Connecting AI and SEL: A New Approach in Teacher Education

Alenka Lipovec
Univetrsity of Maribor, Faculty of Education, Maribor, Slovenia
alenka.lipovec@um.si

The study addresses the critical need for artificial intelligence (AI) literacy in teacher education and explores the most effective methods of equipping teachers in this emerging field, suggesting that a combination of AI literacy and Social-Emotional Learning (SEL) could substantially boost digital proficiency beyond conventional training approaches. The research employs quantitative analysis, initially surveying 571 pre-service and in-service teachers, and following up with 252 participants after a 12-hour course. The study utilized various self-reporting and standardized instruments to assess the programme's effectiveness. Notably, the effect size for self-reported competence in AI integration within teaching practices was found to surpass Hattie's hinge point twice, underlining its substantial impact on educational outcomes. Other measures, though slightly less striking, also achieved increases in digital competences surpassing other similar studies. This highlights the potential of combining AI literacy with SEL in teacher education to elevate digital competence effectively.

DOI
https://doi.org/10.18690/um.pef.2.2024.9

ISBN
978-961-286-899-4

Keywords:
artificial intelligence, education, longitudinal evaluation, self-reporting, standardised instruments

University of Maribor Press

DOI
https://doi.org/10.18690/um.pef.2.2024.9

ISBN
978-961-286-899-4

Ključne besede:
umetna inteligenca, izobraževanje, longitudinalna evalvacija, samoporočanje, standardizirani inštrumenti

Univerzitetna založba Univerze v Mariboru

POVEZOVANJE UI IN SEL: NOV PRISTOP V IZOBRAŽEVANJU UČITELJEV

ALENKA LIPOVEC
Univerza v Mariboru, Pedagoška fakulteta, Maribor, Slovenija
alenka.lipovec@um.si

Prispevek razpravlja o ključni potrebi po znanju s področja umetne inteligence (UI) v izobraževanju učiteljev ter raziskuje najučinkovitejše načine usposabljanja učiteljev na tem področju. Trdimo, da kombinacija UI pismenosti in socialno-čustvenega učenja (SEL) presega tradicionalne metode izobraževanja učiteljev na digitalnem področju. Uporabljena je bila kvantitativna metodologija, pri čemer je bilo najprej anketiranih 571 učiteljev pred začetkom programa, po 12-urnem programu pa je sledila anketa z 252 udeleženci. V študiji so bili za oceno učinkovitosti programa uporabljeni različni inštrumenti samoporočanja in standardizirani instrumenti. Ugotovili smo, da je velikost učinka samoocene usposobljenosti za vključevanje umetne inteligence v učne prakse po zaključenem programu dvakrat presegla Hattiejevo točko preloma. Tudi pri drugih ukrepih, čeprav nekoliko manj očitno, je bilo doseženo izboljšanje digitalnih kompetenc, ki je preseglo druge podobne študije. Rezultati torej podpirajo potencial združevanja UI pismenosti in SEL v izobraževanju učiteljev za učinkovito dvigovanje digitalnih kompetenc.

1 Introduction

The contemporary landscape of education is undergoing a significant transformation, driven by the integration of advanced technologies such as artificial intelligence (AI). AI is increasingly recognized for its capacity to tailor learning experiences to individual needs, thereby enhancing the effectiveness and efficiency of education. This technology's adaptive learning capabilities are paving the way for more personalized educational approaches, which have shown to substantially boost student performance. These advancements, as highlighted by Chiu et al. (2023), reflect the potential of AI to revolutionize traditional teaching methodologies. Artificial intelligence in education (AIEd) refers to the application of AI technologies, such as chatbots, automatic marking systems, intelligent tutoring systems, and student performance prediction platforms that support and enhance education (Chiu et al., 2023). To ensure the effective functioning of future society, teacher education must include AI literacy, which is usually defined as "… a set of competencies that enable individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and use AI as a tool online, at home and in the workplace" (Long & Magerko , 2020). A recent OECD study reports "implications for employment and education" and "highlights the need to strengthen the foundation skills of the workforce and prepare it to work together with AI" (OECD, 2023). Recent studies have focused on identifying teachers' AI content knowledge and desired students' learning outcomes, providing guidelines for schools to design and deliver their AI curricula.

However, the integration of AI into educational settings is not without its challenges. As noted by Zhai et al. (2021), educators and institutions face a myriad of technical hurdles and ethical dilemmas when implementing AI. These challenges range from overcoming the limitations of current technologies to addressing the ethical implications of AI in education.

In response to these evolving needs, the SETCOM intervention has been developed to strategically integrate AI literacy with social-emotional learning (SEL). This approach is not merely about incorporating new technology into the classroom, it is about redefining the educational process to incorporate a comprehensive understanding of AI, underscored by the principles of SEL. By intertwining AI literacy with SEL, SETCOM proposes a method that enhances educators' digital

competencies while fostering a deeper, more empathetic understanding of AI. This method goes beyond the technical aspects of AI, delving into its impact on human emotions, social interactions, and ethical considerations.

At the heart of SETCOM's philosophy is the belief that education should be human-centric, focusing on the role and attitudes of educators as pivotal elements in the learning process. It advocates for the responsible use of AI, encouraging positive attitudes towards technology among both educators and learners. This approach aligns with the findings of Durlak et al. (2011), who have demonstrated the significant impact of SEL on academic success. The SETCOM programme at the University of Maribor provides a unique opportunity to explore this intersection. The central hypothesis suggests that integrating SEL with AI literacy may significantly enhance the digital competencies of educators, particularly emphasizing the transformative influence of educators' attitudes towards technology in this integrative process.

This research delves into how the SETCOM programme's unique approach impacts the digital and intra- and interpersonal competencies of pre-service and in-service teachers. It examines the extent to which the programme's focus on AI literacy and SEL contributes to a more comprehensive understanding and adeptness in digital skills. Additionally, the study explores the dynamic interplay between educators' attitudes towards technology and their ability to assimilate and apply these integrated skills in educational settings. The findings of this research provide valuable insights into the development of future teacher training programmes, ensuring they are well-equipped to meet the demands of a technology-driven educational landscape.

1.1 SETCOM Intervention Programme

The SETCOM intervention, intricately designed in alignment with the guidelines set forth by the European Commission in Artificial Intelligence and Education (Holmes in drugi, 2022), is structured into three distinct yet interconnected strands: ABOUT, WITH, and FOR. This comprehensive structure aims to offer a holistic approach to integrating AI literacy and SEL in the education of future teachers.

ABOUT Strand: Technological Dimension of AI Literacy. The ABOUT strand serves as the foundational layer of the programme, introducing pre-service teachers to the fundamental aspects of AI and SEL. This includes an overview of the CASEL model, which is pivotal in understanding the socio-emotional aspects in educational contexts. The strand delves deep into AI technologies, techniques, and concepts, providing a robust technological grounding. This phase of the intervention is crucial in building a solid base of AI literacy, focusing on the technological dimension. The primary goal here is to ensure that future educators are well-versed in the basics of AI, its potential applications, and the ethical considerations involved.

WITH Strand: Didactical Dimension of AI Literacy. The WITH strand takes a more applied approach, focusing on the practical integration of AI and SEL within teaching methodologies. It showcases various tools and methods that enhance the learning experience, including specialized support for learners with disabilities and the optimization of administrative tasks in educational settings. An innovative aspect of this strand is the incorporation of learning analytics and data mining, which, while not strictly AI, involves similar data analysis and analytical techniques used in AI-driven learning tools. This strand also includes an exploration of how AI can be used to understand and improve learning processes, as evidenced by the work of Drožđek & Pesek (2024) in reinforcement learning for teaching multiplication tables. The WITH strand is thus characterized as the didactical dimension of AI literacy, where the emphasis is on applying AI and SEL principles in an educational context.

FOR Strand: Human Dimension of AI Literacy. The FOR strand, referred to as AI literacy's human dimension in educational literature, is forward-looking and prepares educators for future integration of AI into teaching and learning environments. It emphasizes developing skills critical for the ethical use and understanding of AI, such as prompt engineering and ethical considerations. This strand is pivotal in equipping future educators with the competencies needed to navigate the evolving landscape of AI in education, focusing on the human-centred aspects of technology use.

Each of these strands comprises four lessons, with a balanced mix of lectures and hands-on workshops. Such a structure allows for both theoretical understanding and practical application, providing a comprehensive learning experience for pre-service teachers. The intervention's design reflects a commitment to developing well-

rounded educators who are not only technically proficient in AI but also adept in integrating SEL into their teaching practices. This approach aligns with the broader objective of enhancing digital competence in educators, as outlined in the DigComp 2.1 framework (Carretero Gomez in drugi, 2017) and DigCompEdu (Redecker, 2017), ensuring that future teachers are prepared to effectively navigate and contribute to the digital transformation of education.

2 Methodology

This research delved into how the SETCOM programme's unique approach impacts the digital competencies of pre-service teachers. It examined the extent to which the programme's focus on AI literacy and SEL contributed to a more comprehensive understanding and adeptness in digital skills. Additionally, the study explored the dynamic interplay between educators' attitudes towards technology and their ability to assimilate and apply these integrated skills in educational settings. The findings of this research provided an insight into the development of future teacher training programmes, ensuring they are well-equipped to meet the demands of a technology-driven educational landscape.

The following research question has been formulated: How does the integration of SEL and AI literacy within the SETCOM programme at the University of Maribor influence the development of digital and inter-/intrapersonal competencies in education?

To address this question, methods of quantitative empirical pedagogical research in a longitudinal context have been used.

2.1 Instrument

The anonymous questionnaire consisted of three sections of questions: a) demographics, b) Artificial Competence Literacy: two knowledge self-reporting items, General Attitudes towards AI Scale – GAAIS (Schepman & Rodway, 2020), Attitudes towards the Ethics of AI – AT-EAI (Jang in drugi, 2022) and Competence Framework for Citizens DigComp 2.1 (Carretero Gomez in drugi, 2017); and c) two knowledge self-reporting items and Brackett et al. questionnaire (2012) assessing participants' beliefs about SEL.

The knowledge self-reporting items were designed for the purposes of this study and were as follows:

AI1: I am very familiar with the term artificial intelligence.
AI2: I feel fully competent to use AI in teaching.
SEL1: I am very familiar with the term socio-emotional competence.
SEL2: I feel fully competent to develop social-emotional competences in teaching.

All items except the DigComp2.1 items were designed on a five-level Linkert scale with the following response options: strongly disagree, disagree, neutral, agree, and strongly agree. Questions from section (b) DigComp 2.1 were answered by agreeing with the proficiency levels on an eight-level scale, measured with complexity of tasks and autonomy: (1) simple tasks, with guidance, (2) simple tasks with autonomy, with guidance when needed, (3) well-defined and routine tasks, and straightforward problems, on my own, (4) tasks, and well-defined and non-routine problems independently, according to my needs, (5) different tasks and problems, guiding others, (6) most appropriate tasks, able to adapt to others in a complex context, (7) resolve complex problems with limited solutions, integrate to contribute to the professional practice and to guide others, (8) resolve complex problems with many interacting factors, propose new ideas and processes to the field.

2.2 Sample

The SETCOM intervention involved a diverse group of participants, including pre-service teachers from kindergartens, elementary, and secondary school levels, as well as in-service teachers from kindergartens through to high school. The intervention saw a substantial participation rate, with 571 individuals completing the initial questionnaire and 252 completing the final questionnaire.

A notable characteristic of both the initial and final participant groups was the predominance of female participants, who constituted 80% of each sample. There was, however, a significant difference in the average age of participants between the two samples. Initially, the average age was 31.5 years, but this decreased to 24.7 years in the final sample. This shift in average age can be attributed to the composition of the participants: in the initial sample, 59% were pre-service teachers, with the

remainder being in-service teachers. By contrast, in the final sample, a higher proportion, 86%, were pre-service teachers.

The structure of the sample and the nature of the questionnaire likely influenced the difference in response rates between pre-service and in-service teachers. While pre-service teachers completed the questionnaire during their course, in-service teachers did so in their own time, which might explain the lower completion rate among the latter group.

Participants were engaged in different segments of the programme, with 29% actively participating in one strand, 23% in two strands, and a notable 48% participating in all three strands. These strands, labelled ABOUT, WITH, and FOR, each focused on different aspects of the intervention, offering a comprehensive approach to the topics covered.

2.3 Data Gathering and Data Analysis

The SETCOM intervention programme was structured in a way to accommodate the varied schedules and academic commitments of its participants, particularly the pre-service teachers. The process of collecting initial state data commenced in October 2022 and continued through January 2023. This initial phase was crucial in establishing a baseline understanding of the participants' competencies and attitudes. Following this, the data collection for the final state was conducted over a more extended period, from February 2023 to December 2023. This extended period allowed for a thorough and comprehensive assessment of the intervention's impact over time.

The duration of the intervention for each pre-service teacher was quite variable, ranging approximately from 5 to 12 months. This variation was influenced by several factors related to the academic calendar and the specific curriculum of the participants. For instance, whether the intervention was integrated into a subject that was taught in the winter or summer semester played a significant role. Additionally, the possibility of following a cohort into the next academic year also contributed to the variation in the intervention's length across different sub-samples of pre-service teachers.

The analysis of the data was carried out using the 1KA online analysis tool. This involved a comparative study of the results from both the initial and final states of the intervention. Such a comparison was critical in quantifying the impact of the SETCOM programme.

To calculate the SETCOM effect in terms of percentage, the following formula was used:

$$\frac{(\overline{x}_{final} - \bar{x}_{initial})}{range} \cdot 100.$$

In this calculation, a range of 5 was consistently applied across all assessments, except for DigComp2.2, where a range of 8 was used to accommodate its broader scale.

Furthermore, the effect size, a crucial measure of the intervention's impact, was determined using Cohen's d. This statistical tool is represented by the formula:

$$d = \frac{(\overline{x}_{final} - \bar{x}_{initial})}{\sqrt{\frac{SD^2_{final} + SD^2_{initial}}{2}}}).$$

Cohen's d provided a standardized measure of the effect, offering a clear and objective insight into the magnitude of the intervention's impact on the participants. This meticulous approach to analysis ensured that the findings were both reliable and meaningful, providing a robust assessment of the SETCOM programme's effectiveness.

2.4 Limitations

The study in question presents a set of limitations that need to be acknowledged for a comprehensive understanding of its outcomes. One of the primary constraints is the diverse nature of the participant group. This heterogeneity is evident in the varying backgrounds of the participants, such as computer science teachers, primary teachers, or STEM, social science, art or humanities teachers. In our sample, primary pre-service teachers prevailed, followed by social science teachers, and less than one-tenth of the sample consisted of (future) STEM teachers. While this diversity

enriched the data, it also complicated the process of drawing generalized conclusions, especially when comparing across different teaching specializations. The gender distribution within the sample also presents a notable limitation. The predominance of one gender over another can lead to skewed results, particularly when analysing aspects of the study that may vary significantly between genders. This imbalance could affect the study's findings, especially in areas where gender differences are known to play a crucial role. One such area is technology. While various studies have yielded inconsistent results regarding gender differences in technology use and perception in education, a notable meta-analysis by Cai, Fan, and Du (2017) brought some clarity to this area. Their comprehensive review confirmed the mixed nature of previous findings but importantly highlighted that men generally tend to have more favourable attitudes towards technology. Additionnalyy, the longitudinal design, while thorough, resulted in a significant drop-off in participant numbers from the initial to the final questionnaire, potentially affecting the results' reliability and representativeness. Next, the reliance on self-report measures for evaluating knowledge and competencies might introduce bias, as participants could overestimate their abilities or the intervention's impact. Lastly, the length of the questionnaire poses its own set of challenges. With an approximate completion time of 15-20 minutes, there is a concern that the latter sections of the questionnaire, particularly those focusing on SEL, might not have been answered with the same level of attention or reflective thought as the earlier sections, which were primarily AI-focused. This variation in response attentiveness may have led to inconsistencies in the data quality across different sections of the questionnaire.

3 Results

First, results for knowledge self-reporting items (5-level scale) are reported in Table 1. The results regarding standardized questionnaires are shown in Table 1 in the form $\bar{x} \pm \sigma$, where $\bar{x}$ denotes average, and standard deviation is marked by σ.

Table 1 highlights the effect sizes for two main areas: AI and SEL. In the AI domain, the effect sizes indicated a significant impact of the intervention. Familiarity with AI showed a notable effect size of 0.44, while the ability to use AI in teaching exhibited an even more substantial impact, with an effect size of 0.88. For SEL, the results also demonstrated a positive influence. The effect size for socio-emotional competence stood at 0.31, and for developing socio-emotional competences in

teaching, it was 0.34. These figures collectively suggest that the intervention was particularly effective in enhancing skills related to AI, with a strong influence also seen in the SEL competencies.

Table 1. Self-reporting items

	I am very familiar with the term …		I feel fully competent to …	
	artificial intelligence.	socio-emotional competence.	use AI in teaching.	develop social-emotional competences in teaching.
Initial state	3.4 ± 0.86	3.5±0.83	2.7 ± 0.92	3.3±0.87
Final state	3.8 ± 0.69	3.8±0.61	3.4 ± 0.85	3.6±0.71
Effect (%)	8	6	14	6
Effect size	0.44	0.31	0.88	0,34

The outcomes from several standardized assessments are comprehensively detailed in Table 2. This includes the Competence Framework for Citizens DigComp 2.1, developed by Carretero Gomez et al. in 2017, which provides a structured analysis of digital competencies. Additionally, the table includes results from the General Attitudes towards AI Scale – GAAIS, formulated by Schepman & Rodway in 2020, and the Attitudes towards the Ethics of Artificial Intelligence – AT-EAI, researched by Jang et al. in 2022. Furthermore, insights into participants' beliefs about SEL were gathered using the Brackett et al. questionnaire from 2012, offering a deeper understanding of their perspectives in these critical areas.

Table 2. SETCOM impact on standardized questionnaires

	DigComp2.2	GAAIS	AT-EAI	Brackett et al. SEL
Initial state	4.45 ± 1.90	3.16±1.23	3.85±1.13	3.83±0.76
Final state	4.98 ± 1.81	3.32±1.10	3.91±1.10	3.86±0.75
Effect (%)	6.6	3.2	1.5	0.8
Effect size	0.40	0.19	0.08	0.06

In Table 2, the SETCOM programme's impact on standardized questionnaires is grouped into two categories: AI-related Competencies (DigComp2.2, GAAIS, AT-EAI) and Socio-Emotional Learning (SEL) – Brackett et al. (2012). There was an observable improvement in AI-related competencies. The effect sizes for DigComp2.2, GAAIS, and AT-EAI were 0.40, 0.19, and 0.08, respectively. These

figures indicate a moderate to slight enhancement in participants' digital and AI-related competencies and attitudes. The SEL competency, assessed by the Brackett et al. questionnaire, showed a marginal increase with an effect size of 0.06. It is obvious that in SEL domain almost no progress was observed. One of the reasons could be that participants felt more confident in this domain already at the beginning of the intervention since only 3% totally disagreed or disagreed with the statement *I am confident in my ability to support social and emotional learning in school settings*. This pre-existing confidence could mean that there was less perceived room for improvement in SEL compared to digital competencies. Additionally, digital skills might have been a newer or less familiar area for participants compared to SEL, making the learning curve steeper and the noticeable progress more significant in digital areas.

Unfortunately, attitudes toward the ethics of AI improved only by 1.5 %. A detailed analysis showed that one statement in AT-EAI showed no difference between the initial and final states, in three statements lower agreement on the level -0.1 or -0.2 (on a 5-level scale) was recorded, and in six statements higher agreement on the level 0.1, 0.2 or 0.3 was recorded. The highest shift was recorded with respect to the statement favouring regulation *(In the case of problems caused by AI, it is difficult to determine exactly who is responsible, so there needs to be a social consensus on who should compensate and how.)*

4 Discussion

The results of the SETCOM intervention programme are not only promising but also indicative of significant effectiveness in enhancing digital competencies, especially in the realm of pedagogical AI competence. This is underscored by the remarkable effect sizes noted in the study. For the standardized DigComp2.1, the effect size closely approaches the influential benchmark set by Hattie in 2023, known as Hattie's (2023) hinge point, which stands at 0.40. This already suggests a substantial impact of the programme.

Even more impressive is the effect size of 0.44 observed for self-reported knowledge about AI. This indicates that the intervention has been particularly effective in boosting participants' understanding and awareness of AI, which is a crucial aspect of modern digital literacy. The highlight, however, is the staggering effect size of 0.88 measured for self-reported efficiency in AI use in teaching. Such a high effect

size is practically meaningful, pointing to a profound improvement in the skills and confidence of educators in integrating AI into their teaching practices.

Given these compelling results, it is clear that the SETCOM intervention programme stands out as a substantial and impactful initiative. It effectively elevates general digital competencies and, more importantly, hones specific pedagogical AI skills.

Some other intervention programmes, e.g. Çebi et al. (Çebi et al., 2022) reported lesser improvement even though the intervention was much longer and designed around the DigComp2.1 framework. This difference highlights how important it is, in our opinion, to consider the social and emotional aspects when teaching digital skills. The importance of synergies of these two domains was also highlighted in the first phase of the intervention (Lipovec et al., 2023).

There are numerous other studies reflecting upon the DigComp 2.1 competence framework of educators, for a review, see Bilbao Aiastui et al. (2021). For instance, the results for secondary school teachers in Malaysia suggest that digital competence, according to DigComp 2.1, is highly significant in influencing workforce agility (Lim et al., 2021), where teachers' workforce agility refers to a flexible and well-trained workforce that can easily and quickly adapt to new situations and opportunities (Muduli & Pandya, 2018).

Notwithstanding the small progress in the SEL area, the results of this study offer empirical evidence that there is more progress in digital areas when SEL is included than when SEL is not included, like, for example, in the Turkish intervention (Çebi et al., 2022). Çebi et al. (2022) crafted a 46-hour training module for pre-service teachers in Turkey, aiming to bolster their digital competencies in technology assimilation. This programme's effect was smaller than those of the 12-hour SETCOM programme effect, for more details, see (Lipovec et al., 2024).

The positive effect of the SETCOM project in the AI ethics area is also reported in Krašna et al. (Krašna et al., 2024) who compared the data from the beginning of the project (October 2022) with the contemporary teachers' opinions. They report that over 70% of teachers have used AI services like ChatGPT, with the purpose of introducing AI to students and incorporating it into tasks. However, less than 30%

felt confident in evaluating AI responses, even though more than half have planned to use the AI system feedback to enhance their teaching methodologies. It is clear also in Slovenian settings that addressing the transformative effects of ChatGPT on the learning environment, and educating teachers and students alike about its capabilities and limitations, will be crucial in the future (2024).

It was reported (Lipovec & Flogie, 2023) that general attitudes towards AI were less favourable at the beginning of SETCOM intervention in October 2022 compared to the results for general population (Schepman & Rodway, 2020). The most striking differences were found in GAAIS item 1, where only 12% of our participants (47% for the general population) agreed that they prefer AI over humans in routine transactions. The second significant gap was found in item 14, where the agreement of future Slovenian teachers with claims about many beneficial applications of AI is 32,1% (86% for the general population). Applying the same methodology by combining (dis)agreement from the "strongly" and "somewhat" levels and retaining the neutral type, results showed that agreement with item 1 rose to 41%, and agreement with item 14 rose to 84%.

5 Conclusion

In the field of educational technology, Artificial Intelligence in Education (AIEd) is an emerging field that is projected to have a profound impact on the teaching and learning process. The AIEd has already been around for more than 30 years, but educators may still have concerns about scaling the pedagogical benefits of AIEd and how it could positively impact the teaching and learning process. After conducting a thorough review of existing literature, it became apparent that there is a notable gap in properly monitored and evaluated intervention programmes specifically focused on AIEd. While this precise area of research seems to be under-explored, there have been numerous calls underscoring the need for such studies, e.g. Falloon (2020). It is our aspiration that the current study contributes significantly towards bridging this gap, shedding new light on this vital aspect of educational research. Nonetheless, it's clear that this field still requires more extensive exploration and research to fully understand and harness the potential of learning intelligence in educational contexts.

As educational institutions increasingly adopt technology-centred teaching methodologies, there is a pressing need to understand how these modern approaches align with and enhance existing frameworks for assessing digital competence. Traditional methods of evaluating digital skills may not fully encapsulate the nuances introduced by new technologies like AI. The SETCOM programme, an innovative intervention at the University of Maribor, emerges as a critical case study in this regard. It aims to blend AI literacy, a burgeoning field in the digital landscape, with the principles of SEL, which focuses on developing emotional intelligence and social skills in educational settings.

The underlying premise of the research is that by melding AI literacy with SEL, the SETCOM programme could potentially elevate the digital proficiency of future teachers beyond traditional training methods. This hypothesis stems from the understanding that digital competence in the contemporary era entails not just technical know-how but also the ability to navigate the social and ethical dimensions of technology. Educators' attitudes towards technology, especially AI, play a crucial role in this context. Their perceptions, openness to integration, and overall stance towards AI and SEL could significantly influence the effectiveness of such interventions.

The SETCOM curriculum integrates AI's technological, didactic, and human dimensions with activities focused on empathy, emotional management, and decision-making skills. It combines practical AI tool usage with the application of SEL scenarios, equipping participants to create a comprehensive and empathetic learning environment. This approach aims to blend technological expertise with socio-emotional growth, showcasing a holistic educational model.

This study's findings are crucial for educational strategies, emphasizing the need for well-equipped classrooms and ongoing teacher development. They underscore the importance of adapting to rapid technological changes and addressing AI's ethical challenges in education. Future research should focus on navigating these ethical complexities to merge digital and personal competencies effectively, paving the way for a more human-centred approach to educational technology.

Acknowledgments

This research was conducted in the framework of the Supportive Environments to Enhance Transversal Competencies in Education – SETCOM project.

During the preparation of this work the authors used ChatGPT 4.0 in order to improve the language. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

References

Bilbao Aiastui, E., Arruti , A., & Carballedo Morillo, R. (2021). A systematic literature review about the level of digital competences defined by DigCompEdu in higher education. *Aula abierta, 50(4)*, pp. 841-850. https://doi.org/https://doi.org/10.17811/rifie.50.4.2021.841-850

Brackett, M. A., Reyes, M. R., Rivers, S. E., Elbertson, N. A., & Salovey, P. (2012). Assessing Teachers' Beliefs About Social and Emotional Learning. *Journal of Psychoeducational Assessment, 30(3)*, pp. 219-236. https://doi.org/10.1177/0734282911424879

Cai, Z., Fan, X., & Du, J. (2017). Gender and attitudes toward technology use: A meta analysis. *Computers & Education*, pp. 1-13. https://doi.org/https://doi.org/10.1016/j.compedu.2016.11.003

Carretero Gomez, S., Vourikari, R., & Punie, Y. (2017). *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use.* Luxembourg: Publications Office of the European Union.

Çebi , A., Özdemir a, İlknur R, T. B., Reisoğlu, İ., & Çolak, C. (2022). From digital competences to technology integration: Re-formation of pre-service teachers' knowledge and understanding. *International Journal of Educational Research, 113*, p. 101965. https://doi.org/https://doi.org/10.1016/j.ijer.2022.101965

Chiu, T. K., Xia, Q., Zhou, X., Sing Chai, C., & Cheng, M. (2023). Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education. *Computers and Education:Artificial Inteligence, 4*, p. 100118. https://doi.org/https://doi.org/10.1016/j.caeai.2022.100118

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal Interventions. *Child Development, 82(1)*, pp. 405-432. https://doi.org/https://doi.org/10.1111/j.1467-8624.2010.01564.x.

Falloon, G. (2020). From digital literacy to digital competence: The teacher digital competency (TDC) framework. *Educational Technology Research and Development*, pp. 1-24. https://doi.org/10.1007/s11423-020-09767-4

Gill, S. S., Xu, M., Patros, P., Wu, H., Kaur, R., Kaur, K., Fuller, S., Singh, M., Arora, P., Parlikad, A. K., Stankovski, V., Abraham, A., Ghosh, S. K., Lutfiyya, H., Kanhere, S. S., Bahsoon, R., Rana, O., Dustdar, S., Sakellariou, R., Uhlig, S., & Buyya, R. (2024). Transformative effects of ChatGPT on modern education: Emerging Era of AI Chatbots. *Internet of Things and Cyber-Physical Systems*, pp. 19-23. https://doi.org/https://doi.org/10.1016/j.iotcps.2023.06.002

Hattie, J. (2023). *Visible Learning: The Sequel A Synthesis of Over 2.100 Meta-Analyses Relating to Achievement.* Routlege.

Holmes, W., Persson, J., Chounta, I. A., & Dimitrova, V. (2022). *Artificial intelligence and Education. A critical view through the lens of human rights, democracy, and the rule of law.* https://rm.coe.int/artificial-intelligence-and-education-a-critical-view-through-the-lens/1680a886bd

Jang, Y., Choi, S., & Kim, H. (2022). Development and validation of an instrument to measure undergraduate students' attitudes toward the ethics of artificial intelligence (AT-EAI) and

analysis of its difference by gender and experience of AI education. *Education and Information Technologies*. https://doi.org/https://doi.org/10.1007/s10639-022-11086-5

Krašna, M., Arcet, B., & Gartner, S. (2024). Teachers' opinion about the application of AI in the education. *INTED2024 Proceedings, 18th annual International Technology, Education and Development Conference* (p. in press). Valencia, Spain. In press.: IATED Academy. https://doi.org/10.21125/inted.2024

Lim, Y. S., Halim, A. H., & Ramayah, T. (2021). Agile or not? The upsurge of digcomp and social media usage among teachers. *Journal of Applied Structural Equation Modeling, 5(2)*, pp. 1-21. https://doi.org/ 10.47263

Lipovec, A., & Flogie, A. (2023). Empowering future teachers : unveiling their attitudes and knowledge about AI in Slovenian K-12 education. *12th Mediterranean Conference on Embedded Computing (MECO), 6-10 June 2023*, (pp. 1-4). Budva, Montenegro. https://doi.org/10.1109/MECO58584.2023.10155010

Lipovec, A., Arcet, B., & Ferme, J. (2023). Connecting the Dots: Exploring the Correlation Between Socio-Emotional Learning Beliefs and Attitudes Toward Artificial Intelligence. In B. Aberšek, & M. Cotič (Eds.), *Challenges and Transformation of Education for 21st Century Schools* (p. in press). Cambridge Scholars Publishing.

Lipovec, A., Kaučič, B., & Arcet, B. (2024). Intersecting Evaluations: Digital Competence and AI Attitudes among Future Slovenian Educators. In M. Licardo, & A. Lipovec (Eds.), *Artificial Intelligence Literacy and Social-Emotional Skills as Transversal Competencies in Education* (pp. 28-58). Verlag dr. Kovač. In press.

Long, D., & Magerko , B. (2020). What is AI Literacy? Competencies and Design Considerations. *CHI '20: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, (pp. 1-16). https://doi.org/https://doi.org/10.1145/3313831.3376727

Muduli, A., & Pandya, G. (2018). Psychological Empowerment and Workforce Agility. *Psychological Studies*, pp. 276-285. https://doi.org/https://doi.org/10.1007/s12646-018-0456-8

OECD. (2023). *Is Education Losing the Race with Technology?: AI's Progress in Maths and Reading.* Paris: Innovation, OECD Publishing. https://doi.org/https://doi.org/10.1787/73105f99-en

Redecker, C. (2017). *European Framework for the Digital Competence of Educators: DigCompEdu.* (Y. Punie, Ured.) Luxembourg: Publications Office of the European Union. https://doi.org/https://data.europa.eu/doi/10.2760/159770

Schepman, A., & Rodway, P. (2020). Initial validation of the general attitudes towards Artificial Intelligence Scale. *Computers in Human Behavior Reports, 1*, p. 100014. https://doi.org/https://doi.org/10.1016/j.chbr.2020.100014

Zhai, X., Chu, X., Chai, C. S., Yung Jong, M. S., Istenić, A., Spector, M., Liu, J. B., Yuan, J., & Li, Y. (2021). A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. *Complexity*, 1-18. https://doi.org/ https://doi.org/10.1155/2021/8812542.