



EDUCATION AND ARTIFICIAL INTELLIGENCE

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BOOK OF ABSTRACTS



EDUCATION AND ARTIFICIAL INTELLIGENCE
(EDAI 2024)



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Plenary lectures

THE ROLE OF ARTIFICIAL INTELLIGENCE IN EDUCATION WITH REGARD TO THE DEVELOPMENT OF GIFTEDNESS AND TALENT

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Abstract. It is considered that to this day, no natural, even other phenomenon has created such an obsession with the "occupation of the human mind" as artificial intelligence. They would certainly assume that it was due to uncertainty and the inability to limit its effects. Even though we thought she was still myth, she quickly became our reality. She crossed the future with an "invisible" speed and entered the present as a threat to the human superior mind. That coming into the spectrum of the human mind has opened up many dilemmas, controversies, problems, challenges and questions. The work focuses on the latest world scientific considerations, which we have classified into several interesting theoretical-empirical questions related to the very title of the work. These are: what is the difference between "genetic" superiority of intelligence and "natural power of natural intelligence". Another question is why there are so many "civilizational frustrations" about mastering the world of artificial intelligence. The third question refers to what is the role of artificial intelligence in education? The last question is "how are gifted and talented people coping?" At the very end, we ask one quite atypical question "Who stands behind artificial intelligence"?? We hope that these questions will draw the attention of all those who are looking for an answer to these or similar challenges posed by artificial intelligence.

Keywords: artificial intelligence, myth, education, giftedness, talent

LABORATORY 4.0 IN EDUCATION - RENAISSANCE OF EDUCATION

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Abstract. The paradigm of Industry 4.0 (I4) has brought with it a lot of significant innovations and changes, which are very far-reaching and quite extensive. These changes require an appropriate social and human response. Since the I4-concept is based on a multidisciplinary approach, it is to be expected that special human skills will be needed that will be able to respond to the requirements of the mentioned concept. So far, classical fundamental and applied sciences offer traditional knowledge and approach, but this is no longer enough to educate the workers of the future. The I4 concept sets a new task for the educational system related to the efficient sublimation of several traditional sciences into one new approach that will ensure proper human functioning in the Industry 4.0 paradigm. One of the mechanisms that ensures the necessary education of workers of the future is Laboratory 4.0 or Learning factory (LF). LF is one of the mechanisms that is multifunctional. Its main function is scientific-research work, and in addition it has very good resources that are applicable in the education system. Regarding the research domain, LF offers the opportunity for scientists and students to improve and optimize existing technologies while simultaneously developing and creating completely new technologies. It is possible to immediately test new technologies and see their functionality and effectiveness in practice. With this, it is possible to optimize the new technology, which eventually becomes a product with its own increased value. The new technology created becomes an innovation that can further be transferred to the end user. LF offers multi-phase development of new products with the possibility of direct implementation in the educational system, i.e. student participation is possible in all product development phases, which is an exceptional benefit in the field of education, i.e. its quality. This paper has the task of explaining the function of LF as an integral part of the new way of education, as well as the benefits it brings.

Keywords: industry 4.0, learning factory, scientific-research platform, education, artificial intelligence

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TOPIC 1

Social and Theoretical Aspects of AI and Education

IMAGINING WAR WITH AI: AN EXPERIMENT IN EDUCATIONAL SEMIOTICS

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Abstract. Here we aim to describe how we employed generative AI for an educational experiment based on the principles of visual socio-semiotics. In fact, we collected hundreds of images posted on Instagram by Italian and Iranian mass media and stored in many repositories of AI generated pictures since the beginning of the last Israeli-Palestinian conflict in the Gaza Strip. We analyzed them using structural semiotics, so that we described their meanings through some keywords and short sentences aimed at reproducing the topics and focusing points of the messages they conveyed. Then, we presented our results to young teenagers – Italian and Iranian students aged 14 to 19 – and through a questionnaire we asked them to reflect on how the war was represented in their respective cultural contexts, comparing them. Finally, as the keywords and short sentences we used to describe the images were meant at inspiring a certain “prompting attitude”, we asked the participants to recur to generative AI to create new images that expressed their own perspectives on the war and to comment on them. Analyzing their reflections on this experience, we concluded that visual socio-semiotics and artificial intelligence can be employed in educational processes to help people develop critical awareness of the cultural context in which they live and the positions they can take within it. Situated at the crossroads of studies on the relationship between iconicity and the narration of reality, media socio-semiotics, educational semiotics, and critical AI theory, the main research question of our research was: can generative AI be used in education to contrast the spread of ideological narratives, instead of favoring it, as many scholars seem to fear?

Keywords: artificial intelligence, generative AI, ideology, education, war, images, semiotics

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REGULATORY FRAMEWORK OF THE USE OF ARTIFICIAL INTELLIGENCE TOOLS IN EDUCATION

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Abstract. Artificial intelligence is an innovation that is increasingly infiltrating all aspects of society and represents an inevitability of the modern era. The growing tendency to use artificial intelligence across various areas of human life and work necessitates the adoption of AI tools in education as well. A significant danger faced by civilization, and consequently the educational system at all levels, is the potential erosion of fundamental human values and relationships: the role of teachers and role models, the process of socialization, and more. The aim of this text is to demonstrate how law has historically protected certain values in education that are now considered traditional, and to identify elements of the educational system that could be potentially threatened by the uncontrolled use of artificial intelligence: healthy authority, respect in the teacher/student relationship, and others. We intend to emphasize the necessity for law to keep pace with these rapid technological changes, playing a crucial role in preventing harmful and dangerous consequences of AI use in the educational process while also enabling the positive effects to be harnessed. It is essential for legal regulation to evolve alongside societal changes, as has been the case since Roman law to the present day, because only in this way can it fulfill its functions within society. This task poses a significant challenge for our legal system, which has yet to make substantial progress in regulating the use of artificial intelligence. To achieve these objectives, we will employ a comparative analysis of domestic and foreign legal regulations in this area.

Keywords: education, artificial intelligence, law

ANXIETY RELATED TO ARTIFICIAL INTELLIGENCE AMONG EDUCATORS IN THE REPUBLIC OF SERBIA

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Abstract. This study investigates the latent structure of the Artificial Intelligence Anxiety (AIA) scale, developed by Yu-Yin Wang and Yi-Shun Wang, and examines the levels of AI-related anxiety among educators in the Republic of Serbia. The research also explores the association between AI anxiety and sociodemographic variables, such as gender, age, and years of work experience. The sample included 324 educators, of whom 70% were female, with an average age of 40.44 years and an average work experience of 13.49 years. Participants were employed in elementary (51.5%) and secondary schools (48.5%). Factor analysis confirmed the scale's two-factor structure, identifying *Doubt in One's Ability to Understand AI* and *Concern About the Consequences of AI Development* as the main dimensions. The scale demonstrated excellent reliability, with Cronbach's alpha coefficients of 0.975 and 0.977 for the respective factors, indicating strong internal consistency. Results revealed that educators exhibit below-average levels of doubt regarding their ability to comprehend AI, while their concern about the broader societal impacts of AI remains average. Despite the lack of significant associations with sociodemographic variables, the findings emphasize the need for targeted professional development programs. Such initiatives should address educators' concerns by focusing on the ethical and societal aspects of AI, ultimately reducing anxiety and promoting a more informed and confident approach to AI integration in educational settings.

Keywords: artificial intelligence, AI anxiety, educators, AIA scale

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ADVANTAGES AND RISKS OF USING ARTIFICIAL INTELLIGENCE IN EDUCATION

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Abstract. For a number of years, the use of artificial intelligence in education has been the focus of attention of representatives from various professional fields and has sparked significant controversy. Advantages of using artificial intelligence include the automation of the educational process, the use of virtual assistants, personalized training, adaptive learning, and real-time monitoring of student progress, all of which can enhance learning outcomes and make educational experiences more engaging and accessible. AI-driven tools, such as intelligent tutoring systems, can adapt to individual student needs, providing customized support and enabling students to learn at their own pace. Despite these advantages, the implementation of artificial intelligence in educational settings also introduces certain risks and barriers. Key barriers include resistance to innovation, as educators and institutions often exhibit a conservative stance toward new technologies. Additionally, teachers and educators are frequently excluded from the AI development process, limiting the alignment of these technologies with pedagogical goals. Ethical risks, such as privacy concerns, data security, and the potential for algorithmic bias, are also significant challenges that need to be addressed to foster trust and ensure equitable use of AI in education. Balancing the benefits with these challenges requires thoughtful strategies that involve educators in the design and deployment of AI solutions, foster ethical standards, and provide training to equip teachers and students with the skills needed to navigate AI-driven educational landscapes effectively. This paper examines these advantages and risks, proposing approaches to harness the potential of AI while mitigating its drawbacks in educational environments.

Keywords: psychology, artificial intelligence, university education, the advantage of artificial intelligence, barriers to the use of artificial intelligence

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ETHICAL DILEMMAS AND PSYCHOLOGICAL IMPACTS OF AI INTEGRATION IN SPECIAL NEEDS EDUCATION

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Abstract. This systematic review investigates the ethical and psychological implications of integrating artificial intelligence into special needs education. AI technologies, such as adaptive learning systems, speech recognition and chatbots hold promise for improving individualized support and inclusivity for students with special needs. However, these technologies also create ethical challenges, including privacy risks due to data collection, algorithmic bias that may strengthen stereotypes and psychological concerns related to student autonomy and social development. Following PRISMA guidelines, 28 studies were selected based on criteria focusing on AI’s role in special education, ethical implications and psychological impacts. Findings reveal that, while AI tools can improve accessibility and personalized learning, they require careful implementation to avoid negative consequences on students’ social skills and self-esteem. The review underscores the need for responsible AI frameworks that prioritize privacy, transparency and fairness, recommending balanced approach that includes human errors. Further research is recommended to explore long-term effects and develop guidelines that safeguard student well-being in AI-assisted educational environments.

Keywords: artificial intelligence in education, special needs education, ethical implications, psychological impact, inclusive learning.

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SOCIO-PEDAGOGICAL CHARACTERISTICS OF TEACHERS AND THEIR ATTITUDES TOWARD THE USE OF ARTIFICIAL INTELLIGENCE IN THE EDUCATIONAL PROCESS

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Abstract. Artificial intelligence is rapidly infiltrating all aspects of human activity, including the educational field. Its application in the preparation and implementation of teaching is partially influenced by teachers' attitudes. The authors of this paper present the results of extensive research on the possibilities of applying artificial intelligence in the educational process. The focus is on the attitudes of primary and subject teachers regarding artificial intelligence and their socio-pedagogical characteristics: years of work experience, the environment in which they work (rural versus urban), and their employment (primary and subject teachers). A descriptive research method and scaling technique were applied. The research instrument, developed by the authors, consists of 30 statements through which respondents expressed their attitudes using a five-point Likert scale. The research was conducted on an online platform during September 2024, with a sample of 117 respondents employed in various schools in the Republic of Srpska. The application of the t-test did not reveal a statistically significant difference between the attitudes of subject and primary teachers regarding the use of artificial intelligence in teaching; however, significant differences were confirmed depending on whether they work in urban or rural settings. Furthermore, significant correlations were found between years of work experience and negative attitudes toward the application of artificial intelligence. The results imply the need for teacher education on the possibilities of applying artificial intelligence in the preparation and implementation of teaching.

Keywords: socio-pedagogical characteristics of teachers, artificial intelligence, educational process

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN INFORMATION AND DISINFORMATION IN THE GLOBAL WORLD

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Abstract. Artificial intelligence in the global world has become an ever-present phenomenon with far-reaching implications. It has a special place in the process of information and disinformation in the global world. This article discusses several theoretical and practical issues related to the role of artificial intelligence in providing information and disinformation in the global world. A special emphasis in the work is placed on the process of informing with the help of artificial intelligence and the creation of disinformation patterns that relate to the personal and business world. So it can be seen that on one side there is a positive interference about the role of artificial intelligence in informing, and on the other side we are talking about the negative implication of the misinformation generated by artificial intelligence. This would be a "real lesson" for all of us as recognized positive code in informing with artificial intelligence and its manipulative positioning in the disinformation context. We think that the title itself is a challenge that we have to face, especially in the educational framework.

Keywords: artificial intelligence, information sharing, disinformation, globalization

THE MIRROR OF THE MODERN AGE: TWO FACES OF ARTIFICIAL INTELLIGENCE

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Abstract. Due to the introduction of artificial intelligence (AI - short for Artificial intelligence) in the plans and programs of primary and secondary schools, Serbia is highly positioned in the UNESCO research and this best confirms the efforts of our country in that field. As education is one of the pillars of the Artificial Intelligence Strategy, in our country the implementation of the education reform was first started by preparing curriculum changes in schools and universities, at almost all levels of education. Considering the views of optimists and pessimists, we can freely say that the progress of artificial intelligence has a rather polarizing effect on society. Hence, the author's intention is to analyze the impact of technology to explain the change in the way we learn and teach, what are the advantages and disadvantages of its use. By highlighting the potential benefits and risks of the use of artificial intelligence in education, the authors try to analyze the content to highlight the knowledge and skills needed by teaching staff and students so that the opportunities provided by artificial intelligence can be used for the benefit of the whole society. Through a critical review of the current situation in the use of artificial intelligence in education, the paper provides a general assessment of the current situation, recognizing the importance of further development and adaptation of pedagogical practices to the possibilities of artificial intelligence. Finally, the paper will provide recommendations, measures and conclusions that will serve educators, policy makers, researchers and other interested parties, which are exclusively based on the basic principles of inclusion and equality, but also the protection of the welfare of children/youth as a central point.

Keywords: society, education, artificial intelligence, artificial intelligence strategy, children, youth, modern age

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN PREVENTING GENERATIONAL CONFLICTS IN SCHOOLS

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Abstract. Artificial intelligence is becoming more prevalent in modern schools, both in our country and around the world. It is expected that its share will significantly increase and become dominant in the educational process over the next five to ten years. In addition to its educational role, artificial intelligence will increasingly take its place in the educational aspect of educational institutions, especially in primary and secondary schools. This paper deals with the role of artificial intelligence in preventing generational conflicts in schools. Accordingly, we explore several key issues, including how artificial intelligence can help in recognizing and preventing antisocial behaviors. It is expected that artificial intelligence will identify potential conflicts in schools, provide training and resources, and model different scenarios in conflict prevention. A deep theoretical analysis of this problem should provide guidelines in the area of risk reduction of conflicts and in creating a positive school environment. We believe that this paper will serve as motivation and inspiration for further research in this area and that artificial intelligence will significantly contribute to increasing the ability of schools in providing an inclusive and harmonious place for learning and upbringing of young people.

Keywords: artificial intelligence, generational conflicts, prevention, harmonization

ARTIFICIAL INTELLIGENCE AND PLAGIARISM IN STUDENT WRITING

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Abstract. Usage of AI, especially text generating tools, such as ChatGPT, raises ethical issues and dilemmas on how to guide students to achieve learning outcomes, by respecting core values of academic integrity. Specifically, AI tools are becoming more accessible, and easy to use, so teachers are faced with new concerns: does using AI to complete writing assignments represent a form of plagiarism by students? When can it be considered that AI tools are technical assistance, and from which point we may say that AI enables and enhances plagiarism? This paper tries to summarize current state of knowledge on this topic, and offers insights on different points of view presented in the relevant literature. This research also explores the legislature in the Republic of Serbia in an attempt to define whether current normative acts offer clear answers on relation between plagiarism and AI. The paper seeks to provide an overview of the rules adopted by universities at Republic of Serbia which regulate plagiarism, or the ethical norms which set the standards for academic integrity, that academic writing, also, must follow. This paper tries to provide answers to questions are we in a need to redefine the notion of plagiarism in the realm of higher education, and if so, how to do it.

Keywords: AI, plagiarism, higher education, academic writing

ATTITUDES TOWARDS ARTIFICIAL INTELLIGENCE: PERSPECTIVES AND IMPLICATIONS FOR THE PRESENT AND FUTURE WORKFORCE

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Abstract. Artificial intelligence (AI) is increasingly shaping various aspects of contemporary society. This paper investigates the perceptions of AI within the academic community in Serbia, with the goal of understanding these attitudes to support improved application and integration of AI technologies. Understanding such attitudes is essential for exploring new opportunities for AI implementation across society and economy. The study, conducted in 2024, surveyed 194 participants across Serbian cities, including younger and employed students from both humanities and technical-technological fields. Results reveal a generally positive attitudes on AI, with its potential to contribute to social development being rated the highest. Concerns regarding ethical use and potential risks are present, yet less pronounced. Younger respondents and those from the field of engineering and technology display significantly more positive attitudes toward AI compared to older respondents or those from the field of social sciences and humanities, as confirmed by a t-test analysis. These findings highlight the importance of targeted education and training to increase understanding and acceptance of AI, which is crucial for its successful integration into Serbia’s social and economic systems. Furthermore, these results suggest that a positively inclined present and future workforce, particularly from technical fields, could foster a more favorable climate for AI-driven innovations in the Serbian economy. Embracing AI in workforce development could thus enhance productivity, attract investment, and support economic growth, underscoring the strategic value of AI literacy across educational domains for Serbia’s economic advancement.

Keywords: artificial intelligence, academic community, society, attitudes, workforce, menagement

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE DEVELOPMENT OF COGNITIVE AND SOCIO-EMOTIONAL COMPETENCIES OF PRIMARY SCHOOL STUDENTS

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Abstract. In the process of globalization in the field of education, intense scientific and technical changes and challenges are taking place, which should be applied in the educational process in order to shape students who will be equipped with appropriate knowledge and skills that will open up new opportunities and perspectives. The main goal of this paper is to prepare students to be able to understand the landscape shaped by artificial intelligence, which is a new paradigm in modern living. With the use of electronic devices that are an essential part of modern life, it is necessary to emphasize artificial intelligence that will facilitate the learning process in the classroom while encouraging and developing creativity among students when solving problems and systemic situations. , using numerous tools and techniques from artificial intelligence. In addition, artificial intelligence contributes to faster and more reliable access to the necessary data and information that students can integrate into teaching. In the paper, we will present modest experiences regarding the application of artificial intelligence in an interdisciplinary context with students in primary education. We believe that our experience will be an inspiration for other similar actions and thoughts.

Keywords: artificial intelligence, implementation, creative students, cognitive and socio-emotional competencies.

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THE INTERSECTION OF ARTIFICIAL INTELLIGENCE AND PROSOCIAL BEHAVIOR

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Abstract. Artificial intelligence (AI) has become an integral part of our daily lives, with applications spanning various fields including education, communication, and decision-making. As the development and integration of artificial intelligence systems continue to evolve, it is crucial to explore the potential impact of artificial intelligence on human behavior, particularly in the area of prosociality. Our exploratory study aims to investigate how artificial intelligence can be used to promote pro-social behavior in education, we will use the virtual museum's model developed within the "Scanitaly project" as a starting point. Scanitaly is a project by the Teaching Learning Centre for Education and Inclusive Technologies Laboratory - Elisa Frauenfelder of the Department of Human, Philosophical, and Educational Sciences at the University of Salerno. Our survey will be conducted following the students' use of the virtual museum, using mixed methods to assess the impact of using augmented, virtual, and extended reality in the educational context on the target population in performance, experience perception, and inclusion. The sampling will use a convenience sampling method. The planned intervention will take place during the school year through workshop activities involving students. The ultimate goal is to stimulate critical reflection on the opportunities and challenges that AI poses in the field of virtual museums, highlighting how this technology can be used to create experiences that are not only innovative and engaging but also ethical and socially responsible, aiming at the dissemination of pro-social cultures aimed at achieving systemic ecological well-being, i.e., the of each individual's potential concerning others.

Keywords: AI, inclusion, virtual museum

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EDUCATIONAL PRACTICE SUPPORTED BY THE USE OF CHATGPT

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Abstract. The use of artificial intelligence in education has triggered a snowball effect of research trends on this topic. A significant number of studies support the use of ChatGPT, as one of many artificial intelligence systems, for educational purposes. This qualitative study focuses on the use of ChatGPT by teachers and students, determining the advantages and risks of using ChatGPT for educational purposes, and presenting effective uses of this artificial intelligence system for teaching and learning, which are also the objectives of this research. The aim of the study is to contribute to the understanding of the significance of using ChatGPT in educational practice. Using theoretical analysis, we approached available papers in the Google Scholar database and summarized the importance of ChatGPT for educational practice. The data analysis model consists of four phases: data collection, data reduction, data presentation, and conclusion drawing. The paper implies the need for support for both teachers and students in using ChatGPT for educational purposes, along with precautions and examples of using ChatGPT in teaching and learning, thereby facilitating the acceptance and adoption of this artificial intelligence system as a significant element in innovating educational work.

Keywords: ChatGPT, education, teacher, student, advantages and risks

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TOPIC 2

Empirical and Theoretical Aspects of AI Contributions to the Educational Process

RESEARCH ACTIVITY IN MATHEMATICS EDUCATION IN PRIMARY GRADES

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Abstract. Mathematics education in primary grades has a developmental character. The main tools by which students' thinking was developed until now were word problems. The new educational needs of modern students require other tools, apart from word problems. With a purpose to develop their mathematical and creative thinking we have to use new tools that meet their needs. These new tools are the research tasks. The research tasks provoke a research activity, which the students in the elementary grades independently discover new ways of applying already acquired mathematical knowledge. As a part of research activities student can use variety of AI tools. The specificity of the research activity allows the development of a number of personal and learning-cognitive qualities within the mathematics education in primary grades. This article presents a general structure of a research activity that students can carry out and offers some AI tools for helping them.

Keywords: primary grades, mathematics, research

OPTIMIZING FOREIGN LANGUAGE LEARNERS' WRITING SKILLS WITH AI: EVALUATING THE IMPACT OF CHATGPT

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Abstract. Writing is one of the main language skills that foreign language learners are expected to master in the process of language acquisition. It is also one of the most challenging skills, as it integrates aspects such as a solid grasp of grammar, extensive vocabulary, cultural knowledge, creative and critical thinking abilities, adherence to spelling and punctuation rules, cohesion and coherence, and an appropriate use of register and formatting depending on the text type (e.g., a letter, an essay, an email, a report, a message, etc.). With the advent of AI-driven technology, particularly chatbots such as ChatGPT, the development of writing skills in language learners is approached from a new perspective. While chatbots can significantly accelerate and facilitate the writing process, they also introduce learners to challenges in the form of cheating and plagiarism, which, if not managed properly, can seriously undermine the language acquisition process. To mitigate these risks and to harness the full potential of these tools, it is crucial for foreign language educators to provide appropriate instructions and guidance. This paper seeks to address the use of AI in enhancing foreign language learners' writing skills. By reviewing existing research, it aims to highlight some key strategies for utilizing ChatGPT effectively while maintaining academic integrity and ethical behavior. The study also reports on a small-scale experiment conducted with university students from RN Macedonia who received explicit instructions on how to use ChatGPT to improve their writing skills. The qualitative and quantitative analysis of students' comments in tailor-made reflection sheets, teachers' field notes and assessment of students' writing assignments confirm the importance of clear guidance in using AI and demonstrate the significant potential of AI to enhance learners' writing skills.

Keywords: ChatGPT, foreign language acquisition, university students, writing

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EMPOWERING LECTURERS IN TERTIARY EDUCATION: AI TOOLS FOR LESSON PLANNING

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Abstract. In the era of digital transformation, artificial intelligence (AI) has emerged as a powerful ally in higher education. Recognizing the importance of supporting educators in navigating this new landscape, this paper explores the potential of AI tools in enhancing teaching at the tertiary level, with a focus on lesson planning. The research seeks to address two main questions: (1) To what extent are lecturers familiar with AI tools for lesson planning? (2) How effectively are these tools being integrated into their teaching practice? To answer these questions, a quantitative approach was used, consisting of a survey distributed to lecturers of the University of Priština in Kosovska Mitrovica and University of Niš. The survey assessed lecturers' familiarity, current use, and perceived benefits and challenges of AI tools in lesson planning. The core of the presentation will highlight key survey findings, which reveal both the potential of AI tools and the barriers teachers face in adopting them. In the final section, specific AI tools for lesson planning will be presented, including tools for content generation, interactive learning activities, and assessment design. These findings underscore the growing importance of AI in educational settings and suggest practical applications for improving teaching efficiency and enhancing student engagement.

Keywords: AI teaching tools, university lecturers, lesson planning, tertiary education, technology-assisted teaching

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CHATGPT-4 HALLUCINATIONS IN REFERENCE GENERATION: FREQUENCY, ETHICAL CONCERNS, AND IMPACT ON RESEARCH INTEGRITY

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Abstract. Artificial Intelligence (AI) is becoming increasingly prevalent in academia, offering numerous benefits alongside various challenges. One such challenge is the issue of AI hallucinations. AI Hallucinations are said to be prevalent when one generates academic texts using the model, but just how prevalent are they? Our study explores the frequency of hallucinations in ChatGPT-4's reference generation, aiming to answer the central research question: *How frequently does ChatGPT-4 hallucinate when generating references, and can prompt-engineering minimize the number of hallucinations?* To assess this, a corpus of references generated by the model was compiled – the model generated content and references across ten different academic topics; each reference was then copied, formatted and input into a corpus. Following this, each reference was manually verified through online searches to determine whether it corresponded to an actual source or was a hallucination. Initial results indicate that ChatGPT-4 produces significantly fewer hallucinated references when detailed prompt-engineering is used—particularly through refining queries and clarifying reference requests. However, though the number of hallucinations isn't substantial, we still advise that researchers and students use ChatGPT's reference generation cautiously and always cross-check the references manually for accuracy. This study underscores the need for human oversight and careful prompt design to minimize errors in AI-generated content and references.

Keywords: artificial intelligence, academic writing, research, ChatGPT, AI hallucinations

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INTEGRATING GAMIFICATION WITH INTELLIGENT TUTORING SYSTEMS AS A STRATEGY TO INCREASE STUDENT'S MOTIVATION AND ENGAGEMENT IN STEM EDUCATION: A SYSTEMATIC LITERATURE REVIEW

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Abstract. The aim of this study is to investigate the synergistic combination of gamification and intelligent tutoring systems in order to boost students' motivation and engagement in STEM education. Gamification uses game design elements such as points, badges, leaderboards, and challenges to promote interactivity while also serving as an incentive for learning. On the other hand, ITS allows for the customization of teaching content to suit the needs and learning pace of individual students. Therefore, a systematic literature review was conducted following the PRISMA guidelines. The research further included twenty relevant studies assessing the effectiveness of this integrated pedagogical approach within K-12 educational settings. According to this analysis, there is an increasing body of academic research that demonstrates improved student engagement and motivation in STEM disciplines. These results indicate that adding gamification elements can lead not only to increased motivation but also sustained engagement and deepened learning outcomes from the integration with ITS technology. Furthermore, prior experience with digital gaming environments or background knowledge in STEM subjects significantly boosts learners' motivations to engage more actively during learning sessions. This systematic review underlines how gamification, along with intelligent teaching systems, has the potential to transform STEM education into an enjoyable, customized, and efficient one, thereby advancing its course. Nonetheless, this investigation offers valuable pieces of advice for educators on how they can use this approach in their STEM lessons. The findings suggest that incorporating intelligent teaching systems can greatly enhance student engagement and learning outcomes in STEM education.

Keywords: intelligent tutoring systems, STEM education, gamification, learning motivation, artificial intelligence in education, game-based learning

DIGITAL AND MEDIA COMPETENCES OF FUTURE TEACHERS IN THE AGE OF AI




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Abstract. *This paper highlighted two types of digital competences necessary in today's schools, namely basic digital and media competences and teacher digital competences. The research showed the challenges over the diagnosis and development of holistic theoretical frameworks defining a contemporary model of professional preparation for functioning in the information society. Referring to the increasing popularity of AI in education, a number of measurement scales were presented, such as the AI Literacy Competency Model, the Meta AI Literacy Scale (MAILS), the EETAM, or the UNESCO scale defining knowledge and skills related to the effective application of generative artificial intelligence in learning and teaching. The research is based on the results of the REMEDIS international research network.*

Keywords: digital competences, teacher digital skills, AI literacy in education, information society education, generative AI in education

EXAMINATION OF THE IMPACT OF AI APPLICATION ON THE ACHIEVEMENTS OF STUDENTS FROM STUDY PROGRAMS BELONGING TO DIFFERENT SCIENTIFIC FIELDS

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Abstract. Artificial intelligence (AI) and computational sciences have aroused a growing interest in education. Despite its relatively recent history, AI is increasingly being introduced into the classroom through different modalities, with the aim of improving student achievement. The integration of artificial intelligence (AI) in higher education has the potential to revolutionize the learning experience by promoting engagement, personalization, efficiency, and innovation. AI offers a wide range of possibilities where AI-based tools enable students to receive customized feedback and guidance, allowing them to learn at their own pace and excel academically. However, the question arises as to whether the effects of applying AI in teaching on student achievements depend on the type of study program or if this impact is uniform regardless of the program type. Data were collected using a structured questionnaire developed for this research. The study involved students from the Academy of Applied Studies in Šumadija, across three study programs belonging to different scientific fields. For the purposes of this research, ANOVA was employed. Since ANOVA does not reveal which groups differ, the applied Games-Howell Post Hoc test was conducted to address this issue. The results indicate that the impact depends on the type of study program when they belong to different scientific fields.

Keywords: artificial intelligence, student achievements, ANOVA, education

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN PERSONALIZATION OF EDUCATION

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Abstract. The digital age has opened new frontiers of knowledge, research and innovation in all areas of science and society in general. The accelerated improvement of technologies in various segments of the fourth industrial revolution, especially robotics and artificial intelligence, is increasingly evident. Artificial intelligence is the future that has begun and its potential is huge. Despite justified fears of potential abuses, adaptation to modern trends and the use of artificial intelligence in the education process is inevitable. Changes in education are just beginning. There are numerous possibilities for the application of artificial intelligence in improving teaching and the learning process, among which the key ones are: personalized learning (individualization of teaching), monitoring of student progress, automation of tasks, customized resources for teachers, learning on demand, learning through interaction, data analysis, access to textbooks and resources on the Internet. In the paper, a special focus will be on the role of artificial intelligence in creating a personalized approach to students. It is an important support tool that helps teachers provide a better educational experience for students and improve their practice. Nevertheless, the teacher still has a dominant role in shaping and directing the learning process. With its thoughtful integration of artificial intelligence and didactic strategies, education can become more efficient, relevant and adapted to the demands of today's society.

Keywords: artificial intelligence, personalized learning, individualization of teaching, automation of tasks, learning through interaction

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CHALLENGES AND OPPORTUNITIES OF IMPLEMENTING ARTIFICIAL INTELLIGENCE IN MUSIC EDUCATION: A CASE STUDY

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Abstract. The introduction of this paper delves into the dynamics of artificial intelligence (AI) applications, which in recent decades has spread across numerous social domains: manufacturing, banking, healthcare, art, sports, and daily life. This paper examines the extent to which AI has positively influenced education as a supportive tool, aiming to promote its applications in music education. The theoretical section reviews various documents to demonstrate that AI has yet to fully integrate into educational systems and institutions; however, modern society increasingly adopts guidelines toward its responsible use. It is assumed that the future classroom will incorporate at least three innovations: biometrics, AR glasses, and various touch-sensitive devices. We also assume that many students use AI during their studies, particularly when distinguishing between music created by AI and music created by traditional artists. The case study on the dynamics and elements of the music education process highlights AI's long-standing role in preserving musical scores and sound materials. However, it lacks the natural potential for interpretation, which is reflected in its name—artificial. The results of this paper reveal AI's limitations in conducting remote music education, where significant gaps in students' knowledge acquisition and development of fundamental musical skills were observed. It is certain that innovative learning will evolve alongside arts education, respecting the specificities of individual creativity. In the concluding section, we outline areas in AI where there is still much room for advancement. As before, AI will continue to represent the fifth industrial revolution and machine learning, impacting both education and business, and addressing questions of social self-regulation, ethics, and positive influence.

Keywords: artificial intelligence (AI), modern society, music education, interpretation of musical ideas, reliable and responsible use of AI

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TOPIC 3

Technical Aspects and Contributions to Applications of AI in Education

TECHNOLOGY FOR IMPROVING MATHEMATICAL COMPETENCES IN PRE-SCHOOL CHILDREN THROUGH GAME LEARNING

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Abstract. In this article, the problem related to the construction of a technological model for the improvement of mathematical competences by means of game learning is raised. Play is a leading activity in the child's personality. The improvement of mathematical competences through the game contributes to the development of many personal qualities of children, such as: attention, concentration, resourcefulness, decisiveness, thoughtfulness in a given situation. In this way, communicative speech skills are developed, as well as teamwork skills, and the qualities of tolerance and mutual assistance are built in the participants. In real practice, it is observed that artificial intelligence also supports the improvement of mathematical competences. Artificial intelligence helps children develop their thinking with the help of information technology. Along with the artificial intelligence and the game, there is an entertainment activity, it is also distinguished by a cognitive scientific activity. Through it, children absorb the learning material laid down in the educational fields. In order to make sense of whether the game really helps to improve mathematical competences, it is necessary to build such a technology. The technology is subordinated to stages, and they themselves are checked through a system of criteria and indicators, which are grouped into three levels: high, medium and low with the corresponding quality characteristics. The game, apart from being beneficial for the children, is also of essential importance for the teacher, because in this way he manages to attract the attention of the children. The important thing that is noticed in the game itself is the final results that are reported to the children. The results are visible and significantly significant, not only for the teachers, but also for the parents themselves. In order for the children themselves to be effective, there must also be consistency in the way of working, such as the implementation of artificial intelligence, both in theory and in practice.

Keywords: mathematical competence, kindergarten mathematics, preschool age, play learning

CHARACTER-BASED BILSTM FOR DIACRITIC RESTORATION IN SERBIAN

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Abstract. One of the most common irregularities in languages that contain letters with diacritics is the omission of diacritics. Their lack can lead to a misunderstanding and changes in the semantics of the text. Therefore, it is essential to restore diacritics automatically. This paper presents how contemporary deep-learning techniques can solve automatic diacritic restoration or diacritization problems without using powerful hardware. We proposed a two-layer Bidirectional Long short-term memory (BiLSTM) sequential Neural Network for multiclass classification that learns to predict one of seven possible letters to replace a letter without the diacritic. The sequential nature of the text makes sequence networks efficient in Natural Language Processing and Understanding. The model was learned from Serbian text data. It is implemented using the character-based approach, a language-independent technique that can efficiently generate models for others, especially Slavic languages. The evaluation shows that all macro, micro, and weighted average metrics, such as precision, recall, and F1, achieved 98%. The main advantages of the proposed model are the easy and quick creation of a labeled dataset, not the very deep network, small vocabulary, small context window, a small number of fitting epochs, and easy manipulation of preprocessing and learning parameters to obtain the efficient and accurate model. The model is publicly available; it can be downloaded or tested on the corresponding website.

Keywords: neural networks, deep learning, computational linguistics, diacritic restoration, BiLSTM

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CHATGPT-ASSISTED EDUCATIONAL GAME DEVELOPMENT: A PROMPT ENGINEERING TECHNIQUE FOR TEACHERS WITHOUT CODING EXPERIENCE

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Abstract. Extensive research in the field of AI has raised various questions, among others the way how AI transformers can advance teaching and learning practice. Typically, ChatGPT is employed for tasks like content creation, research assistance, and language learning, including coding in computer languages. The main objective of this study was to examine possibilities of design and development of teaching material based on educational games by teachers, assuming the lack of their coding competencies. This study presents the development and implementation of a simple educational card game known as the Memory Game (also called Matching Pairs or Concentration) using HTML5, CSS3, and JavaScript. The objective of the game is to enhance memory retention and cognitive skills through a classic card-matching game. The method used here is a creating of carefully designed prompt using natural language. The prompt suggested here can be classified as a software development task prompt with a focus on educational game design using web technologies. It provides a mix of functional requirements (game mechanics, grid layout) and non-functional requirements (aesthetic consistency, performance). Such prompts are commonly used in software engineering to guide developers through structured feature implementations for applications that have both educational and entertainment value. The first significant finding of this study highlights the remarkable capacity of ChatGPT to emulate programmer-like responses. Secondly, the results obtained indicate that a carefully tailored prompting approach can be the preferred strategy for teachers with lack of coding competencies, when generating educational games using ChatGPT. As a conclusion, the research suggests that a slight modifications and adjustments of presented prompt can be used in design of similar educational card games. Continuation of this research should demonstrate possibilities of ChatGPT and similar AI tools in designing more complex educational games.

Keywords: Prompt engineering with ChatGPT, memory game, cognitive training, web-based interaction, HTML5, Canvas and JavaScript game logic

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PERFORMANCE OF AN AI TOOL IN SOLVING NON-STANDARD MATHEMATICS COMPETITION PROBLEMS

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Abstract. For some time now, researchers around the world have been examining the effects of using AI in mathematics education to provide additional support and assistance to students. One line of research focuses on helping students who wish to participate in math competitions by solving more complex mathematical problems. In addition to regular national math competitions, which allow students to progress to international mathematical Olympiads, there are competitions aimed at popularizing mathematics and developing logical thinking in students. One such competition is the international Kangaroo competition. In this paper, we analyze the performance of the AI Math Solver on the Interactive Mathematics platform in solving problems from the 2024 Kangaroo competition for students in the 3rd and 4th grades of elementary school, as well as the 7th and 8th grades of elementary school, and the 3rd and 4th grades of high school. The tasks were uploaded in the form of images (screenshots), both in Serbian and English, because in the formulation of the tasks and/or provided answers for the Kangaroo competition, images often appear. Out of a total of 84 tasks, both in Serbian and in English, it correctly solved 24, which is just under 30% success in both cases. Furthermore, some tasks solved in Serbian were not solved in English, and vice versa. Additionally, differences were found in the distribution of correct answers among tasks of different difficulty levels.

Keywords: AI tools, Kangaroo competition, math education, non-standard tasks

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INFORMATIZATION OF EDUCATION IN THE ERA OF GLOBALIZATION: THE ROLE OF “INTERNET OF MUSICAL THINGS” AND SMART MUSICAL INSTRUMENTS IN CONTEMPORARY TEACHING PRACTICE

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Abstract. In the era of globalization, education is facing significant changes due to the progress of information and communication technologies. This paper explores the role of informatization in the educational process, with special reference to the application of Internet of Musical Things (IoMusT) and smart musical instruments in contemporary teaching practice. Globalization enables wider access to information and technologies, opening new opportunities for interactive and personalized learning. Smart musical instruments, connected to cloud platforms, using their knowledge about the goals of a specific lesson, enable students to develop musical abilities through innovative learning methods. Using artificial intelligence, these musical instruments can create customized instructions for students on how to practice, analyze students progress in performing compositions, and continuously improve by monitoring their progress. In addition, this paper discusses the challenges brought by standardization and technological integration in the educational system, while highlighting the opportunities for the development of IoMusT technologies in schools. In the context of contemporary educational practice, IoMusT technologies and smart musical instruments provide numerous advantages, such as increased students engagement, adaptation of teaching methods to the specific needs of each individual, and the connection of educational institutions. These technologies allow teachers to monitor students results and progress remotely using data generated during the interactive learning process. The integration of IoMusT technologies into the curricula of music education can contribute to the development of new forms of educational resources, enabling students to acquire skills that are necessary in the digital age. Through the analysis of existing research, the paper offers insight into the potential advantages of these technologies and explores how they can improve the educational process in the modern globalized society.

Keywords: informatization of education, Internet of Musical Things (IoMusT), cloud platforms, smart musical instruments, personalized learning, contemporary teaching practice

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THE IMPACT OF IMMERSIVE VIRTUAL REALITY ON SHAPING STUDENTS' ATTITUDES TOWARDS NATURAL AND CULTURAL HERITAGE

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Abstract. In addition to its educational objectives, geography as a school subject also plays an important pedagogical role. One of pedagogical objectives of geography is to raise students' awareness of the need to preserve our natural and cultural heritage. This task is becoming increasingly important as the time students spend in the natural environment is replaced by activities in digital environments. Researchers in the fields of didactics and methodology are constantly looking for innovative approaches to improve the teaching process and achieve better learning outcomes by increasing student engagement. The generation of "digital natives" currently in classrooms has triggered a growing number of studies on the use of ICT tools and VR technologies in the classroom. The aim of this study is to find out whether the use of immersive virtual reality in geography lessons influences students' attitudes towards natural and cultural heritage. Two groups of students participated in the study: an experimental group that used VR headsets to explore a geography lesson about Serbia's natural and cultural heritage, and a control group that completed the same lesson without VR technology. After the lesson, the students' attitudes towards cultural heritage and their motivation to learn geography were measured using questionnaires. The results, which were analyzed using SPSS 26.0, show that the experimental group developed a significantly more positive attitude towards the preservation of cultural heritage and showed a higher motivation to learn geography compared to the control group. These statistically significant differences underline the potential of immersive virtual reality in geography education.

Keywords: virtual reality, natural heritage, cultural heritage, geography education

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IMPROVING THE QUALITY OF PRACTICAL TEACHING BY APPLYING ELEMENTS OF MACHINE LEARNING AND PREDICTIVE ANALYTICS

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Abstract. The standard practice in calculation and laboratory exercises often involves students working with the same dataset. While this simplifies the process, it also creates a significant opportunity for academic dishonesty, such as plagiarism, as students may resort to using others' work or results. This undermines the intended learning outcomes. Additionally, there is tendency of the use of measurement data from real world which presents some challenges, particularly in terms of providing a large volume of diverse datasets due to limitations in time, funding, resources, and the accuracy and repeatability of measurements. This paper introduces a new approach that leverages machine learning and predictive analytics to address these issues. Starting with an initial real dataset obtained through experimental methods, different models are used to predict results, generating new synthetic datasets for educational purposes. By varying the models and their parameters, multiple versions of the data are created, ensuring that smaller student groups receive identical datasets for their tasks, while in some cases, each student may be assigned a unique dataset. The paper also has an evaluation of the results achieved through this approach in teaching both basic and master's level courses in a one technical faculty's study program.

Keywords: higher education, learning outcomes, machine learning, model, predictive analytics

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