uličná[2], Katarína Kozlíková[3]
[1]Faculty of Medicine, Pavol Jozef Šafárik University, Department of Medical Informatics and Simulator Medicine, [1]Faculty of Medicine, Pavol Jozef Šafárik University, Department of Medical and Cllinical Biophysics, [3]Faculty of Medicine, Comenius University in Bratislava, Institute of Medical Physic

The parcial goal of the project "Content innovation and digitization of the medical biophysics subject and related mandatory optional subjects" is the innovation and automation of individual protocols from the medical biophysics subject. The intention was to create protocols with a possible record of the results of measured variables and the transmission of protocols via a digital environment, at the same time to provide teachers with the possibility of uniform automatic processing and evaluation of protocols. The inspiration for the creation of new, improved forms was the forms used at the MF UK in the past. Calculation functions for verifying values, functions for assigning evaluations of individual partial calculations according to teachers' instructions were incorporated into the new protocols. The evaluation part was moved to the open source RStudio environment, in which verification mechanisms are set for each protocol, which are accessible only to teachers. Creating automated protocols for biophysical measurements is time-consuming, but from the teacher's point of view, it will significantly reduce the time for evaluating protocols in large study groups. The first results with pilot protocols, functionality testing and getting feedback will serve us to analyze possible imperfections.

The work is supported by the project KEGA 040UK-4/2022 MŠVVŠ SR "Content innovation and digitization of the compulsory subject medical biophysics and related compulsory optional subjects".

ESTABLISHMENT OF THE DEPARTMENT OF MEDICAL EDUCATION AND SIMULATION AS A STEP TOWARDS IMPROVING QUALITY OF EDUCATION AT THE FACULTY OF MEDICINE OF COMENIUS UNIVERSITY, BRATISLAVA

Hnilicova S, Vitovic P
Faculty of Medicine, Comenius University in Bratislava

After a decade of successful establishment of medical simulations, on October 1st, 2023, a new Department of Medical Education and Simulations was established at the Faculty of Medicine, Comenius University in Bratislava. The primary drive for its establishment was a key requirement to expand the scope of the department by innovating current medical education in our medical school including the integration of clinical medicine into theoretical subjects, supporting student

involvement in teaching and learning, and implementation of the latest and innovative educational trends in medical education (e.g. OSCE, TBL, CBL, PBL) into the current curriculum.

The Institute works based on the following five pillars:

1. Innovation of teaching and learning for students
   As part of the innovation and reform of teaching and learning, there is an effort to increase student-oriented learning, and cooperation between our department and theoretical institutes. With the aim of integrating clinical teaching into theoretical subjects, we support early clinical exposure of medical students from the first year in the form of medical simulations. The new subject "Foundations of Clinical Education", which we plan to include from the first year, will com¬bine a system of pre-defined simulations and clinical scenarios with the teaching of patient-oriented medicine skills.

2. Faculty Development
   Well-educated teachers form the foundation of quality education. The institute will support other institutes with the teaching of Medical Education Basics, a workshop for new teachers. Courses in simulation medicine for all teachers par¬ticipating in the simulation center are focused workshops on new methods such as Team-Based Learning, Problem-Based Learning, etc. These will support teachers interested in leveling up their own teaching.

3. Simulation Education
   Nowadays, simulation medicine is considered a standard and is successfully applied in a wide range of theoretical and clinical subjects at our medical school. Therefore, its implementation in undergraduate studies is included in several subjects (Medical Biophysics, Nursing, First Aid, Medical and Clinical Ethics, Slovak or English) in the first year of study. During the simulation, students get familiar with the role of simulation technology in medical education, including medical expertise/hard skills with the implementation of soft skills as a part of simulation training.

4. Science and research in Medical Education
   Established processes in medical education will be measured and subsequently evaluated. From the feedback and results, it is possible to deter¬mine how successful the introduction of individual steps during the change imple¬mentation was, and propose changes based on feedback into the teaching itself. Hence, this way quality of medical education continuously improves. By publishing results, our experience will be shared with scientific community.

5. Cooperation between institutes, clinics, and universities in Medical Education
   The institute aims to create a platform for cooperation among our institutes and cli¬nics, as well as external cooperation with other universities in medical education, offering opportunities to create joint projects and mutual support.

APPLYING THEORETICAL BIOCHEMISTRY KNOWLEDGE THROUGH CASE STUDIES

Anna Birková, Monika Švecová, Beáta Čižmárová, Beáta Hubková, Vladimíra Tomečková, Mária Mareková
Faculty of Medicine, Pavol Jozef Šafárik University

The gradual shift of the medical clinic towards lower grades is a widely debated topic. Many doctors find the use of case studies in teaching medical biochemistry impractical due to the high level of clinical detail, which surpasses the knowledge level of second-year students. Case studies are generally well-regarded as a valuable tool, particularly for higher-level students and those pursuing postgraduate studies in medicine.

Teachers from the Department of Medical and Clinical Biochemistry prepare case studies specially adapted to the needs of junior general medicine students. The educational material is prepared in two main versions. The first version of educational case studies is prepared as .ppt presentations, which are moderated by the teacher during practical exercises. The second version supports self-study and consists of full-text simplified cases in which the student receives all the necessary information about the course and medical solution of the case. Both versions are supplemented with extension questions and answers that support and highlight biochemistry knowledge. In addition to the full-text version (printed + Portal), the material will also be available to students in the Moodle environment as a course.

The initial pilot experience involved the implementation of case studies for students enrolled in Medical Biochemistry 2, a course primarily focused on organ biochemistry. These case studies were presented in the form of engaging presentations during practical lessons. Student response has been overwhelmingly positive, with students appreciating the hands-on approach of the case studies and finding them helpful in understanding complex real-world scenarios. Currently, efforts are underway to create a comprehensive database of full-text moderated case reports, comprising texts, a set of questions with answers, and illustrative images and diagrams. Case reports and supplementary questions and answers are intentionally designed to partially overlap, emphasizing the relationship of biochemical pathways to one another and to clinical manifestations.

Balancing the 'clinical message dose' with student comprehension is crucial. Well-worded, tailored case studies are powerful learning tools for medical biochemistry students. They foster enthusiasm, critical thinking, and vital problem-solving skills needed in future healthcare professionals.The development of educational material in several versions will allow students to choose a more attractive form for them. The application in the Moodle environment will give teachers the opportunity to moderate self-study.

KEGA 017UPJŠ-4/2023 (CASE-PORTAL for the support and innovation of medical biochemistry teaching)

USE OF AUDIO-VISUAL MATERIALS IN THE TEACHING OF MEDICAL CHEMISTRY AT UPJŠ IN KOŠICE

Marek Stupák, Ivana Večurkovská, Lukáš Smolko, Ivana Špaková
Faculty of Medicine, Pavol Jozef Šafárik University

Continuous updating of the content and innovation of teaching methods is the basis of the modern teaching process. The subjects taught by the Department of Medical and Clinical Biochemistry of the Faculty of Medicine of the UPJŠ in Košice are no exception in this respect, and we have long-term efforts to follow the trends in the teaching of Medical Chemistry and Biochemistry at universities

abroad and subsequently apply and implement them. In the last decade, e-learning has become one of the important tools supplementing standard teaching methods.

As part of the innovation of practical exercises of Medical Chemistry, we have attempted to supplement electronic learning materials for students of general and dental medicine, as well as to prepare new instructional videos focused on laboratory safety rules, the basics of laboratory technique (measurement of volumes, separation methods) and selected analytical methods (volumetric analysis, spectrophotometry). The original goal of the implementation of these videos was not to replace the practical part of laboratory exercises, but to familiarize students with individual methods within the framework of self-study before performing the practical tasks.

The COVID-19 pandemic disrupted teaching at all levels of education, and since the situation during the 2019/20 and 2020/21 academic years did not allow face-to-face teaching of practical exercises, the prepared teaching videos became an integral part of the distance learning of Medical Chemistry. Although the videos did not represent a complete replacement for the students' experimental work, they served as tutorials for the students during the distance learning period.

In conclusion, experience with distance teaching of practical exercises showed that the use of e-learning methods cannot fully replace the face-to-face teaching, since the students did not acquire and develop sufficient manual skills as well as critical thinking when solving experimental tasks. The key lies in effectively integrating e-learning methods with other teaching approaches to provide a more comprehensive and flexible educational experience for students.

KEGA 014UPJŠ-4/2023

3D RECONSTRUCTION AND REGISTRATION FOR MEDICAL IMAGING

Patrik Kamencay, Roberta Hlavata, Slavomir Matuska, Miroslav Benco, Robert Hudec
Faculty of Electrical Engineering and Information Technology, University of Zilina

Three-Dimensional (3D) reconstruction and registration are essential processes in the field of medical imaging and healthcare. They play a pivotal role in transforming two-dimensional medical data, such as CT scans, MRIs, and X-rays, into detailed, volumetric representations of anatomical structures or pathological conditions. These techniques are indispensable for accurate diagnosis, treatment planning, and research in the medical domain. Our approach initially conducts image segmentation, followed by the reconstruction of a 3D model of the human skull. Furthermore, we generate 3D models for point clouds (PCs). Finally, we visualize the disparities between the point clouds of these 3D models.

3D reconstruction is the process of creating a three-dimensional model or representation of an object or a scene from a set of two-dimensional images. In the context of medical imaging, it involves the conversion of 2D cross-sectional images (slices) into a coherent 3D volume, allowing for a more comprehensive understanding of the patient's anatomy or pathology. Registration, in the context of medical imaging, is the process of aligning or overlaying multiple medical images or data sets. It ensures that different scans or images are spatially coordinated, allowing healthcare professionals to compare and analyze data effectively. For non-rigid or deformable object registration, advanced methods are used to allow local deformations while aligning point clouds. This is particularly useful in medical imaging, such as registering pre- and post-surgery scans. The registered point cloud data can be visualized in 3D space to assess the quality of the alignment and integrated into various applications, including robotics, augmented reality, and mapping. Validation of the registration results is crucial. Metrics such as the residual error, overlap ratio, or feature matching quality are used to evaluate the accuracy and reliability of the registration.

Presenting a 3D model involves a series of sequential steps. Initially, the patch function is employed to generate one or multiple filled polygons, with X and Y coordinates defining each vertex. In the context of 3D visualization, several additional functions are employed for the purpose of refining the display model. These functions are integral for tasks such as configuring the model's viewing perspective, altering the aspect ratio, and adjusting various lighting parameters, including the angle, color, and how light interacts with the model's surface. Subsequently, we proceeded to convert the 3D models into point clouds. This transformation was accomplished through the utilization of the "pointCloud" function. The output of this function is an object that contains coordinates defined by the x, y, and z points. In our particular scenario, these input coordinates [x, y, z] were derived from the vertices of the previously reconstructed 3D model, which were generated after applying the "isosurface" function responsible for creating both the vertices and faces of the 3D model. Once this conversion was completed, we visualized disparities between these point clouds using the "pcshowpair" function within a dedicated visualization window.

In conclusion, 3D reconstruction and registration from medical data have revolutionized the field of healthcare. The results include more accurate diagnoses, tailored treatment plans, improved surgical outcomes, and enhanced patient education. These techniques continue to drive advancements in patient care, research, and medical education, ultimately improving the quality of healthcare delivery. Emerging complex situations can be effectively tackled by harnessing the potential of machine learning and computer vision technologies, which have already proven their worth in the 2D domain. Additionally, novel advancements influenced by the latest developments in computer animation techniques hold promise.

This work was supported by the projects APVV-21-0502: BrainWatch: System for automatic detection of intracranial aneurysms.

PRESSURE SENSORS IN SMART MEDICAL APPLICATIONS

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In this paper, we discuss the feasibility of using pressure sensors in smart medical applications. In our studies, we designed smart IoT systems based on pressure sensors to improve the health and well-being of various groups of people. Using IoT embedded devices connected to pressure sensors, we collect data about the pressure distribution of individuals sitting on chairs or lying in beds. We then deploy AI algorithms to analyze the collected data and provide valuable information for preventing different problems, such as bedsores or spinal pain.

Our system consists of one or more embedded IoT devices with attached pressure sensors, a server, and a software application on a personal computer. For the pressure sensors, we utilize an in-house developed textile pressure sensor based on electrically conductive yarn, as well as either Velostat or the commercially available FSR402 sensor. The IoT devices transmit data over WiFi using the MQTT protocol.

On the server side, we employ a Node-Red-based application to create the system's logic and provide backend services. Clients have two options for accessing information from the system. We have developed a mobile application to provide users with feedback on their sitting posture. The second option is a desktop-based application, which can offer information about multiple people, for instance, in a hospital setting where the smart system can simultaneously detect bedsores in several patients.

We developed two solutions for evaluating the results. The first is a straightforward method for detecting sitting postures on the chair without utilizing AI. We defined nine different sitting postures for further examination. Among these, one posture is considered correct, three postures are

deemed acceptable, and five postures are categorized as incorrect. To determine the threshold values, we conducted experiments to measure the standard deviation for each posture. Using these thresholds, we were able to identify poor sitting postures.

Our second solution is based on Convolutional Neural Networks (CNN). We had to create a dataset using our proposed smart topper for training the neural network. In our study, we classified individuals in four different postures while lying down: supine, left side, prone, and right side. Our results showed an F1 score ranging from 0.79 for the prone posture to 0.84 for the supine posture.

In this paper, we have presented two smart IoT-based solutions for medical applications. We have also introduced our novel textile pressure sensor, which is based on electrically conductive yarn and Velostat. The core idea of our application is to gather information about pressure distribution across chairs or beds and send this data to the server for classification. The next step involves data evaluation and providing valuable information to system users. Overall, our proposed smart IoT systems could assist in preventing bedsores in long-term lying subjects and alleviating spinal pain.

This work was supported by the Slovak Research and Development Agency under the contracts no. APVV-21-0502 BrainWatch

INTRACRANIAL ANEURYSM DETECTION USING DEEP LEARNING

Roberta Hlavata, Patrik Kamencay, Peter Sykora, Robert Hudec
Faculty of Electrical Engineering and Information Technology, University of Zilina

In the present, the detection of various diseases using neural networks is an important part of medicine. Convolutional neural networks can detect various disorders and diseases from 2D and 3D images. Intracranial aneurysm detection from an image is a very important area of research. Without timely detection of an aneurysm, the blood vessel may burst and subsequently lead to fatal consequences. The goal of this research is to create software that will be able to detect an aneurysm and make the detection easier for the doctor himself. As part of the research, we tested several types of neural networks.

Neural networks use different approaches to machine learning. Among the most famous are supervised learning, unsupervised learning, a combination of supervised learning and unsupervised learning, and reinforcement learning. When detecting aneurysms, we encounter two types: supervised learning and unsupervised learning. In addition, various types of convolutional neural networks are mainly used to detect aneurysms in the brain. The most commonly used types of neural network architectures include PointNet, PointNet++, Single_PointNet (unsupervised), and Single_PointNet++ (unsupervised), 2DCNN, 3DCNN. Different types of PointNet networks are mainly used for processing point clouds, which are actually sets of 3D points representing the spatial coordinates of objects. The PointCNN method also processes point clouds but looks at individual points as a set in which these points are not ordered.

As part of our research, we designed several neural networks for aneurysm detection. We were inspired by already known methods and created two 2DCNN type neural network architectures and one 3DCNN type architecture. Architectures of the 2DCNN type contain 2D convolutional layers, where, based on the knowledge from PointCNN, we assigned 1024 filters to the last layer. Both designed networks differ from each other in the number of filters in individual layers and also in the change of the last block, the so-called multilayer perceptron. In this block, the number of dense and dropout layers and the values assigned to these layers are different. 3DCNN differs in the shape of the input of the neural network, works directly with 3D data, and does not need to be specially modified to a 2D vector. Within our achieved results, the proposed neural networks 2DCNN_1 and

2DCNN_2 achieved an F1 score of 90.45% and 93.93%, respectively, while the trained proposed neural network 3DCNN achieved an F1 score of 90.97%. Compared to the other approaches, we achieved the best results, as the other approaches achieved F1 score values from 68.35% to 90.29% after detection.

As part of our research, we proved that even proposed 2DCNN and 3DCNN networks have the potential to improve the diagnosis of intracranial aneurysms, which contributes to early detection. With correct and timely detection, we can prevent the rupture of blood vessels and subsequent death. The proposed neural network architectures in our research achieved significantly better results compared to other approaches and could make the detection of aneurysms easier for doctors. In further research, we plan to improve the accuracy of the proposed NNs. We are also considering other image preprocessing options and different interpretations of NN.

This work was supported by the Slovak Research and Development Agency under the contracts no. APVV-21-0502 BrainWatch

OBJECTIVISATION OF EVALUATION CLINICAL SKILLS OF STUDENTS OF MIDWIFERY BY OSCE

Ľubica Rybárová, Mária Gábor
Faculty of Health Care Professions, University of Prešov

The main aim of the project is the application of the method of objective structured examinationand evaluation (OSCE) of clinical skills in the clinical training of students of midwifery.

Through the creation of OSCE clinical scenarios and checklists, embedded in the e-learning environment, which will focus on clinical situations common in the midwife's clinical practice, using simulated clinical conditions in the sim labs, we want to ensure an attractive and safe clinical preparation environment for students, as well as an objectively structured formative-summative assessment of acquired clinical competencies, knowledge, skills, and abilities. The content of clinical scenarios and structured checklists will be processed on the basis of summarizing the knowledge of researched sources of relevant professional literature based on EBP in midwifery and will subsequently be reviewed by experts from clinical practice. After a successful pilot test on a selected subject and a group of selected students, further clinical scenarios and OSCE checklists will be prepared, which will be gradually implemented in e-learning courses in the LMS Moodle environment. These will also be subject to review and revision based on the evaluation of feedback questionnaires that will be addressed to educators and students. Subsequently, the validation of the structured evaluation forms will be carried out. Individual clinical scenarios and evaluation forms will be published as a summary in the electronic and printed form of the university textbook.

Current trends in the implementation of activating methods of information technology with a focus on the use of virtual reality, multimedia textbooks, and the creation of simulated clinical situations in clinical training in medical disciplines, are bringing with them the need for a change in the view of the evaluation of acquired clinical competencies. The use of the method of Objective Structured Clinical Examination (OSCE) in the undergraduate professional training of midwives in simulated conditions of clinical practice, does the aim to increase the quality of midwifery training. National as well as international professional midwifery organisations (ICM, EMA) have defined the key clinical competencies to be acquired during the training of a future midwife. The core competencies that curricula should focus on include communication and interpersonal competencies, knowledge and cognitive competencies; skills and activities needed to provide optimal care, clinical practice, and clinical decision-making, professional values, leadership, management, and team competencies

(Tuning 2005). Clinical scenarios and OSCE checklists are developed for the field of obstetrics, gynaecology, and neonatology and the clinical practice of midwives in these areas as defined in the Decree of the Ministry of Health of the Slovak Republic No. 95/2018 Coll., which determines the content of midwifery practice provided by midwives independently, independently on the basis of a physician's indication and in collaboration with a physician.

In relation to the assessment and evaluation of clinical competencies and skills, we currently find the most effective use of Objective Structured Examination (OSCE) under simulated clinical conditions, through the creation of a database of clinical scenarios and checklists embedded in an e-learning environment, which will focus on clinical situations common in midwifery clinical practice.

Objectivization of evaluation clinical skills of students of midwifery in simulated condition project KEGA 002PU-4/2022

AUTOMATED EXTERNAL AED DEFIBRILLATOR IN VIRTUAL REALITY

Alena Lochmannová, Marek Bureš
Faculty of Health Care Studies at University of West Bohemia

In various situations, unconsciousness and cardiac arrest can occur in any person. Therefore, it is very important to perform resuscitation properly and use AED that can increase the chances of saving that person. That is why a virtual application has been created which contains two modules: training and testing.

The app is designed for Oculus Quest 2, an all-in-one solution that doesn't require a connection to a computer. The goggles include storage, processor, and graphics, so they work independently. The communication device, most often in the form of a tablet, is used only to run applications using the control software and to stream video from the glasses. The glasses and the device must therefore be connected to the same Wi-fi network. The battery life of the glasses is 2 hours of active use. The testing room must be well lit and free of mirrors. To maintain hygiene, the device is disinfected after each use.

This app serves as a basic guide for the proper use and application of the AED device on the affected person, thus helping the patient in critical condition. The student will be able to correctly use and set up the AED machine. Further, the student can operate it and knows the proper guidelines for using it on a patient.The student enters the simulation using a headset. He/she finds himself inside a surgery, where he/she observes a fictitiously created environment. At the very beginning of the simulation, the user has time to explore and become familiar with the environment. The avatar welcomes him/her in this room and after some time (about 20 seconds) a start button appears in front of him/her. He/she is therefore free to decide when to start the training. To start, he/she just needs to touch the START button with any hand. Next, the standardized procedure is followed according to the avatar's instructions.

Virtual reality is a suitable complementary tool for educating healthcare professionals. It has its undeniable advantages as well as limitations, both of which will be highlighted in the presentation using a selected model example of an AED operator module. In general, it can be summarized that virtual reality is suitable wherever a certain standardized or standardizable procedure or process can be used. The presented application was tested during the development process and then redesigned because during the testing of the first version, it was difficult for the user to operate. Therefore, it was redesigned from hand controls to haptic hand controls, which are more natural. Another point was to lift the patient (manikin) to a higher position. Here it was positioned on a recliner, as opposed to lying on the ground. Bending down with the headset display resulted in

poor hand tracking and users had to focus more on tracking them than the content itself. The last change was converting text to audio tracks. These sounds were also used because the AED has a spoken procedure in it, thus assisting the user when using it.

KEYNOTE LECTURE II

10^{30}–11^{00} WEDNESDAY

3D PRINTING IN MEDICINE

Radovan Hudák, Jozef Živčák, Marek Schnitzer
Technical University in Košice

Technologies are currently bringing the possibilities of manufacturing orthopedic implants closer to nature - personalization, imitating the structure of bones and their material-mechanical properties and the application of cellular or non-cellular 3D bioprinting in the production of biological substitutes. For several years now, 3D printing (or additive manufacturing) has played an important role here, which enables the digital production of personalized implants, surgical guidance systems, cutting templates, anatomical preoperative models, but also mass-produced implants with the application of porous structures.

The aim of the presentation is to bring closer the applications of 3D printing in orthopedics, focusing on the description of technologies, material trends and selected studies. The future in the field of orthopedics towards tissue engineering and regenerative medicine has already begun today. The conclusion of the presentation will be devoted to technological progress and trends in the development of orthopedic replacements of the movement system.

SYMPOSIUM

11^{15}–12^{30} WEDNESDAY

AI4MEDED SYMPOSIUM

Jaroslav Majerník[1], Daniel Schwarz[2]
[1]Faculty of Medicine, Pavol Jozef Šafárik University, [2]Faculty of Medicine, Masaryk University

The development of computer systems has reached a level where they can not only imitate, but also successfully perform various tasks where visual perception, speech recognition or decision-making are required. We live in an era where we are witnessing how machines are designed to think and work like humans. This brings with it not only many challenges and expectations, but also changes that affect normal activities in almost all areas of human life, including medical applications. On the other hand, a number of questions are also raised here, for example, how far can such development go or what risks can it bring to humanity? Therefore, we decided to enrich the MEFANET conference program with a symposium, which is dedicated to the topics of using artificial intelligence in medicine and education. The experiences and achieved results in this area will be presented to participants of the conference by academics and researchers. The vice-dean Frantisek Babic from Technical University in Kosice will present how the artificial intelligence is used in medical diagnostic processes. Roberta Hlavata from University of Zilina will think about where the use of artificial intelligence in medicine is headed. Matej Gazda, the researcher at the Technical University in Kosice will continue with the presentation about benefits of artificial intelligence in clinical medicine. The second part of the symposium will be dedicated to the moderated discussion with the audience on presented topics, but also on other specific and/or general effects of artificial intelligence in the areas ranging from medical education, through clinical support to patient health care. You are warmly welcome to the symposium as well as your questions to this discussion.

Organisation if the symposium work was supported by the national grant KEGA 003UPJŠ-4/2023, Innovation of the teaching process in medical and non-medical study programs using medical simulation tools and virtual reality.

QUO VADIS ARTIFICIAL INTELLIGENCE (AI) IN MEDICINE

Roberta Hlavata, Robert Hudec, Patrik Kamencay
University of Zilina

Nowadays, some of the most advanced technologies, such as robotics and artificial intelligence, are being integrated into everyday activities in many industries. The implementation of these technologies support innovation in various industrial sectors, including healthcare. In the medical field, artificial intelligence and robotics are used for a range of tasks, from genetic testing and surgery to cancer research and others. Artificial intelligence has been with us since the first half of the 20th century. In 1950, Alan Turing asked the question “Can machines think?”. This question became a springboard for the subsequent development of artificial intelligence. In 1956, the concept of artificial intelligence was introduced at a conference at Dartmouth to unify the various research efforts to make machines “think”. Various AI approaches in medicine can be used for classification, segmentation, registration detection, and localization of images. Pattern recognition tasks can be

applied to different modalities from which we get an image, such as X-rays, MRIs, histopathology, and miscellaneous. AI techniques can also be applied to signal processing, involving data from EMG, ECG, EEG, and EOG, enabling classification, detection, and prediction of electrical signals generated within the body. The use of AI in medicine is suitable for hundreds of applications in healthcare. In particular, the drug development is a key area where artificial intelligence is used. The drug development process takes several years and costs a lot of money. To overcome the challenges, many drug development companies are introducing AI into their daily lives. It is currently estimated that the deployment of AI in certain clinical trials can lead to savings of up to 90% in drug development costs. Another crucial application is the use of AI as a virtual nursing assistant, significantly enhancing the capacity of healthcare organizations to care for multiple patients concurrently. We can see this kind of application as one of the most important components. AI-powered virtual nursing assistant helps monitor the patient's condition. AI-driven robots also play an important role in the healthcare industry, serving purposes such as medical supply transport, sanitation and disinfection, prescription dispensing systems, and surgical assistance. These applications offer numerous advantages, including more informed patient care, error reduction, cost savings in healthcare delivery, enhanced doctor-patient engagement, contextual relevance, reduction of minor procedural variations, automation of less critical tasks such as suturing, improved patient outcomes, and comprehensive surgical data collection. However, with the development and applications of AI, ethical and legal considerations that we encounter in various industries go hand in hand. Alongside the opportunities, AI brings about various barriers and challenges, including issues related to legislation and standardization, as well as concerns about building trust in AI and ensuring the quality of the data utilized. Nevertheless, it is important to emphasize that AI serves as a valuable tool to aid medical professionals but is not intended as a replacement for their expertise and judgment. However, the bottom line is that AI is a good aid for doctors but not a replacement.

We would like to thank the Slovak Research and Development Agency under the contracts no. APVV-21-0502: BrainWatch: System for automatic detection of intracranial aneurysms and the Integrated Infrastructure Operational Program for the project: Biobank for Cancer and Rare diseases, ITMS: 313011AFG4 and 313011AFG5, PP-COVID-20-0100: DOLORES.AI: The pandemic guard system and DIGITAL-2022-CLOUD-AI-02-TEF-HEALTH - Testing and Experimentation Facility for Health, (01/2023-12/2027).

ARTIFICIAL INTELLIGENCE AS A SUPPORT TOOL FOR DIAGNOSTIC PROCESSES IN MEDICINE

František Babič
Technical University in Košice

Due to the rapid growth in data quantity and complexity, in both medical research and clinical practice, it is necessary to deploy new technologies or customize the existing ones for effective decision support. Artificial intelligence and relevant methods for e.g., digital image processing, big data processing and analysis, machine learning, or interactive data visualization represent a way how we can help the doctors and medical experts with respective diagnostical processes or procedures. In called Processing and analysis of ultrasonography video sequences using artificial intelligence methods (in cooperation with the Department of Thoracic Surgery of Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, and University hospital in Martin) we focus on develop methods and tools of artificial intelligence for the analysis of chest USG video sequences to aid and explain in the process of medical diagnosis. In another project (in cooperation with Faculty of Medicine, Pavol Jozef Šafárik University in Košice) called Determinants of

increased cardiovascular risk and their prognostic significance analyzed using machine learning in the diagnosis of high-risk patients we focused on primary detection of subclinical atherosclerosis using data-based algorithms helping the identification of high-risk individuals and early detection and management of atherosclerotic coronary artery disease.

The work was supported by The Slovak Research and Development Agency under grants no. APVV-20-0232 and APVV-17-0550.

ARTIFICIAL INTELLIGENCE IN CLINICAL MEDICINE

Matej Gazda
Technical University in Košice

Intensity Modulated Radiotherapy (IMRT) is a prevalent method for treating cancer. A significant hurdle in this process is ensuring accurate treatment delivery, especially considering the motion caused by free breathing. Currently, the guidance for IMRT is primarily 2D because 3D tracking is complex. We suggest a cutting-edge attention-graph neural network model. This model can instantly produce a triangular representation of the liver, leveraging a reference segmentation from the preoperative phase and a 2D MRI coronal image captured during treatment. Graph neural networks excel at working with graph data, unveiling hidden trends in non-Euclidean areas. Our model's ability to generate the liver shape in a complete mesh format, deducing the correct mesh form and location from a surrogate image. We've developed two real-time methods to link liver mesh points with 2D images taken during treatment. We've also introduced a unique identity loss tailored for the task, which curtails unwanted deformations in the graph neural network, such as mesh anomalies.

SHORT COMMUNICATIONS: BRIDGING MEDICAL PHYSICS AND ANATOMY

13^{30}–14^{30} WEDNESDAY

THE USE OF SELF-PRODUCED DISSECTION VIDEOS IN ANATOMY TEACHING, OUR EXPERIENCES

Vecanová J.[1], Hvizdošová N.[1], Pavliuk-Karachevtseva A.[1], Kolesár D.[1], Lovásová K.[1], Boleková A.[1], Hodorová I.[1], Majerník J.[2]

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For generations, the use of cadavers has been the chief pillar for learning anatomy. However, the limited availability of cadavers and the arrival of modern technologies in learning have led to use audio-visual aids. Therefore, our team is working to compile a database of dissecting based videos that are primarily directed to beginning medical students to promote deep learning and meaningful understanding of the subject.

Twenty human donor formaldehyde-fixed cadavers were used for dissection and recording individual video-clips in order to describe particular human body parts. The dissections were done by skilled anatomists, using the finest surgical techniques. The images were recorded by using a broadcast-quality, digital video camera Canon G10 mounted on a rotating arm. The names of structures, when seen for the first time, appear on screen in labels as a learning reinforcement. Video processing, adding desriptions, and uploading commentary has been done in computer programme Sony Vegas Pro.

Over the last decade, our team has created more than 150 short educational dissection videos of the human body regions, highlighting the complex spatial relationship of various structures in the body, which is the very essence of gross anatomy. When students use our dissection audiovisual material as additional resource for learning, we observe their better learning outcome. Half of the videos were prepared before a pandemic, and they were extremely helpful for us during ´virtualization´ of anatomy during COVID-19.

Our collection of videos has been incredibly well-received by students and new anatomy teachers. Students feel more motivated by the use of audiovisual technology and appreciate viewing videos at home as many times as they wish that results to better learning. Our future goal is to expand the array of topics, such as brain sections and to increase productivity of videos via the addition of team members and to create multimedia atlas of human body.

The work was supported by the Grant VVGS IPEL -2023-2536.

DOSIMETRY AND ABSORPTION OF IONISING RADIATION IN PRACTICAL EXERCISES IN MEDICAL BIOPHYSICS

Katarína Kozlíková
ÚLFBFIaTM, Lekárska fakulta, Univerzita Komenského v Bratislave, SR

Future doctors will come into contact with ionising radiation either directly during individual procedures or indirectly when referring their patients for examinations or therapy using such radiation. In order to understand its effects properly, they need to become familiar as early as possible with the dosimetric quantities used in risk estimation. We have therefore introduced practical exercises in ionising radiation dosimetry for medical students as part of the compulsory course Medical Biophysics.

The aim of this work is to show, by applying the students' measurements, that the effective dose of background radiation during the practical session is within the limits for the students; to prove this affirmation, the absorption of ionising radiation is measured in parallel.

Before both tasks, the students were informed about the safety of working with ionising radiation. During the practical task "Dosimetry", 30 students measured the equivalent dose rate using a Gamma-Beta digital dosimeter (Geiger-Müller tube) at two different locations - in the classroom and in an adjacent corridor.

In parallel, the practical task "Absorption of ionising radiation" was carried out in the same room. For this task, the school's closed gamma-ray source with an energy of 60 keV, the isotope 241Am with an activity of 300 kBq, from the school's Gamma-Beta kit, was used.

The collimated beam of the source was used to measure radiation attenuation (distance dependence, inverse square law) at five different distances between the source and the detector (from 11 mm to 146 mm) and radiation attenuation using two different absorbing materials placed at a distance of 26 mm in front of the source with the detector immediately behind the material (material thickness dependence, Lambert's law). The pulses were counted for 50 seconds. Since up to three such sources can be used simultaneously in a practical classroom, we assumed that their activity may occasionally increase the background radiation in the classroom.

We evaluated 150 equivalent dose rate measurements. To estimate the risk, we also calculated the potential effective dose from these, assuming the same exposure throughout the year as was measured during the practical exercise.

We found that the range of equivalent dose rates in individual measurements ranged between 10 nSv/h and 260 nSv/h in the corridor, but up to 300 nSv/h in the classroom. The average values of the equivalent dose rate in the individual student measurements ranged between 70 nSv/h and 170 nSv/h in the classroom and between 50 nSv/h and 210 nSv/h outside the classroom. The overall mean equivalent dose rate was 127 nSv/h ± 33 nSv/h in the classroom and 134 nSv/h ± 31 nSv/h in the corridor. The corresponding mean effective dose was 1.14 mSv ± 0.35 mSv (ranging from 0.88 mSv to 2.63 mSv for individual measurements).

The calculated average effective dose for the whole body is very close to the annual limit for the public, which is 1 mSv. The corresponding annual limit for students aged 16 to 18 years is 6 mSv, for older students (which was our case) the limit is 20 mSv. The total effective dose was calculated assuming the same exposure for the whole year as during the practical exercise. However, such exposure lasted for a maximum of 2 hours for each student. On the other hand, typical values of the equivalent dose rate in Bratislava are approximately equal to or slightly less than 100 nSv/h [4], which corresponds to an average total effective body dose of 0.9 mSv per year.

Even if we take into account some possible measurement uncertainties when the students perform the measurements, due to a large number of measurements, we can conclude that the two above tasks can be measured by students in parallel in the same premises without any doubts

about the safety rules and they can gain their first experience with ionising radiation dosimetry and with protection against the undesirable effects of ionising radiation.

The publication is supported by the KEGA project 040UK-4/2022 “Content innovation and digitisation of the compulsory course of medical biophysics and related compulsory elective courses”.

ANATOMICALLY ACCURATE 3D MODELS

Ing. Jiří Travěnec, Ing. David Pospíšil, Ph.D.
Faculty of Medicine, Masaryk University

While more and more medical schools are building simulation centres for teaching, the use of 3D printing for teaching in medical schools is currently just beginning: at all participating medical schools, technicians have started with 3D printing small everyday equipment and are gradually moving to 3D printing anatomical models that could be used in teaching. Based on these early experiences, the idea of using anatomically accurate 3D models in teaching was born as another innovative and nowadays easily achievable tool.

The main objective of the project is to improve the quality of medical and non-medical education across Europe by incorporating anatomically accurate 3D printed products into the teaching of subjects that emphasise morphology (preclinical - especially anatomy, and clinical - surgery, orthopaedics, forensic medicine, obstetrics and gynaecology, etc.).

To this end, the following steps will be taken:

Creation of the necessary skill set for 3D printing for all techniques in the participating medical simulation centres. As the different teams of simulation technicians focus on different areas of 3D printing in teaching and in the operation of the simulation centres, sharing experiences during joint workshops will lead to mutual enrichment and alignment of working practices. The concrete output will be a unified methodology in the form of a manual for the creation of electronic templates for 3D printing of anatomical structures.

A set of high-quality 3D printing models for educational use in medical and non-medical curricula will be prepared and made available. These models are being prepared according to a uniform methodology established by the members of the involved project teams at the beginning of the project implementation. The output will consist of 70 electronic templates for 3D printing of anatomical structures. These files will be assessed by medical experts and further enriched after the end of the project.

To ensure educational usability, a test set of printed structures will be piloted at participating medical faculties for use in practical exercises in anatomy and clinical subjects. Based on the feedback received, the templates will be further refined and improved.

The novelty of this research project is the development of a reliable source for 3D printing of anatomical structures, which will be:

- robust enough to be applicable for teaching in medical schools,
- reliably guaranteed by experts in anatomy and clinical medicine,
- free of charge.

No comparable portal is currently available. We see the added value of the project in the involvement of experts in anatomy and various clinical disciplines as supervisors. The currently available materials for 3D printing of biological models are not based on CT scans, are not reviewed by experts and their anatomical and medical accuracy is not guaranteed. Their use in undergraduate teaching may therefore be counterproductive.

Anatomically aCCuratE 3D modEls (2022-1-CZ01-KA220-HED-000089231)

A SET FOR TEACHING THE PRINCIPLES OF RADIOACTIVITY

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Although the knowledge of the principles of radioactivity, the properties of radioactive radiation and the principles of safety when working with ionizing radiation is a very important area not only for the training of medical students, but also for high school physics teaching, there is a lack of didactic equipment suitable for teaching this topic on our market. Therefore, we have created a purpose-built didactic kit to demonstrate the basic principles of radioactivity.

The kit consists of a basic unit made with 3D printing and containing commercially available electronic modules (Arduino microcontroller, a two line display, and a G-M tube with source module and pulse processing) and a school radioactivity source containing an Americium capsule (originally designed for smoke detectors) and lead shielding. The kit also includes a set of metal shielding plates. The set includes an electronic log (programmed using Excel) that automatically evaluates the accuracy of the calculations and transmits the student's results to a central log database. Also included are didactic materials (theory and instructions for the problems, didactic video tutorial).

The proposed kit is designed for student measurements of natural background activity, source activity and its safety, measurement of activity decrease with source distance, measurement of activity behind shielding of different thickness and calculation of half-layer for shielding material. The instrument is easy to use by students and is accompanied by a theoretical introduction, instructions for each task and an instructional video. The kit includes an electronic log automatically evaluating the accuracy of the calculations and transmitting the student's results to a central log database.

For student work in small groups during practical exercises, we have created a set of practical didactic aids at an affordable price, which will allow students to practically verify the knowledge about ionizing radiation, which they have so far discussed only in theoretical lessons.

SHORT COMMUNICATIONS: BLENDING TECHNOLOGY, ASSESSMENT, AND CREATIVITY

14^{45}–16^{15} WEDNESDAY

BALANCING FORMATIVE AND SUMMATIVE ASSESSMENTS IN TEAM-BASED LEARNING (TBL): EXPERIENCE FROM THE THEORETICAL BACKGROUNDS OF CLINICAL MEDICINE SUBJECT

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Initiated in the autumn semester of 2023, the Theoretical Backgrounds of Clinical Medicine (TBCM) integrated the TBL design into its final two semesters after three years of meticulous preparation, which included multiple TBL pilot events. This method emphasizes the application of foundational pathophysiological knowledge through personalized medicine using 15 virtual patients. A significant challenge emerged in finding the right balance between formative and summative assessments within this pedagogical design.

To accommodate the TBL instruction for 395 students biweekly, each lesson is replicated 11 times. Pre-class reading materials ensure foundational concepts are well-understood. Readiness Assessment Tests (RAT) – specifically iRAT, tRAT, and gRA – are employed sequentially to measure both individual and team comprehension. The application exercise, built around virtual patients, facilitates the development of students' clinical reasoning, critical thinking, and decision-making skills.

The incorporation of summative assessment through iRAT results precipitated a noticeable shift in student behavior compared to the sole use of formative assessments. This transition led to heightened student anxiety, necessitating tailored communication interventions. Feedback strategies, like calming emails and direct dialogues, were initiated to comfort and support students during their academic experience.

TBL provides a potent platform for fostering clinical reasoning skills. Yet, the balance between formative and summative assessments significantly influences students' perspectives and involvement. Our journey underscores the need to carefully select assessment methods, considering overarching educational aims, and ensuring that students remain engaged, informed, and nurtured throughout the learning process.

Our sincere thanks to the content experts for their invaluable contributions to the TBL lessons. We also appreciate the support from the faculty management and the Department for Simulation Medicine in implementing TBL into TBCM.

MIND MAPPING INTEGRATED INTO THEORY AND PRACTICE: WHAT WORKS?

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Klinická výučba je dôležitá súčasť vzdelávania zdravotníckych pracovníkov, čo si vyžaduje od študentov zdravotníckych študijných odborov, aby vedeli kritický myslieť a robiť správne rozhodnutia. Teoretické poznatky a s nimi súvisiace klinické zásahy sú integrované v učebných osnovách a návrhoch výučby. Pojmové mapy sú metódou, ktorá uľahčuje prepojenie teoretickej a praktickej výučby. Výskumy zamerané na pojmové mapovanie prezentujú túto metódu ako podporujúcu kooperatívne učenie poskytujúce interakciu pri výmene informácií vedúce k potrebe multidisciplinárnej spolupráci. Sú užitočné v klinickej výučbe pri vizualizácii pacientovej diagnózy a ošetrovateľských zásahov súvisiacich s poskytovaním starostlivosti zameranej na pacienta. Pojmovú mapu si možno predstaviť ako grafickú vizualizujúcu znalosti študenta v základných pojmoch a ich vzájomných vzťahoch.

Účelom tejto štúdie bolo implementovať pojmové mapovanie ako učebnú stratégiu u študentov v nelekárskych odboroch a zhodnotiť výsledok učenia sa študentov prostredníctvom tvorby digitálnej pojmovej mapy založenej na klinickej diagnóze a intervenciách. Išlo o implementáciu digitálnej pojmovej mapy do teoretickej výučby predmetu Prevencia vo vnútornom lekárstve. Hlavnú metodiku práce tvorilo vizualizovanie klinickej diagnózy a zásahov tvorených kognitívnou doménou študentových vedomostí v kontexte Bloomovej taxonómie vzdelávacích cieľov. Na dosiahnutie vzdelávacieho cieľa bol použitý program ContextMinds (www.contexminds.com). Údaje boli analyzované prostredníctvom programu SPSS verzia 25.0 s využitím deskriptívnych dát a induktívnej štatistiky, konkrétne párového t-testu, analýzy rozptylu (ANOVA) a Pearsonovho korelačného koeficientu.

Spracovanie informácií o klinickej diagnóze je aspektom klinického uvažovania. V tejto štúdii sme zistili veľké pracovné zaťaženie študenta v súvislosti s časom potrebným na získanie digitálnych zručností, tvorby vizualizovanej klinickej diagnózy a klinických zásahov. V pojmovej mape sa to prejavilo v štruktúre a organizovaní komplexných teoretických údajov o klinickej diagnóze, analýzou vzťahov medzi pojmami a identifikáciou klinických zásahov. Reprezentácia klinickej diagnózy zahŕňala spôsob výberu pojmov z kognitívnej úrovne obsahu študentových vedomostí a generovaním očakávaných intervencií. Odovzdanie finálnej verzie pojmovej mapy trvala študentom v priemere M = 2,10 (SD ± 0,77), teda týždne až mesiace. Zaujímavým zistením bolo, že študenti nedokázali pomocou pojmového mapovania vizualizovať teoretické vedomosti s klinickými zásahmi, ktoré sa prejavili neschopnosťou identifikovať súvisiace pojmy definujúce špecifické klinické zásahy.

Tvorba pojmovej mapy umožňuje učiteľovi zistiť ako kognitívne procesy u študentov môžu viesť k diagnostickým chybám a zistiť ako dochádza k zlepšovaniu schopností klinického uvažovania, najmä pri činnostiach založených na výkone v skutočných alebo simulačných klinických podmienkach. Reprezentácia vedomostí a vytvorenie referenčnej pojmovej mapy si vyžaduje ďalší výskum použitia tejto metódy vo výučbe v klinických, či simulačných podmienkach.

This work was supported by the national grant KEGA 003UPJŠ-4/2023, Innovation of the teaching process in medical and non-medical study programs using medical simulation tools and virtual reality.

EVALUATION OF THE EFFECT OF DISTANCE LEARNING DURING THE COVID-19 PANDEMIC AT THE UPJŠ FACULTY OF MEDICINE USING THE EXAMPLE OF THE SUBJECT NUCLEAR MEDICINE IN 2018-2022

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The COVID-19 pandemic forced us to make some radical changes in the teaching process as well, which we would not have used under normal conditions, or introduced much more slowly. Such a turning point in the pedagogical process was complete distance learning.

In our contribution, we evaluate the teaching results of the subject nuclear medicine from the winter semester (WS) 2018 to the summer semester (SS) 2022. This longer period analyses the situation before the pandemic, during 100% distance learning, through two semesters of combined teaching and after the return to normal conditions of face-to-face teaching after the pandemic.

During the evaluated period, the same two teachers participated in teaching and testing, the requirements and evaluation criteria remained the same, therefore the objectivity of the obtained results can be considered high. The curriculum of the subject also changed only minimally during this period.

We found that using the same test in a distance form increased the % of matching answers, which is a measure of cheating, by 10-fold (from 0.3% to 3.5%).

After overcoming the difficult situation and discovering the degradation of students' knowledge, we were forced to revise the feedback (examination) procedures and introduce some innovative forms. For example, an exam after the first half of the semester, control questions during the lecture, and others. These require higher attention from students and consequently responsibility in preparation. Nevertheless, towards the end of the pandemic, insufficient knowledge of the subjects taught during the pandemic was evident. The average grade was better for Slovak students and decreased less from 1.63 to 1.76 than for foreign students (decrease from 1.94 to 2.24). The rate of examination repetition was significantly higher among foreign students. We discuss the possible causes of this phenomenon.

The pedagogical process that uses modern technologies has an ambivalent effect. Distance education can be a good servant but a bad master. They do not allow the full application of pedagogical approaches and should be considered only as a substitute solution or a supplementary method. It reduces non-verbal communication, active teacher-pupil interaction, comparison between students, joint discussions. It causes the gap between students' knowledge to widen. It can be helpful for students with a sincere interest in learning, but unfortunately it allows slackers to cheat. It is not enough to just impart knowledge. We need to strengthen responsibility and initiative in medical students in preparing for exams. A student must understand that a serious approach to his studies gives him a higher probability of progressing in building the foundation of knowledge in order to be successful in his demanding profession.

USE OF SOME ELEMENTS OF VIRTUAL PATIENT IN "MICROBIOLOGY AND IMMUNOLOGY" SUBJECT OF NURSES, MIDWIVES AND PARAMEDICS

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At Masaryk University, some bachelor study programs have a subject called "Microbiology and Immunology". The subject includes the basics of microbiology, especially topics important for nurses, midwives and paramedics (sampling, filling out the order form, pre-analytical phase of the examination, but also the basic interpretation of the results). It also includes some basics of immunology at a level appropriate for the subjects. The thesis describes the implementation of some elements of the virtual patient (VP) in the contact part of the education.

The teaching "Microbiology and immunology" takes the form of blended learning. Currently, teaching has four basic pillars: 1) basic texts in MS Word (pre-class reading), 2) basic explanation of the topic in MS Powerpoint (can also be used as pre-class reading), 3) so-called "ROPOT questionaires" for self-evaluation and 4) contact education in the classroom (1/2 lectures and 1/2 seminars). The contact part of the teaching currently contains 30 hours of teaching, divided into six 4-hour lessons and one 2-hour lesson common to all three subjects, as well as one separate 4-hour lesson for each program (to emphasize specific topics of each subject). In the past, MS PowerPoint e-learning material was very similar to materials used in contact education (just the e-learning version contained some interactive elements). This did not seem to be very effective because the student was discussing the same things that were already covered in the pre-class reading materials. Therefore, we decided to reduce part of the interpretation to only some problematic topics. This is the first part of contact education (lecture). The remaining part (seminar) can take the form of an "application exercise" with an emphasis on practical skills associated with sampling, the appropriate choice of sampling kits, etc. An important part is "decision-making" training.

The work involved the creation of nine specific virtual stories. They were prepared as interactive: students used the application "KVIS" available in the Information System of Masaryk University (similar to systems such as Sli.do or Socrative) and in parallel the same questions were included in the powerpoint. The interactive features of the powerpoint allowed students to be given feedback. In the creation of these stories, some know-how was gained in the preparation of application exercises in team courses for general medical students. When preparing them, it became clear that it was not possible to have all of them as simple VP cases, because they would not cover the complete topic. So our decision was to keep an "open mind" and be able to modify the cases to fulfill the expected role. So, in some stories, the original virtual patient changes over time into a "virtual friend" who advises someone else who now has a certain health problem. In some cases, there has even been a form of "virtual nurse" who tries to help her patients. However, this form has proven to be good for keeping students on topic. This "gamification" also made the educational language more suitable for the "native generation of smartphone users". The form was widely accepted, although no precise method of opinion formation was used. Some examples of real situations will be shown directly at the MEFANET meeting.

Current medical education, including nursing, midwifery and paramedic training, includes hi-fi simulations, but low-fidelity simulations are also an important part, especially for decision-making training. These low-fidelity simulations can include VP as a good tool. The most commonly used methods are team-based learning (TBL), problem-based learning (PBL) and flipped classroom (FC). However, it is also possible to set up a model that does not exactly fit any of them, but still contains some VP elements. The use of these elements increases the educational potential and makes education more enjoyable for students and teachers.

SIMUPORTFOLIO: EVALUATION OF STUDENTS AND SUPPORT TOOL FOR TEACHING AT SIMULATION CENTRE, MASARYK UNIVERSITY

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The SIMUportfolio platform is an integrative online web application built on the experience of more than ten previous national and international projects. It is thus a unique tool for Masaryk University Faculty of Medicine, which significantly supports modern teaching at the Masaryk University Simulation Centre (SIMU MED MUNI). The application focuses primarily on creating innovative and advanced features essential for learning and teaching at MED MUNI, such as Objective Structured Clinical Examination (OSCE) and Readiness Assurance Tests (RAT).

SIMUportfolio has been widely used for the fourth year in a row, especially by teachers for the purposes of testing and evaluation of students using OSCE and RAT methods, as well as for the support of scheduling Student as a Teacher (SaT) lecturers. A piloted novelty in SIMUportfolio is a module for warehouse management and effective preparation of lessons taking place in the Simulation Centre MED MUNI. The development of the application has been continuously in process for six years, and thanks to the support of the faculty management and cooperation with individual users of the application, it is possible to continuously adapt technologically and methodologically to the needs that come not only from the course guarantors and users of SIMUportfolio, but also result from the available reports and analyses that are prepared over the data from the entire system.

SIMUportfolio is used in several courses across the General and Dental Medicine curriculum and other medical disciplines. OSCE is used as a by First Aid and Propaedeutics courses in various exam settings, and OSCE will be piloted for the Intensive Care Medicine course in the next academic year. RAT is used in Theoretical Foundations of Clinical Medicine and Applied Pharmacology courses. A set of visualizations and reports are available for both methods of testing students and are further used to enhance existing functionality.

Over many years of using the SIMUportfolio platform, the application has become an essential and valuable part of the daily routine of the MED MUNI Simulation Centre. The main advantages of using SIMUportfolio, besides its being a system tailored to the needs of SIMU, are its online availability, ability to automate and facilitate the work of educators, adaptability, and support for data-driven decision-making. SIMUportfolio is the result of a successful long-term collaboration between several teams.

NATIONAL HEALTH INFORMATION PORTAL: GAMIFICATION IN HEALTH LITERACY

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The nzip.cz web portal ensures trustworthy communication between individual user target groups of health care, citizens - patients, public administration representatives and professional societies. This communication is implemented on both sides: (i) public administration and experts communicate necessary information from Czech healthcare to the public through NZIP, (ii) the public provides feedback through NZIP and defines needs in the form of topics that are not sufficiently covered by information, including evaluation of the content already published.

The NZIP directly follows and complements the eHealth concept and the overall strategy for the digitisation of healthcare and thus serves as a gateway for authenticated communication between

individual authorised units. It is based on original author content in the form of static articles, external resources and index terms, which is complemented by an interactive map of healthcare accessibility and educational quizzes (games). An integral part is a specialised section dedicated to data reporting, where comprehensive information on the release of the individual components of the National Health Information System (NHIS) is published in a structured manner. In terms of content, the following supporting modular units have been implemented, consisting of a two-level categorisation with accessible content under the guarantee of experts:

- Living situations: advice and recommendations
- Prevention and healthy lifestyle: Guiding Principles
- Disease information: basic facts
- Health care map: Find your nearest healthcare provider
- Games: interactive education
- Index of terms: short explanations for the general public
- Data intelligence: comprehensive NZIS reporting

Since its pilot launch in July 2020, NZIP has become a significant source of valid information across priority domains of the Czech health sector and is steadily increasing its relevance and visibility regionally and nationally through project and departmental support. NZIP has become the primary communication platform for the publication of guaranteed and trustworthy information for the lay and professional public.

The Games module allows the creation, editing and overall management of individual games using the portal's administration interface. This interface allows the editorial team to easily create a new game using "nodes", add relevant content (not only textual but also interactive or audiovisual), and define right and wrong answers with feedback to the user. The goal of the games is to educate the visitor on the issues at hand and refer them to further relevant content across the portal (articles, recommended resources, index terms). Currently, games are being developed across NZIP categories to cover the most requested categories from users.

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