

# Editorial: The Second International Workshop on Artificial Intelligence Systems in Education - AIxEDU

Gabriella Casalino<sup>1</sup>, Carla Limongelli<sup>2</sup>, Daniele Schicchi<sup>3</sup>, Davide Taibi<sup>3</sup> and Marco Temperini<sup>4</sup>

<sup>1</sup>Department of Computer Science, University of Bari Aldo Moro Bari, Italy

<sup>2</sup>Department of Civil, Computer Science and Aeronautical Technologies Engineering, Roma Tre University, Rome, Italy

<sup>3</sup>Institute for Educational Technology, Italian National Research Council, CNR-ITD, Palermo, Italy

<sup>4</sup>Department of Computer, Control, and Management Engineering, Sapienza University of Rome, Rome, Italy

## Abstract

The Second International Workshop on Artificial Intelligence Systems in Education (AIxEDU) marks its 2024 edition in conjunction with the 23rd International Conference of the Italian Association for Artificial Intelligence (AIxA), held from 25–28 November 2024 in Bolzano, Italy.

This workshop brings together Artificial Intelligence and Education experts to explore the latest innovations and best practices in applying AI to educational contexts. Participants discuss recent trends, research initiatives, and emerging developments in AI technologies that aim to enhance teaching methodologies, support personalized learning, and address pressing educational challenges. The workshop emphasizes a multidisciplinary approach to understanding how AI systems can promote inclusion, improve learning outcomes, and empower educators while addressing ethical considerations and ensuring equitable access to education aligned with global sustainable development goals.

## Keywords

Artificial Intelligence in Education, Personalized Learning, Inclusive Education, Explainable AI, Learning Analytics, Ethical AI in Education.

## 1. Introduction

The rapid advancement of artificial intelligence (AI) has ushered in a new era of technological innovation characterized by the development of models capable of automating and enhancing human tasks with remarkable efficiency. AI systems, such as ChatGPT, DALL-E, and Perplexity, have gained widespread popularity, transforming how society interacts with technology [1, 2]. These platforms and others have made cutting-edge AI capabilities accessible to a broad audience, demonstrating their potential to impact nearly every facet of human life. In education, the influence of AI is particularly profound, as it introduces novel opportunities and challenges that are reshaping the educational landscape [3, 4].

---

*AIxEDU - 2nd International Workshop on Artificial Intelligence Systems in Education - 26th November 2024, Bolzano, Italy*

\*Corresponding author.

✉ [gabriella.casalino@uniba.it](mailto:gabriella.casalino@uniba.it) (G. Casalino); [carla.limongelli@uniroma3.it](mailto:carla.limongelli@uniroma3.it) (C. Limongelli);

[daniele.schicchi@itd.cnr.it](mailto:daniele.schicchi@itd.cnr.it) (D. Schicchi); [davide.taibi@itd.cnr.it](mailto:davide.taibi@itd.cnr.it) (D. Taibi); [marte@diag.uniroma1.it](mailto:marte@diag.uniroma1.it) (M. Temperini)

🆔 0000-0003-0713-2260 (G. Casalino); 0000-0002-0323-7738 (C. Limongelli); 0000-0003-0154-2736 (D. Schicchi);

0000-0002-0785-6771 (D. Taibi); 0000-0002-8597-4634 (M. Temperini)



© 2024 Copyright for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

Integrating AI into education brings forward the potential to enhance teaching methodologies and learning experiences. For educators, AI offers tools to design personalized instructional materials tailored to the needs of individual students, including those with disabilities [5]. Recent studies have highlighted how AI-driven systems support teachers in automating time-intensive tasks such as grading and assessment, allowing them to focus more on pedagogical strategies [6, 7, 8]. From the learners' perspective, intelligent tutoring systems provide personalized, real-time assistance, fostering improved engagement and skill acquisition across diverse contexts [9]. These AI applications extend beyond traditional curricula, aiding in developing everyday competencies and mitigating risks associated with digital environments [10].

One significant area where AI intersects with education is addressing societal and global challenges, such as those outlined in the United Nations Sustainable Development Goals (SDGs) [11]. For instance, AI has shown promise in promoting inclusive education by generating adaptive materials for students with special needs, including automatically generated concept maps [12, 13]. Moreover, AI-driven intelligent companions can help students navigate online risks, such as exposure to toxic content on social media, while fostering digital literacy and critical thinking skills [14]. Such applications underscore AI's role in advancing SDG 4, emphasizing inclusive and equitable quality education for all [15].

Despite these benefits, the adoption of AI in educational contexts is not without its challenges. Recent literature has widely discussed concerns about the misuse of generative AI models, the amplification of biases, and the dissemination of incorrect information [16, 17, 18]. Generative models capable of performing complex tasks such as essay writing and image creation raise ethical and pedagogical questions about their impact on student learning and academic integrity [19]. Thus, educators and students alike must develop a nuanced understanding of AI's capabilities and limitations to ensure its ethical and practical use in educational settings [20].

Building on the principles outlined in the UNESCO Beijing Consensus, the AIxEDU workshop seeks to address these issues by providing a platform for exploring the transformative potential of AI in education. It aims to foster interdisciplinary dialogue and encourage contributions investigating the development and deployment of AI systems in educational contexts. The workshop highlights the need for innovative approaches to human-AI collaboration, promoting inclusive practices, and the ethical management of educational data. Furthermore, it emphasizes the importance of explainable AI in fostering trust and transparency, adaptive lifelong learning, and personalized educational experiences [21, 22, 23]. By bringing together researchers and practitioners, the workshop aspires to chart a path forward that maximizes the benefits of AI in education while addressing its inherent challenges.

## **2. Workshop's Contributions**

We received 37 submissions for the AIxEDU workshop, and after a rigorous review process, 16 were accepted for presentation. In addition to submissions from Italian authors, accepted papers included contributions from researchers in Sweden, Slovenia, Ukraine, France, and Finland. This highlights the international significance of the topic of AI in education and underscores the Italian Conference on Artificial Intelligence as a pivotal event for discussing AI-related issues,



efficiency and creativity in idea generation. Participants noted both benefits and challenges, including the need for critical evaluation of AI-generated content. The study underscores the transformative potential of AI when integrated with pedagogical frameworks to train educators in developing technology-enhanced learning experiences.

The paper *Generative AI for Teaching Latin and Greek in High School*[25] examines the application of generative AI, particularly ChatGPT, in teaching Latin and Ancient Greek to high school students, focusing on its potential in Italian Liceo Classico settings. The study highlights the dual response of resistance and acceptance in educational institutions regarding generative AI. By using examples and prompts, the research demonstrates how ChatGPT can serve as a valuable ally, aiding in grammatical analysis, translation, and contextual understanding of classical texts. Emphasizing a constructivist approach, the paper advocates for the cautious yet proactive integration of AI to complement traditional pedagogies, thereby enriching the study of classics without replacing teacher-student interactions.

The paper *Fostering Metacognitive Skills in Programming: Leveraging AI to Reflect on Code*[26] introduces the Reflective AI Programming Lab (RAP Lab), a novel pedagogical framework designed to enhance metacognition and reflective learning in computer science education. By having students collaborate on programming tasks using AI-generated code under structured constraints, the lab encourages them to articulate problem-solving strategies and critically evaluate AI assistance. AI tools act as impartial observers, fostering a safe environment for experimentation and error analysis. The approach bridges the gap between educational and industry practices, emphasizing the development of higher-order cognitive skills crucial for AI-assisted programming.

The paper *Speeding Up Design and Making to Reduce Time-to-Project and Time-to-Market: An AI-Enhanced Approach in Engineering Education*[27] details the integration of AI tools such as ChatGPT and GitHub Copilot in an advanced engineering course focused on embedded systems. Students employed AI for tasks including design optimization, coding, debugging, and documentation, significantly reducing development time. The approach emphasized prompt-based learning, which honed students' ability to communicate effectively with AI systems. While AI enhanced efficiency and supported decision-making, students retained control over critical aspects of their projects, demonstrating the synergy between human creativity and AI-driven solutions in accelerating innovation.

The paper *Enhancing Digital Object-Based Learning with Haptic Gloves and Virtual Reality in the Virtual Museum of Tor Vergata*[28] explores the RESTART project at the University of Tor Vergata, which integrates digital object-based learning (OBL) with virtual reality (VR) and haptic gloves to enrich cultural heritage education. The project employs advanced immersive technologies to foster the development of transversal skills, including creativity and critical thinking, while also enhancing participant well-being. Through AI-adapted experiences and inclusive design, the initiative ensures accessibility for diverse users, including those with disabilities. The research highlights how technology-driven OBL promotes engagement and understanding of cultural content while fostering social inclusion and psychological well-being.

## 2.2. Session 2: AI in Assessment and Evaluation

The paper *EULER: Fine-Tuning a Large Language Model for Socratic Interactions* [29] presents an innovative approach to enhancing educational utility in large language models (LLMs) by fine-tuning them to support Socratic dialogue rather than providing direct answers. Using Direct Preference Optimization (DPO) and datasets containing Socratic conversations, the study demonstrates that models can be trained to guide students toward discovering solutions independently. The methodology involves processing educational datasets to align with Socratic principles and evaluating the tuned models against advanced systems like GPT-4o. Results suggest that this fine-tuning approach significantly improves the models' ability to foster critical thinking in educational contexts.

The paper *Large Language Models for the Assessment of Students' Authentic Tasks: A Replication Study in Higher Education* [30] explores the use of LLMs in evaluating student-written tasks within a higher education context. Building on previous research, this replication study employs updated models to assess student submissions using rubrics developed by educators. By comparing evaluations from LLMs and human experts, the study examines the accuracy and reliability of AI in academic assessment. Findings indicate that specific adaptations and guidelines are essential for achieving reliable assessments, highlighting the potential of AI to enhance scalability and sustainability in educational evaluation.

The paper *Uninvited Generative AI Has Joined Our Students: Tackling Disinformation and Creating Content with the Help of Generative AI Apps* [31] details a workshop aimed at enhancing students' information literacy and critical thinking skills through generative AI applications. Conducted across multiple high school grades, the workshop involved students using AI tools to address disinformation and create digital content. The study highlights students' native interaction with generative AI and their growing awareness of its capabilities. Results underscore the need for integrating media literacy and ethical considerations into curricula to address the challenges and opportunities presented by AI in education.

The paper *Redefining Education: A Personalized AI Platform for Enhanced Learning Experiences* [32] discusses the PROSPETTIVA project sponsored by the Sicilian region (Italy), which aims to enrich secondary education by incorporating AI technologies. The web-based PROSPETTIVA platform leverages advanced Large Language Models to create personalized learning environments that actively engage students and enhance AI literacy. Key functions of the platform include summarization, simplification, and the creation of concept maps, which are selected for their ability to support in-depth learning and critical thinking. The platform's design facilitates seamless switching between different LLMs, allowing it to adapt to various educational needs efficiently. This flexibility, combined with targeted functionalities, ensures that the platform provides high-quality educational experiences. Initial findings suggest this approach significantly enhances learning outcomes and helps bridge educational inequalities. Future work will refine these functionalities and expand the platform based on user feedback.

The paper *Artificial Intelligence in the Professional Activity of a University Lecturer in Ukraine: Realities and Prospects* [33] examines the integration of AI tools into the professional tasks of Ukrainian university lecturers. Through a comprehensive survey of 205 educators, the study evaluates the current use and attitudes toward AI in handling routine educational, methodological, and scientific tasks. Findings reveal varying levels of AI literacy and adoption, emphasizing



the potential of AI to streamline administrative functions while encouraging deeper exploration of its pedagogical applications. The paper calls for targeted training and guidelines to support effective AI integration in academia.

The paper *Teacher-AI interaction in the selection of target texts* [34] investigates the integration of an Artificial Agent (AA) in the student assessment correction process and the delivery of online recursive feedback within educational settings. The main objective is to enhance the efficiency and effectiveness of feedback to improve the learning process. This research primarily examines the interaction between the AA and a human agent during the correction phase. Methodologically, the study employs an AI-driven approach, utilizing a BERT model specifically tailored for the Italian language to analyze text-based student responses. The AI system categorizes and ranks student submissions by comparing them with predefined target texts (TTs), using measures like cosine similarity to assess the degree of resemblance. The main results indicate that about 80% of student responses were reliably assessed using this AI approach. The AI system is particularly adept at identifying which texts require further human evaluation and helps highlight the uncertain elements in the evaluations. It suggests that while the AI can significantly support the correction process, there are still areas, particularly regarding subjective assessments, where human intervention remains crucial.

### **2.3. Session 3: AI in Educational Systems, Data Analysis, and Challenges**

The paper *Co-Designing Media Education Strategies: A Workshop on AI and Information Literacy* [35] examines a pilot workshop conducted under the TADAM project to address the role of generative AI in media education. This workshop, hosted at the MED Summer School, engaged educators and researchers in exploring critical aspects of AI's impact on media production and misinformation. Using Merrill's instructional design principles, participants engaged in hands-on tasks, such as generating and analyzing fake news, to foster critical thinking and media literacy. The outcome included collaboratively developed guidelines for "critical prompting," promoting informed citizenship and the effective use of AI in educational and media contexts.

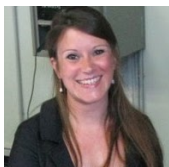
The paper *From Training KPIs to Learning KPIs: Ensuring Effectiveness in Learning Processes Through Predictive Analytics and Data-Based Tutoring Actions* [36] presents the LearnalizerR framework, a data-driven model for enhancing online course effectiveness. This model employs predictive analytics and macro performance indices to identify critical issues in learning environments and guide tutoring interventions. The framework's application in two real-world case studies demonstrates its potential to improve participation, mitigate risks, and optimize course design. The findings underscore the importance of transitioning from traditional training-focused KPIs to learning-centered evaluation metrics for more impactful digital education.

The paper *Does Time Matter in Analyzing Educational Data? A New Dataset for Streaming Learning Analytics* [37] introduces a novel temporal dataset derived from the Open University Learning Analytics Dataset (OULAD). This dataset incorporates time-based interaction data, enabling advanced stream algorithms to analyze learning patterns in real-time. Experiments with Online Bagging algorithms reveal that temporal structures significantly enhance the predictive capabilities for student outcomes, particularly for the majority class. However, challenges remain in addressing minority classes. This research highlights the dataset's potential to support dynamic and responsive interventions in Virtual Learning Environments.

The paper *NoVAGraphS: Towards an Accessible Educational-Oriented Dialogue System* [38] discusses the development of NoVABOT, a dialogue system designed for visually impaired individuals to explore graphical structures like UML diagrams and circuits. Utilizing AIML technology, the system translates graphical data into interactive textual dialogues accessible through screen readers. Preliminary evaluations with visually impaired students and their teachers indicate the system's effectiveness in facilitating understanding and problem-solving in various academic disciplines. This project underscores the importance of inclusive educational technologies in ensuring equitable learning opportunities.

The paper *Evolution of LMS Design and Implementation in the Age of AI and Large Language Models* [39] critiques the outdated architecture of current Learning Management Systems (LMSs) and proposes a shift to graph-based models integrated with AI functionalities. By transforming content storage into a knowledge graph, the proposed architecture enables advanced AI features such as semantic searches and personalized learning. The study highlights challenges in integrating multi-domain ontologies and adapting to evolving educational demands while showcasing the transformative potential of AI-driven LMS platforms.

### 3. Organizing Committee



**Gabriella Casalino** is currently an Assistant Professor (Tenure Track) at the Computational Intelligence Laboratory (CILab) of the Informatics Department of the University of Bari. Her research is focused on Computational Intelligence methods for interpretable data analysis. She is actively involved in eHealth, Data Stream Mining, and eXplainable Artificial Intelligence. Her work primarily focuses on the medical domain. She holds membership in the IEEE Task Force on Explainable Fuzzy Systems. She is an active member of the computer science community and contributes by organizing committees of workshops and special sessions in prestigious international conferences.



**Carla Limongelli** Carla Limongelli is an Associate Professor at Roma Tre University, where she teaches "Fundamentals of Computer Science" at the bachelor in Informatics and Artificial Intelligence Engineering and "Technologies and Methodologies for E-learning" at the master in E-learning and Media Education. Her research activity mainly focuses on Artificial Intelligence in Education, Recommender Systems, and Information Retrieval. She was one of the Program Chairs of the 22nd Conference of the Italian Association for Artificial Intelligence, held in Rome from November 6-9, 2023.



**Daniele Schicchi** Daniele Schicchi is a research fellow at the Institute for Educational Technologies of the National Research Council of Italy (CNR-ITD). He obtained a Ph.D. in Information Communication Technology at the Doctoral School in Computer Science offered by the Consortium of Catania, Messina, and Palermo universities (Italy). He is involved in the study of the Artificial Intelligence field and his research interests cover the application of computer science methodologies and innovative technologies to several domains such as

education and natural-language related fields.



**Davide Taibi** Davide Taibi is currently a Senior Researcher with the Institute for Education Technology, National Research Council of Italy. He is also a part-time Lecturer with Computer Science Department, University of Palermo. Since more than 20 years, he has been working in the educational technology research area, and his main research interests concern pedagogical applications to smart environments, learning analytics, enriched reality in education, AI in education and data literacy.



**Marco Temperini** Marco Temperini is an associate professor of Engineering in Computer Science at the Dept. of Computer, Control, and Management Engineering, Sapienza University of Rome, Italy.

He teaches programming techniques and programming of the Web. He got a Ph.D. in Computer Science at Sapienza in 1992. His recent research activity is on the theory and technology of distance learning, artificial intelligence in education, automated assessment, gamification, game based learning, adaptive e-learning, social and collaborative learning.

He was workpackage (Intellectual Output) leader and/or national research unit coordinator in several international projects

### 3.1. Program Committee

- Pasquale Ardimento, Dipartimento di Informatica, Università degli Studi di Bari "Aldo Moro", Bari, Italy
- Gabriella Casalino, Dipartimento di Informatica, Università degli Studi di Bari Aldo Moro, Bari, Italy
- Edoardo Datteri, Department of Human Sciences for Education, Università degli Studi di Milano Bicocca, Milan, Italy
- Emiliano del Gobbo, Dipartimento di Economia, Management e Territorio, University of Foggia, Foggia, Italy
- Carlo De Medio, Dipartimento di Scienze della Formazione, Roma Tre University, Rome, Italy
- Stefano D'Urso, Universitas Mercatorum, Rome, Italy
- Alessio Ferrato, Dipartimento di Ingegneria civile, informatica e delle tecnologie aeronautiche, Roma Tre University, Rome, Italy
- Marco Fisichella, L3S Research Center of Leibniz University of Hannover, Germany
- Carla Limongelli, Dipartimento di Ingegneria civile, informatica e delle tecnologie aeronautiche, Università degli Studi Roma Tre, Italy
- Giosué Lo Bosco, Dipartimento di Matematica e Informatica, University of Palermo, Italy
- Christian Napoli, Department of Computer, Control, and Management Engineering "Antonio Ruberti", Sapienza University of Rome, Rome, Italy



- Dimitri Ognibene, Department Psychology, Università degli Studi di Milano Bicocca, Milan, Italy
- Ruskov Martin Petkov, Department of Languages, Literatures, Cultures and Mediations, Università degli Studi di Milano, Milan, Italy
- Elvira Popescu, Faculty of Automation, Computers and Electronics, Computers and Information Technology Department, University of Craiova, Craiova, Romania
- Domenico Santoro, Dipartimento di Economia, Management e Territorio, University of Foggia, Foggia, Italy
- Daniele Schicchi, Institute for Educational Technologies, National Research Council of Italy
- Filippo Sciarrone, Universitas Mercatorum, Rome, Italy
- Andrea Sterbini, Dipartimento di Informatica, University of Rome Sapienza, Rome, Italy
- Davide Taibi, Institute for Educational Technologies, National Research Council of Italy
- Marco Temperini, Department of Computer, Control, and Management Engineering, Sapienza University of Rome, Italy
- Andrea Tinterri, University Unipegaso, Roma, Italy
- Crispino Tosto, Istituto per le Tecnologie Didattiche, Consiglio Nazionale delle Ricerche, Palermo, Italy
- Pierpaolo Vittorini, Dipartimento di Medicina clinica, sanità pubblica, scienze della vita e dell'ambiente, University of Aquila, Aquila, Italy
- Gianluca Zaza, Department of informatics, University of Bari Aldo Moro, Bari, Italy

## References

- [1] T. Brown, B. Mann, N. Ryder, M. Subbiah, J. D. Kaplan, P. Dhariwal, A. Neelakantan, P. Shyam, G. Sastry, A. Askell, S. Agarwal, A. Herbert-Voss, G. Krueger, T. Henighan, R. Child, A. Ramesh, D. Ziegler, J. Wu, C. Winter, C. Hesse, M. Chen, E. Sigler, M. Litwin, S. Gray, B. Chess, J. Clark, C. Berner, S. McCandlish, A. Radford, I. Sutskever, D. Amodei, Language models are few-shot learners 33 (2020) 1877–1901.
- [2] J. Burton, E. Lopez-Lopez, S. Hechtlinger, Z. Rahwan, S. Aeschbach, M. Bakker, J. Becker, A. Berditchevskaia, J. Berger, L. Brinkmann, L. Flek, S. Herzog, S. Huang, S. Kapoor, A. Narayanan, A.-M. Nussberger, T. Yasseri, P. Nickl, A. Almaatouq, R. Hertwig, How large language models can reshape collective intelligence, Nature human behaviour 8 (2024).
- [3] R. Luckin, K. George, M. Cukurova, AI for school teachers, CRC Press, 2022.
- [4] T. K. Chiu, Q. Xia, X. Zhou, C. S. Chai, M. Cheng, Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education, Computers and Education: Artificial Intelligence 4 (2023) 100118.
- [5] O. O. Ayeni, N. M. Al Hamad, O. N. Chisom, B. Osawaru, O. E. Adewusi, Ai in education: A review of personalized learning and educational technology, GSC Advanced Research and Reviews 18 (2024) 261–271.
- [6] M. Messer, N. C. Brown, M. Kölling, M. Shi, Automated grading and feedback tools for programming education: A systematic review, ACM Transactions on Computing Education 24 (2024) 1–43.

- [7] P. V. de Campos Souza, E. Lughofer, A. J. Guimaraes, Regularized neuro-fuzzy ai model to aid score management in online distance learning forums, in: 2021 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), IEEE, 2021, pp. 1–8.
- [8] G. Biancini, A. Ferrato, C. Limongelli, Multiple-choice question generation using large language models: Methodology and educator insights, in: Adjunct Proceedings of the 32nd ACM Conference on User Modeling, Adaptation and Personalization, UMAP Adjunct '24, Association for Computing Machinery, New York, NY, USA, 2024, p. 584–590. doi:10.1145/3631700.3665233.
- [9] S. Maity, A. Deroy, Generative ai and its impact on personalized intelligent tutoring systems, arXiv preprint arXiv:2410.10650 (2024).
- [10] B. U. iu Zaman, Transforming education through ai benefits risks and ethical considerations (2024).
- [11] D. Schicchi, D. Taibi, Ai-driven inclusion: Exploring automatic text simplification and complexity evaluation for enhanced educational accessibility, in: International Conference on Higher Education Learning Methodologies and Technologies Online, Springer, 2023, pp. 359–371.
- [12] B. Abu-Salih, S. Alotaibi, A systematic literature review of knowledge graph construction and application in education, Heliyon (2024).
- [13] P. Ardimento, L. Aversano, M. L. Bernardi, V. A. Carella, M. Cimitile, M. Scalera, Uml miner: a tool for mining uml diagrams, in: 2023 ACM/IEEE International Conference on Model Driven Engineering Languages and Systems Companion (MODELS-C), IEEE, 2023, pp. 30–34.
- [14] L. A. T. Nguyen, A. Habók, Tools for assessing teacher digital literacy: a review, Journal of Computers in Education 11 (2024) 305–346.
- [15] UNESCO, Unesco education for sustainable development goals: Learning objectives, 2021. URL: <https://unesdoc.unesco.org/ark:/48223/pf0000247444>.
- [16] A. D. Samala, S. Rawas, T. Wang, J. M. Reed, J. Kim, N.-J. Howard, M. Ertz, Unveiling the landscape of generative artificial intelligence in education: a comprehensive taxonomy of applications, challenges, and future prospects, Education and Information Technologies (2024) 1–40.
- [17] E. M. Bender, T. Gebru, A. McMillan-Major, S. Shmitchell, On the dangers of stochastic parrots: Can language models be too big?, Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency (2021) 610–623.
- [18] D. Taibi, G. Fulantelli, V. Monteleone, D. Schicchi, L. Scifo, An innovative platform to promote social media literacy in school contexts, in: Proceedings of the European Conference on e-Learning, ECEL, 2021, p. 460 – 470. doi:10.34190/EEL.21.064.
- [19] L. Yan, L. Sha, L. Zhao, Y. Li, R. Martinez-Maldonado, G. Chen, X. Li, Y. Jin, D. Gašević, Practical and ethical challenges of large language models in education: A systematic scoping review, British Journal of Educational Technology 55 (2024) 90–112.
- [20] Y. Fu, Z. Weng, Navigating the ethical terrain of ai in education: A systematic review on framing responsible human-centered ai practices, Computers and Education: Artificial Intelligence (2024) 100306.
- [21] H. Khosravi, S. B. Shum, G. Chen, C. Conati, Y.-S. Tsai, J. Kay, S. Knight, R. Martinez-Maldonado, S. Sadiq, D. Gašević, Explainable artificial intelligence in education, Computers

- and Education: Artificial Intelligence 3 (2022) 100074.
- [22] R. Farrow, The possibilities and limits of xai in education: a socio-technical perspective, *Learning, Media and Technology* 48 (2023) 266–279.
  - [23] G. Casalino, G. Castellano, P. Ducange, M. Fazzolari, R. Pecori, G. Zaza, Leveraging explainable ai methods and tools for educational data, in: *International Conference on Higher Education Learning Methodologies and Technologies Online*, Springer, 2023, pp. 95–111.
  - [24] D. Lombardi, L. Traetta, A. Maffei, P. Podrżaj, Enhancing instructional design: The impact of conali ontology and chatgpt in primary education training, in: *Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024)*, volume – of *CEUR Workshop Proceedings*, 2024.
  - [25] C. Abbondanza, Generative ai for teaching latin and greek in high school, in: *Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024)*, volume – of *CEUR Workshop Proceedings*, 2024.
  - [26] G. Paludo, A. Montresor, Fostering metacognitive skills in programming: Leveraging ai to reflect on code, in: *Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024)*, volume – of *CEUR Workshop Proceedings*, 2024.
  - [27] G. Adorni, D. Grosso, Speeding up design and making to reduce time-to-project and time-to-market: an ai-enhanced approach in engineering education, in: *Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024)*, volume – of *CEUR Workshop Proceedings*, 2024.
  - [28] C. De Medio, A. Poce, M. R. Re, Enhancing educational outcomes and well-being through technology-supported object-based learning: The restart project at the university of tor vergata, in: *Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024)*, volume – of *CEUR Workshop Proceedings*, 2024.
  - [29] G. Bonino, G. Sanmartino, G. Gatti Pinheiro, P. Papotti, R. Troncy, P. Michiardi, Euler: Fine tuning a large language model for socratic interactions, in: *Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024)*, volume – of *CEUR Workshop Proceedings*, 2024.
  - [30] D. Agostini, F. Picasso, H. Ballardini, Large language models for the assessment of students' authentic tasks. a replication study in higher education, in: *Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024)*, volume – of *CEUR Workshop Proceedings*, 2024.
  - [31] E. Murgia, B. S. I. Fumagalli, E. Nicchia, D. Parmigiani, Uninvited generative ai has joined our students. tackling disinformation and creating content with the help of ai apps, in:

- Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024), volume — of *CEUR Workshop Proceedings*, 2024.
- [32] D. Schicchi, D. Taibi, Redefining education: A personalized ai platform for enhanced learning experiences, in: Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024), volume — of *CEUR Workshop Proceedings*, 2024.
- [33] S. Skvortsova, T. Symonenko, T. Britskan, O. Onopriienko, R. Romanyshyn, Artificial intelligence in professional activities of a university lecturer in ukraine: realities and prospects, in: Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024), volume — of *CEUR Workshop Proceedings*, 2024.
- [34] L. Giannandrea, F. Gratani, L. Screpanti, P. G. Rossi, D. Scaradozzi, Teacher-ai interaction in the selection of target texts, in: Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024), volume — of *CEUR Workshop Proceedings*, 2024.
- [35] M. Ranieri, S. Cuomo, G. Biagini, Co-designing media education strategies: A workshop on ai and information literacy, in: Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024), volume — of *CEUR Workshop Proceedings*, 2024.
- [36] D. Pellegrini, M. Santoro, S. Zuzzi, From training kpis to learning kpis: ensuring effectiveness in learning processes through predictive analytics and data-based tutoring actions, in: Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024), volume — of *CEUR Workshop Proceedings*, 2024.
- [37] G. Casalino, G. Castellano, G. Zaza, Does time matter in analyzing educational data? - a new dataset for streaming learning analytics, in: Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024), volume — of *CEUR Workshop Proceedings*, 2024.
- [38] M. Oliverio, M. Piroi, D. De Giorgi, P. F. Balestrucci, C. Manolino, A. Mazzei, L. Anselma, C. Bernareggi, M. Serio, C. Sabena, T. Armano, S. Coriasco, A. Capietto, Novagraphs: Towards an accessible educational-oriented dialogue system, in: Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024), volume — of *CEUR Workshop Proceedings*, 2024.
- [39] A. Molinari, S. Sandri, Evolution of lms design and implementation in the age of ai and large language models, in: Proceedings of the Second International Workshop on Artificial Intelligence Systems in Education co-located with 23rd International Conference of the Italian Association for Artificial Intelligence (AIxIA 2024), volume — of *CEUR Workshop Proceedings*, 2024.