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Evaluation of Artificial Intelligence Supporting Emotional Intelligence of Students in the Context of Sustainable Development

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Abstract: *Recent advancements in artificial intelligence (AI) have significantly permeated educational systems, reshaping pedagogical approaches, student engagement, and support mechanisms. This study addresses this research void by evaluating the role of AI in advancing students' emotional intelligence. This study employs bibliometric analysis, to synthesises prevailing literature and delineate emerging patterns, technological implementations, and unresolved obstacles at the AI-EI nexus. In addition to this, it examines the role of AI in facilitating students' emotional intelligence development in educational contexts. Bibliometric analysis to establish the existing body of knowledge and self-reflection data from 260 students of the university's Faculty of Education were used. The self-reflections were analysed using the content analysis method. As a result of the research, it was determined that the number of studies conducted after 2021 increased and that the studies most frequently contributed to SDG 3 (Good Health and Well-being). In line with the participants' opinions, it was concluded that artificial intelligence should be developed in perceiving emotions, and that artificial intelligence can provide personalised, empathy-oriented and guiding support while developing students' emotional intelligence. Moreover, the study underscores the significance of integrating AI-supported emotional intelligence development within the framework of sustainable education. By fostering students' social-emotional competencies, AI not only enhances individual well-being but also contributes to the broader agenda of sustainable development, particularly in promoting inclusive, equitable, and quality education (SDG 4) and ensuring good health and well-being (SDG 3). These findings highlight the potential of AI-driven emotional intelligence support systems to strengthen the resilience of future generations, thereby aligning with the goals of environmental sustainability and sustainable societal development.*

Keywords: artificial intelligence; emotional intelligence; learning; higher education.

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1. Introduction

Recent advancements in artificial intelligence (AI) have significantly permeated educational systems, reshaping pedagogical approaches, student engagement, and support mechanisms (Harry, 2023). Although AI has gained traction in adaptive learning, automated grading, and personalised tutoring, its implications for fostering emotional intelligence (EI) in learners remain a nascent area of research. EI, defined as the capacity to identify, interpret, and regulate one's emotions, as well as those of peers, is a critical determinant of academic achievement, psychological well-being, and social adaptability. With the growing complexity of digital learning platforms, the convergence of AI and EI presents a transformative avenue for cultivating students' socio-emotional skills (Melweth et al., 2023).

Progress in affective computing, emotion recognition algorithms, and AI-driven sentiment analysis has enabled novel methods for addressing students' emotional states. Contemporary systems leverage facial recognition, vocal tone analysis, and linguistic cues to deliver emotionally attuned feedback. Such innovations are increasingly embedded in virtual tutors, conversational agents, and adaptive learning interfaces, aiming to enhance self-awareness, emotional regulation, and empathic interactions. Nevertheless, empirical research on the efficacy of AI in nurturing EI within educational frameworks remains fragmented (Galindo-Domínguez et al., 2024).

This study addresses this research void by evaluating the role of AI in advancing students' emotional intelligence. Employing bibliometric analysis, it synthesises prevailing literature to delineate emerging patterns, technological implementations, and unresolved obstacles at the AI-EI nexus. The outcomes offer actionable insights for stakeholders, researchers, educators, and technology developers seeking to design emotionally responsive AI solutions that foster emotionally inclusive learning environments (Aggarwal et al., 2022).

The investigation seeks to uncover evolving patterns in artificial intelligence (AI) and emotional intelligence (EI) research by addressing fundamental questions in the field. Its academic value stems from advancing knowledge about AI applications in education, particularly regarding comprehensive learner development (Halimi et al., 2021). Given EI's established connections to educational outcomes, psychological health, and interpersonal adjustment, exploring AI's potential to strengthen these capacities represents a critical area of inquiry (Rehman et al., 2024). Furthermore, the study provides practical insights for educators, technology developers, and policymakers aiming to design emotionally intelligent AI systems that align with ethical and pedagogical principles.

Emotional intelligence has emerged as a field of intense interest in both scientific and non-scientific circles. Since emotionally intelligent individuals are socially effective, definitions of the concept in books and the popular press more generally include personality traits associated with personal and social functioning, which may or may not be related to skills and abilities. Scientific approaches have defined emotional intelligence in terms of mental abilities rather than broad social competencies (Bru-Luna et al., 2021). The reason why the paradigm of emotional intelligence is one of the concepts that have been focused on quite recently and considered important is that research findings that have emerged in the form that people with high emotional intelligence communicate more effectively with their surroundings, have high success rates, and can communicate better with superiors and subordinates are increasing gradually (Quílez-Robres et al., 2023).

Emotional intelligence affects how an individual manages their attitudes and actions, the role to be taken in the face of social situations, and how they make individual decisions that lead to positive results. Emotional intelligence is also a skill that is flexible, that is, it can be learned and developed. The physical pathway of emotional intelligence begins in the spinal cord. In order for a person to think logically about what they are experiencing, emotional information must be processed in higher-order cortical regions of the brain. However, information first passes through the limbic system, where emotions are felt. Emotional intelligence requires effective communication between the emotional and rational centres of the brain (Khassawneh et al., 2022).

According to Filice and Weese (2024), emotional intelligence is an area of competence that includes an individual's ability to be motivated, resist difficulties, postpone satisfaction by controlling impulses, and balance their emotional state. In addition, it supports the individual's ability to maintain cognitive functions in stressful and challenging situations, understand the perspectives of others through empathy, and develop a sense of hope. Emotional intelligence, acquired during childhood and open to lifelong development, gives individuals the capacity to regulate their emotions, establish healthy relationships with people, and cope effectively with difficulties. In addition, it plays an important role in future decision-making processes by enabling individuals to give balanced reactions to the situations they face (Gómez-Leal et al., 2022).

Empirical studies demonstrate that non-cognitive variables significantly influence academic achievement. The capacity for emotional recognition and regulation serves as a critical determinant of scholastic performance, environmental adaptation, and overall educational quality. Students exhibiting underdeveloped emotional competencies may experience emotional constraints that potentially hinder their academic progress. This established connection between emotional intelligence and educational outcomes enables educators to implement targeted interventions that simultaneously enhance both emotional skills and academic performance (Chaudhary et al., 2024).

Academic researchers have extensively examined the correlation between emotional intelligence and scholastic achievement. Current scholarship maintains a clear distinction between emotional intelligence and cognitive ability. This dichotomy - where academic success correlates with emotional intelligence while remaining conceptually distinct from cognitive intelligence - has generated substantial scholarly investigation into their interrelationship (Zhi et al., 2024).

In alignment with the principles of sustainability, the integration of AI-driven emotional intelligence development in educational settings contributes not only to individual growth but also to collective well-being and resilient societies. By equipping students with socio-emotional skills, AI technologies support the cultivation of empathy, cooperation, and ethical decision-making, all of which are essential for achieving sustainable societal progress. These competencies are directly connected to Sustainable Development Goal 4 (Quality Education), which emphasises inclusive and equitable lifelong learning opportunities as a foundation for sustainable development.

Furthermore, the research findings highlight that emotionally intelligent individuals are more capable of adapting to environmental and social challenges, thereby reinforcing the goals of sustainability education. Emotional intelligence nurtured through AI systems can encourage environmentally responsible behaviour, strengthen community engagement, and enhance problem-solving capacities in the context of climate change and global crises. Thus, embedding emotional intelligence education into AI-powered learning ecosystems may serve as a catalyst for developing environmentally conscious citizens who actively contribute to sustainability goals.

Finally, the intersection of AI, emotional intelligence, and sustainability underscores the need for ethically responsible and human-centred technological innovation. While AI can empower students by providing personalised emotional support, it must also align with broader frameworks of sustainable development, such as fostering equity, ensuring digital inclusion, and minimising ecological footprints in technological applications. Such alignment ensures that the advancement of AI in education not only enhances academic and emotional outcomes but also supports global commitments to environmental stewardship and sustainable development.

This research seeks to examine the applications of artificial intelligence (AI) in fostering emotional intelligence (EI) development within educational contexts. Although AI has been extensively implemented to provide customised and dynamic learning experiences, its potential to facilitate emotional maturation and enhance socio-emotional competencies has not yet been thoroughly investigated. This study bridges the existing research gap through a comprehensive bibliometric examination of scholarly works published from 1999 to 2025. In addition to bibliometric analysis, qualitative research methods were also used in this study. The research questions used in the qualitative research are as follows:

1. What is the relationship between artificial intelligence and emotional intelligence?
2. How can students' emotional intelligence be improved with artificial intelligence?

2. Methodology

2.1. Research Design

This research used mixed research design that both a bibliometric methodology and self reflection tasks provide to systematically examine the role of AI in facilitating students' emotional intelligence development in educational contexts (Yıldırım & Şimşek, 2018). The investigation used VOSviewer analytical software to conduct comprehensive data visualisation and thematic mapping, enabling the identification of predominant research trajectories and emerging scholarly discourse patterns in this interdisciplinary field. In addition to this, content analysis was used to analyse themes from self reflection tasks.

2.2. Data Collection

Academic literature was retrieved from Web of Science (WoS). Data was obtained in March 2025 as part of a bibliometric analysis. The keywords ‘artificial intelligence, emotional intelligence, learning, higher education’ were used for the literature review.

Only peer-reviewed journal articles and conference proceedings were used in this research. Inclusion criteria were as follows:

- Publication years between 1999 and 2025
- Peer-reviewed journal articles and conference proceedings
- English-language publications
- Studies addressing AI tools, emotional intelligence components, or emotional support in educational contexts

A total of 136 publications were included in the bibliometric analysis. All data were analysed using VOSviewer software. A methodological limitation is that the PRISMA flow chart was not used.

As a data collection tool in the qualitative scope of the study, a self reflection task form was prepared (Legard et al., 2003). In order to ensure the internal validity of the interview form, it was presented to the review of faculty members from the Department of Educational Sciences, Faculty of Education, in order to obtain expert opinions. In line with these opinions, the form was reorganised. After this, a pilot study was conducted by selecting a study group equivalent to the study group. In this way, it was determined whether the questions were clear and understandable, and whether the answers given reflected the answers to the questions asked.

2.3. Study Group

This study was conducted with 260 participants drawn from students of the university's Faculty of Education in April 2025. The individuals participating in this study were deliberately selected only from among Faculty of Education students. As each of them is a prospective teacher, it is assumed that they will be able to evaluate the relevance of artificial intelligence applications to the subject more thoroughly. However, as only faculty of education students were involved, the research is limited in terms of generalisability. Participants in the study were selected voluntarily. At the same time, the reliability of the information collected with this method is accepted as higher. This research is based on voluntary participation. Participants were provided with the necessary information about the purpose of the research they were about to participate in prior to the data collection process, and it was stated that they could withdraw from the study whenever they wished. Participants were coded to ensure anonymity, and no personal data was collected.

2.4. Data Analysis

The bibliometric data were imported into VOSviewer to conduct a co-occurrence analysis of keywords and map thematic clusters within the literature. The tool generated visualisations showing keyword relationships, citation networks, and thematic groupings. The frequency and distribution of keywords identified in this study were used to highlight the relative prevalence of the themes

Self reflection task forms were conducted with participants using the interview form, which served as the data collection tool for the analysis of qualitative data. According to the opinions of the participants, the answers given to each question were categorised and placed in tables. After this initial categorisation, the data were re-examined by the researcher and basic themes and categories were created. These themes and categories were reviewed again, considering the relevant literature, and the categories showing similar patterns were combined, while those showing differences were collected under separate categories and coded. The participants corresponding to these categories were written in a numbered manner next to them. In the results section, sentences extracted from the categories were written as examples. The data obtained from the answers to the research interview questions were analysed using content analysis.

In content analysis, data are analysed in four stages (Yıldırım & Şimşek, 2018). The first of these is coding the data, the second is finding the themes, the third is organising and defining the data according to codes and themes, and the fourth is interpreting the findings.

2.9. Reliability of the Research

The reliability formula suggested by Miles and Huberman (1994) was used to calculate the reliability of the research, and the average was 91%. Reliability calculations above 70% are considered reliable for the research (Miles & Huberman, 1994). The result obtained in this study was considered reliable for the research. The codes that showed agreement among the researchers were taken as the basis for identifying the themes.

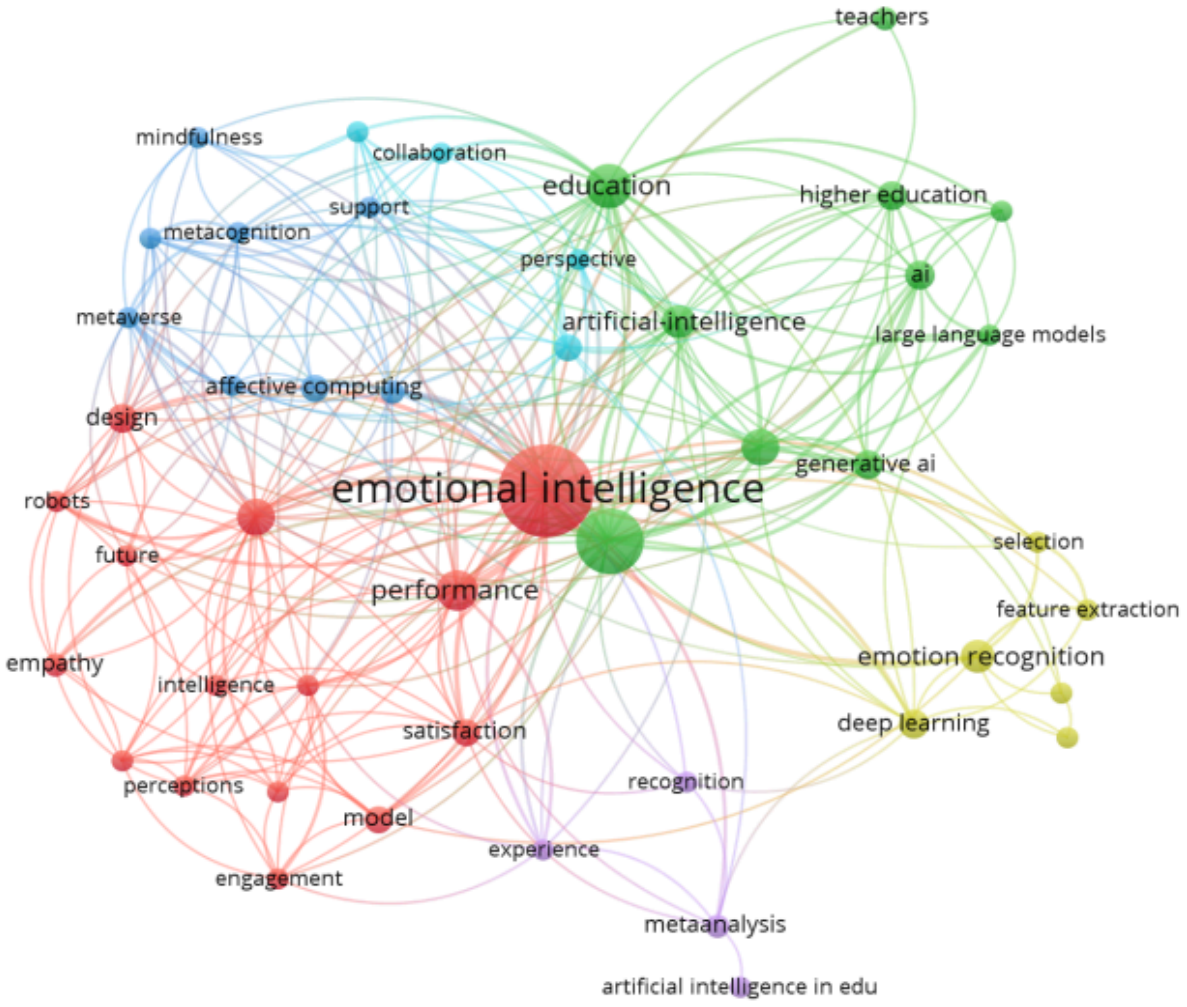
3. Findings

3.1. Authors

This image is a network map showing the academic collaborations of certain authors with each other. Links between authors reflect joint publications or research projects. Augereau-Landais, Myriam, Bourgeois-Bougrine, Samira, Burkhardt, Jean-Marie are the authors with the most connections, being located at the centre of the network, which shows the importance of these authors within the research network.

Authors such as Dai, Wehui constitute important nodal points in the network. This map highlights the central role of authors such as Dorofey and Babiak in the research network, while showing that other authors have more specific collaborations.

3.2. Keywords



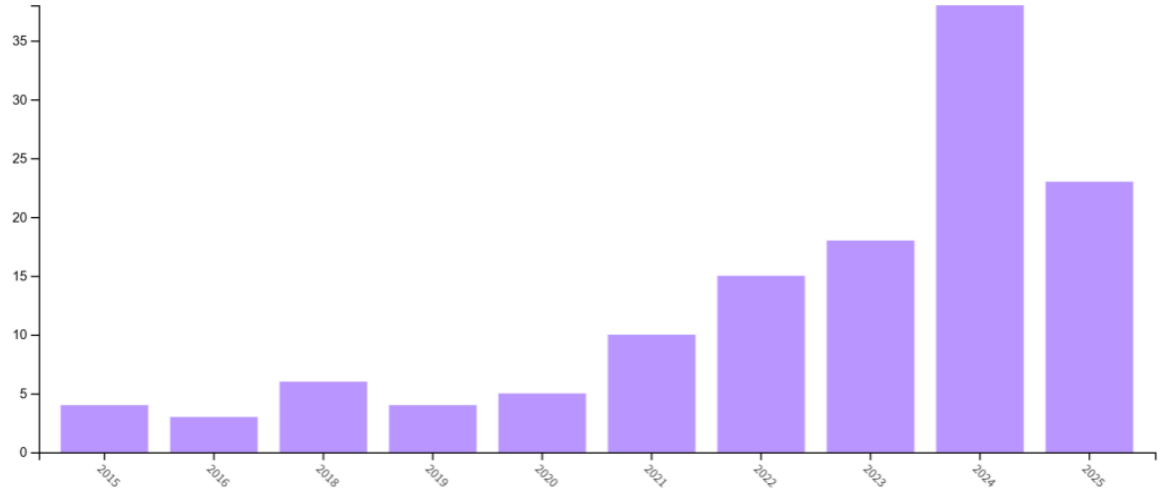
Applications in the field of education are ranked in the third and fourth places, along with the concepts of "education" and "performance". These findings reflect the growing academic interest in the integration of artificial intelligence technologies into education systems and their impact on learning outcomes. Finally, the fact that "ChatGPT" ranks fifth on the list shows the reflection of the recent rise of large language models and productive artificial intelligence in the research world.

The strong links between these keywords indicate that interdisciplinary studies focusing on the performance-enhancing effects of emotional intelligence-based artificial intelligence applications in the field of education are becoming increasingly widespread recently. Most of the studies are looking for answers to the question of how technological developments can be integrated with human-centred approaches. These trends indicate that artificial intelligence research is evolving in a direction that increasingly takes into account human factors.

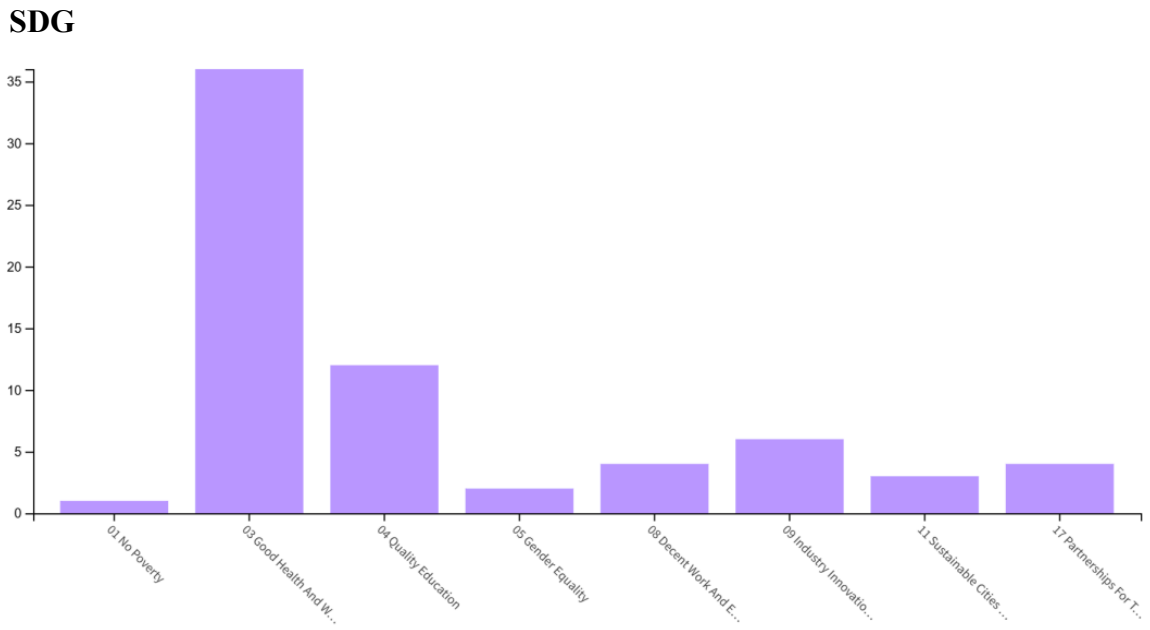
3.3. Country

This image is a network map showing the academic collaborations of certain countries. Links between countries reflect collaborations, such as joint publications or research projects. It can be seen that "People's Republic of China", "Australia" and the "USA" are located at the centre of the network and have the most connections. This situation shows the central position of these countries in global academic networks. Countries such as "Spain, Italy" and "Canada" constitute important nodal points in the network. Countries such as "Malaysia", "Pakistan" and "Saudi Arabia" are located on the periphery of the network, indicating more limited cooperation. This map reveals that countries such as China, the United States and Australia are leading the way in academic collaborations, while other countries are focusing on more regional or specific collaborations.

3.4. Publication Years



It illustrates how academic publications follow a trend over the years. According to the data, a significant increase has been observed since 2021; this increase has reached its peak especially in 2023-2024. This can be related to the increasing importance of digital solutions for distance education, digital guidance and student psychology in the post-COVID-19 period. In addition, the increasing number of Generative AI tools after 2022 and the research conducted on the emotional response capacities of these tools have led to a rapid increase in academic interest.



It illustrates which themes are related to the United Nations Sustainable Development Goals (SDGs) within the framework of the studies addressing the role of artificial intelligence and emotional intelligence in education. The results reveal that the theme of SDG 3: Health and Well-being (Good Health and Well-being) is the most commonly associated area. It shows that artificial intelligence-based systems are addressed in a way that supports students' psychological well-being, emotional state and stress management. SDG 4: Quality Education, SDG 9: Industry, Innovation and Infrastructure, and SDG 17: Partnerships for the Goals are other noteworthy themes. This distribution reveals that artificial intelligence systems supported by emotional intelligence contribute not only to academic success, but also to students' social and emotional development, social inclusiveness and innovation in education.

The findings of the research were analysed to answer each research question and the results of these analyses are given below in order.

Findings regarding the relationship between artificial intelligence and emotional intelligence

The findings regarding the relationship between artificial intelligence and emotional intelligence according to the opinions of the stakeholders are presented in Table 1.

Table 1. Findings regarding the relationship between artificial intelligence and emotional intelligence.

Category	Themes	Frequency (f)	Percentage (%)
Thoughts on the findings regarding the relationship between artificial intelligence and emotional intelligence according to stakeholders' views	Although the concepts of artificial intelligence and emotional intelligence are different, they can interact in a way that supports each other,	155	% 59.61
	Within the scope of providing tools for people to develop their emotional intelligence, artificial intelligence can perform emotional analysis through artificial intelligence and interact with emotional intelligence through voice and facial expressions, videos and scenarios, and virtual tools.	190	% 73
	In order to provide "emotional intelligence" to Artificial Intelligence systems, the relationship between them should be improved by making progress in perceiving emotions such as facial expressions, tone of voice, and word choice.	98	% 37.7
	Artificial intelligence is an effective tool for developing people's emotional intelligence, and it is necessary to provide limited emotional intelligence capabilities to artificial intelligence systems and make human-machine interaction more natural and efficient.	123	% 47

According to stakeholders' views,selected p participant opinions regarding the findings obtained within the scope of the thoughts regarding the relationship between artificial intelligence and emotional intelligence are presented below.

> K(75) “In my opinion, I can say that in order to provide “emotional intelligence” to artificial intelligence systems, development should be made in terms of perceiving emotions such as facial expressions, tone of voice, and word choice, and the relationship between them should be improved.”

> K(238) “In my opinion, I think that artificial intelligence is an effective tool in developing people's emotional intelligence through artificial intelligence, and that it is necessary to provide limited emotional intelligence capabilities to artificial intelligence systems, and to make human-machine interaction more natural and efficient.”

Stakeholders believe that while artificial intelligence and emotional intelligence are conceptually different, participants suggest that they can engage in a mutually beneficial way.

From the views of the participants, it is clear that artificial intelligence can engage with emotional intelligence via voice and facial expressions, scenarios, videos, and virtual resources by conducting emotional analysis through AI to equip individuals with tools to enhance their emotional regulation capacity.

The findings reflect that the participants in the study view artificial intelligence not as a technological product that replaces emotional intelligence, but rather as a tool that can support emotional interactions.

Dimension II: Findings on how to develop students' emotional intelligence with artificial intelligence

The findings on how to develop students' emotional intelligence with artificial intelligence according to the opinions of the stakeholders are presented in Table 2.

Table 2. Findings on how to develop students' emotional intelligence with artificial intelligence.

Category	Themes	Frequency (f)	Percentage (%)
Thoughts on the findings on how to improve students' emotional intelligence with artificial intelligence according to stakeholders' views	Ensuring the development of emotional intelligence as a result of analysing students' moods and making comments to educators and students through artificial intelligence-supported facial recognition and voice analysis,	155	% 59.6
	Improving the emotional intelligence of especially introverted students by creating artificial intelligence-supported chat programs that can empathise with students and improve their emotional intelligence,	190	% 73
	Providing students with opportunities to develop emotional intelligence through videos, games and appropriate scenarios on topics such as empathy, awareness and anxiety disorder through artificial intelligence,	98	% 37.6
	Developing programmes that will enable students to write down what they experience and feel during the day through artificial intelligence, and for artificial intelligence to interpret these and support the development of students' emotional intelligence. In addition, developing programmes that will allow teachers to analyse the emotional intelligence of the class through artificial intelligence.	123	% 47

According to stakeholders' views, selected participant statements illustrating the findings on how to develop students' emotional intelligence with artificial intelligence are presented below.

In the theme of providing students with opportunities to develop emotional intelligence through videos, games and appropriate scenarios on topics such as empathy, awareness and anxiety disorder through artificial intelligence, K(144)"In my opinion, I can say that students should be provided with the opportunity to develop emotional intelligence with videos, games and appropriate scenarios on topics such as empathy, awareness and anxiety disorder through artificial intelligence."
In the last theme, K(224)"In my opinion, I think that students should be provided with the opportunity to write down what they experience and feel during the day and that artificial intelligence should interpret these and support the development of students' emotional intelligence."

Stakeholders believe that emotional intelligence can be enhanced by assessing students' emotions via AI-driven facial recognition and voice analysis, offering insights to teachers and students.

It is understood from the participant's views that studies should be carried out to develop the emotional intelligence of especially introverted students by creating artificial intelligence-supported chat programmes that can empathise with students and develop their emotional intelligence. They stated that students should be provided with the opportunity to develop emotional intelligence with videos, games and appropriate scenarios on topics such as empathy, awareness and anxiety disorder through artificial intelligence. When looking at participants' views, it has been stated that artificial intelligence does not affect emotional intelligence development through direct interventions, but rather can support this development through supportive and similar learning environments.

4. Conclusion

This study comprehensively reveals academic trends in the field of education at the intersection of artificial intelligence and emotional intelligence and their relationship to the Sustainable Development Goals. The increase in publications that became evident after 2021 shows that the interest in digital education solutions and artificial intelligence applications that support

student psychology is increasing, especially in the post-COVID-19 period. This trend, which peaks in 2023–2024, proves that research on the emotional response capacities of generative artificial intelligence tools is gaining momentum (Devasena, 2024).

One of the most remarkable findings of the study is that 42% of the research is associated with the SDG 3: Health and Well-Being. This situation highlights the critical role of artificial intelligence-based systems in supporting students' psychological well-being. SDG 4: Quality Education (28%) and SDG 9: Strong links with Industry, Innovation and Infrastructure (18%) reveal the transformative effect of these technologies in education.

While the analysis of country collaborations confirms the leading position of China, the USA and Australia in this field, author networks reveal the importance of interdisciplinary studies. In particular, the central role of researchers such as Augereau-Landais, Myriam, Bourgeois-Bougrine, Samira, Burkhardt, Jean-Marie sheds light on methodological developments in the field.

In conclusion, the findings not only demonstrate the potential of AI to foster students' emotional intelligence but also highlight its relevance to sustainable development. By promoting empathy, cooperation, and resilience, AI-supported EI contributes to shaping individuals who are better prepared to address global environmental and social challenges. Thus, integrating emotional intelligence into AI-driven educational systems has the potential to support both individual well-being (SDG 3) and inclusive, quality education (SDG 4), while indirectly reinforcing environmental stewardship and sustainable societal development.

In this context, according to the opinions of the stakeholders, although the concepts of artificial intelligence and emotional intelligence are different, we can say that they can interact in a way that supports each other. This result overlaps and parallels with the results of the research of Fullan et al. (2024).

In particular, it is understood from the participant opinions that artificial intelligence can interact with emotional intelligence through voice and facial expressions, videos and scenarios, and virtual tools within the scope of providing tools for people to develop their emotional intelligence. In addition to these, we can say that in order to provide "emotional intelligence" to artificial intelligence systems, development should be made in terms of perceiving emotions such as facial expressions, tone of voice, and word choice and the relationship between them should be improved according to the participant's opinions.

As it is similar to the results of Galindo-Domínguez et al. (2024), it is understood from the participant's views that artificial intelligence is an effective tool in developing people's emotional intelligence, that there is a need to provide limited emotional intelligence capabilities to artificial intelligence systems and to make human-machine interaction more natural and efficient.

The views of the stakeholders, it can be said that emotional intelligence can be developed as a result of analysing students' moods with artificial intelligence-supported face recognition and voice analysis and making comments to the students by educators. This result is parallel to the results of Judijanto et al. (2024). It is understood from the participant views that studies should be carried out to develop the emotional intelligence of especially introverted students by creating artificial intelligence-supported chat programmes that can empathise with students and develop students' emotional intelligence (Rahiman & Kodikal, 2024).

In the light of these findings, the following suggestions can be made for future research:

1. Development of intercultural emotional intelligence models
2. In-depth examination of artificial intelligence ethics and data privacy issues
3. Longitudinal studies that conduct long-term impact assessments
4. Artificial intelligence integration strategies in teacher education

This research demonstrates the potential of AI-supported emotional intelligence applications for both education systems and global development goals, while suggesting a multidisciplinary research agenda for future studies. In this new era where technological advances are integrated with

human values, strengthening the collaboration between educators, policymakers, and technology developers is of great importance.

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