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Future of Artificial Intelligence Applications in Education: Pedagogical Integration, Fairness and Algorithmic Transparency Perspective

Ipek Maasoglu
Near East University, Atatürk Faculty of Education, Division of Curriculum and Instruction, Nicosia, North Cyprus, Via Mersin 10, Turkey
ipek.maasoglu@neu.edu.tr
https://orcid.org/0009-0003-4115-0486

Didem Islek
Near East University, Atatürk Faculty of Education, Division of Curriculum and Instruction, Nicosia, North Cyprus, Via Mersin 10, Turkey
didem.islek@neu.edu.tr
https://orcid.org/0000-0002-4056-8894

Abstract: *This research examines how AI-powered educational technologies are perceived by academic staff in higher education. The study highlights issues of pedagogical integration, ethical implications, and transparency. Using a phenomenological design from qualitative research, semi-structured interviews were conducted with 90 faculty members. The findings reveal that AI-supported applications facilitate personalised learning, increase student motivation, and improve time efficiency in teaching processes. The results also highlight the automation of repetitive tasks and the alleviation of teaching workload through targeted feedback. However, participants also expressed concerns such as a lack of algorithmic transparency, data uncertainty, and limited support for complex pedagogical tasks by AI. The research emphasises the need for systematic and ethically conscious integration of AI into education. It also points to the importance of future research on algorithmic literacy, pedagogical compatibility, and ethical use.*

Keywords: *pedagogical integration; use of artificial intelligence in education; algorithmic transparency; fairness, personalised learning.*

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1. Introduction

Digitisation undertakes essential roles for education systems as it does in every field of social life in the 21st century. In this context, developments in artificial intelligence (AI) technologies have affected educational practices in education positively. For example, these technologies overcome the limitations of traditional education systems and enable the popularisation of personalised and data-driven learning approaches (Luckin et al., 2016; Holmes, Bialik, & Fadel, 2022). These technologies also make a huge contribution to lifelong learning. AI-based learning applications offer adjusted content based on individual learning needs of students. As a result, the learning process is realised in a more effective, interactive, and motivated manner (Zawacki Richter et al., 2019). Thanks to these educational technologies, each student can have the opportunity to progress according to his or her potential considering his or her individual learning pace and style (Varol, 2025). In addition, this technology accelerates the operation of feedback mechanisms, which reportedly adds dynamism and interaction to learning processes, increases student motivation, and ensures permanence of learning (Holstein, McLaren & Aleven, 2019). The use of artificial intelligence in education systems deserves careful examination as regards its pedagogical, ethical and social dimensions (Dignum, 2018). In this sense, respecting such principles as pedagogical integration, algorithmic transparency and fairness is essential as regards effective and fair use of artificial intelligence applications (Williamson & Piattoeva, 2020). For instance, related research mentions that lack of transparency in decision-making processes of artificial intelligence systems can lead to trust issues between educators and students which in turn can raise ethical concerns (Holstein, McLaren & Aleven, 2019). On the other hand, artificial intelligence algorithms used in education are compromised by biases, which can affect the fairness and inclusivity targets of education (Crawford, 2021). Artificial intelligence technologies have pedagogical importance. Their compatibility with current education technologies and approaches and the contributions they make to learning processes are essential topics to address. In this context, related research argues that artificial intelligence-supported technologies can be used by integrating them with pedagogical approaches such as learning by doing and living, student-centred learning, and personalised teaching (Woolf, 2010). Likewise, there are prejudices regarding artificial intelligence algorithms that are integrated into education. Within this scope, there is criticism that fundamental educational elements such as teacher guidance, emotional interaction and critical thinking are not sufficiently supported by artificial intelligence systems (Baker & Inventado, 2014). The first step to avoid this problem is that effective use of artificial intelligence should be based on pedagogical foundations. In addition, adequate professional development opportunities should also be offered so that teachers can utilise these technologies effectively (Özdere, 2024). In light of this information, it is essential that the perceptions, experiences and needs of lecturers as regards these applications are comprehensively examined so that artificial intelligence can be sustained and efficiently used in education. In this regard, one critical step is to integrate these technologies into educational settings effectively and to constantly improve the application processes (Kulik & Fletcher, 2016). Moreover, encouraging interdisciplinary cooperation schemes makes an essential contribution both pedagogically and technically to the artificial intelligence technology development processes (Holstein, McLaren & Aleven, 2019). Within this scope, the aim of this study is to examine in a multidimensional manner the pedagogical integration of artificial intelligence-supported educative technologies within the framework of algorithmic transparency and fairness principles. In this context, detailed investigation of perceptions, experiences and needs of educators as regards these technologies using a phenomenological approach is viewed as significant for addressing this gap in the relevant literature. It should also be noted that the findings of the study could provide some input in the shaping of education policies as well as the planning of professional development programmes for educators. Last but not least, it is believed that discussing the effectiveness of algorithmic transparency and fairness in education technologies will promote the creation of more equitable, reliable and inclusive learning settings. This study contributes by bridging the gap between AI's technical affordances and its ethical-pedagogical implementation, providing a systematic analysis of

faculty perspectives on how algorithmic transparency and fairness directly impact pedagogical integration in higher education.

2. Literature Review

2.1. Pedagogical Integration

The effective use of AI-driven systems in education depends not only on technological capacity but also on teaching approaches, teacher qualifications, and student needs (Luckin et al., 2016; Holmes, Bialik, & Fadel, 2022). However, Zawacki-Richter et al. (2019) show that current studies generally focus on technical aspects; pedagogical and didactic dimensions are not adequately addressed. This creates a significant gap that prevents in-depth examination of AI integration in classroom practices. Furthermore, Woolf (2010) emphasises the importance of professional development programmes, pointing to the need for training for instructors to effectively utilise these systems.

2.2. Fairness and Algorithmic Transparency

The use of AI brings with it ethical responsibilities; algorithmic bias, data-driven discrimination, and lack of transparency are major problems (Binns, 2018; Selwyn, 2019). The current literature shows that algorithms are often presented as unbiased and objective, but the principle of fairness can be violated due to a lack of transparency in data collection and processing (Williamson & Eynon, 2020; Kuang et al., 2025). Lack of transparency reduces user trust and hinders pedagogical integration (Lawal, 2021). This gap highlights the need for AI-powered systems to be designed in an ethically and pedagogically sustainable manner. For example, the ARCHED model (Baker & Inventado, 2014) offers a human-centred, transparent, and controllable AI design framework.

Despite the optimistic discourse surrounding AI's potential to enhance personalized learning, the literature also presents significant critical perspectives that challenge this consensus. Some scholars argue that the excessive reliance on AI-driven platforms may lead to 'pedagogical reductionism,' where complex human interactions are reduced to data-driven metrics, potentially undermining the professional autonomy of educators (Selwyn, 2019). Furthermore, the promise of inclusivity is often countered by concerns regarding algorithmic bias, which can reinforce existing social inequalities and marginalize certain student groups through data-driven profiling (Noble, 2018; Eubanks, 2018). While AI is credited with reducing workload, divergent viewpoints suggest it may instead create a 'digital labor' paradox, requiring teachers to perform constant oversight and data management, which shifts their role from pedagogical mentors to system monitors (Knox, 2020). Addressing these tensions is crucial for a balanced understanding of AI's future in higher education.

2.3. Importance of the Study

Rapid popularisation of artificial intelligence technologies in education raises the question of how these systems should be evaluated in pedagogical, ethical, and social terms. This study fills an important gap by examining academic views on AI-driven systems, especially in the context of pedagogical integration, algorithmic transparency, and fairness principles. While previous studies have primarily addressed these dimensions separately, this study approaches them as interrelated and mutually reinforcing elements emerging from the practical experiences of teaching staff. The study offers concrete examples of how artificial intelligence can be used in education more effectively, ethically, and inclusively. It also contributes to shaping education policies, planning teacher education, and improving technological applications. In addition, it emphasises the risks created by the lack of transparency and algorithmic biases in decision-making processes and aims to raise awareness of making artificial intelligence applications more reliable and fairer. Against this background, the study makes an important contribution to education systems undergoing digital transformations at both theoretical and practical levels.

2.4. A Multidimensional Framework for Ethical and Pedagogical AI Integration

This research does not treat pedagogical integration, algorithmic transparency, and the principles of justice as independent concepts. Instead, it proposes a multidimensional framework by highlighting the important role of these dimensions in the sustainable use of artificial intelligence in higher education. In this context, pedagogical integration is considered as a practical approach, algorithmic transparency as a mechanism for building trust, and justice as the normative foundation guiding ethical decision-making processes. In this research, the dimensions of pedagogical integration, algorithmic transparency, and equality are studied in relation to and in interaction with each other, as shown in Figure 1. A literature review conducted within the scope of this research revealed that many studies have addressed these dimensions separately. However, this research has combined all three dimensions under a holistic conceptual model.

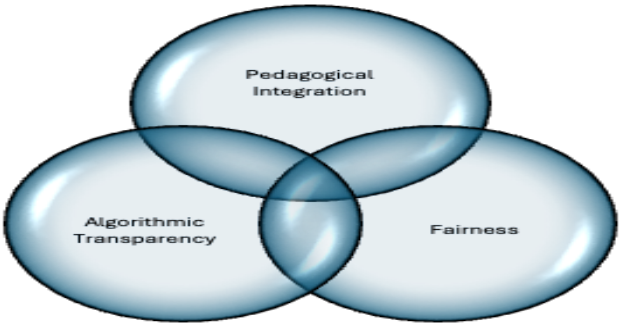

Figure 1. Interactions among Pedagogical Integration, Algorithmic Transparency, and Fairness in AI-Supported Education

3. Objective of the Study

The purpose of this study is to provide a multidimensional evaluation of the use of artificial intelligence in education within the framework of pedagogical integration, algorithmic transparency, and fairness principles. In this context, the study aims not only to examine lecturers' perceptions from a multidimensional perspective, but also to develop a holistic conceptual framework that interrelates pedagogical integration, algorithmic transparency, and fairness based on lecturers' practical experiences.

Within this scope, the following research questions have been suggested:

1. What are the views of lecturers as regards the usage of AI-driven systems in educational practices?
2. What are the views of lecturers as regards compatibility of AI-driven systems with current pedagogical theories?
3. What are the views of lecturers as regards effective strategies that can support the pedagogical integration principle in the process of adapting AI-driven systems to teaching environments?
4. What are the views of lecturers as regards ensuring algorithmic transparency in AI-driven systems?

4. Research Method

This study was conducted using a qualitative research design. The lecturers' views on the pedagogical integration, algorithmic transparency, fairness and inclusiveness dimensions of AI-driven systems were explored through phenomenological methods. This design focuses on the examination of phenomena that emerge in different forms including but not limited to the experiences, perceptions and attitudes of individuals and the situations they encounter, which should be comprehended in an in-depth and detailed manner (Yıldırım and Şimşek, 2018).

For this reason, the phenomenological method was preferred with a view to obtaining in-depth understanding of subjective experiences, individual perceptions and semantic worlds as

regards AI-driven systems. The phenomenological approach was chosen as the method for deeply examining the experiences and perceptions of lecturers regarding AI-assisted educational technologies. During the analysis process, the bracketing method was used to disregard researcher biases and allow for the interpretation of participants' statements within their own contexts. This process went beyond mere descriptive coding, enabling a multidimensional and holistic understanding of participants' experiences.

However, the fact that the sample group was selected from Near East University means that the findings obtained in this research cannot be generalised to other higher education institutions, which reveals the limitations of the study. Nevertheless, the richness of the phenomenological data and the systematic coding processes offer valuable information about the experiences of the lecturers.

4.1. Sample Group of the Study

The sample group of the study consisted of 90 lecturers working at various faculties of Near East University. The sample was selected using criterion sampling, a purposive method that ensures individuals meeting predetermined criteria are chosen (Marshall & Rossman, 2014; Nyimbili & Nyimbili, 2024). The first criterion was that lecturers actively use AI-driven systems in their classes. This criterion was adopted to ensure that the sample could provide in-depth, information-rich insights on the pedagogical integration, algorithmic transparency, and fairness of AI applications. While the study focused on a single university in Northern Cyprus, which limits the generalisability of findings, this approach allows for a deeper understanding of lecturers' perceptions within their specific cultural and institutional context. Future research could expand to other universities, countries, or disciplines to validate and extend these findings.

4.2. Collection and Analysis of Data

A comprehensive review was conducted in national and international databases to identify the studies on the application of AI-driven systems in teaching and learning contexts. This review highlighted the inadequacy of studies that address intertwined topics such as pedagogical integration, algorithmic transparency, and fairness in a holistic manner. As a result, in order to generate fit-for-purpose qualitative data, the researcher developed a semi-structured interview protocol which aimed to reveal the views of lecturers as regards these critical dimensions of artificial intelligence in education. In the presentation of findings, numerical values (frequencies and percentages) are provided alongside qualitative descriptors to ensure clarity. As individual lecturers often expressed viewpoints spanning more than one thematic category, the frequencies reported in the tables reflect multiple coding. Therefore, the total number of frequencies may exceed the total number of participants (n=90).

4.2.1. Semi-Structured Interview Form

The semi-structured interview form consists of four open-ended questions in total. The first section of the form explores the demographic information of the participants, and the second part includes questions related to the objectives of the study. During the preparation phase of interview questions, six artificial intelligence experts (n=6), as well as specialists on curriculum development (n=4) and measuring-evaluation (n=5) were consulted to assess the scope and validity of the questions. The content validity index (CVI) technique developed by Lawshe (1975) was used to evaluate these expert opinions. Categories were formed with options such as "I understood a little" and "I did not understand at all" in order to measure the level of intelligibility , and boxes were provided under items that were difficult to understand so as to receive expert suggestions. Each item was analysed according to the determined categories. As a result of these analyses, the content validity ratio of the interview form was found to be +1, indicating that the form had high validity (Lawshe, 1975). Necessary corrections were made according to the feedback received from the

experts before the form was finalised. Each interview with a lecturer took approximately 30 to 40 minutes and was conducted face-to-face.

4.2.2. Data Analysis

The data obtained in the study were analysed using descriptive analysis methods as required by qualitative research. Yıldırım and Şimşek (2018) defined descriptive analysis as systematic and meticulous coding, categorisation and organisation of qualitative data in accordance with a preset theoretical or conceptual framework. At this stage, the collected data are fragmented so as to reveal meaningful themes and patterns. Coding was conducted independently by two researchers; emerging themes were then compared and reconciled through discussion to ensure consistency and minimise bias. At the second stage, these themes are defined, analysed and interpreted in detail in line with the objectives of the study. Findings obtained at this stage are enriched using representative quotations from the original expressions of the participants and organised in explanatory tables so that the readers can have a better understanding of the data. This endeavor ensures that data are presented systematically and interpreted in-depth. This method supports the reliability and validity of the study and makes sure that the perspectives of the participants are reflected in a comprehensive and holistic manner. The qualitative data were analyzed using the thematic analysis method proposed by Braun and Clarke (2006). The process of category derivation followed a systematic six-step approach: (1) familiarizing with the data, (2) generating initial codes for key concepts such as 'personalized learning' and 'algorithmic bias', (3) searching for potential themes by grouping related codes, (4) reviewing themes against the entire data set, (5) defining and naming the final categories, and (6) producing the report. To ensure reliability, the coding process was cross-checked by two researchers, and consensus was reached on the final thematic structure presented in the findings.

4.2.3. Validity and Reliability

Three basic strategies were used in order to secure the internal validity (accuracy) of the study. First, expert verification was performed which included sharing the interview transcriptions with participant lecturers and receiving their approval to verify the accuracy of the recorded data. Second, methodological triangulation was conducted by using multiple data sources. To realise this, interviews were conducted with lecturers from different disciplines and geographical regions, which increased the scope and depth of the data. Third, the thematic framework for the interview protocol and data analysis was subjected to the scrutiny of two specialists and necessary revisions were made based on their feedback. As regards reliability, the coding process was performed independently by two experts, which was followed by a comparative analysis to evaluate the concordance between coders. The concordance value was found to be 87%, indicating a high level of consistency which reinforced the reliability of the coding procedure.

5. Findings

Findings as regards the sub-objectives determined within the scope of the study are presented below.

5.1. Findings Regarding Lecturers' Opinions on the Use of AI-Driven Systems in Educational Practices

In accordance with the first sub-objective of the study, the views of lecturers on the use of intelligent learning technologies in educational practices are presented in Table 1.

Table 1. Lecturers' views on artificial intelligence-supported educational technologies in the instructional processes

Views	Interpretive Summary	Frequency Distribution (f) (%)
Providing a teaching environment suitable for personalised learning	AI-powered tools were found to be adaptable and customisable in terms of content by participants. It was also noted that they enabled an individualised learning pace, allowing instruction to respond more effectively to students' diverse learning needs.	39 (%43.3)
Ensuring an increase in motivation levels	Participants described artificial intelligence applications as interactive and active learning environments that increase engagement and motivation to learn.	18 (%20.0)
The ability to provide instant feedback	Participants emphasised that AI-powered educational technologies provide rapid feedback and allow for the evaluation of student performance. They also noted that they help in adjusting learning strategies in a timely manner.	16 (%17.8)
Ensuring time savings	Participants stated that AI-powered applications save time and increase teaching efficiency. They also emphasised that educators can offer more individualised support to students.	7 (%7.8)
Ensuring accessibility with ease	Participants stated that artificial intelligence technologies increase accessibility by eliminating time and space limitations.	6 (%6.7)
The existence of trust issues	Participants also expressed concerns about data privacy and the lack of transparency in decision-making processes.	4 (%4.4)

As Table 1 indicates, a significant portion of lecturers (n=39, 43.3%) stated that intelligent learning technologies provided teaching settings suitable for personalised learning. One example of this phenomenon is given below:

"*Thanks to using artificial intelligence in learning-teaching environments, I can create content customised to the individual needs of every student. I can plan activities suitable for the learning speed and level of my students using artificial intelligence integration*." (L 81)

In addition, some lecturers (n=18, 20.0%) stated that these technologies significantly contributed to the motivation level of students. Below is a sample expression.

"*I believe that intelligent learning technologies significantly increase the motivation of students during instruction. These technologies offer the students the opportunity to experience classes in a more interactive manner. Compared to conventional methods, artificial intelligence technologies offer a more dynamic and interesting learning environment and considerably increase the enthusiasm and participation of students in class. This increase in motivation has a potential for directly reflecting on academic achievements*."(L 44)

On the other hand, other lecturers (n=16, 17.8%) stated that artificial intelligence applications provided an important contribution in the form of instant feedback. One example of this view is given below.

"*Artificial intelligence-based applications ensure that students can review their performance instantly and develop an awareness of the subjects that they lag behind. As a result, the learning process becomes more effective. In addition, instant feedback bears importance in ensuring the sustainability of learning.*" (L23)

Furthermore, a group of lecturers (n=7, 7.8%) emphasised that AI applications allow for more efficient use of time during instruction. In this context, an example of these views is provided below.

"*Artificial intelligence-supported applications facilitate time management during instruction processes and make sure that the curriculum content is completed in a faster and more effective manner. This, in turn, allows for the students to reinforce their learning and create additional time for more activities, resulting in more efficient teaching processes."* (L89)

Regarding accessibility, some participants (n=6, 6.7%) noted that these tools enhance equality of opportunity. An example of this perspective is given below.

"*Artificial intelligence-based applications can be easily reached through digital devices such as computers, tablets and smartphones, which allows for students to participate in the learning process at any time and place they want. Thus, students with different socioeconomic and individual conditions can take part in the instructional process more effectively, which contributes to equality of opportunity in education."* (L13)

Finally, a limited number of lecturers (n=4, 4.4%) argued that these applications can lead to certain security issues.One example of this view is provided below.

"*Employment of artificial intelligence-based applications in education processes offers several advantages. However, uncertainties regarding data confidentiality and the decision-making schemes employed by these systems have raised some concerns. For example, there is not enough transparency as to how the personal and performance data of students regarding learning processes are collected, stored and used, which implies some ethical issues. In addition, decision-making mechanisms of artificial intelligence are usually not disclosed to the users, which adds to the uncertainties about the working styles of these systems."* (L38)

Findings regarding the use of artificial intelligence-based applications in educational processes indicate that the majority of lecturers believe that artificial intelligence-based applications make positive contributions to learning-teaching processes. It has been observed that these applications offer personalised learning settings, allow for the design of effective teaching processes adjusted to the personal needs of the students, and increase their motivation. In addition, it was found that these applications facilitate feedback and time management and increase the effectiveness of learning processes. These applications can be accessed via a variety of digital devices, which expand participation within learning contexts and support the inclusiveness of education. However, some lecturers indicated concerns about data security and transparency, and it was stated that uncertainties as regards the collection, storage and usage of personal and performance data lead to ethical problems. These results show that besides the potential benefits of intelligent learning technologies, attention should be paid to the data security and ethical issues.

5.2. Findings on the Views of Lecturers as Regards the Compatibility of AI-Driven Systems with Contemporary Pedagogical Theories

In accordance with the second sub-objective of the study, the opinions of lecturers on the compatibility of intelligent learning technologies with contemporary pedagogical theories are presented in Table 2.

Table 2. Lecturers' views on the compatibility of artificial intelligence-supported educational technologies with contemporary pedagogical theories

Views	Interpretive Summary	Frequency Distributionn (f) (%)
Compatibility with the constructivist approach	Participants emphasised that while AI tools contribute to constructivist learning through problem-solving methods, these tools should not replace student-centred activities.	45 (%50)
Compatibility with personalised learning	Participants stated that artificial intelligence technologies contribute to a personalised learning model, which in turn increases student motivation and participation.	24 (%26.7)
Limitations in pedagogical adaptation	Participants noted that some AI tools need to be aligned with learning objectives and curricula.	15 (%16.7)
Restriction of higher-order thinking skills	Some participants noted that AI applications encourage rote learning, potentially limiting students' opportunities to engage in higher-order cognitive processes such as critical thinking and problem-solving.	6 (%6.7)

As suggested by Table 2, half of the lecturers (n=45, 50.0%) stated that AI-driven systems are compatible with contemporary pedagogical theories, especially in the context of the constructivist approach. An opinion exemplifying this finding is given below.

"*Artificial intelligence has personalised learning by allowing students to learn and repeat at their own pace. However, I believe that more interaction and guidance is needed to develop higher-order thinking skills*." (L 42)

In addition, in line with the second sub-objective, some lecturers (n=24, 26.7%) argued that AI-driven systems offered personalised learning opportunities and thus they were compatible with contemporary pedagogical approaches. A sample statement is given below:

"*Artificial intelligence-based teaching instruments offer personalised content which takes into account individual differences, and this ensures that each student can manage the process according to their pace and method*." (L 86)

On the other hand, several lecturers (n=15, 16.7%) noted limitations in pedagogical adaptation, stressing the need for alignment with curricula. In this context, it was argued that these technologies which focus on information-presenting and fast-responding prevent students from participating in higher-order cognitive processes including analysis, synthesis and assessment. Below is an example of this perspective:

"*I believe that artificial intelligence applications are beneficial in presenting information. However, when it comes to understanding student mistakes and helping them learn different ways of thinking, they are not as effective as teacher guidance, and they lower the efficiency level of [the] learning process*." (L 56)

Finally, a small group of lecturers (n=6, 6.7%) expressed the view that intelligent learning technologies might restrict higher-order thinking skills by focusing on fast responses rather than deep analysis.In this context, it was argued that these technologies which focus on information-presenting and fast-responding prevent students from participating in higher-order cognitive processes including analysis, synthesis and assessment. Following is a sample expression:

"*Intelligent learning technologies mostly focus on providing information and fast responses. For this reason, they do not give enough support to students in their efforts to develop higher-order thinking skills such as analysis, synthesis and assessment*." (L 39)

Opinions provided by lecturers indicate that intelligent learning technologies are largely compatible with contemporary pedagogical approaches, especially with the constructivist learning approach.

Participants stated that these technologies allow students to progress according to their individual learning speed and manage their learning processes using personalised content.

On the other hand, some lecturers argued that artificial intelligence is not adequate in every aspect, indicating the limitations of these technologies as regards teacher guidance, emotional interaction, and critical thinking. In addition, it was claimed that artificial intelligence applications which focus on providing information and responding fast are not as effective in developing the higher-order thinking skills of students such as analysis, synthesis, and assessment.

5.3. Findings regarding the Views of Lecturers on Adaptation of AI-driven Systems to Learning Environments

In accordance with the third sub-objective of the study, the views of lecturers on the adaptation process of AI-driven systems to learning settings are given in Table 3.

Table 3. Lecturers' views on the process of adapting artificial intelligence-supported educational technologies to learning environments

Views	Interpretive Summary	Frequency Distribution n (f) (%)
Planning Education Technology Based on Pedagogy	Participants emphasised the importance of using educational technologies in alignment with pedagogical goals. They also stated that technology supports meaningful learning and can complement teaching strategies.	36 (%40.0)
Ensuring the Continuous Professional Development of Lecturers	Participants emphasised that continuous professional development is necessary for the effective use of artificial intelligence technologies, so that educators can implement practices using up-to-date tools and methods.	20 (%22.2)
Determining Learner-Centred Artificial Intelligence Application Strategies	Participants emphasised the importance of prioritising student needs and preferences in integrating artificial intelligence into education; they highlighted that student-centred design enhances participation, individualised learning, and active learning.	18 (%20.0)
Implementation of Multidisciplinary Collaborative Education Technology Integration	Participants emphasised the necessity of interdisciplinary collaboration in educational technology applications, highlighting how expertise from different fields can enrich instructional design.	16 (%17.8)

Table 3 shows that a significant portion of lecturers (n=36, 40.0%) stated that a pedagogy-based planning process is needed so that intelligent learning technologies can be effective. In this context, it is emphasised that technology is not only an instrument, and that it has to be structured in harmony with learning targets and pedagogical approaches. An example of the views related to this finding is presented below:

"*In order for artificial intelligence technologies to make teaching effective, they should not be used only as an instrument, but they have to be compatible with the learning targets of the course and integrated with pedagogical principles. This integration ensures that technology is used in a meaningful and purposeful manner in teaching processes and that pedagogical objectives can be reached more effectively*." (L 67)

In addition, some lecturers (n=20, 22.2%) argued that professional development should be sustainable so that intelligent learning technologies can be used more effectively. Participants also emphasised that institutional support is needed in addition to individual efforts to ensure the sustainability of this process. An example of this view is presented below:

"*We pay attention to use artificial intelligence tools both in and out of the class so as to help students acquire theoretical knowledge. However, we expect our institution to provide regular and structured in-service training so that we can learn how to use these technologies more effectively in education. A continuous professional development process, instead of one-time seminars, will make sure that we can offer more permanent learning and deliver more effective teaching*." (L76)

Other lecturers (n=18, 20.0%) underlined that AI-driven systems should be adjusted according to the individual needs of students. As such, participants believe that developing artificial intelligence applications sensitive to the level, learning pace and individual differences of students is essential. Below is an example expression:

"*In order for intelligent learning technologies to be successfully adapted to learning environments, these applications have to be designed in a sensitive manner to individual differences of students. Learning speeds, preliminary knowledge levels and areas of interest of students differ; thus, strategies that offer customised learning experiences are needed instead of fixed and uniform*

content presentation. For this reason, I believe that artificial intelligence applications can offer content adapted to student needs and increase their class participation and motivation for learning." (L 23)

Last but not least, the remaining lecturers (n=16, 17.8%) claimed that for effective integration of intelligent learning technologies the cooperation between experts from various disciplines is essential. It was stated that bringing together experts from different fields would ensure that more comprehensive and functional solutions are developed. It was also emphasised that this cooperation approach would strengthen the integration process both technically and pedagogically.

"*Effective implementation of intelligent learning technologies requires collaboration of experts from different disciplines. This cooperation ensures that technological infrastructure is strengthened and pedagogically suitable contents are created. A multidisciplinary approach will increase the efficiency of the integration process*."(L 42)

The obtained findings show that lecturers emphasise that intelligent learning technologies have to be pedagogically planned in harmony with learning targets to ensure their effective use. In addition, it is argued that regular and structured professional development programmes are needed for the sustainable employment of these technologies. Developing customised artificial intelligence applications which are sensitive to the individual differences of students is seen as a factor that will improve the effectiveness of learning processes. Moreover, interdisciplinary cooperation has critical importance in terms of strengthening technological infrastructure and developing pedagogical content. It is concluded that this holistic approach will add effectiveness and sustainability to the integration of AI-driven systems

5.4. Findings of the Views of Lecturers Regarding Ensuring Algorithmic Transparency in Educational Technologies

In line with the fourth sub-purpose of the study, the opinions of lecturers as regards ensuring algorithmic transparency in educational technologies are provided in Table 4.

As clarified in Table 4, nearly half of the lecturers (n=44, 48.9%) stated that understanding the operating principles of algorithms used in educational technologies is necessary for them to trust these systems and to use them effectively. Participants emphasised that these algorithms should be transparent and intelligible and that algorithmic literacy has become an essential requirement for all educators.

Table 4. Lecturers' Views on Ensuring Algorithmic Transparency in Educational Technologies

Views	Interpretive Summary	Frequency Distribution (f) (%)
The Necessity of Educators' Understanding of Algorithmic Functionality	Participants emphasised that learning how algorithms work increases confidence in the use of artificial intelligence and supports its effective implementation.	44 (%48.9)
The Importance of Transparency and Information in Data Use	Participants predicted that communicating the purpose, method, and scope of data use to students and teachers would reduce ethical concerns and increase trust.	18 (%20.0)
Ensuring Transparency in Educational Decision-Making Processes	Participants stated that the transparency and the rationale behind the algorithms' decisions in student evaluations and content recommendations enable a fair and reliable learning environment.	16 (%17.8)
Algorithmic Neutrality and the Necessity of Access Rights	According to the participants, if algorithms are unbiased and provide unrestricted access for all users, equal opportunities in education can be created.	7 (%7.8)
Algorithm Developers' Responsibility to Provide Information	Participants emphasised that algorithm developers have a responsibility to inform users, and that transparency and reliability are essential.	5 (%5.5)

An example of a viewpoint regarding this finding can be seen below.

"*When we do not know which criteria are used by our systems for decision-making, we cannot evaluate the accuracy of the process or provide consistent feedback to our students. For example, when we cannot explain the algorithmic foundations of a test score or recommended content to a student, it may lead to trust problems for both us and our student. Understanding these processes is part of our pedagogical responsibilities as educators*." (L 87)

A significant group of lecturers (n=18 20.0%) stated that understanding the operating principles of algorithms used in educational technologies is necessary for them to trust these systems and to use them effectively.The participants stated that informing themselves and their students about data use will improve trust and mitigate ethical concerns. Below is a sample expression regarding this topic:

"*I believe that open and understandable information should be provided about what kind of data our systems collect, how they use these data, and with whom these data are shared. Such transparency will increase the trust of both lecturers and students for the system.*" (L 8)

A significant group of lecturers (n=16 17.8%) emphasised that the purpose, method and scope of data use in educational technologies should be clearly explained. Lecturers indicated that the decision-making processes of algorithms should be stated clearly while evaluating students, recommending content and estimating success rates, which could provide a fair and reliable learning setting for both educators and students alike. An example view is given below.

"*Unless decision-making mechanisms are expressed clearly and understandable cannot be justifiable. For this reason, in order to ensure fairness and the sense of trust for both educators and students, it is essential that decision-making processes are transparent*." (L45)

In addition, a smaller number of lecturers (n=7 7.8%) emphasised that the purpose, method and scope of data use in educational technologies should be clearly explained. They also underlined the importance of ensuring fair and unhindered access for all users to these technologies. Participants argued that preventing algorithmic biases and the removal of access barriers are critical for equality of opportunity in education and the effective use of technology. A sample opinion is offered below.

"*Algorithms used in educational technologies must be impartial and fair, as this is a critical factor for equality of opportunity in education. Prevention of algorithmic bias and providing unhindered access to all technologies for all users will serve to improve effectiveness and inclusiveness in education. For this reason, fairness and accessibility must be given priority in the development process of educational technologies*." (L 76)

Finally, a minority of lecturers (n=5, 5.5%) underlined that educational decisions based on outputs provided by educational technologies had to be justified in a transparent manner. Participants stated that informing users about the operating method of algorithms contributes to identifying and preventing algorithmic bias and developing fair applications in education. For this reason, it has been emphasised that the developers should adopt the principle of transparency. Below is an example expression:

"*Algorithm developers must fully perform their information provision responsibility which bears critical importance for the transparency and reliability of educational technologies. Informing the users on the operation of algorithms helps identify and prevent potential biases and develop fair applications in education. For this reason, developers should embrace the principle of transparency*." (L 84)

Findings reveal that lecturers emphasised that algorithms used in educational technologies should be transparent, understandable, and impartial. Participants stated that clear knowledge of how algorithms work and how data are used increases trust; they also argued that transparency in

algorithmic decision-making processes provides a fair and reliable learning environment. In addition, it was claimed that unhindered access to these technologies by all users plays a critical role in equality of opportunity in education. On the other hand, a minority of lecturers pointed out that it is vital for transparency and fairness that developers fully perform their information-providing responsibilities.

6. Discussion and Conclusion

This study aims to examine the perceptions of lecturers regarding artificial intelligence-based educational technologies, the pedagogical compliance of these technologies with teaching and learning processes, as well as their application procedures, and ethical dimensions. Findings indicate that lecturers usually have a positive attitude towards artificial intelligence-based technologies, and that integrating these technologies into educational settings has the potential to transform teaching processes and improve the quality of learning outcomes. As such, certain functions of artificial intelligence including providing personalised learning opportunities, increasing student motivation, and ensuring time and resource saving within learning contexts processes are found to be significant and valuable by the lecturers.

Findings obtained from the study are in agreement with the research reported in the literature on a large scale. For example, Zawacki-Richter et al. (2019) emphasised that artificial intelligence-assisted systems reinforced student-oriented learning, and Yannier et al. (2024) underlined that these systems are effective in adapting the learning experiences of students to individual needs. Similarly, studies conducted by Holmes, Bialik, and Fadel (2022) indicate that artificial intelligence applications are in considerable agreement with contemporary pedagogical approaches and support constructivist learning environments in particular. In the same vein, research findings reveal that artificial intelligence-based applications support student-oriented, personalised, and flexible learning experiences and add dynamism to learning processes through constant feedback.

In addition, critical assessments made by the lecturers clarify that the pedagogical integration of artificial intelligence technologies should not be limited to technical infrastructure and software competencies. Some participants stated that these technologies are inadequate in cognitively and emotionally complex educational processes such as teacher guidance, emotional interaction, and critical thinking. The fact that artificial intelligence is not able to fully reflect the pedagogical and emotional elements provided by human interaction indicates that educators continue to play a determinant role in instructional processes In this context, Selwyn (2019) states that artificial intelligence will not be able to replace educators; on the contrary, it should be strategically used to enrich the guidance, evaluation and learning environments.

Another finding of this study is that not only individual use capabilities, but also institutional structures and pedagogical planning, play a significant role in the process of integrating artificial intelligence applications into education systems. Lecturers emphasised that the effective use of artificial intelligence-supported technologies requires planning compatible with clear pedagogical targets and that it is critical to ensure continuous professional development of educators in this process. Köseoğlu, Altun & Mercan (2024) argued that in this digital era, besides skills for using technology, educators should be equipped with high-level knowledge as regards the adaptation of technologies to pedagogical objectives. In this regard, improving the digital pedagogical capabilities of lecturers is essential for reinforcing institutional capacity as well as their personal development.

Furthermore, strengthening interdisciplinary cooperation is accepted as a preliminary condition for the effective, reliable, and ethical use of artificial intelligence technologies in education. Within the scope of such cooperation, in addition to the development of technological infrastructure, ethics experts, educational scientists, and software developers have to collaborate in the integration of artificial intelligence applications into pedagogical content (Holmes, Bialik & Fadel, 2022; Köseoğlu, Altun & Mercan 2024). Creating a multi-stakeholder and coordinated structure is seen as a critical element for the sustainable integration of artificial intelligence into

education systems (Temur, 2024). Viewed from an ethical perspective, the lecturers who participated in the study displayed a shared view that the algorithms have to be transparent, impartial, and understandable. Uncertainties as regards the collection, processing, and evaluation of student data emerge as a factor which negatively affects trust in artificial intelligence applications (Temur, 2025). Eynon (2023) emphasised that the transparency of decision-making processes plays a central role in ensuring fairness and trust in education. In this context, algorithms should not generate bias, but offer equal opportunities to all users, and use processes should be defined transparently (Zawacki-Richter et al., 2019). In addition to the socio-economic disparities, unhindered access should be provided to technologies considering physical disabilities as well, which is a critical necessity in terms of ensuring equality of opportunity in education and reducing the digital gap (Selwyn, 2019).

When the findings of the research and the literature are evaluated, it is revealed that artificial intelligence technology brings with it some limitations in terms of student autonomy, data uncertainty, and pedagogical control dimensions. At this point, it is possible to say that algorithmic transparency alone cannot provide trust. It can also be said that the suggestions offered by artificial intelligence to students may negatively affect their decision-making and critical thinking processes. Uncertainties experienced in data collection and evaluation processes reduce instructors' trust in AI systems. The lack of pedagogical integration also indicates that AI is limited in supporting teacher guidance, emotional interaction, and higher-order thinking skills. In this context, a multi-stakeholder approach is considered necessary for the ethical and pedagogical sustainability of AI applications in education systems. In this regard, lecturers, ethics experts, and software developers can collaborate to develop strategies that ensure algorithms are transparent, unbiased, and aligned with pedagogical goals. This approach can support students' decision-making skills, reduce trust issues caused by data uncertainty, and protect the pedagogical control of lecturers.

On the other hand, the findings of the research show that AI-supported educational technologies positively affect elements such as individualised learning, increased motivation, and time savings. However, the effective integration of these technologies is possible not only in the context of technical innovations but also by simultaneously considering ethical and pedagogical frameworks such as pedagogical appropriateness, algorithmic transparency, and fairness.

The benefits to be obtained from artificial intelligence are also linked to the awareness, pedagogical competencies, and critical thinking skills of the teaching staff. In conclusion, it can be said that correctly determining the role of artificial intelligence in education is possible with a comprehensive strategy that is consistent with pedagogical principles, considers ethical responsibilities, and is based on a multi-stakeholder approach.

7. Recommendation

To ensure the effective and sustainable integration of artificial intelligence tools into education systems, it is recommended that the digital pedagogical competencies of teaching staff be improved. In this context, workshops, professional development programmes, and structured guidance in course design should be provided for teachers, lecturers, and instructors to enable them to use technology effectively for pedagogical purposes. Furthermore, strategic plans are needed at the institutional level to ensure the integration of artificial intelligence applications into the teaching process in a way that is compatible with pedagogical goals. It is also recommended that studies be conducted in this direction.

However, regarding the ethical dimensions, it is necessary for software developers, educational scientists, and ethics experts to create mechanisms through interdisciplinary collaboration to ensure the transparency and impartiality of algorithms, and to conduct data use in an equitable and understandable manner. Furthermore, all users should have unrestricted access to technologies, and equal opportunities in education should be supported. In this context, it is recommended that comprehensive policies be developed to reduce the digital divide stemming from

socio-economic disparities. Adopting artificial intelligence as a multidimensional, systematic approach intertwined with pedagogical and ethical dimensions enables its potential for holistic and sustainable use in education. In this context, data privacy, student consent, and algorithmic accountability within the framework of AI Teaching Ethics; as well as fundamental logic, awareness of bias, and the explainability of algorithms for teachers within the framework of Algorithmic Literacy, can be further emphasised. It is believed that future research examining the pedagogical and ethical dimensions with broader and more diverse participant groups using quantitative and mixed methods will provide a more solid foundation for the sustainable use of AI-supported systems in education.

8. Limitation

This study suffers from a number of limitations. First of all, the study is restricted to the views of 90 lecturers and does not include the experiences of teachers at different education levels and institutions, which limits the generalisability of the data. In addition, the semi-structured interview forms used in the study are based on the personal perceptions and experiences of the participants, as a result of which they are outside the scope of objective measurement.The long-term effects of AI-driven systems and their direct impact on students are not covered by this research, either. Last but not least, it must be remembered that due to rapid developments in the fields of technology and education, the validity of the obtained findings can change over time. These limitations emphasise the importance of examining wider participant groups and different education levels, and the employment of quantitative methods in further studies.

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