XV International Conference on Mathematics, Science and Technology Education

XV International Conference on Mathematics, Science and Technology Education

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Abstract. This paper introduces the Proceedings of the XV International Conference on Mathematics, Science and Technology Education (ICon-MaSTEd 2023), which took place at the Kryvyi Rih State Pedagogical University, Ukraine, from 17 to 19 May 2023. It provides background information and the organizational structure of the conference, as well as the structure of the proceedings. It also acknowledges the many people who contributed to the success of the conference.

1. Background

The **International Conference on Mathematics, Science, and Technology Education** (**ICon-MaSTEd**) stands as a prominent and esteemed platform for researchers, educators, professionals, policymakers, and practitioners to convene and exchange their cutting-edge research findings, innovative ideas, and practical applications in the realms of mathematics, science, and technology education. The conference also emphasizes technology-enhanced learning, encompassing various approaches such as blended learning, E-learning, ICT-based assessment, mobile learning, among others, to enrich and advance educational practices (figure 1).

Initiated in 2001, ICon-MaSTEd has consistently fostered interdisciplinary collaboration, bringing together experts from diverse backgrounds to address the evolving challenges and opportunities in the fields of mathematics, science, and technology education. Over the years, the conference has witnessed substantial contributions from scholars and practitioners worldwide,

propelling the domain forward with promising theories, models, tools, services, networks, and communications [1–4].

The ongoing Russian invasion of Ukraine changed the conference organization. Therefore, the XV International Conference on Mathematics, Science and Technology Education (ICon-MaSTEd 2023) took place on 17–19 May 2023 at the Kryvyi Rih State Pedagogical University, Ukraine, in a hybrid format, accommodating both in-person and online participation, to ensure inclusivity and enable attendees from various regions to engage seamlessly.

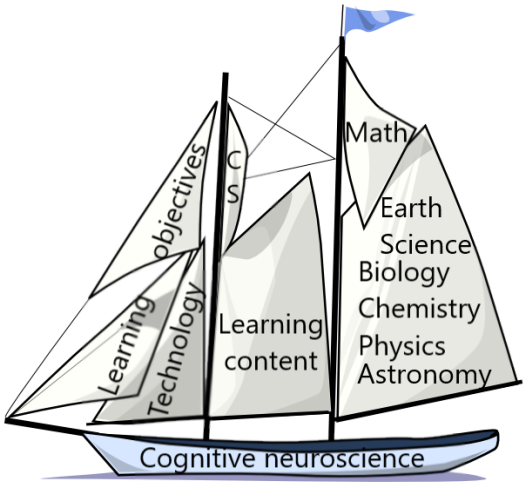

Figure 1. ICon-MaSTEd logo.

The significance of ICon-MaSTEd 2023 was evident with the participation of over 100 attendees from 7 countries, who actively joined the event using the digital platform Google Meet. The conference's program comprised a diverse array of subject areas, including Computer Science and Computer Science Education, Biology and Biology Education, Chemistry Education, Mathematics Education, Physics and Physics Education, Integrated Science Education, Educational Technology, and Technology Education.

A total of 58 submissions were received for consideration at ICon-MaSTEd 2023. Each of these submissions underwent a rigorous review process, with a minimum of three program committee members evaluating and providing feedback on each submission. After careful deliberation, the program committee selected and accepted 39 papers to be presented at the conference. These chosen papers represent the most impactful and innovative contributions to the field of mathematics, science, technology education and educational technology, and they will be showcased during the event to foster insightful discussions and knowledge sharing among the conference attendees.

To enrich the conference experience, the organizing committee curated an engaging agenda featuring both invited talks and contributed presentations. These sessions provided a comprehensive outlook on the latest developments and emerging trends in mathematics, science, and technology education. The allotted presentation slots were thoughtfully structured to encourage interactive discussions and foster meaningful exchange of ideas among participants. Invited talks spanned 25 minutes, with a 15-minute presentation followed by a dedicated 10-minute session for questions and discussions. Other talks were allocated 15 minutes, comprising a 10-minute presentation segment and an additional 5 minutes for audience engagement and inquiry.

The conference's detailed program and session information were made available to all attendees on the official website: `https://ICon-MaSTEd.easyscience.education/2023/`. Additionally, to ensure wider accessibility and reach, video recordings of all talks were uploaded to the *Not So Easy Science* YouTube channel (`https://www.youtube.com/@NotSoEasyScience`).

2. ICon-MaSTEd 2022 program committee

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3. Proceedings structure

3.1. Mathematics Education

The Mathematics Education section of the ICon-MaSTEd 2023 conference showcased a diverse range of topics related to innovative teaching methods, interdisciplinary connections, and the integration of technology in the field of mathematics. The papers presented at the conference highlighted the commitment of educators and researchers to enhance mathematics learning and teaching experiences:

- *The Wheel of Mathematics Learning Methods* [57] provided insights into various pedagogical techniques aimed at making mathematics learning engaging and effective. The talk discussed different approaches to cater to students with diverse learning styles.
- *Interdisciplinary Connections of Mathematics and Literature in the preparation for External Independent Assessment of Humanities Students* [58] explored the potential synergies between mathematics and literature, illustrating how cross-disciplinary connections can enrich the learning experience for humanities students.
- *The Method of Using the Online Course 'Creative Thinking through Learning Elementary Maths' in the Mathematics Teacher Training System* [59] discussed the integration of modern online resources to enhance the training of mathematics teachers, emphasizing creative and interactive teaching methods.
- *Studies about Zones of Proximal Mathematical Development and Methods of Developmental Teaching of Mathematics* [60] delved into research related to zone of proximal development (ZPD) in mathematics education, exploring effective teaching strategies to bridge the gap between a student's current knowledge and their potential understanding.
- *Methodology of Project-Based Learning for Training Junior Students in Applied Mathematics: General Scheme of the Educational Process* [61] focused on project-based learning as an innovative approach to training junior students in applied mathematics, encouraging active learning and problem-solving skills.

- *The Use of Immersive Technologies in Teaching Mathematics to Vocational Students* [62] explored the integration of immersive technologies, such as virtual reality or augmented reality, in the teaching of mathematics to vocational students, offering new and engaging learning experiences.

Overall, the Mathematics Education section of the conference provided valuable insights into the ongoing efforts to improve mathematics education through innovative approaches, interdisciplinary connections, and the integration of modern technologies in the classroom.

3.2. Physics and Astronomy Education

The Physics and Astronomy Education section of the ICon-MaSTEd 2023 conference covered a wide range of topics related to innovative teaching methods, experimental setups, and the use of technology to enhance physics and astronomy education:

- *Measuring Earth's Mean Density Using BYOD Technology* [63] presented a fascinating approach to involving students in hands-on experiments by utilizing Bring Your Own Device (BYOD) technology. The talk demonstrated how technology can be leveraged to enhance understanding of fundamental physics principles.
- *Using Open Experimental Data of the European Organization for Nuclear Research in the Process of Studying the Physics of Elementary Particles* [64] explored how real-world data from prestigious research institutions like CERN can be incorporated into physics education to provide students with valuable insights into particle physics.
- *Design and Fabrication of an Improvised Young's Modulus Apparatus* [65] discussed the development of an innovative apparatus for measuring Young's modulus, which is essential in understanding the mechanical properties of materials. The talk highlighted the practical implications of the apparatus for physics experiments in educational settings.
- *Effects of Physics Alphabet Model on the Mean Achievement of Student's Performance* [66] explored the impact of the Physics Alphabet Model on student learning outcomes. The talk discussed how this novel teaching approach affects students' understanding and performance in physics.
- *Laboratory Equipment for Practice Learning in the Framework of Educational Course 'Molecular Physics and Thermodynamics'* [67] showcased innovative laboratory equipment designed to support hands-on learning experiences in the field of molecular physics and thermodynamics.
- *Fabrication and Applications of a Novel and Multi-Feature Spectroscope* [68] introduced a cutting-edge spectroscope with multiple features and applications. The talk highlighted the versatility of the spectroscope and its significance in various experiments.
- *Interactive Technology Use During the Study of the Universe* [69] demonstrated how interactive technology can be employed to make the study of the universe more engaging and immersive for students. The talk discussed the positive impact of interactive learning on students' comprehension and interest in astronomy.

Overall, the Physics and Astronomy Education section showcased the commitment of educators and researchers to enhance physics and astronomy learning experiences through practical experiments, novel teaching approaches, and the integration of technology.

3.3. Earth Science Education

The Earth Science Education section of the ICon-MaSTEd 2023 conference presented a collection of talks that focused on the integration of modern technologies and Geographic Information Systems (GIS) to enhance the teaching and learning experiences in the field of earth science:

- *The Use of ICT for Mathematical Calculations in Water Quality Assessment in the Teaching of Ecologists* [70] demonstrated the application of Information and Communication Technology (ICT) in the assessment of water quality. The talk discussed how ecologists can use mathematical calculations through digital tools to improve their understanding of water ecosystems.
- *Digitalization of Geographic Higher Education: Problems and Prospects* [71] explored the challenges and opportunities associated with the digital transformation of geographic higher education. The talk discussed the potential benefits of incorporating digital tools and technologies to advance geospatial learning.
- *The Use of GIS in Renewable Energy Specialist's Learning* [72] focused on the integration of Geographic Information Systems (GIS) in the education of renewable energy specialists. The talk highlighted how GIS can be leveraged to analyze spatial data related to renewable energy sources, leading to more informed decision-making in the field.

Overall, the Earth Science Education section showcased how technology, particularly ICT and GIS, plays a crucial role in advancing earth science education. By incorporating these modern tools and approaches into the teaching process, educators and students can gain deeper insights into complex environmental issues, enhance data analysis, and make more informed decisions in various earth science domains.

3.4. Computer Science Education

The Computer Science Education section of the ICon-MaSTEd 2023 conference featured talks that covered a range of topics related to teaching experiences, curriculum development, and human-computer interaction:

- *Branding Theory, Design, and Identity: Course Teaching Experience for Modern IT Specialists* [73] showcased a unique approach to teaching IT specialists by incorporating concepts from branding theory, design, and identity. The talk highlighted how these interdisciplinary elements can enhance the skillset of future IT professionals, equipping them not only with technical knowledge but also with the ability to create compelling and user-friendly products.
- *Modelling the Content of Professional Training of Future Software Engineers in the Field of Parallel Computing* [74] discussed the design of a specialized curriculum for future software engineers focusing on parallel computing. The talk delved into the importance of preparing students for the complexities of parallel processing and distributed systems, which are critical in modern computing environments.
- *Anthropologically Oriented Strategies of Interaction in the Human-Computer System* [75] explored innovative strategies of interaction between humans and computers. The talk emphasized the significance of user-centered design and human-computer interaction in creating seamless and intuitive interfaces that cater to users' needs and behaviors.

Overall, the Computer Science Education section presented valuable insights into the evolving landscape of computer science education. The talks showcased a variety of teaching approaches, including interdisciplinary concepts, specialized curriculum development, and user-centered design principles. These contributions signify the commitment of educators and researchers to equip future IT professionals with the necessary skills and knowledge to succeed in the ever-changing field of computer science. The section talks serve as an important resource for advancing computer science education and ensuring its relevance in today's technological landscape.

3.5. Technology Education

The Technology Education section of the ICon-MaSTEd 2023 conference featured talks that highlighted the use of technology in education and innovative approaches to enhancing learning experiences in technical disciplines:

- *Technology of Creating Educational Content for Open Digital Resources in General Technical Disciplines* [76] discussed an approach to developing educational content for open digital resources. The talk focused on the utilization of technology to create interactive and engaging learning materials for general technical disciplines, making them more accessible and effective for learners.
- *Project-Based Learning as an Approach to Enhance the Ecological Component in Professional Education* [77] explored the implementation of project-based learning in professional education with a focus on ecological aspects. The talk demonstrated how this pedagogical approach can deepen students' understanding of environmental issues and foster their problem-solving skills.

Overall, the Technology Education section provided valuable insights into the intersection of technology and education, emphasizing the importance of integrating innovative teaching methods and digital resources in technical disciplines.

3.6. Educational Technology

The Educational Technology section of the ICon-MaSTEd 2023 conference covered a wide range of topics related to the integration of technology in education, exploring various innovative approaches to enhance teaching and learning experiences:

- *Digital Comics for Developing Primary School Students' English Dialogic Speaking Skills* [78] demonstrated the use of digital comics as a creative tool to foster English dialogic speaking skills in primary school students. The talk highlighted the effectiveness of this approach in engaging young learners and improving their language abilities.
- *Understanding and Attitude Toward Upcycling According to the Survey of Students of Various Specialties* [79] discussed the findings of a survey that examined students' perceptions and attitudes towards upcycling. The talk shed light on how environmental consciousness and sustainable practices can be integrated into professional education.
- *Analysis of the State of the Art of Modern E-learning in Higher Education in Germany* [80] explored the current landscape of e-learning in higher education institutions in Germany. The talk provided insights into the trends, challenges, and opportunities in adopting digital learning methodologies.
- *Application of Chatbots in Business English Learning* [81] discussed the utilization of chatbots to enhance Business English learning. The talk showcased how chatbots can offer personalized and interactive language learning experiences to students.
- *Peculiarities of Foreign Language Training of Students at the Higher Education Institution in the Occupied Territories During the War in Ukraine* [82] focused on the challenges and innovative strategies of providing foreign language training in higher education institutions in occupied territories during times of conflict.
- *Selection of Pedagogical Conditions for Training STEM Teachers to Use Augmented Reality Technologies in Their Work* [83] discussed the pedagogical considerations for training STEM teachers in the use of augmented reality technologies. The talk emphasized the importance of preparing educators to leverage immersive technologies effectively in the classroom.

- *Technologization of Sudden Cardiac Death Prevention Based on the Disciplinary-Methodological Matrix of Health-Preserving Competence* [84] focused on the integration of technology in sudden cardiac death prevention strategies, combining disciplinary knowledge with health-preserving competence.
- *Enhancing Foreign Language Learning With Cloud-Based Mind Mapping Techniques* [85] discussed how cloud-based mind mapping techniques can aid in improving foreign language learning outcomes for students.
- *Challenges Facing Distance Learning During Martial Law: Results of a Survey of Ukrainian Students* [86] presented findings from a survey that explored the challenges faced by Ukrainian students during distance learning, especially in the context of martial law.
- *Digitization of Learning Environment of Higher Education Institutions: Conceptual Foundations and Practical Cases* [87] discussed the conceptual framework and practical implementations of digitizing the learning environment in higher education institutions.
- *Video Integration as an Instructional Strategy* [88] explored the use of video integration as an effective instructional strategy in educational settings.
- *Approaches to Blended Learning Organization* [89] delved into various approaches to organizing blended learning, combining traditional classroom teaching with digital resources.
- *STEM Education and Personnel Training: Systematic Review* [90] presented a systematic review of STEM education and its impact on personnel training in various fields of education.
- *Enhancing Foreign Language Learning in Ukraine: Immersive Technologies as Catalysts for Cognitive Interest and Achievement* [91] discussed the use of immersive technologies to enhance foreign language learning outcomes, particularly in the Ukrainian context.
- *The Issues of Design of a Petri Net-Based Software Component for Modelling Holistic and Coordinated Curriculum for Potential Specialists' Training* [92] focused on the design and development of a Petri net-based software component for creating holistic and coordinated curricula for specialized training.
- *Substantiation of the Sustainable Education Terms as One of the Modern Views on STEM Education Taking to Account the European Experience* [93] discussed the concept of sustainable education in the context of STEM education, considering European experiences and perspectives for Ukraine.
- *Application of Augmented Reality Technologies in the Development of Constructive Coping Strategies for Internally Displaced People* [94] explored the use of augmented reality technologies to develop constructive coping strategies for internally displaced people.
- *Artificial Intelligence in a Modernizing Science and Technology Education: A Textual Narrative Synthesis in the COVID-19 Era* [95] offered a narrative synthesis on the integration of artificial intelligence in science and technology education, particularly in the context of the COVID-19 pandemic.

The Educational Technology section of the conference showcased a diverse range of research and practical applications in leveraging technology for educational purposes. The talks demonstrated the significance of incorporating innovative approaches, digital resources, and immersive technologies to enhance teaching and learning experiences across various fields. These contributions are invaluable in advancing the field of educational technology and its impact on modern education. The section talks will serve as a valuable resource for educators, researchers, and policymakers seeking to integrate technology effectively into educational practices and improve learning outcomes.

4. Conclusion

XV installment of ICon-MaSTEd was organized by the Academy of Cognitive and Natural Sciences (https://acnsci.org) in collaboration with Kryvyi Rih State Pedagogical University, Ukraine (with support of the rector Prof. Yaroslav Shramko), Kryvyi Rih National University, Ukraine (with support of the rector Prof. Mykola Stupnik), Institute for Digitalisation of Education of the NAES of Ukraine (with support of the director Prof. Oleg Spirin) and Ben-Gurion University of the Negev, Israel (with support of the rector Prof. Chaim Hames).

We are thankful to all the authors who submitted papers and the delegates for their participation and their interest in ICon-MaSTEd as a platform to share their ideas and innovation. Also, we are also thankful to all the program committee members for providing continuous guidance and efforts taken by peer reviewers contributed to improving the quality of papers provided constructive critical comments, improvements, and corrections to the authors are gratefully appreciated for their contribution to the success of the conference. Moreover, we would like to thank the developers of Morressier, who made it possible for us to use the resources of this excellent and comprehensive conference management system, from the call of papers and inviting reviewers, to handling paper submissions and creating the volume of the conference proceedings. Special thanks to session chairs for their work on the conference and its program, excellent and gratefully appreciated conference support.

We are looking forward to excellent presentations and fruitful discussions, which will broaden our professional horizons. We hope all participants enjoy this conference and meet again in a more friendly, hilarious, and peaceful further ICon-MaSTEd 2024. The next meeting in the series is the XVI International Conference on Mathematics, Science and Technology Education, 2024, Kryvyi Rih, Ukraine (https://icon-masted.easyscience.education/2024/).

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