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The Ethical Compass of Digital Classrooms: Teachers' Perspectives on AI Ethics in Education

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Abstract

The aim of the study is to examine primary school teachers' perspectives on the ethics of artificial intelligence [AI] in education in depth. The research was conducted using a phenomenological design. The study group consisted of 62 primary school teachers working in Türkiye. Data were analyzed using an inductive content analysis approach, allowing themes and categories to emerge directly from the participants' responses. The results indicate that teachers recognize both the potential benefits and challenges of AI in classroom settings. Participants highlighted concerns regarding ethical risks, the need for effective control and oversight of AI tools, precautions against technical problems, and the impact of security vulnerabilities on student data. Teachers also emphasized the importance of ensuring privacy, fairness, and equal opportunities in AI-supported education, as well as informing stakeholders about AI decision-making processes. Furthermore, the results underscore the necessity of establishing clear ethical rules and assigning accountability for AI errors. These insights provide a comprehensive understanding of responsible AI implementation in educational contexts and offer guidance for policymakers, administrators, and educators aiming to integrate AI technologies in ways that enhance learning while upholding ethical and security standards.

Keywords: Artificial intelligence, ethics, artificial intelligence ethics, primary school teachers, education.

Introduction

The 21st century represents a period in which artificial intelligence [AI] technologies have not only infiltrated every aspect of social life but have also had transformational effects on educational systems. From AI-based learning analytics systems to adaptive learning software and automated assessment tools, many applications make it possible to conduct learning processes in a more effective, individualized and data-driven manner. However, the integration of AI into educational environments brings with it ethical debates. Issues such as data privacy, student privacy, algorithmic bias, transparency, and accountability necessitate an ethical inquiry into the use of AI in education (Bensason et al., 2024; Floridi et al., 2018).

The integration of AI in education presents both great opportunities and significant ethical challenges. Teachers recognize the transformative power of this technology and are generally embracing it. However, addressing ethical issues such as data privacy, algorithm bias, and accountability is vital for the responsible and beneficial use of AI in education (Solak et al., 2025). AI ethics presents the basic principles guiding responsible AI development and addresses moral dilemmas such as the balance between privacy and innovation, the conflict between bias and fairness (Bayan, 2024). The questioning of the ethical dimension of AI in education raises the question of the extent to which technologies are compatible not only with pedagogical effectiveness but also with fundamental principles such as justice, inclusion, and human rights. Practices such as labeling, observing, or tracking students through algorithmic decisions go beyond pedagogical benefit and are also related to universal ethical norms such as children's rights and respect for human dignity (Crawford, 2021; Williamson & Eynon, 2020). Therefore, the use of AI applications in educational settings should be addressed within the framework of not only technical and pedagogical, but also moral and social responsibilities.

The rapid integration of AI technologies into social life and educational systems has necessitated a governance approach based on ethical principles. AI ethics supports the

development of systems that respect human rights and fundamental values and uphold principles such as transparency, accountability, and security (Santhoshkumar et al., 2023). In particular, potential negative impacts such as discrimination, invasion of privacy, and economic inequality are critical issues that need to be addressed within an ethical framework. In this context, designing AI systems in a fair, transparent, and accountable manner is of great importance in terms of protecting individual rights and preventing discriminatory outcomes (Sahoo, 2024). In the context of education, the ethics of AI takes on the task of protecting a value-based approach while supporting technological innovations. For institutions, educators, and policy makers, ethical principles provide a guiding framework for ensuring the responsible use of AI in education and preventing potential risks (Owino & Paschal, 2023). Therefore, the development and use of AI technologies in a sustainable and equitable manner requires interdisciplinary collaboration and policies based on ethical principles.

Although there are many studies in the literature on the use of AI in education, the ethical dimensions of these applications are generally secondary; especially, the ethical perceptions of primary school teachers are not sufficiently examined (Gouseti et al., 2024; Seyrek et al., 2024). However, teachers are the actors who can most closely observe and direct the ethical reflections of the applications of technologies in the classroom. This study aims to contribute to the theoretical and practical gaps in this field by examining primary school teachers' perceptions and perspectives on the ethical use of AI in education.

The aim of this study is to examine primary school teachers' perspectives on the ethics of AI in education in depth. By investigating how teachers evaluate the use of AI within the framework of ethical principles (human rights, data privacy, security, justice, and transparency), the study will reveal their awareness of the ethical integration of AI in the classroom environment. In this way, it is aimed to contribute to the shaping of AI applications in education in line with ethical foundations and the development of educational policies in this field. In line with the aim of the study, following research questions were addressed.

1. How do teachers perceive the ethical risks of using AI in education?

2. How do teachers perceive the control and oversight of AI in educational settings?

3. How do teachers perceive the precautions needed for potential technical problems with AI tools in classrooms?

4. How do teachers perceive the effects of AI-related security vulnerabilities in classrooms?

5. How do teachers perceive AI's ability to ensure student data privacy and security?

6. How do teachers perceive the need to inform and involve students, parents, and colleagues in AI decision-making processes?

7. How do teachers perceive AI's role in promoting equality and justice in education?

8. How do teachers perceive the potential for AI to cause discrimination in educational settings?

9. How do teachers perceive the development of AI to support educational processes and stakeholders?

10. How do teachers perceive who should be responsible when AI produces erroneous results?

11. How do teachers perceive the necessity and content of ethical rules for using AI in classrooms?

Ethics of AI in Education

AI technologies lead to radical transformations in education, as in many areas of life (Solak et al., 2025). AI applications in education emerged with limited uses at the end of the 20th century, with the increase in the need for personalized learning as well as developments in data collection and modeling processes. Since the beginning of the 21st century, these applications have become increasingly widespread and have found a wider usage area in the field of education (Jackson & Papa, 2023). The use of AI in education aims to make students' learning processes more effective, individualized, and interactive (Keskin & Sevli, 2024). It is stated that AI makes significant contributions in terms of providing personalized learning opportunities, providing effective feedback and improving student assessment processes. It also helps to identify at-risk students early and increases teaching efficiency through real-time, individualized feedback. However, in order to effectively utilize this potential, important issues such as data quality and ethical concerns need to be considered (Duarte et al., 2023). However, although AI applications in education have the potential to improve learning processes, they also raise important ethical issues such as security, transparency, and privacy. Ethical discussions on artificial intelligence are generally based on two main philosophical approaches: deontological ethics, which emphasizes responsibilities such as data privacy and individual rights, and utilitarian ethics, which focuses on maximizing social benefit; therefore, scholars highlight the need for a multidimensional ethical framework that prioritizes transparency, auditability, and justice in decision-making processes (Pinto & Garcia, 2024). AI ethics is a field that questions the effects of the actions of AI systems on humans and how these systems can be developed in a responsible, reliable, and socially beneficial manner (Russell & Norvig, 2021). It is also an interdisciplinary field of study that examines the moral responsibilities that arise in the design, development, and use of AI systems. AI ethics provides a broad ethical framework covering issues such as data use, algorithmic decision-making, transparency, accountability, bias, and discrimination (Floridi & Cowls, 2019). However, AI ethics emphasizes the need for trustworthiness and transparency in order to develop and use these systems responsibly and safely. The ultimate goal is to minimize the potential ethical risks and harms associated with AI applications (Sethy et al., 2024). The ethical use of AI in a field such as education, where human relations are intense, can be possible with fair and inclusive practices that take into account individual differences and respect student rights. Seven basic AI ethical principles developed within the framework of the European Commission [EC] provide guidance in this regard (EC, 2019); (1) human oversight, (2) technical robustness and security, (3) privacy and data management, (4) transparency, (5) non-discrimination, (6) social welfare, and (7) accountability. These principles emphasize that the use of AI in education should be conducted in a human-centered and ethics-based framework.

Developments in the field of AI have gained a legal framework with the European Union's regulation known as the "AI Law". This law aims to regulate the use of AI systems as well as to promote innovation and protect the fundamental rights of individuals (Council of the EU, 2023; Görentaş & Çiftçi, 2024). The ethics of AI in education requires addressing issues such as mass data collection, privacy violations, algorithmic bias, and the negative consequences of automated decision-making. This includes ensuring fair access to technology, protecting student data, and ensuring that AI tools support each individual's learning process without discrimination. In addition, promoting critical and ethical thinking and increasing the competencies of educators in this field are of great importance for the effective integration of AI in digitalized educational environments (Bernardo et al., 2024).

Establishing transparency, explainability, confidentiality, responsibility, and accountability mechanisms in AI applications plays a critical role in ensuring equality in education. These approaches increase trust in AI systems among educators and students and support their responsible use (Contreras & Jaimes, 2024). Teachers are responsible for ensuring that AI-supported assessments are fair, reliable, and valid, as well as ensuring the ethical use of student data by protecting their privacy (Köse et al., 2023). Teachers' perspectives are of great importance for the effective integration of AI applications in education. Teachers, who know the classroom environment best, have the competence to observe and evaluate the practical functioning of AI technologies (Yolcu, 2024). With the rapid development of technology, teachers' ethical evaluations and perspectives on this field positively affect both the development of students and the effectiveness of teaching processes (Seyhan, 2024). Teachers who use AI applications in their lessons encourage students to use these technologies effectively. Teachers approach these applications positively due to the advantages of AI, such as increasing creativity, supporting productivity, providing new perspectives, adapting to individual learning speed, and saving time (Yılmaz & Çakır, 2024). While AI allows teachers to focus more on teaching, ethical concerns such as data privacy and the reduction of human touch in teaching are also raised (Ali & Okon, 2024). Teachers expressed concerns about the effects of AI on student data privacy and the ethical use of this data, especially in teaching and assessment processes (Kölemen, 2024; Uygun, 2024). In addition, it is important to prevent students from having their homework done by AI and to raise awareness to detect such ethical violations (Yılmaz & Çakır, 2024). Some pre-service teachers have concerns about autonomy and control in terms of the impact of AI on decision-making processes in education (Guggemos et al., 2024).

In recent years, the concept of "AI Literacy" emphasizes the need to equip educators with skills to use AI technologies ethically, critically, and responsibly (Long & Magerko, 2020). Therefore, examining the ethical perceptions of primary school teachers towards the use of AI in education is thought to be necessary not only for technological competence but also for raising awareness about digital ethics. Primary school teachers, as students' first guides in the educational process, play a crucial role in supporting the effective and safe use of digital technologies and helping students become responsible individuals in the digital world (Kaya et al., 2023).When the literature on the use of AI in education is examined, it is seen that the number of studies addressing the perspectives of different stakeholders, such as teachers, prospective teachers and school administrators has increased in recent years. Most of these

studies focus on evaluating how AI tools are used in educational environments, their adoption levels and their contributions to teaching processes. Sontay et al. (2024) reported that primary school teachers view AI applications as tools that support teaching processes and individualized learning. At the same time, it was also revealed that teachers think that ethical principles should be considered when using AI and that they have concerns that these technologies may weaken social and cultural values. Similarly, in a qualitative study conducted by Seyhan (2024) with social studies teachers, it was emphasized that AI provides significant convenience to teachers, especially in material preparation and measurement and evaluation processes. However, it was also stated that some teachers were cautious about these technologies due to their concerns about ethical issues and data privacy. This situation shows that not only functional aspects but also ethical dimensions should be addressed regarding the use of AI in education. In this context, examining the ethical perceptions of primary school teachers towards AI will contribute to the understanding of not only technological competencies but also the ethics of AI in education. Therefore, it is thought that this study will fill the ethics-oriented gap in the existing literature and contribute to the development of a more holistic understanding of AI ethics through the unique positions of primary school teachers.

In other studies focusing on teachers' opinions, general trends, and implementation practices for the use of AI technologies in education are evaluated. In this context, factors such as teachers' attitudes towards technology, application habits and the difficulties they face were analyzed (Özer et al., 2023; Seyrek et al., 2024; Yılmaz & Çakır, 2024). In addition, quantitative data revealing that primary school teachers' attitudes towards AI differ according to demographic variables also contribute to the literature (Aksakal et al., 2024). In studies examining pre-service teachers' awareness of the concept of AI, pre-service teachers defined AI as a structure created on the basis of human intelligence, and stated that these technologies can be used in the education and training process in order to teach lessons, carry out classroom teaching practices, support the teacher, evaluate students individually and eliminate their deficiencies (Çam et al., 2021). In a study focusing on the perspective of administrators, school administrators' opinions on AI were examined, and various difficulties encountered in the use of technology, such as data security, manipulative algorithms, and inequalities in access to technology, were pointed out (Kurt, 2024). These studies are important in terms of showing the way AI is perceived and used by different actors in the field of education. In the literature, it is observed that topics such as ethical principles related to AI, the reflection of these principles in educational environments, and stakeholders' views on AI ethics are not sufficiently addressed. This situation reveals the need for AI to be evaluated holistically, not only in terms of its pedagogical and technical dimensions, but also in terms of its social and ethical impacts.

When the literature on the ethical dimensions of AI is examined, it is seen that studies are largely shaped by the frameworks developed by technology design, industry practices, and policymakers. In this context, ethical guidelines and policy documents developed by various national and international organizations define general principles for the responsible use of AI (Bensason et al., 2024; Thiebes et al., 2021). In the context of education, ethical debates are addressed in a more limited number of studies. Sain and Lawal (2024) examined the opinions

of higher education lecturers on the ethics of AI and found that these individuals have ethical concerns in terms of both technological and pedagogical responsibilities. Similarly, Öksüz Gül (2024) analyzed the opportunities and risks faced by academics on AI ethics in education. Although research focusing on the K-12 level is more limited, it contains remarkable findings. The systematic literature review conducted by Gouseti et al. (2024) was created by analyzing 25 peer-reviewed studies published between 2010 and 2023. This study highlighted key themes and concerns regarding AI ethics at the compulsory education level. In another study focusing on the factors affecting teachers' ethical sensitivity towards AI technologies, Viberg et al. (2024) found that teachers' level of trust in AI is closely related to their level of knowledge and self-efficacy regarding these technologies, based on research conducted in six different countries. The literature provides an important framework for understanding the role of AI ethics in education. However, the perceptions and concerns of primary school teachers, who play a crucial role in helping students acquire foundational knowledge and skills, regarding the ethical dimensions of AI technologies have not been sufficiently explored. Therefore, investigating primary school teachers' ethical concerns is important for the conscious and responsible use of AI in education. This study aims to address this gap in the literature.

The effective use of AI technologies in education by considering ethical principles depends on teachers' perspectives on AI ethics. This is because if teachers find AI ethically problematic or unreliable, this can make it difficult to adopt the technologies. Challenges hindering the widespread use of AI in education systems in Europe include ethical concerns, incomplete knowledge, insufficient policy guidelines, and concerns about data use. Therefore, extensive research is needed to understand whether AI can provide quality educational opportunities to more students without jeopardizing student safety (Seyrek et al., 2024). Therefore, determining teachers' perspectives on AI ethics can lead to more effective and ethical use of AI applications in education. Lubis et al. (2024) stated that teachers play an important role not only in transferring academic knowledge but also in guiding students to grow up as responsible individuals who can cope with global challenges and have strong moral values. Bölükbaş et al. (2023) stated that teachers are role models especially for young children by exhibiting appropriate behaviors and attitudes in the use of technology and teaching the necessary rules for safe and ethical technology use. In addition, educators provide guidance on digital ethics by teaching children how to protect themselves from the harms of technology and help them act responsibly in the digital world. In this context, it can be said that primary school teachers can play an important role in helping children recognize the ethical risks of AI systems, such as bias generation, privacy violation, and transparency, and in providing them with early AI ethical awareness. In addition, by guiding children on issues such as the processing of their personal data, impartiality and security, they can support them to become conscious individuals about AI in the future. The ethical principles (such as privacy, fairness, transparency) described in detail in the TRAI AI Ethical Principles and Legal Regulations Report (Bensason et al., 2024) can be conveyed by primary school teachers through simple examples, and games that primary school students can understand. For example, topics such as the importance of protecting personal information in the digital environment or the need for AI systems to be fair in their decisions can be covered. For this reason, it is thought that the

results obtained from the research by determining the perspectives of primary school teachers on AI ethics in education will make a significant contribution to the literature.

Method

Research Design

In the study, phenomenology, one of the qualitative research designs, was used in order to examine the perspectives of primary school teachers on the subject of AI ethics in education in depth. Phenomenology is an approach that aims to understand how individuals experience a particular phenomenon. In this context, the aim of phenomenological studies is to reveal the participants' perceptions, feelings, and thoughts about a particular phenomenon in depth based on their experiences (Moustakas, 1994). The phenomenological approach tries to understand the essence of individuals' experiences, and in this process, the researcher should stay away from his/her own prejudices and approach the phenomenon from the participants' point of view (Van Manen, 2016). The phenomenon examined in this study is the concept of "AI ethics". In this context, phenomenology design was used in order to directly access primary school teachers experiences regarding AI ethics in education.

Study Group

The study group consisted of 62 primary school teachers working in a province in Turkey. The participants were determined by a convenience sampling method. This type of sampling is a practical selection strategy that allows the researcher to collect data from accessible participants with easy access (Patton, 2014). Participants were determined on a voluntary basis, and care was taken to ensure the participation of teachers from different seniority, and gender groups in order to ensure the diversity of the data. The distribution in the professional seniority of the participants ensured that the perspectives of teachers from different experience levels were included.

In qualitative research, the sample size is determined not based on statistical power calculations as in quantitative studies, but on factors such as the diversity of participants who can answer the research questions in depth and the repetitiveness of the data obtained. In this context, data saturation was taken as the basis for determining the sample size (Patton, 2014). Data saturation is when new themes, opinions, or meaningful information no longer emerge in the data obtained from new participants (Guest et al., 2006). In this study, during the extensive open-ended data collection process with participants from different genders, seniority, and geographical regions, it was observed that certain themes started to recur and new findings were limited. This indicates that the sample reached sufficient information richness for the research purpose, and data saturation was achieved. Therefore, the data obtained from 62 primary school teachers allowed for an in-depth examination of the research questions and was found sufficient to ensure representativeness and diversity. Details about the demographic characteristics of the participants are given in Table 1.

Table 1.

Demographic Characteristics of the Participants

Professional seniority	Female (f)	Male (f)	Total	Female % (In-group)	Male % (In-group)	Total % (General)
1-5 years	16	10	26	62%	38%	42%
6-10 years	5	4	9	56%	44%	15%
11-15 years	5	4	9	56%	44%	15%
16-20 years	10	2	12	83%	17%	19%
Over 20 years	2	4	6	33%	67%	10%
Total	38	24	62	61%	39%	100%

Table 1 presents the distribution of teachers according to working time and gender, both within the group and overall. According to the data, 61% of the participants were female and 39% were male. The highest participation rate was 42% among teachers with 0-5 years of experience. In this group, the female rate is 62% and the male rate is 38%. In the ranges of 6-10 years and 11-15 years, the female rate is similarly 56% and the male rate is 44%. The majority (83%) of teachers with 16-20 years of service are women. On the other hand, the proportion of men is higher in the over 20 years group with 67%.

Data Collection Tool

Interview Form

The semi-structured interview method was used to obtain data in line with the aim of the research. Inthe research the semi-structured interview form was used. The interview questions were prepared based on the principles of AI ethics in the literature (Bensason et al., 2024) (e.g., transparency, fairness, data privacy, responsibility), and content validity was ensured by obtaining the opinions of two faculty members who are experts in the field of AI. Corrections were made to the interview form according to the feedback received from the experts. One expert stated that preparing the interview questions with clearer and more specific expressions would allow the participants to understand the subject better and thus give more meaningful answers. For example, in the first stage, examples of ethical risks for the first interview question are provided in parentheses. In line with the experts' recommendations, it was noted that presenting participants with only the concept of 'ethical risks' would facilitate them in expressing their own unique views based on their experiences and perceptions. After the expert opinion, the questions were sent to three primary school teachers for pilot implementation. Thus, the representativeness of the concepts to be measured was increased. During this process, teachers expressed that they found the questions clear and understandable.

Sample questions:

1. What do you think are the ethical risks that may arise for the use of AI in educational processes?

2. How should teachers control and oversight AI in educational processes?

In the final version of the interview form, 11 open-ended questions were included to obtain the opinions of primary school teachers on the ethics of AI in education. The interview form includes basic principles such as ethical risks, data security, control, and oversight

processes, equal opportunity, potential for discrimination, accountability, and educational contribution.

Data Collection Process

The data were collected online between 11.02.2025 and 20.06.2025. At the beginning of the form, teachers were informed about the purpose and scope of the study. The semi-structured interview form was sent to the teachers via Google Form. This method allowed teachers to respond freely and thoughtfully in their own time. The responses were collected anonymously to ensure the confidentiality of the teachers. During the data collection process, care was taken to include the participants in the study on a voluntary basis. Before the teachers were asked open-ended questions online, they were presented with the interview protocol and asked to read it carefully. In the protocol, the purpose of the research, data use, confidentiality and anonymity principles were clearly stated. After reading the protocol, the teachers gave their consent and participated in the interview process. With this application, both ethical principles were complied with and the informed consent of the participants was obtained.

Data Analysis

The interview data were analyzed using inductive content analysis. Inductive content analysis is an approach to construct meaning based on data without relying on predetermined theories. This process is carried out by coding the data, categorizing similar codes into categories, and developing themes from these categories (Saldaña, 2016). In the data analysis process, the data were first examined in depth by the researcher, and the data were coded in detail. During the coding phase, the researcher collaborated with an academician specialized in AI to ensure the accuracy and consistency of the codes. Categories and themes were created based on the resulting codes, and these themes were reviewed with the expert and evaluated in terms of scope and meaning. The themes were restructured and clarified when necessary. A few sample revisions made in the analysis of the third question of the study, in line with the expert opinion, are presented in Table 2.

Table 2.

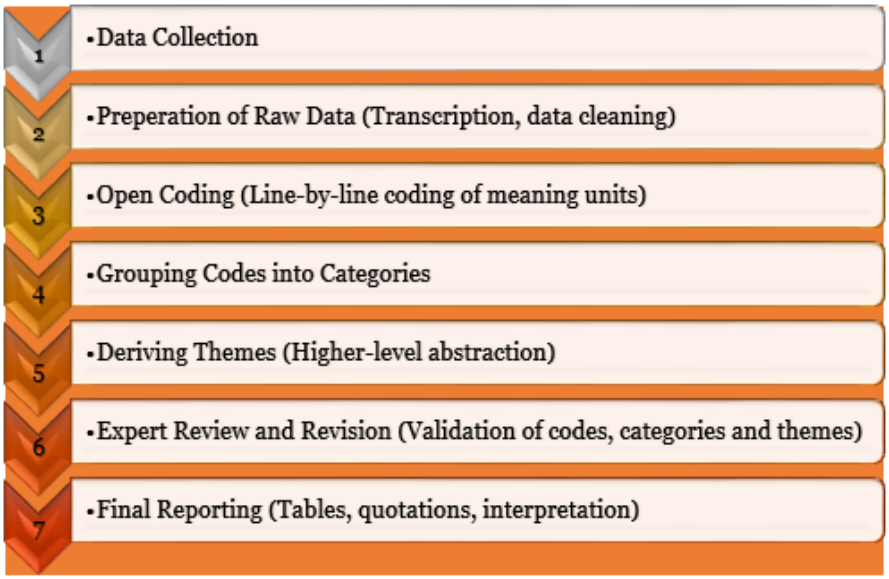
Revisions Based on Expert Opinion

First theme	Corporate infrastructure and expert support	Conscious use	Corporate infrastructure
First category	Expert support	Preparation and planning	Technical support
First code	Getting expert support	Preliminary preparation	The organization provides infrastructure
Revised theme	Security measures	-	Corporate infrastructure and expert support
Revised category	Emergency response	Preparation and compliance check	Technical infrastructure support
Revised code	Getting expert support	Preparation/testing	The organization provides technical infrastructure and support
Revision justification	Changed the theme as the content directly refers to intervention in a security crisis.	Expanded the category scope with expert suggestion, clarified the code.	The scope was expanded and explicitly renamed.

In data analysis, attention was paid to researcher neutrality, and clarity, and consistency were observed in the coding of meaning units. In addition, presenting the findings with supportive direct quotations enabled the reader to follow the interpretation process. Finally, the themes, categories, and codes obtained for each research question were tabulated and reported. The data analysis process is given in Figure 1.

Figure 1.

Data Analysis Process



Validity and Reliability

In qualitative research, validity and reliability are accepted as the basic criteria for ensuring the credibility of the study and the accuracy of the findings (Lincoln & Guba, 1985). In this context, in order to increase the internal validity of the research, the semi-structured interview form used to collect the data was created by taking into account the literature review. In order to ensure the content validity of the interview form, the opinions of two academicians in the field of AI ethics were consulted, a pilot study was conducted and the questions were revised in line with the suggestions received. This process was effective in evaluating whether the data collection tool was sufficient in terms of content (Yıldırım & Şimşek, 2011).

In the analysis of the data obtained, the inductive content analysis method was used, and the coding process was carried out separately by the researcher and an expert. After the independent analysis by the coders, the codes obtained were compared, the differences in meaning were discussed, and a common consensus was reached. This process was carried out in accordance with the principles of data triangulation, systematicity, and transparency suggested by Patton (2014) to increase reliability in qualitative research. In the interpretation of the data obtained in the study, direct quotations were used to avoid researcher bias, and participant opinions were supported by the findings. In addition, in the analysis of the data, the formation of themes and categories was clearly defined and the process of reaching findings from the data was reported transparently. Thus, the external validity and transferability of the study were tried to be increased (Creswell, 2016).

Limitations

This study has some limitations. First, the study was conducted with primary school teachers working in only one province. This situation limits the generalizability of the results obtained and prevents the reflection of teachers' perspectives in different geographical, socioeconomic, and cultural contexts. Secondly, written responses to open-ended questions were used as a qualitative data collection method. This method may have limited the level of in-depth expression of the participants' thoughts and also caused the responses to vary in detail. In addition, since the data is based on teachers' subjective statements, there is a possibility that participants may give more positive or representative answers due to the social expectation effect. Finally, the data analysis process was based on the seven ethical principles recommended by TRAI (Bensason et al., 2024).

Ethical Permits of Research:

In this study, all the rules specified to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were complied with. None of the actions specified under the heading "Actions Contrary to Scientific Research and Publication Ethics", which is the second part of the directive, have been taken.

Ethics Committee Permission Information:

Name of the committee that made the ethical evaluation = Muş Alparslan University Scientific Research and Publication Ethics Committee

Date of ethical review decision = 10 February 2025

Ethics assessment document issue number = 66

Findings

The analyses conducted to the first question of the study are given in Table 3.

Table 3.

Ethical Risks of Using AI in Education

Theme	Category	Code	Teacher
Privacy and data governance	Personal data security and invasion of privacy	Data privacy and violation	P11, P12, P13, P28, P29, P30, P31, P32, P34
		Academic ethical violation	P49, P1, P2, P6, P17, P35
		Data security problem	P45, P51, P8, P31, P34
		Unauthorized data use	P4, P33
Reduced responsibility for learning	Causing superficial learning	Access to ready information	P39, P47, P57, P6, P18, P19, P21
		Failure to provide deep learning	P10, P18
	Digital addiction	Technology addiction	P47, P15
		Violation of duty	P42
Diversity, discrimination and fairness	Inequality of access and injustice	Limited access to technology	P7, P30
		Lack of personalization	P22, P35
		Risk of peer bullying	P53
		Socioeconomic inequality	P7
		Unfair scoring	P17
		Generating biased content	P34
		Discrimination	P26
The problem of information reliability	Questioning the accuracy of information	Risk of false and unverifiable information	P41, P52, P56, P61, P11, P16, P38
Security	Security risks	Malicious use	P42, P48, P58, P7, P23, P37
		Cyber attacks	P10, P28
Loss of professional role	Teacher role	Weakening of the role of the teacher	P40, P49, P61, P62, P20, P30
Negative effects on the learning process	Decline in human values	Human and emotional deprivation	P3, P30, P27
	Machine learning processes	Lack of experiential and natural learning	P43
	Communication breakdown	Decrease in teacher-student communication	P8
	Time management	Waste of time	P40
Social and cultural influences	Failure to protect social and cultural values	Incompatibility with social and cultural values	P50, P55, P13
		Disappearance of traditional education	P54
		Risk of harmful content	P44, P46
Human control	Control issues	Risk of loss of control	P51, P52, P5, P9, P36
Readiness for artificial intelligence	Pedagogical deficit	Lack of readiness	P24
	Lack of infrastructure	Inadequate school infrastructure	P24
Accountability	Uncertainty of responsibility	Risks to authenticity	P59, P60, P25
		No ownership of erroneous results	P26
Perception of ethical risk	Lack of perception of ethical risk	Do not think there is an ethical risk	P14

Note: Participants gave more than one answer all tables.

When Table 3 is analyzed, it is seen that teachers have strong ethical concerns, especially about the privacy of personal data, discrimination, and information reliability and security. In addition, concerns were also expressed about the negative effects of AI tools on learning processes and students' cognitive development. Teachers perceive that AI may

diminish their professional role in educational decision-making, obscure responsibilities, and weaken control mechanisms. In addition, statements pointing to pedagogical and technical infrastructure deficiencies indicate that the level of readiness for AI tools and the application conditions in schools are not yet sufficient. It is seen that teachers have multidimensional perspectives on the ethical risks that AI technologies may pose in the educational environment. These opinions were expressed in various dimensions such as pedagogical processes, ethical values, data security, and social responsibility. Direct quotations from teachers' opinions are given below.

P4: *"I think there are ethical risks in terms of violating personal rights and freedoms. For example, using a person's voice tone without their consent to make a speech material."*

P1: *"There may be labor theft. Taking the information directly from AI tools and using it as it is without reaching its source, without mentioning its source, can be considered as doing an injustice to the labor of the researchers who put that information forward."*

The analyses conducted to the second question of the study are given in Table 4.

Table 4.

Control and Oversight of AI

Theme	Category.	Code	Teacher
Teacher's oversight and control over AI	Teacher responsibility	The teacher is in oversight	P39, P40, P46, P47, P49, P62, P3, P10, P14, P16, P19, P26, P30, P33
		Teacher being directive	P49, P60, P2
		Raising technology literate individuals	P4, P18
		Teaching the use of AI	P48
		Student-oriented time planning	P19
		Balanced application of control	P53
	Teacher-AI interaction	AI as a supportive and productive tool	P54, P55, P7, P20, P35
		AI undermines the authority of the teacher	P55, P62, P5
		AI makes teachers lazy	P2
	Teacher competence	Increased control through teacher training	P58, P13, P36
		Control affects occupational motivation	P60, P40
		Ability to control AI	P28
		Decline in social skills	P22
	Oversight mechanisms	Systematic control of AI	P44, P57, P7, P23, P30, P34
The impact of using AI on students	Risks of lack of oversight	Misuse	P45, P53, P15, P15, P21, P29, P37, P38
		Incorrect learning and assessment	P60, P31, P14
		Risk of unlimited use	P47, P7, P51
		Difficulty in obtaining information	P12
	Learning process and development	Student learning to learn	P51
		Cognitive laziness	P43, P48, P7, P9, P17
		Ensuring individual development	P60, P46
		Isolation as a result of overuse	P19
Content and information control	Accuracy and reliability of information	Transferring false and unreliable information to students	P41, P46, P52, P1, P6, P7, P11
		Confirmation of the source of information	P1, P32
		Misinformation negatively affects the process	P61, P33
		Information pollution	P56
	Content quality and relevance	Content inappropriate for the age level	P59
		Imitation content	P59
		Biased content	P34
		Tracking irrelevant content	P50
Impacts on The education process	Process management	Disruption of the education process	P5, P27, P12, P28
		Weakening of teacher-student relationship	P7, P30
		Managing the process by the teacher	P42, P43
	The role of AI in the process	AI as an auxiliary resource	P41
		Teacher and course resource orientation	P41
		Class-independence of AI	P55
Ethical and social risks	Data security and privacy	Confidentiality of student data	P7, P26, P30
		Invasion of privacy	P7
	Equality and justice	Inequality of opportunity	P7
		There are injustices	P57
	Social and moral values	Failure to transmit human qualities	P13
		Materialism and moral risks	P13, P51
		Damage to rights and freedoms	P8

When Table 4 is examined, it is seen that teachers prioritize keeping the responsibility of oversight and control over AI in their hands, especially in classroom processes; they show sensitivity in preventing negativities that may arise in students' learning processes and ensuring the reliability of the content used. It has been determined that teachers have perspectives in multidimensional areas such as the role of AI in the integration of AI applications into the educational environment, control, responsibility, teacher-AI interaction, student development, and teacher competence. These opinions were not only limited to the functional dimension of technology but also associated with the management of educational processes and the risks that may occur in the lack of control and social values. Direct quotations from teachers' opinions are given below:

P30: *"The use of AI in education must be under teacher oversight. The teacher should check content accuracy, student suitability, and ethical sensitivities. If this control is missing, students may be misguided, personal data may be compromised, and the student-teacher relationship may weaken. AI is a tool; the teacher should always be the guide."*

P43: *"The teacher should control the process; if the necessary control is not provided, students remain passive in learning."*

The analyses conducted to the third question of the study are given in Table 5.

Table 5.

Precautions for Technical Problems

Theme	Category	Code	Teacher
Conscious use	Teacher training	Providing training to teachers	P53, P57, P59, P6, P8, P9, P11, P17, P19, P20, P21, P22, P25, P30
		Attending AI seminars/courses	P46, P3, P18, P23, P29
		Mandatory AI education at university	P52, P19
	Preparation and compliance check	Preparation/testing	P51, P55, P2, P12, P26, P28, P34
		Using a program appropriate to the level	P51
	User awareness and information	Knowing the program feature	P39, P28
		Providing preliminary information	P45, P35
		Keeping documents related to the use of AI	P62, P28
	Source verification	Confirmation with primary sources	P41, P61
		Not dependent on AI	P44
	Student training	Providing preliminary training to students	P53
Security measures	Emergency response	Getting expert support	P40, P48, P50, P52, P57, P4, P13, P25, P29, P30, P37
		Shutting down the system	P42, P5, P30, P31, P37, P38
		Ensuring physical and digital security of the classroom	P40, P7, P30, P34
	Digital security	Establish backup and recovery plans	P26, P30, P31, P31, P32, P33, P34
		Secure software selection	P44, P33
		Selection of up-to-date and original software	P59, P38
		Use of an encryption method	P10, P16
		Audit software	P60
		Powerful system control	P43
	Turn to alternative practices	Attending class with traditional methods	P42, P62, P12
		Using alternative learning methods	P54, P30, P34
		Orientation to different applications	P41, P60
		Research on the internet	P58
		Orientation to encodings	P54
	Oversight	Teacher oversight	P15, P31
		Technical oversight	P30, P38
Institutional infrastructure and expert support	Expert support	Having technical staff	P14, P22, P23, P28
		Getting support from school computer teachers	P61, P3, P27
		Establishment of cyber security units in schools	P8
		Assigning AI teachers to schools	P52
	Technical infrastructure support	The organization provides technical infrastructure and support	P49, P24
No comments	Lack of knowledge and experience	No response	P47, P1
		Lack of experience	P56
		Lack of training	P36

When Table 5 is analyzed, it is seen that teachers' perspectives are concentrated on "Conscious use", "Security measures", "Institutional infrastructure and expert support", "Teacher training", and "Emergency response". Teachers stated that preparations should be made at both individual and institutional levels for the conscious and safe use of AI in the classroom; they emphasized the need for training on preliminary information, source verification, pedagogical adaptation, and increasing AI literacy. The need for institutional infrastructure and expert support shows the importance of planning in the fields of technical hardware, cybersecurity, and expertise. Within the scope of security measures, practices such as digital security protocols, system oversight, data backup, and shutting down the system when necessary were emphasized. It was also found that some teachers lacked knowledge and experience in AI ethics. Teachers emphasized the need for institutional support and expert help, as well as teacher training, user awareness, and appropriate preparation and attention to technical problems that may be encountered; they also emphasized measures such as emergency response and digital security. Direct quotations from teachers' opinions are given below:

P52: *"In such a situation in the classroom, if there is a malfunction that is beyond my knowledge, I ask for help from people who understand. As a precaution, an AI teacher can be assigned to each school. Or this course can be compulsory for teachers at universities."*

P3: *"I would get help from the computer teacher of the relevant institution. In order to prevent such failures, possible failures can be minimized through seminars and courses on the use of AI tools."*

The analyses conducted to the fourth question of the study are given in Table 6.

Table 6.

Effects of Security Vulnerabilities

Theme	Category	Code	Teacher
Precautions	Technical measures	Strong encryption methods	P60, P62, P11, P12, P15, P16, P16, P17, P18, P34, P38
		Using blocking/filtering programs	P49, P54, P57, P58, P59, P60, P61, P3, P22, P25
		Control/update of software	P55, P3, P24, P26
	Software security	Use of trusted/government-approved apps	P40, P51, P1, P3, P13, P13, P21, P22, P24, P25, P34, P35
	Access restrictions	Access and time limitation	P9, P11, P24
		Child/parent lock	P9, P12
	Oversight and support	Teacher oversight	P29, P31
		Expert intervention/support	P46, P19, P28, P38
	Education and awareness raising	Providing cyber security training	P41, P4, P6, P19, P34, P38
		Not sharing personal information	P40, P44, P50, P6, P32
		Training AI	P49, P59
		Parental awareness raising	P31
Psychosocial impacts	Misuse	Cyberbullying	P61, P62, P4, P7, P8, P23
		Unwanted image/video	P53, P2, P12, P30, P31,
		Risk of misleading students	P39, P7, P36
		Unintentional involvement in crime	P28, P29
	Trust problems	Damage to trust	P13, P21, P25
		Distance from technology	P13
	Effects on the teacher	Weakening of the teacher's authority and control	P53, P7, P12
Data security violations	Violation of confidentiality of personal information	Theft of student-teacher information	P40, P48, P1, P7, P10, P11, P20, P21, P23, P25, P25, P30, P33, P35
		Invasion of privacy	P51, P56, P61, P3, P5
		Information leakage	P7, P11, P18, P34, P38,
Systemic security risks	Disruption of the education process	Deviation/discontinuity from the course objective	P43, P55, P57, P7, P22, P30, P38
		Lack of access to accurate information	P52, P61
		Reduced productivity	P34
		Mismatch of ideas between students and teachers	P52
	Unauthorized access	Unauthorized access to accounts	P61, P1, P5, P30, P38
		Interception of passwords	P61, P23
	Cyber attacks	Damage to digital materials	P7, P30, P38
		Breakdown of devices	P7, P38
Lack of risk perception	Perception of no risk	No perception of risk due to use	P45
		The responsibility is not seen in the teacher	P14
		The difficulty of taking precautions	P42
Opinion not available	Unspecified	No response	P47, P27, P37

When Table 6 is analyzed, it is seen that teachers'perspectives focus on topics such as "Precautions", "Data security violations", and "Psychosocial effects". In addition, themes such as "Systemic security risks" and "Lack of risk perception" are also noteworthy. Teachers attach importance to areas such as privacy of personal information, disruption of the educational process, misuse, technical measures, and training and awareness raising. It was also observed that some participants did not respond to the issue. In general, the table reveals primary school teachers' opinions on data security, systemic, and psychosocial risks that may be encountered in AI tools, technical and pedagogical measures to be taken against these risks, and differences in risk perception. It was found that teachers developed a strong sensitivity towards the protection of personal information, technical security measures, awareness raising, and oversight mechanisms; at the same time, some teachers did not perceive any risk perception regarding security vulnerabilities.

P51: *"The possibility of violating the right to privacy is very high. Storing information prolongs the process of this violation. The authorization of such software should be restricted by the state itself."*

P33: *"Students' data may fall into the hands of malicious people. Teachers may have problems accessing the systems. Strong encryption, teacher and student training, and the use of secure software should be emphasized."*

The analyses conducted to the fifth question of the study are given in Table 7.

Table 7.

AI and Student Data Privacy and Security

Theme	Category	Code	Teacher
Negative perception	Privacy violations	The idea that confidentiality is not ensured	P46, P45, P56, P10, P8, P10, P10, P13, P20, P24, P26, P27, P36
		Unauthorized sharing of personal data	P41, P44, P2, P4, P7, P18, P30
		Uncontrolled access to personal data	P52, P58, P61, P15, P19, P23, P33
		Data processing and storage uncertainty	P48, P60, P19, P32
		Digital track and trace	P42, P51, P59, P12
		Misuse of personal information	P60, P17, P28, P30
		Failure to protect sensitive data	P7, P30
	Security violations	Risk of cyber attack	P40, P43, P3, P31
		General vulnerability	P55, P1, P3
		International data war	P52
		Failure to comply with the rules	P62
		Password vulnerability	P61, P5
		The idea that security is not ensured	P45, P56, P10, P8, P10, P26, P27
		Data leakage and theft	P6, P7, P18, P34, P38
	Unauthorized access	Unauthorized control of the system	P47, P53, P7
		Difficulty limiting access	P50
	Lack of transparency	Uncertainty of data use policies	P7, P30, P33, P38
	Data accuracy	Recurrent information	P57
		Information validation issue	P58
		Unlimited responsiveness	P9
		Persistent data on the Internet	P22
	Inadequate infrastructure	Lack of infrastructure	P29
Precautions	Recommendations for technical measures	Safe app usage	P7, P29, P33, P34
		Taking cyber security measures	P7
		Use strong passwords	P34
		Schools taking precautions	P38
	User training and awareness raising	Digital literacy and awareness trainings	P4, P34
		The need for teacher training	P30
		Unconscious use	P11
	Oversight	Lack of oversight	P7, P25, P30, P38
		Establishment of data protection policies	P30
		No security problems	P54, P16
Positive perception	Perception that security is ensured	The idea that security is ensured	P39
		Data retention to prevent information pollution	P49
		presence of trusted companies	P28
No comments	Lack of Information	Lack of opinion	P14, P21, P35, P37

When Table 7 is analyzed, it is seen that the majority of teachers'opinions are gathered under the theme of "Negative perception". This theme focuses on critical issues such as privacy and security violations. A small number of teachers stated that security is ensured and information pollution is prevented within the scope of "Positive perception". The "Precautions" theme includes suggestions for technical measures, user training, and addressing oversight deficiencies. It was determined that some teachers did not express an opinion due to a lack of knowledge on the subject. It has been determined that teachers have significant concerns about privacy and data security issues related to AI tools; however, they have opinions on eliminating these concerns with technical and educational measures.

P59: *"No, I don't think so, because all kinds of data entry can be easily obtained with cookie permissions and digital footprint."*

P31: *"No, I don't think so. Unfortunately, data loss may occur in any cyber attack."*

The analyses conducted to the sixth question of the study are given in Table 8.

Table 8.

Informing Stakeholders on AI Decisions

Theme	Category	Code	Teacher
Need to inform stakeholders	Stakeholder engagement and information	Informing stakeholders	P39, P43, P44, P45, P46, P51, P56, P61, P2, P5, P10, P12, P14, P17, P20, P21, P24, P25, P29, P35, P36
		Need for information due to lack of knowledge	P40, P41, P42, P43, P25, P26
		Parental control and involvement	P60, P47, P30, P37, P33, P34
		Increasing student participation	P30, P33, P34
		Students know the evaluation criteria	P60, P30
		Expert support	P32
	AI usage knowledge and management	Providing information for efficient and effective use	P53, P54, P3, P4, P6, P13, P21, P34
		Stakeholders know the working principle of AI	P1, P7, P19, P30, P34
		Teachers' process management knowledge	P19, P27, P28, P30,
		Recognition of benefit and harm	P52, P18, P23, P29
		The teacher informs the parent	P62, P22
		Knowing the intended use and methods	P49, P54
	Awareness of controlled use	Awareness-raising against malicious use	P48, P57, P58, P16
		Limited use requirement	P8
		Incorrect use can cause technical failures	P15
		Exposure to harmful content	P19
		Personal data security	P59, P11
	Transparency and trust	Transparency inspires confidence	P7, P30, P33, P34
		Explanation of decision making processes	P7, P38, P30, P33
		Knowing the effects of decisions	P7, P17, P19
		Preventing misunderstandings	P7, P34
		Knowledge of data sources	P7
		Impartiality briefing	P7
		Information for transparency in education	P55
		Teacher control gives confidence	P38
	Sharing responsibility	Attribution of responsibility to a single person	P29
	Areas of use	Evaluating student performance	P7, P30
		Teaching optimization	P7
		Personalized learning	P7
	Digital literacy and education	Providing interactive digital literacy trainings	P9, P31
		Developing students' digital skills	P38
Limitations in providing information	Information difficulties	Difficulty of informing in village schools	P50

When Table 8 is analyzed, it is seen that the most concentrated point of the teachers is "The need to inform stakeholders". In this context, sub-headings such as stakeholder participation and information, knowledge, and management of AI use come to the fore. Especially the necessity of raising awareness due to lack of information, parental control, and increasing student participation are among the main issues emphasized by teachers. It is also emphasized that digital skills should be developed and interactive digital literacy training should be provided. One teacher stated that stakeholder information could not be provided due to the difficulty of providing information. Primary school teachers attach importance to the necessity of active participation and informing stakeholders in the decision-making processes of AI, controlled use, digital literacy, and training activities, and the creation of an environment of transparency and trust.

P58: *"Yes, they should be informed. Because it is a platform that is open to misuse."*

P34: *"Yes, I think it should be informed because knowing how AI works both builds trust and prevents misunderstandings. Students will follow the process more consciously, teachers will provide the right guidance, and parents can be involved in the process in a healthier way. This information is important for transparency, ethical, and effective use."*

The analyses conducted to the seventh question of the study are given in Table 9.

Table 9.

AI and Educational Fairness

Theme	Category	Code	Participant
Injustice	Access and use	Not all students have access to technology	P41, P48, P59, P17, P28, P32, P33, P34, P37
		Inaccessibility for students without financial means	P40, P42, P55, P57, P2, P8
		Difficulty of use by disadvantaged students	P58, P5, P30,
	Unfair learning	Ready access to information for the non-working student	P47, P17
	Professional competence	Differences in professional competence among teachers	P60
	Neutrality	AI is not neutral	P31
Ensuring equality and justice	Widespread access to	Access to technology	P54, P3, P12, P13, P15, P16, P19, P36
		Free AI tools	P54, P11
		Easier access to information	P18
		Low cost	P19
	Personalized learning opportunity	Delivering experiences based on individual needs	P7, P33, P34
		Providing opportunities for disadvantaged groups	P7
	Neutrality	Non-discrimination of people	P51, P52, P54
		Giving what is demanded	P51, P52
		Impartial and fair work	P49
Conditional equality	Providing conditional equality	Provision in any place and institution if the learner can access it	P50, P53, P60, P20, P21, P28, P29, P30
		Ensuring correct use	P45, P4, P33, P34
		Providing equal opportunities through education and information	P11, P29, P38
		Ensuring equality in the classroom	P44
		Providing the student who wants to develop	P45
Technological inequality in education	Inadequate technological infrastructure and equipment	Regional hardware differences	P61, P62, P25, P1, P22, P30
		Lack of infrastructure	P40, P43, P23, P37
		Internet access problems	P55, P9, P30
	Digital competence	Student conflicts due to digital skills gap	P58
		Lack of AI literacy	P29
Limitations of AI	Uncontrolled use	Laziness	P41
		Technological dependence	P41
		Uncontrolled use	P6
	Limited role	AI's inadequacy in equity and justice	P1, P24, P30
		Limited trust in AI	P27
Negative perception	Unjustified	No	P46, P56, P10, P14
Unconsciousness	Lack of information	No information	P26, P35
Positive perception	Unjustified	Yes	P39

When Table 9 is analyzed, it is seen that the themes of "injustice", "ensuring equality and justice" and "conditional equality" stand out in teachers' opinions on AI. Teachers state that there are significant inequalities among students due to technological infrastructure inadequacies, internet access problems, and financial impossibilities. It is emphasized that this situation negatively affects, especially disadvantaged students' access to and effective use of AI technologies. On the other hand, some teachers think that AI can contribute to equality of opportunity by stating that free or low-cost AI tools facilitate access to information and offer personalized learning opportunities. However, alongside these positive opinions, there are also concerns about the uncontrolled use of technology, the risks of addiction, and the reliability of AI tools. It is seen that some teachers make definite judgments that AI can or cannot provide equality and justice in education without having sufficient knowledge. In general, teachers are aware of the potential benefits of AI in terms of equal opportunities; however, they do not ignore the risks such as the digital divide, impartiality issues, and infrastructure deficiencies.

P57: "There may be various inequalities because it is difficult for individuals without economic means to access it."

P7: "While AI applications have the potential to help ensure equality of opportunity and fairness in education, it is difficult to say that it is currently fully realizing this goal. By providing personalized learning experiences, AI can ensure that students receive education based on their individual needs and create opportunities for disadvantaged groups by facilitating access to learning materials."

The analyses conducted to the eighth question of the research are given in Table 10.

Table 10.

Possibility of AI Discrimination

Theme	Category	Code	Participant
Based on usage discrimination	Digital competence gap	Students who use it well have an advantage	P39, P57, P61, P4, P20, P35
	Access facilities	Differences in access to technology	P62, P8, P12, P15, P24, P37
		Those with access exclude others	P58
		Lack of infrastructure and hardware	P24
		Economic differences	P25
Algorithm-based discrimination	Content sensitivity	Personalized information presentation according to the question format	P61, P1, P18
		Achieving advantageous results with accurate data entry	P60, P36
	Data-driven discrimination	Discrimination due to incomplete/biased data	P2, P7, P30, P31, P33, P34
		Biased data from AI system developers	P11, P28
		Software replacement	P23
The neutrality of AI	Software limitations	Lack of ability to discriminate	P9, P28, P29
		Present only what is uploaded	P19, P28, P29
		Software change	P40, P16
	Individuality	Lack of individual decision-making authority	P47, P19
		No physical contact	P16
	Lack of information	Not knowing the students	P49, P17
	Ethical approach	Compliance with ethical principles	P26
Risk of human-induced segregation	Human orientation	Discrimination based on orientation	P53, P59, P3, P29
		Discrimination is inherent to human beings	P21
	Change of control	Shift of software control to AI	P52, P13
	Use abuse	Malicious users	P41
		Access to information without effort	P6
The emotional deprivation of AI	Emotion-based decision making	Inability to discriminate because they have no feelings	P48, P50, P54, P55, P23, P28
		Discriminate because they have no feelings	P42
General perception of discrimination	Unjustified	AI does not discriminate	P43, P44, P44, P45, P46, P22
	Unjustified	Discrimination by AI	P56, P10
Recommendation	Human control	There should be teacher control	P33, P34, P38
Uncertainty	Indecision	The possibility of discrimination in the future	P51, P14, P32
Technical error	Error-human distinction	Machines can make mistakes	P5
Violation of the principle of equality	The problem of student relativity	Ignoring individual differences	P27

When Table 10 is analyzed, it is seen that teachers' perspectives are grouped under various themes. Teachers' perceptions regarding the discrimination caused by AI vary, and the themes of usage-based and algorithm-based discrimination come to the fore. Teachers state that usage-based reasons, such as digital competence differences, inequalities in access opportunities, and economic and infrastructure differences, can lead to discrimination. In addition, there are also risks of discrimination due to algorithmic reasons such as lack of data,

bias, and content sensitivity. Under the theme of impartiality of AI, factors such as software limitations and compliance with ethical principles are evaluated; the opinion that the human factor is determinant in discrimination is expressed with categories such as human-induced discrimination risk and AI's emotion-based decision-making. While emphasizing the necessity of human control in AI systems, teachers emphasize the possibility of future discrimination in the theme of uncertainty and indecision. However, there are also teachers who unjustifiably think that AI does not discriminate or does discriminate. It has been determined that teachers' awareness of the potential of AI to discriminate, their understanding of the conditions of use, and the role of data sources; they also emphasized the importance of human control and an ethical approach.

P50: *"No, it does not. Because there is no emotion or feeling."*

P11: *"AI tools can discriminate between students with biased practices of their producers and biased, inaccurate data."*

The analyses conducted to the ninth question of the research are given in Table 11.

Table 11.

AI Contribution to Education and Stakeholders

Theme	Category	Code	Teacher
Potential to contribute to education	Integration into the education process	Integrate into education processes	P44, P48, P51, P51, P52, P53, P60, P11, P36
		Saving time and space	P41, P1, P9, P28, P30
		Supporting the teaching process	P61, P62, P23, P24, P28
		Facilitate follow-up of the process by stakeholders	P41, P58, P30, P34
		Enriching the process	P39, P7, P24, P28
		Improving the efficiency of the process	P7, P30, P33
	Digital adaptation in education	The need for digital transformation	P40, P42, P45, P53, P5, P8, P11, P12, P13, P15, P18, P19, P21, P25, P28, P29
		Effective and efficient use of technology	P21, P29
	Contribution to the student	Providing an individualized learning experience	P54, P7, P24, P30, P34
		Guiding students in accessing information	P59, P16, P21
		Supporting creativity	P3
	The role of AI	Being a supportive tool	P13, P30
		Lack of decision-making authority	P30
Effects on the teacher	Positive	Reducing the teacher's workload	P41, P1, P7, P20, P22, P28, P31, P32, P33, P34, P38
	Negative	Declining teacher function	P50, P61
Conditional contribution	Usage	Controlled and correct use	P45, P51, P52, P57, P1, P6, P7, P20, P21, P30
	Development	Contributing if development is achieved	P43, P35
	Oversight	Carrying out oversight	P52
Critical approach	Negative impact	Accustoming the student to the ready-made	P55, P1, P4, P17
		Weakening of scientific process skills	P55, P17
		Reducing productivity	P4
	Ethical risks	Ethical principles must be followed	P2, P30
		Providing secure infrastructure	P13
Overall positive perception	Unjustified	Yes	P46, P47, P56, P10, P14, P27
Preliminary preparation	Information	Information about AI	P3, P26
		Introducing students to technology	P49, P31
Social contribution	Community development support	Ensuring social development	P60
No comments	No comments	No response	P37

When Table 11 is examined, it is seen that teachers' perspectives are concentrated especially in the themes of "Potential to contribute to education", "Effects on the teachers", and "Conditional contribution". Teachers attach great importance to the potential of AI in terms of its integration into the educational process; they emphasize contributions such as enriching the process, increasing efficiency, supporting the teaching process, and saving time and space. While critical opinions reveal that the use of AI should be carefully evaluated in terms of its pedagogical effects, the unjustified positive responses of some participants suggest that there are also superficial or unclear perceptions on this issue.

P41: *"Yes, I think so. Thanks to AI tools, it saves time, space, and labor. It makes it easier to follow up on work to be done."*

P13: *"Yes, because our age makes these technologies necessary and useful, but I think it is right to create a security infrastructure and keep it as a tool."*

The analyses conducted to the tenth question of the research are given in Table 12.

Table 12.

AI and Accountability

Theme	Category	Code	Teacher
Accountability	Practitioner/user responsibility	The teacher is responsible	P39, P43, P47, P53, P58, P1, P16, P23, P29, P33, P34, P38
		The user is responsible	P44, P45, P50, P56, P62, P2, P6, P26, P28, P35
		The student is responsible	P48, P58, P17, P23, P38
		The parent is responsible	P47, P58, P37
		The teacher is not responsible	P14
	Software developer responsibility	Program/software developer person/company	P40, P42, P59, P61, P62, P5, P8, P18, P30, P31, P32
	Service provider company	App owners are responsible	P41, P42, P52, P54, P57, P59, P62, P9, P21, P23, P28
	Decision makers	Authority/institution approving integration into education	P55, P1, P20, P27, P30, P34
	Oversight authority	Person or institution responsible for oversight	P60, P3, P15, P31
	Multiple shared responsibility	Sharing responsibility among all stakeholders	P7, P11, P12, P37
	Contingent liability	The level and source of the error determines responsibility	P22, P24
	No accountability	No one is held accountable	P46, P49, P51, P25
Strengthening accountability	Precautions	Providing training	P25, P29
		Oversight and system control	P13, P36
		Establishment of responsible government units	P19
		Responsibility agreement	P4
No comments	Lack of information	Lack of knowledge	P10

When Table 12 is analyzed, it is determined that the most emphasized theme is "accountability". Teachers stated that teachers, students, parents, and users should be responsible for AI applications. In addition, it was stated that software developers and service provider companies should also be evaluated within the scope of accountability. Some participants mentioned the concepts of multiple shared responsibility and contingent

responsibility, stating that responsibility should not be limited to only one party. It was emphasized that decision-makers, and supervisory institutions, and individuals should also assume responsibility. Another prominent theme was "Strengthening Responsibility", which included suggestions such as training, contracts, and state control. Some teachers stated that no one can be held responsible, and one participant could not give an opinion due to a lack of information.

P62: *In AI tools, everyone who first makes the software, then approves it, and gives training to use it is guilty.*

P20: *I think administrators should be held responsible because they are the ones who will integrate it into education.*

The analyses conducted to the eleventh question of the study are given in Table 13.

Table 13.

Establishing Classroom Ethical Rules

Theme	Category	Code	Teacher
Ethical principles required	Human control and oversight	There should be human/teacher control	P47, P49, P52, P1, P6, P9, P30, P33, P38
		There should be human/teacher oversight	P49, P60, P13, P15, P16, P30, P34, P38
		Training on use should be provided	P52, P17
		Protection of human values	P59, P1
		Should not replace the teacher	P54
		Student interaction should be ensured	P23
		Usage limits should be defined	P25
	Social and environmental well-being	Compliance with cultural and moral values	P40, P52, P58, P12, P13, P24, P27
		Ethical use	P43, P60, P22, P31, P36
		Social contribution and public benefit	P60, P61, P12, P21
		Sharing	P59
		Use legal software	P5
		Continuity	P28
		Environmental sustainability	P38
	Discrimination and justice	There must be equality	P57, P59, P6, P28, P30, P33, P38
		Must be fair use	P7, P28, P30, P34
		Accessibility must be ensured	P44, P59, P34, P38
		There must be impartiality	P11, P34
		Non-discrimination	P40, P60
		Human rights must be respected	P60
		Content must be respectful	P53
		There must be respect for labor	P57
	Technical robustness and safety	Security	P42, P26, P28, P29, P33, P34
		Reliability	P7, P60, P6, P21
		Topicality	P59, P6
		Provide accurate information	P52
		Robustness	P60
	Privacy and data governance	Protection of personal data	P41, P60, P2, P4, P11, P13, P24, P28, P29, P30, P32, P34
	Accountability	Responsibility	P41, P60, P28, P34
		There must be a certain framework	P45, P62, P8, P29
		Authenticity	P59
		Plagiarism must be prevented	P2
	Transparency	Transparency	P42, P60, P30, P33, P34, P38
		Aperture	P19, P38
		Understandability	P44
		Integrity	P59
	Unjustified	Yes	P39, P46, P51, P56, P10, P14, P20, P37
Ethical principles not required	Unjustified Not required	No.	P55, P18
		Teacher is adequate	P48
		Moral codes are enough	P48
		Knowledge of use is sufficient	P48
		Regional variation of ethical principles	P50
		Emotion deprivation	P3
No comments	Lack of information	No information	P35

When Table 13 is analyzed, it is seen that the majority of the teachers expressed their perspectives on the theme "The necessity of ethical principles", followed by the theme "Ethical principles are not necessary". The most emphasized ethical principles are "Human control and oversight", "Social and environmental welfare", "Discrimination and justice", "Technical robustness and security", and "Privacy and data governance". On the other hand, some teachers stated that there is no need to establish ethical principles for reasons such as the competence of the teacher, the lack of emotional aspect of AI, and that it is sufficient to have knowledge of its use. There is also a teacher who stated that he/she did not have any information about the subject. It shows that the majority of primary school teachers think that it is necessary to determine ethical principles for the use of AI in the classroom.

P48: *"I don't think ethical principles need to be established in general. Only how it should be used and some moral rules should be mentioned. Teachers are enough."*

P28:"Yes, *I think so. There can be principles such as Privacy, Security, Responsibility, Continuity, Equality, and Justice."*

Discussion and Conclusion

The results obtained from the first question of the study show that primary school teachers have multidimensional ethical risk perceptions regarding the use of AI in education. The prominent themes are "privacy and data governance", "reduced responsibility for learning", "diversity, discrimination and justice", and "security". This may be due to the impact on teachers of the uncertainty created by the lack of clarity in ethical, legal, and pedagogical regulations in the process of rapid integration of AI tools into the field of education. The literature shows that teachers have intense ethical concerns, especially about personal data violations (Floridi et al., 2018; Jobin et al., 2019), weakening of learning processes (Araujo Sandoval, 2024; Ivanov, 2023), discrimination risk (Binns, 2018), and cybersecurity threats (Brundage et al., 2018). In addition, teachers' opinions under the themes of "loss of professional role", "human control", and "accountability" indicate that AI applications may overshadow the decision-making and guidance function of the teaching profession (Chisega-Negrilă, 2024; Williamson & Eynon, 2020). The emphasis on pedagogical and technical infrastructure deficiencies reveals insufficient systemic preparation in the implementation process (Zawacki-Richter et al., 2019). These results are in line with critical pedagogical and ethical dimensions such as inclusiveness, equity, teacher preparation, quality of data systems, and ethics and transparency in data use, as outlined in United Nations Educational, Scientific and Cultural Organization's [UNESCO] report on challenges and opportunities in the field of AI-enhanced education for sustainable development (AIEd) (Pedró et al., 2019).

The results obtained from the second question of the study show that teachers believe in the necessity of human-centered and effective oversight mechanisms for the control and oversight of AI in education. In this context, it was stated that the responsibility of the teacher to manage the pedagogical process should continue, while AI should be positioned as a tool that supports this process. In the literature supporting the research results, it is stated that teachers can maintain their leadership roles by strengthening their professional development, promoting human-machine collaboration, and increasing their AI literacy (Li & Dan, 2024).

This shows that in the age of AI, the teacher should be a leader who not only uses technology but also directs and integrates it into education. Indeed, Albahijan et al. (2025) emphasize that the integration of AI in education poses various risks, and therefore, effective oversight mechanisms are needed. Leong et al. (2025) draw attention to the importance of governance frameworks in line with the principles of data privacy, fair access and responsible use. Ružičić et al. (2024) argue that educators, researchers, and policymakers should take decisive roles in decision-making processes based on ethical principles. In parallel with these studies, the results of the current study reveal that teachers think that both technical infrastructure and ethical oversight should be addressed simultaneously for the effective use of AI technologies in educational environments. However, although in some scenarios it was thought that AI could replace the teacher or school administrator, it was stated that current AI systems are not capable of assuming these roles. It is considered more realistic and functional to position AI as an assistant instead of replacing teachers or school principals (Çetin & Aktaş, 2021).

The results obtained from the third question of the research show that primary school teachers are aware of the technical problems that may occur in AI tools and that they adopt pedagogical, technical, pre-service, and in-service training support requirements for the solution of these problems. This situation shows that primary school teachers adopt the importance of continuous education and institutional support mechanisms in order to increase their competencies in this field as well as being prepared for technical problems for the effective and uninterrupted use of AI technologies in educational environments. In this context, Filiz et al. (2025) found that technical infrastructure problems are prioritized among the difficulties faced by teachers in AI integration and that teachers expect adequate support and training against these problems. Similarly, Dimitriadou and Lanitis (2023) emphasized the importance of teachers preparing back-up plans, having alternative teaching materials, and effective operation of technological support systems against technical problems that may occur during the use of AI and emerging technologies in smart classrooms. Furthermore, Arranz-Garcia et al. (2025) reported that teachers take conscious steps to improve their digital skills against technical problems and to increase their competencies in this field through continuous professional training. This points to the need to develop teachers' technopedagogical skills as well as their pedagogical competencies. In addition, it is important to strengthen technical support mechanisms for teachers, disseminate professional development programs, and establish crisis management plans in schools.

The results obtained from the fourth question of the research show that primary school teachers have knowledge and awareness about data security, systemic risks, and precautions that can be taken for AI applications, but very few teachers lack knowledge on these issues and cannot perceive security risks sufficiently. This shows that teachers are aware that AI applications may have various security vulnerabilities such as data privacy violations, cyber-attacks, unauthorized access, and system availability. They emphasize that these risks should be carefully evaluated, managed, and audited. The literature supports teachers' perspectives. Schaeffer et al. (2024) state that the vulnerabilities of AI tools can lead to negative consequences such as prejudice and discrimination. Kamenskih (2022) points out that the access of AI systems to sensitive student data increases the risks of data violation and unauthorized access. Similarly, Bu (2022) emphasizes that the integration of AI in education

brings serious security risks such as data violations and misuse of personal information, which threaten student and educator privacy. In addition, Karan and Angadi (2023) state that AI tools in the classroom can lead to threats such as privacy and autonomy risks, AI biases, accuracy issues, and deepfakes, which can harm the learning environment and teaching quality. Ma and Jiang (2023) state that excessive data collection jeopardizes students' personal safety by increasing the risks of data leakage, unauthorized data use, and hacking. Therefore, technical security measures, data protection policies and awareness programs for teachers and students should be implemented in schools to prevent these risks. Thus, the integrity of the learning environment can be ensured by protecting the privacy and security of both students and educators.

The results obtained from the fifth question of the research show that primary school teachers have serious concerns about the privacy and data security of AI applications; however, they think that these concerns can be reduced through technical measures, user training, and awareness-raising, and that it is important to fulfil ethical responsibilities. While this reflects teachers' awareness of the risks to data privacy and security, it also reveals the importance of the technical and awareness-raising approaches mentioned under the "Precautions" theme. It is noteworthy that some teachers lack knowledge of the subject. There are similar results in the literature. Jose (2024) emphasizes that although AI technologies can improve educational experiences, they pose significant risks in terms of student data privacy and security. Robust data protection frameworks and strategies are needed to effectively manage these threats. Huang (2023) states that the proliferation of AI in education reduces student privacy and complicates data security; therefore, educational institutions, governments, and AI developers should collaborate to create effective data protection mechanisms. In their study, Ismail and Aloshi (2025) state that current regulations in AI-oriented education are insufficient, and growing surveillance concerns increase the need for comprehensive data governance and educator training on the privacy and security of student data. Schleiss et al. (2022) emphasize that although AI offers new analytical opportunities in education, the protection of student data needs to be supported by technical and organizational measures. In light of these results, it is of great importance to implement strong and holistic data protection policies in educational environments, to raise teachers' awareness on this issue, and to strengthen the technological security infrastructure in order to address teachers' concerns about data privacy and security.

The results obtained from the sixth question of the research show that primary school teachers think that it is important to actively inform and involve stakeholders in the decision-making processes of AI. They also believe that digital literacy training, transparency, and a trust environment should be created. This shows that teachers think that transparent and participatory management of AI applications is important for ensuring trust and effective use in education. Similarly in the literature, informing stakeholders, transparency, and explainability stand out as the basic principles in AI decision-making processes. Bhat (2024) emphasizes that increasing AI literacy among non-expert users contributes to a critical understanding of these technologies and strengthens ethical awareness. This makes it meaningful for teachers to address the problems they face in accessing information due to a lack of digital literacy, especially in rural areas. MoDastoni (2023) states that Explainable

Artificial Intelligence (XAI) applications and advanced visualization tools increase user trust and make AI decisions more transparent. In this context, teachers' efforts to convey how AI tools work in the classroom to both students and parents can form the basis for a more explainable and reliable use of AI in education. Similarly, Pentland (2021) states that informing users about decision processes can reduce overdependence on AI and prevent errors by increasing human oversight. Aldossari (2024) emphasizes that when AI decisions are understandable, users develop a sense of control, and this supports ethical AI practices. As a result, the fact that primary school teachers emphasize the need for transparency, information, and digital literacy regarding the decision-making processes of AI is extremely valuable in terms of both the ethical use of technology and the active participation of educational stakeholders in these processes.

The results obtained from the seventh and eighth questions of the study show that primary school teachers have serious concerns about the ethics of AI (AI) in education, especially about ethical problems such as discrimination, bias, inequality of opportunity, and justice. This shows that primary school teachers are sensitive to the ethical dimensions of AI in education in terms of equal opportunity, justice and discrimination, and that they consciously evaluate the ethical risks of AI in education. At the same time, it reveals that teachers embrace the need for human oversight and ethical guidance necessary for the effective, fair, and ethical use of AI applications. These results are in line with critical evaluations in the literature. For example, Williamson et al. (2023) point out that AI systems can reproduce cultural biases and reinforce socioeconomic inequalities and draw attention to the importance of interdisciplinary and ethical approaches in this context. Similarly, Bhavana et al. (2025) emphasize that biased data sets have the potential to shape education and argue for the necessity of ethical AI design and systematic evaluation processes. According to the research results, teachers drew attention to the risk that AI tools may not be unbiased in assessing student achievement and potential, and expressed concern that especially vulnerable groups may be excluded. This is in line with Ahmed et al.'s (2024) study, which emphasizes that teachers should receive ongoing training and support to use technology ethically and fairly. On the other hand, Li (2023) states that AI can further deepen existing inequalities if equal access to resources in education is not ensured. At this point, it is seen that teachers think that technological equipment and infrastructure inadequacies prevent equality of opportunity for students, especially in rural and low-income areas. Despite these concerns, some teachers also expressed that AI can increase equity and inclusion through its capacity to create personalized learning environments. These opinions are supported by Roshanaei et al. (2023) and Edam (2024). In particular, the ability to tailor educational content to individual needs can enable students to find opportunities for progress despite their different starting points. However, the fair delivery of these opportunities depends not only on technical competence but also on ethical design and transparent algorithmic processes. Edam (2024) has stated that AI has the potential to provide equal opportunities in education, but that these technologies raise concerns due to ethical issues and data bias. It has been emphasised that AI systems operating with incorrect or biased data can lead to discrimination and undermine fair education. Therefore, it has been stated that AI must be used responsibly, fairly, and inclusively

in education. As a result, teachers' perspectives show that AI in education has a bidirectional potential in providing equal opportunities.

The results obtained from the ninth question of the research show that the majority of teachers think that it is important and necessary to develop AI in a way that contributes to educational processes. Teachers state that AI offers contributions such as enriching the teaching process, increasing efficiency, supporting the process, and saving time and space. However, it is noteworthy that some teachers were critical about the pedagogical effects, while some participants expressed superficial or unclear perceptions with unjustified positive statements. This situation shows that both conscious evaluations and teacher training are needed for the effective use of AI applications in the classroom environment. These results coincide with Wangdi's (2024) finding that integrating AI into education promotes personalized learning, increases productivity, and supports collaboration among stakeholders. In particular, teachers' perception of AI as a "guiding tool to support teaching" reflects the potential for optimizing assessment processes and increasing school management efficiency through the strategic use of AI, as suggested by Patrizi et al. (2025). Moreover, teachers point out that for this contribution to be realized effectively, teachers and students need to be informed in advance, technological competencies need to be developed, and ethical controls need to be conducted. Indeed, Malik (2024) states that AI can support personalized learning and inclusive education, but emphasizes that ethical challenges such as data privacy and algorithmic biases need to be addressed for these benefits to be sustainable. Some of the teachers' reservations can also be considered in this context. For example, critical approaches or superficially positive attitudes about the pedagogical implications of the technology suggest that negative effects such as overconfidence in AI, low explainability, invasion of privacy, and loss of skills should not be ignored, as Ivanov (2023) suggests. Teachers' perspectives point to the necessity of integrating AI in education with a holistic approach and critical awareness. Unless not only technological competence but also ethical responsibility and pedagogical relevance are considered, the contribution of AI applications may be limited and potentially problematic.

The results obtained from the tenth question of the study show that the vast majority of teachers think that the ultimate responsibility should lie with the human being in case AI tools produce erroneous results in education. However, the participants are not satisfied with only individual responsibility, but emphasize that technical and structural actors such as software developers, service provider companies, decision makers, and supervisory institutions should also be accountable in these systems. This may have resulted from the teachers' understanding of the complex and multi-actor structure of AI systems and their realization that the errors that may occur in the education process depend not only on the user but also on the parties who develop and manage the technology. This perception of multi-layered responsibility is in line with Zainuddin's (2024) opinion that faulty results arising from AI are primarily the responsibility of the developer companies, but a collective control mechanism should be established in cooperation with educational institutions and policymakers. The fact that participants emphasized the concepts of "multiple shared responsibility" and "situational responsibility" reveals the need for a flexible and context-sensitive approach to this issue. In line with the hybrid understanding of responsibility

advocated by Ninaus and Sailer (2022), this situation brings up the necessity of evaluating both the predictions of AI and human judgment together. It is clear that placing the responsibility solely on the software or the user will not produce ethical and fair results in complex educational processes. Mishara (2024) similarly emphasizes the need for clear accountability structures between technological actors, educators, and policymakers, without which biases may increase and student privacy may be at risk. Moreover, the fact that some teachers did not provide an opinion due to "no one being held accountable" (f=6) or "lack of knowledge" points to a lack of awareness in this area. This result, as suggested by Mubofu and Kitali (2024), clearly shows the need for institutional arrangements, continuous monitoring systems, and strengthening the critical thinking skills of both staff and students in order to develop a culture of responsibility in the use of AI. As Salloum (2024) emphasizes, educators knowing the limitations of AI, policy makers providing ethical guidelines, and developers producing transparent algorithms will form the basis for a culture of accountability in these systems.

The results obtained from the eleventh question of the research show that the majority of teachers think that it is necessary to determine ethical principles for the use of AI in the classroom. This result indicates that in a period when AI applications in education have become widespread, teachers have realized not only technological competence but also the need for ethical governance. Among the ethical principles most emphasized by teachers, "human control and oversight", "social and environmental welfare", and "discrimination/justice" stood out. This shows that, as Şenocak et al. (2024) emphasize, multidimensional ethical structures such as transparency, diversity, accountability and invasion of privacy in AI applications have started to be accepted on a global scale. The importance given to ethical principles reveals not only the sensitivity of individual teachers but also the necessity to reflect on the societal impacts of AI. Meylani (2024) argues that teachers should be equipped with ethical guidelines against the potential risks of AI systems such as the potential for bias in classrooms and data privacy violations. The theme of "privacy and data governance" in the research results also supports that these concerns are shared at the teacher level. In particular, the necessity of using AI-developed systems in the classroom in accordance with ethical principles on sensitive issues such as data security and student privacy shows that teachers' responsibility in the classroom is not only pedagogical but also extends to digital ethics. The fact that some teachers argue that there is no need for ethical rules or that only the technical competence of the teacher is sufficient reveals that there is diversity in the level of ethical sensitivity. This makes it clear that, as Paschal and Melly (2023) state, for the integration of AI in education, not only technical infrastructure but also continuous ethical training programs, regular monitoring of biases, and mechanisms to address unintended consequences need to be established. In addition, the fact that teachers consider "technical soundness and security" among the ethical principles shows that ethical AI use is also integrated with technological security. This shows that ethical rules in educational settings provide an important framework for teachers to use technology consciously, safely, and responsibly. As a result, it is concluded that primary school teachers largely support the establishment of ethical rules to guide AI, and that these rules should be based on core values such as human control, justice, data privacy and security.

Recommendations

In line with the first result of the study, it is recommended that teachers be provided with informative training about AI and ethical risks. In line with the second result, it is recommended to clarify the human role in AI oversight and to increase the competencies of teachers in this subject. In line with the third result, it is recommended to provide pre-service and in-service training support to teachers against technical problems. In line with the fourth and fifth results, it is recommended that studies should be conducted to raise teachers' awareness on data security and privacy issues, and privacy and security measures for AI applications should be strengthened in educational processes. In line with the sixth result, it is recommended to ensure active information and participation of stakeholders in AI decision-making processes. In line with the seventh and eighth implications, it is recommended to ensure the impartiality and fairness of AI algorithms and to support the technopedagogical skills of teachers to address concerns about ethical issues such as discrimination, bias, inequality of opportunity, and fairness. In line with the ninth results, it is recommended to design applications that take into account the needs and expectations of teachers, are compatible with pedagogical goals, and support learning-teaching processes in the process of developing AI technologies. In line with the tenth result, it is recommended that responsibility and accountability principles should be clearly defined and cooperation models should be established between software developers, service providers, and educational institutions. In line with the eleventh result, it is recommended to determine and implement ethical principles for the use of AI in the classroom with students. In future studies, it is recommended to provide a multidimensional perspective by including teachers from different branches, school administrators, parents, and students. In future studies, it is recommended to reach more generalizable results by using mixed research method approaches supported by quantitative data collection tools.

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Notice of Use of Artificial Intelligence

The author utilised artificial intelligence tools for the language editing (e.g., grammar, spelling and clarity improvements).

Dijital Sınıfların Etik Pusulası: Sınıf Öğretmenlerinin Eğitimde Yapay Zekâ Etiğine Yönelik Görüşleri

Özet

Çalışmanın amacı, sınıf öğretmenlerinin eğitimde yapay zekâ [YZ] etiğine ilişkin görüşlerini derinlemesine incelemektir. Araştırma, fenomenolojik desen kullanılarak yürütülmüştür. Çalışma grubunu, Türkiye'de bir ilde görev yapan 62 sınıf öğretmeni oluşturmaktadır. Veriler, katılımcıların yanıtlarından temalar ve kategorilerin doğrudan ortaya çıkmasına olanak tanıyan tümevarımsal içerik analizi yaklaşımıyla analiz edilmiştir. Araştırmadan elde edilen sonuçlar, öğretmenlerin sınıf ortamlarında YZ'nin kullanımının hem potansiyel yararlarını hem de karşılaşılabilecek güçlüklerini fark ettiklerini göstermektedir. Sınıf öğretmenleri etik riskler, YZ araçlarının etkili biçimde kontrol edilmesi ve denetlenmesi gerekliliği, teknik sorunlara karşı alınması gereken önlemler ile güvenlik açıklarının öğrenci verileri üzerindeki etkilerine ilişkin kaygılarını dile getirmiştir. Öğretmenler ayrıca, YZ destekli eğitimde gizlilik, adalet ve fırsat eşitliğinin sağlanmasının önemini vurgulamış; YZ'nin karar verme süreçleri hakkında tüm paydaşların bilgilendirilmesi gerektiğini belirtmiştir. Bununla birlikte, bulgular YZ'ye ilişkin açık etik kuralların oluşturulması ve YZ kaynaklı hatalar için sorumluluğun net biçimde tanımlanması gerekliliğine işaret etmektedir. Elde edilen bu sonuçlar, eğitim bağlamında sorumlu yapay zekâ uygulamalarına ilişkin kapsamlı bir anlayış sunmakta ve öğrenmeyi desteklerken etik ve güvenlik standartlarını gözeten YZ entegrasyonu hedefleyen politika yapıcılar, yöneticiler ve eğitimciler için yol gösterici nitelik taşımaktadır.

Anahtar Kelimeler: Yapay zekâ, etik, yapay zekâ etiği, sınıf öğretmenleri, eğitim.

Giriş

21. yüzyıl, yapay zekâ [YZ] teknolojilerinin toplumsal yaşamın her alanına sızmasıyla birlikte, eğitim sistemlerinde de dönüşümsel etkiler yarattığı bir dönemi temsil etmektedir. YZ tabanlı öğrenme analitiği sistemlerinden, uyarlanabilir öğrenme yazılımlarına ve otomatik değerlendirme araçlarına kadar pek çok uygulama, öğrenme süreçlerinin daha etkili, bireyselleştirilmiş ve veri odaklı bir biçimde yürütülmesini mümkün kılmaktadır. Bununla birlikte, YZ'nin eğitim ortamlarına entegrasyonu beraberinde etik tartışmaları da getirmektedir. Veri gizliliği, öğrenci mahremiyeti, algoritmik önyargı, şeffaflık ve hesap verebilirlik gibi sorunlar, YZ'nin eğitimdeki kullanımına dair etik bir sorgulamayı zorunlu kılmaktadır (Bensason vd., 2024; Floridi vd., 2018).

Eğitimde YZ'nin entegrasyonu hem büyük fırsatlar sunmakta hem de önemli etik zorlukları beraberinde getirmektedir. Öğretmenler, bu teknolojinin dönüştürücü gücünün farkındadır ve genel olarak bu teknolojiyi benimsemektedirler. Ancak, veri gizliliği, algoritma ön yargısı ve hesap verebilirlik gibi etik konuların ele alınması, YZ'nin eğitimde sorumlu ve faydalı bir şekilde kullanılabilmesi için hayati önem taşımaktadır (Solak vd., 2025). YZ etiği, sorumlu YZ gelişimine rehberlik eden temel ilkeleri sunar ve gizlilik ile yenilik arasındaki denge, ön yargı ile adalet arasındaki çatışma gibi ahlaki ikilemleri ele alır (Bayan, 2024). Eğitimde YZ'nin etik boyutuna ilişkin sorgulamalar teknolojilerin sadece pedagojik etkinliğiyle

değil, aynı zamanda adalet, kapsayıcılık ve insan hakları gibi temel ilkelerle ne derece uyumlu olduğu sorusunu da gündeme getirmektedir. Öğrencilerin algoritmik kararlar yoluyla etiketlenmesi, gözlemlenmesi ya da izlenmesi gibi uygulamalar, pedagojik yararın ötesinde, çocuk hakları ve insan onuruna saygı gibi evrensel etik normlarla da ilintilidir (Crawford, 2021; Williamson & Eynon, 2020). Bu nedenle, eğitim ortamlarında YZ uygulamalarının kullanımı, sadece teknik ve pedagojik değil, aynı zamanda ahlaki ve toplumsal sorumluluklar çerçevesinde ele alınmalıdır.

Literatürde, YZ'nin eğitimdeki kullanımına ilişkin çok sayıda çalışma bulunmakla birlikte, bu uygulamaların etik boyutları genellikle ikinci planda kalmakta; özellikle ilkokul düzeyinde görev yapan sınıf öğretmenlerinin etik algıları yeterince incelenmemektedir (Gouseti vd., 2024; Seyrek vd., 2024). Oysa öğretmenler, teknolojilerin sınıf içindeki uygulamalarının etik yansımalarını en yakından gözlemleyebilecek ve yönlendirebilecek aktörlerdir. Bu çalışma, sınıf öğretmenlerinin YZ'nin eğitimdeki etik kullanımına ilişkin algılarını ve görüşlerini inceleyerek, bu alandaki kuramsal ve uygulamalı boşluklara katkı sunmayı amaçlamaktadır.

Bu araştırmanın amacı, sınıf öğretmenlerinin eğitimde YZ etiği konusuna ilişkin görüşlerini derinlemesine incelemektir. Çalışmada, öğretmenlerin YZ kullanımını etik ilkeler (insan hakları, veri gizliliği, güvenlik, adalet ve şeffaflık) çerçevesinde nasıl değerlendirdikleri araştırılarak, YZ'nin sınıf ortamında etik bir şekilde entegrasyonuna dair farkındalıkları ortaya konacaktır. Bu sayede, eğitimde YZ uygulamalarının etik temeller doğrultusunda şekillenmesine ve bu alandaki eğitim politikalarının geliştirilmesine katkı sunulması hedeflenmektedir. Araştırmanın amacı doğrultusunda aşağıdaki araştırma sorularına yanıt aranmıştır.

1. Sınıf öğretmenlerinin, YZ'nin eğitimde kullanımına yönelik etik riskler hakkındaki görüşleri nasıl şekillenmektedir?

2. Sınıf öğretmenlerinin, YZ'nin eğitimde kontrol ve denetimi konusunda görüşleri nasıl şekillenmektedir?

3. Sınıf öğretmenlerinin, sınıfta YZ araçlarında meydana gelebilecek teknik sorunlara ilişkin alacakları önlemlere yönelik görüşleri nasıl şekillenmektedir?

4. Sınıf öğretmenlerinin, YZ'nin sınıfta yaratabileceği güvenlik açıklarının etkilerine yönelik görüşleri nasıl şekillenmektedir?

5. Sınıf öğretmenlerinin, YZ'nin öğrenci verilerinin gizliliğini ve güvenliğini sağlayıp sağlamadığına yönelik görüşleri nasıl şekillenmektedir?

6. Sınıf öğretmenlerinin, YZ uygulamalarının karar alma süreçleri hakkında öğretmen, öğrenci ve velilerin bilgilendirilmesine yönelik görüşleri nasıl şekillenmektedir?

7. Sınıf öğretmenlerinin, YZ'nin eğitimde fırsat eşitliği ve adaleti sağlama konusundaki görüşleri nasıl şekillenmektedir?

8. Sınıf öğretmenlerinin, YZ'nin eğitimde ayrımcılık yapma ihtimali konusundaki görüşleri nasıl şekillenmektedir?

9. Sınıf öğretmenlerinin, YZ'nin eğitim süreçlerine ve paydaşlarına katkı sağlayacak biçimde geliştirilmesi konusundaki görüşleri nasıl şekillenmektedir?

10. Sınıf öğretmenlerinin, YZ hatalı sonuçlar verdiğinde sorumluluğun kimde olması gerektiği konusundaki görüşleri nasıl şekillenmektedir?

11. Sınıf öğretmenlerinin, sınıfta YZ kullanımına yönelik etik kuralların oluşturulması gerekliliği ve bu kuralların içeriği hakkındaki görüşleri nasıl şekillenmektedir?

Yöntem

Araştırmanın Deseni

Araştırmada sınıf öğretmenlerinin eğitimde YZ etiği konusuna ilişkin görüşlerini derinlemesine incelemek amacıyla nitel araştırma desenlerinden fenomenoloji kullanılmıştır. Fenomenoloji, bireylerin belirli bir olguyu nasıl deneyimlediklerini anlamayı amaçlayan bir yaklaşımdır. Fenomenolojik yaklaşım, bireylerin yaşantılarının özünü anlamaya çalışır ve bu süreçte araştırmacının kendi ön yargılarından uzak durması, olguya katılımcıların bakış açısından yaklaşması gerekmektedir (Van Manen, 2016). Bu araştırmada incelenen fenomen "YZ etiği" kavramıdır. Bu bağlamda, sınıf öğretmenlerinin eğitimde YZ etiğine ilişkin deneyimlerine doğrudan ulaşmak amacıyla fenomenoloji deseni kullanılmıştır.

Çalışma Grubu

Araştırmanın çalışma grubunu, Türkiye'de bir il merkezinde görev yapan toplam 62 sınıf öğretmeni oluşturmaktadır. Katılımcılar gönüllülük esasına göre belirlenmiş ve verilerin çeşitliliğini sağlamak adına farklı kıdem ve cinsiyet gruplarından öğretmenlerin katılımına özen gösterilmiştir. Katılımcıların mesleki kıdemlerindeki dağılım, farklı deneyim düzeylerinden öğretmenlerin görüşlerine yer verilmesini sağlamıştır.

Veri Toplama Aracı

Araştırmanın amacı doğrultusunda veriler elde edilmesinde yarı yapılandırılmış görüşme yarı yapılandırılmış formu kullanılmıştır. Görüşme soruları, literatürdeki YZ etiği ilkeleri (Bensason vd., 2024), (ör. şeffaflık, adalet, veri gizliliği, sorumluluk) temel alınarak hazırlanmış 11 sorudan oluşmaktadır.

Veri Toplama Süreci

Veriler, araştırmacılar tarafından geliştirilen açık uçlu sorulardan oluşan yarı yapılandırılmış görüşme formu aracılığıyla yüz yüze toplanmıştır. Görüşmeler okulun sessiz alanlarında bireysel olarak yapılmış, süreleri 11 ile 35 dakika arasında değişmiştir. Katılımcıların yanıtları kayıt altına alınmış ve görüşmeler sonrasında yazılı döküme aktarılmıştır. Tüm süreç boyunca gizlilik ilkesi korunmuş ve elde edilen veriler sadece bilimsel amaçlarla kullanılmıştır.

Verilerin Analizi

Görüşme verileri, tümevarımsal içerik analizi yöntemiyle analiz edilmiştir. Tümevarımsal içerik analizi, önceden belirlenmiş kuramlara bağlı kalmadan, veriden yola çıkarak anlam oluşturmaya yönelik bir yaklaşımdır. Bu süreç verilerin kodlanması, benzer kodların kategorilere ayrılması ve bu kategorilerden temaların geliştirilmesiyle gerçekleştirilir

(Saldaña, 2016). Veri analiz sürecinde, ilk olarak araştırmacı tarafından derinlemesine incelenmiş ve veriler detaylı şekilde kodlanmıştır. Kodlama aşamasında, araştırmacı ile YZ alanında uzman bir akademisyen ile iş birliği yapılarak kodların doğruluğu ve tutarlılığı sağlanmıştır. Ortaya çıkan kodlar üzerinden kategoriler ve temalar oluşturulmuş, bu temalar uzmanla birlikte gözden geçirilerek kapsam ve anlam açısından değerlendirilmiştir. Gerekli görülen durumlarda temalar yeniden yapılandırılmış ve netleştirilmiştir.

Araştırmanın Etik İzinleri:

Bu çalışmada "Yükseköğretim Kurumları Bilimsel Araştırma ve Yayın Etiği Yönergesi" kapsamında uyulması gerektiği belirtilen tüm kurallara uyulmuştur. Yönergenin ikinci bölümü olan "Bilimsel Araştırma ve Yayın Etiğine Aykırı Eylemler" başlığı altında belirtilen eylemlerin hiçbiri gerçekleştirilmemiştir.

Etik Kurul İzin Bilgileri:

Etik değerlendirmeyi yapan kurulun adı = Muş Alparslan Üniversitesi Bilimsel Araştırma ve Yayın Etiği Kurulu

Etik Kurul Etik inceleme karar tarihi = 10 Şubat 2025

Etik değerlendirme belgesi konu numarası = 66

Bulgular

Sınıf öğretmenlerinin, YZ'nin eğitimde kullanımına yönelik etik riskler hakkındaki görüşleri incelendiğinde, öğretmenlerin özellikle kişisel verilerin gizliliği, ayrımcılık yapmama ve bilgi güvenilirliği ve güvenlik konusunda güçlü etik kaygılar taşıdığı belirlenmiştir. Ayrıca, YZ araçlarının öğrenme süreçleri ve öğrencilerin bilişsel gelişimleri üzerindeki olumsuz etkileri konusunda da endişeler dile getirilmiştir. Öğretmenler, YZ'nin eğitimde karar alma süreçlerinde mesleki rollerinin azalabileceği, sorumlulukların belirsizleşebileceği ve kontrol mekanizmalarının zayıflayabileceği yönünde algılara sahiptir. Bunun yanı sıra, pedagojik ve teknik altyapı eksikliklerine işaret eden ifadeler, YZ araçlarına yönelik hazırbulunuşluk düzeyinin ve okullardaki uygulama koşullarının henüz yeterli olmadığını göstermektedir. Öğretmenlerin YZ teknolojilerinin eğitim ortamında oluşturabileceği etik risklere karşı çok boyutlu görüşlere sahip olduğunu görülmektedir. Bu görüşler pedagojik süreçler, etik değerler, veri güvenliği ve toplumsal sorumluluk gibi çeşitli boyutlarda ifade edilmiştir.

Sınıf öğretmenlerinin YZ'nin eğitimde kontrol ve denetimi konusunda görüşleri incelendiğinde, öğretmenlerin özellikle sınıf içi süreçlerde YZ üzerindeki denetim ve kontrol sorumluluğunu ellerinde tutmayı öncelikli gördükleri belirlenmiştir. Ayrıca öğrencilerin öğrenme süreçlerinde ortaya çıkabilecek olumsuzlukları engelleme ve kullanılan içeriklerin güvenilirliğini sağlama konusunda duyarlılık gösterdikleri tespit edilmiştir. Öğretmenlerin YZ uygulamalarının eğitim ortamına entegrasyonunda YZ'nin rolü, kontrol, sorumluluk, öğretmen–YZ etkileşimi, öğrenci gelişimi ve öğretmen yeterliliği gibi çok boyutlu alanlarda görüşlerinin olduğu belirlenmiştir. Bu görüşler yalnızca teknolojinin işlevsel boyutuyla sınırlı kalmayıp, aynı zamanda eğitim süreçlerinin yönetimi ile denetim eksikliğinde meydana gelebilecek riskler ve toplumsal değerlerle de ilişkilendirilmiştir.

Sınıf öğretmenlerinin, sınıfta YZ araçlarında meydana gelebilecek teknik sorunlara ilişkin alacakları önlemlere yönelik görüşleri incelendiğinde, öğretmenlerin görüşlerinin "Bilinçli kullanım", "Güvenlik önlemleri", "Kurumsal altyapı ve uzman desteği", "Öğretmen eğitimi" ve "Acil müdahale" konularında yoğunlaştığı belirlenmiştir. Öğretmenler, YZ'nin sınıf içinde bilinçli ve güvenli kullanımı için hem bireysel hem kurumsal düzeyde hazırlık yapılması gerektiğini belirtmiş; ön bilgilendirme, kaynak doğrulama, pedagojik uyum ve YZ okuryazarlığının artırılmasına yönelik eğitim ihtiyacına vurgu yapmıştır. Kurumsal altyapı ve uzman desteği gereksinimi ise teknik donanım, siber güvenlik ve uzmanlık alanlarında planlamaların önemini göstermektedir. Güvenlik önlemleri kapsamında dijital güvenlik protokolleri, sistem denetimi, veri yedekleme ve gerektiğinde sistemin kapatılması gibi uygulamalara dikkat çekilmiştir. Ayrıca, bazı öğretmenlerin YZ etiği konusunda bilgi ve deneyim eksikliği yaşadığı tespit edilmiştir. Öğretmenlerin karşılaşılabilecek teknik sorunlar konusunda öğretmen eğitimi, kullanıcı bilinci ve uygun hazırlık ve gibi dikkat edilmesi gereken noktaların yanı sıra, kurumsal destek ve uzman yardımına duyulan ihtiyacı vurguladığı; ayrıca acil müdahale ve dijital güvenlik gibi önlemlere önem verdikleri görülmektedir.

Sınıf öğretmenlerinin YZ'nin sınıfta yaratabileceği güvenlik açıklarının etkilerine yönelik görüşleri incelendiğinde, öğretmen görüşlerinin "Önlemler", "Veri güvenliği ihlalleri" ve "Psikososyal etkiler" gibi konulara yoğunlaştığı belirlenmiştir Ayrıca "Sistemsel güvenlik riskleri" ve "Risk algısı yokluğu" gibi temalar da dikkat çekmektedir. Öğretmenler, kişisel bilgilerin gizliliği, eğitim sürecinin aksaması, kötüye kullanım, teknik önlemler ile eğitim ve bilinçlendirme gibi alanlara önem vermektedir. Bazı katılımcıların konuya ilişkin yanıt vermediği de gözlemlenmiştir. Bulgular genel olarak, sınıf öğretmenlerinin YZ araçlarında karşılaşılabilecek veri güvenliği, sistemsel ve psikososyal risklere dair görüşlerini, bu risklere karşı alınması gereken teknik ve pedagojik önlemleri ve risk algısındaki farklılıkları ortaya koymaktadır. Öğretmenlerin, kişisel bilgilerin korunması, teknik güvenlik önlemleri, bilinçlendirme ve denetim mekanizmalarına yönelik güçlü bir duyarlılık geliştirdikleri; aynı zamanda bazı öğretmenlerin güvenlik açıklarına dair risk algısı taşımadığı belirlenmiştir.

Sınıf öğretmenlerin YZ'nin öğrenci verilerinin gizliliğini ve güvenliğini sağlayıp sağlamadığı konusunda görüşleri incelendiğinde, öğretmen görüşlerinin büyük çoğunluğunun "Olumsuz algı" teması altında toplandığı belirlenmiştir. Bu tema, özellikle gizlilik ve güvenlik ihlalleri gibi kritik konulara odaklanmaktadır. Az sayıda öğretmen ise "Olumlu algı" kapsamında, güvenliğin sağlandığına ve bilgi kirliliğinin önlenmesine dair görüş belirtmiştir. "Önlemler" teması, teknik tedbirler, kullanıcı eğitimi ve denetim eksikliklerinin giderilmesine yönelik önerileri içermektedir. Bazı öğretmenlerin ise konu hakkında bilgi eksikliği nedeniyle görüş belirtmediği tespit edilmiştir. Öğretmenlerin YZ araçlarıyla ilgili gizlilik ve veri güvenliği konularında önemli kaygılar taşıdıklarını; bununla birlikte teknik ve eğitsel önlemlerle bu kaygıların giderilmesine yönelik görüşlerinin olduğu belirlenmiştir.

Sınıf öğretmenlerinin YZ uygulamalarının karar alma süreçleri hakkında öğretmen, öğrenci ve velilerin bilgilendirilmesine yönelik görüşleri incelendiğinde öğretmenlerin en çok yoğunlaştığı noktanın "Paydaşların bilgilendirilmesi gerekliliği" olduğu belirlenmiştir. Bu kapsamda, paydaş katılımı ve bilgilendirme, YZ kullanım bilgisi ve yönetimi gibi alt başlıklar öne çıkmaktadır. Özellikle bilgi eksikliği nedeniyle bilinçlendirme gerekliliği, veli kontrolü ve

öğrenci katılımının artırılması gibi unsurlar öğretmenlerin üzerinde durduğu başlıca konular arasında yer almaktadır. Ayrıca dijital becerilerin geliştirilmesi ve etkileşimli dijital okuryazarlık eğitimlerinin verilmesi gerektiği de vurgulanmaktadır. Bir öğretmen ise bilgilendirme zorluğu nedeniyle paydaş bilgilendirilmesinin yapılamayacağını belirtmiştir. Sınıf öğretmenlerinin YZ'nin karar alma süreçlerinde paydaşların aktif katılımı ve bilgilendirilmesinin gerekliliğine, kontrollü kullanım, dijital okuryazarlık ve eğitim faaliyetlerine, şeffaflık ve güven ortamının oluşturulmasına önem verdikleri belirlenmiştir.

Sınıf öğretmenlerinin, YZ'nin eğitimde fırsat eşitliği ve adaleti sağlama konusundaki görüşleri incelendiğinde, özellikle "adaletsizlik", "eşitlik ve adaleti sağlaması" ve "koşula bağlı eşitlik" temalarının öne çıktığı tespit edilmiştir. Öğretmenler, teknolojik altyapı yetersizlikleri, internet erişim sorunları ve maddi imkânsızlıklar nedeniyle öğrenciler arasında önemli eşitsizlikler yaşandığını belirtmektedir. Bu durumun, özellikle dezavantajlı öğrencilerin YZ teknolojilerine erişimini ve bu teknolojileri etkin kullanabilmesini olumsuz etkilediği vurgulanmaktadır. Öte yandan, bazı öğretmenler, ücretsiz veya düşük maliyetli YZ araçlarının bilgiye erişimi kolaylaştırdığını ve kişiselleştirilmiş öğrenme imkânları sunduğunu ifade ederek YZ'nin fırsat eşitliğine katkı sağlayabileceğini düşünmektedir. Ancak bu olumlu görüşlerin yanında, teknolojinin kontrolsüz kullanımına, bağımlılık risklerine ve YZ araçlarının güvenilirliğine yönelik kaygılar da dile getirilmektedir. Bazı öğretmenlerin ise yeterli bilgiye sahip olmadan YZ'nin eğitimde eşitlik ve adaleti sağlayabileceği ya da sağlayamayacağı yönünde kesin yargılarda bulunduğu görülmektedir. Genel olarak bakıldığında, öğretmenler YZ'nin fırsat eşitliği açısından potansiyel faydalarının farkındadır; ancak dijital uçurum, tarafsızlık sorunları ve altyapı eksiklikleri gibi riskleri de göz ardı etmemektedir.

Sınıf öğretmenlerinin, YZ'nin eğitimde ayrımcılık yapma ihtimaline yönelik görüşleri incelendiğinde, öğretmenlerin YZ'nin ayrımcılık yapmasına ilişkin algılarının çeşitlilik gösterdiği, "kullanım temelli" ve "algoritma kaynaklı" ayrımcılık temalarının öne çıktığı belirlenmiştir. Öğretmenler, dijital yeterlilik farkları, erişim olanaklarındaki eşitsizlikler, ekonomik ve altyapı farklılıkları gibi kullanım kaynaklı nedenlerin ayrımcılığa yol açabileceğini belirtmektedir. Ayrıca, veri eksikliği, yanlılık ve içerik duyarlılığı gibi algoritmik nedenlerle de ayrımcılık risklerinin mevcut olduğu ifade edilmektedir. YZ'nin tarafsızlığı teması altında, yazılımsal sınırlamalar ve etik ilkelere uyum gibi faktörler değerlendirilmekte; insan kaynaklı ayrım riski ve YZ'nin duyguya dayalı karar verme gibi kategorilerle insan faktörünün ayrımcılıkta belirleyici olduğu görüşü dile getirilmektedir. Öğretmenler, YZ sistemlerinde insan denetiminin gerekliliğine vurgu yaparken, belirsizlik ve kararsızlık temasında gelecekte ayrımcılık yapma ihtimali üzerinde durmaktadır. Bununla birlikte, YZ'nin ayrımcılık yapmadığını veya yaptığını gerekçesiz şekilde düşünen öğretmenlere de rastlanmaktadır. Öğretmenlerin YZ'nin ayrımcılık yapma potansiyeline yönelik farkındalıklarını, kullanım koşulları ve veri kaynaklarının rolünü kavradıklarını; ayrıca insan denetimi ve etik yaklaşımın önemine dikkat çektikleri belirlenmiştir.

Sınıf öğretmenlerinin, YZ'nin eğitim süreçlerine ve paydaşlarına katkı sağlayacak biçimde geliştirilmesi konusundaki görüşleri incelendiğinde, öğretmen görüşlerinin özellikle "YZ'nin eğitim sürecine entegrasyonu", "Öğretmene etkileri" ve "Koşula bağlı katkı sağlama"

temalarında yoğunlaştığı belirlenmiştir Öğretmenler, YZ'nin eğitim sürecine entegrasyonu açısından potansiyeline büyük önem vermekte; süreci zenginleştirme, verimliliği artırma, öğretim sürecine destek olma ve zaman-mekan tasarrufu sağlama gibi katkıları vurgulamaktadırlar. Eleştirel görüşler, YZ kullanımının pedagojik etkileri açısından dikkatle değerlendirilmesi gerektiğini ortaya koyarken; bazı katılımcıların gerekçesiz olumlu yanıtları, bu konuda yüzeysel ya da henüz netleşmemiş algıların da bulunduğunu düşündürmektedir.

Sınıf öğretmenlerinin, YZ hatalı sonuçlar verdiğinde sorumluluğun kimde olması gerektiği konusundaki görüşleri incelendiğinde, en fazla vurgu yapılan temanın "Hesap verilebilirlik" olduğu belirlenmiştir. Öğretmenler, öğretmen, öğrenci, veli ve kullanıcıların YZ uygulamalarında sorumlu olması gerektiğini belirtmiştir. Bunun yanında, yazılım geliştiriciler ve hizmet sağlayıcı şirketlerin de hesap verebilirlik kapsamında değerlendirilmesi gerektiği ifade edilmiştir. Bazı katılımcılar, sorumluluğun sadece bir tarafla sınırlı kalmaması gerektiğini belirterek çoklu paylaşılan sorumluluk ve duruma bağlı sorumluluk kavramlarını dile getirmiştir. Karar vericiler ile denetleyici kurum ve kişilerin de sorumluluk üstlenmesi gerektiği vurgulanmıştır. Öne çıkan bir diğer tema "Sorumluluğun güçlendirilmesi" olup bu bağlamda eğitim verilmesi, sözleşme yapılması ve devlet kontrolü gibi önerilere yer verilmiştir. Bazı öğretmenler ise kimsenin sorumlu tutulamayacağını ifade etmiş, bir katılımcı ise bilgi eksikliği nedeniyle görüş bildirememiştir.

Sınıf öğretmenlerinin, sınıfta YZ kullanımına yönelik etik kuralların oluşturulması gerekliliği ve bu kuralların içeriği hakkındaki görüşleri incelendiğinde, öğretmenlerin büyük çoğunluğunun "Etik ilkelerin gerekliliği" teması altında görüş bildirdiği ve bu temayı "Etik ilkeler gerekli değil" temasının takip ettiği belirlenmiştir. Öğretmenlerin etik ilke olarak en çok vurguladığı konular arasında sırasıyla "İnsan kontrolü ve denetimi", "Toplumsal ve çevresel refah", "Ayrımcılık yapmama ve adalet", "Teknik sağlamlık ve güvenlik" ile "Gizlilik ve veri yönetişimi" yer almaktadır. Buna karşın bazı öğretmenler, öğretmenin yeterliliği, YZ'nin duygusal yön eksikliği ve kullanım bilgisine sahip olmanın yeterli olduğu gibi gerekçelerle etik ilkelerin oluşturulmasına gerek olmadığını belirtmiştir. Ayrıca konu hakkında bilgi sahibi olmadığını ifade eden bir öğretmen de bulunmaktadır. Sınıf öğretmenlerinin büyük çoğunluğunun, sınıf içinde YZ kullanımına yönelik etik ilkelerin belirlenmesinin gerekli olduğunu düşündüğünü göstermektedir.

Tartışma ve Sonuç

Araştırmanın ilk sorusundan elde edilen sonuçlar, sınıf öğretmenlerinin YZ'nin eğitimde kullanımına ilişkin çok boyutlu etik risk algılarına sahip olduğunu göstermektedir. Bu durum, YZ araçlarının eğitim alanına hızla entegre edilmesi sürecinde etik, hukuki ve pedagojik düzenlemelerin henüz netleşmemiş olmasının yarattığı belirsizlik ortamının öğretmenler üzerindeki etkisinden kaynaklanmış olabilir. Literatürde öğretmenlerin özellikle kişisel veri ihlalleri (Floridi vd., 2018; Jobin vd., 2019), öğrenme süreçlerinin zayıflaması (Araujo Sandoval, 2024; Ivanov, 2023), ayrımcılık riski (Binns, 2018) ve siber güvenlik tehditleri (Brundage vd., 2018) gibi konularda yoğun etik kaygılar taşıdığını göstermektedir. Ayrıca öğretmenlerin "mesleki rol kaybı", "insan kontrolü" ve "hesap verebilirlik" temaları altındaki görüşleri, YZ uygulamalarının öğretmenlik mesleğinin karar alma ve rehberlik işlevini gölgeleyebileceğine işaret etmektedir (Chisega-Negrilă, 2024; Williamson & Eynon,

2020). Pedagojik ve teknik altyapı eksikliklerine yapılan vurgu ise, uygulama sürecinde sistemsel hazırlığın yetersiz olduğunu ortaya koymaktadır (Zawacki-Richter vd., 2019).

Araştırmanın ikinci sorusundan elde edilen sonuçlar, öğretmenlerin YZ'nin eğitimde kontrol ve denetimi konusunda insan merkezli ve etkili denetim mekanizmalarının gerekliliğine inandıklarını göstermektedir. Bu bağlamda, öğretmenin pedagojik süreci yönetme sorumluluğunun devam etmesi gerektiği, YZ'nin ise bu süreci destekleyen bir araç olarak konumlandırılması gerektiği ifade edilmiştir. Bu durum, öğretmenlerin eğitim sürecinin karmaşıklığı ve öğrencilerin bireysel ihtiyaçlarının ancak insan kontrolü ve denetimiyle karşılanabileceğine dair inançlarının bir sonucu olarak değerlendirilebilir. Literatürde, öğretmenlerin, mesleki gelişimlerini güçlendirerek, insan-makine iş birliğini teşvik ederek ve YZ okuryazarlığını artırarak liderlik rollerini sürdürebilecekleri belirtilmektedir (Li & Dan, 2024). Bu da YZ çağında öğretmenin sadece teknoloji kullanan değil, onu yönlendiren ve eğitime entegre eden bir lider konumunda olması gerektiğini göstermektedir. Nitekim Albahijan vd. (2025), YZ'nin eğitimde entegrasyonunun çeşitli riskler barındırdığını ve bu nedenle etkili denetim mekanizmalarına ihtiyaç duyulduğunu vurgulamaktadır.

Araştırmanın üçüncü sorusundan elde edilen sonuçlar, sınıf öğretmenlerinin YZ araçlarında oluşabilecek teknik sorunlara karşı bilinçli olduklarını ve bu sorunların çözümüne yönelik pedagojik, teknik ve hizmet öncesi ile hizmet içi eğitim desteği gereksinimlerini benimsediklerini göstermektedir. Bu durum, sınıf öğretmenlerinin YZ teknolojilerinin eğitim ortamlarında etkin ve kesintisiz kullanılabilmesi için teknik sorunlara karşı hazırlıklı olmalarının yanı sıra, bu alandaki yeterliklerini artırmak amacıyla sürekli eğitim ve kurumsal destek mekanizmalarının önemini benimsediklerini göstermektedir. Bu bağlamda, Filiz vd., (2025), öğretmenlerin YZ entegrasyonunda karşılaştıkları zorluklar arasında teknik altyapı sorunlarının öncelikli yer aldığını ve öğretmenlerin bu sorunlara karşı yeterli destek ve eğitim beklentisi içinde olduklarını ortaya koymuştur. Benzer şekilde, Dimitriadou ve Lanitis (2023), akıllı sınıflarda YZ ve gelişen teknolojilerin kullanımı sırasında oluşabilecek teknik problemlere karşı öğretmenlerin yedek planlar hazırlaması, alternatif öğretim materyalleri bulundurması ve teknolojik destek sistemlerinin etkin çalışmasının önemini vurgulamıştır. Ayrıca, Arranz-Garcia vd. (2025) tarafından yapılan çalışmada, öğretmenlerin teknik sorunlara karşı dijital becerilerini geliştirmek ve sürekli mesleki eğitimle bu alandaki yeterliliklerini artırmak için bilinçli adımlar attıkları belirtilmiştir. Bu durum, öğretmenlerin pedagojik yetkinliklerinin yanı sıra teknopedagojik becerilerinin de geliştirilmesi gerektiğine işaret etmektedir. Bununla birlikte öğretmenlere yönelik teknik destek mekanizmalarının güçlendirilmesi, mesleki gelişim programlarının yaygınlaştırılması ve okullarda kriz yönetimi planlarının oluşturulması önem arz etmektedir.

Araştırmanın dördüncü sorusundan elde edilen sonuçlar, sınıf öğretmenlerinin YZ uygulamalarının veri güvenliği, sistemsel riskleri ve buna yönelik alınabilecek önlemlere ilişkin bilgi ve farkındalığa sahip olduklarını ancak çok az sayıda öğretmenin bu konularda bilgi eksikliği yaşadığı ve güvenlik risklerini yeterince algılayamadığını göstermektedir. Bu durum öğretmenlerin YZ uygulamalarının veri gizliliği ihlalleri, siber saldırılar, yetkisiz erişim ve sistem kullanılabilirliği gibi çeşitli güvenlik açıklarının olabileceğinin bilincinde olduğunu göstermektedir. Bu risklerin dikkatli bir şekilde değerlendirilip yönetilmesi ve denetlenmesi

gerektiği üzerinde durmaktadırlar. Schaeffer vd. (2024), YZ araçlarının güvenlik açıklarının önyargı ve ayrımcılık gibi olumsuz sonuçlara yol açabileceğini belirtmektedir. Kamenskih (2022) ise, YZ sistemlerinin hassas öğrenci verilerine erişiminin, veri ihlali ve yetkisiz erişim risklerini artırdığına dikkat çekmektedir.

Araştırmanın beşinci sorusundan elde edilen sonuçlar, sınıf öğretmenlerinin YZ uygulamalarının gizlilik ve veri güvenliği konusunda ciddi kaygılar taşıdığını; ancak teknik önlemler, kullanıcı eğitimi ve bilinçlendirme yoluyla bu kaygıların azaltılabileceği ve etik sorumlulukların yerine getirilmesinin önemli olduğunu düşündüklerini göstermektedir. Bu durum, öğretmenlerin veri gizliliği ve güvenliği konusundaki risklere yönelik farkındalığını yansıtmakla birlikte, "Önlemler" teması altında dile getirilen teknik ve bilinçlendirme yaklaşımlarının önemini de ortaya koymaktadır. Bazı öğretmenlerin ise konu hakkında bilgi eksikliği yaşadığı dikkat çekmektedir. Literatürde de benzer sonuçlar yer almaktadır. Jose (2024), YZ teknolojilerinin eğitim deneyimlerini iyileştirebilse de öğrenci veri gizliliği ve güvenliği açısından önemli riskler oluşturduğunu vurgulamaktadır. Huang (2023) ise YZ'nin eğitimde yaygınlaşmasının, öğrenci mahremiyetini azalttığını ve veri güvenliğini karmaşık hale getirdiğini belirtmekte, bu nedenle eğitim kurumları, hükümetler ve YZ geliştiricilerinin iş birliği yaparak etkili veri koruma mekanizmaları oluşturması gerektiğini ifade etmektedir. Ismail ve Aloshi (2025) çalışmalarında, YZ odaklı eğitimde mevcut düzenlemelerin yetersiz kaldığını ve artan gözetim endişelerinin öğrenci verilerinin gizliliği ve güvenliği konusunda kapsamlı veri yönetişimi ve eğitimci eğitimine olan ihtiyacı artırdığını belirtmektedir. Schleiss vd. (2022) ise, YZ'nin eğitimde yeni analitik fırsatlar sunsa da öğrenci verilerinin korunmasının teknik ve organizasyonel önlemlerle desteklenmesi gerektiğini vurgulamaktadır. Bu sonuçlar ışığında, öğretmenlerin veri gizliliği ve güvenliği konusundaki endişelerini gidermek için eğitim ortamlarında güçlü ve bütüncül veri koruma politikalarının uygulanması, öğretmenlerin bu konuda bilinçlendirilmesi ve teknolojik güvenlik altyapısının güçlendirilmesi büyük önem taşımaktadır.

Araştırmanın altıncı sorusundan elde edilen sonuçlar, sınıf öğretmenlerinin YZ'nin karar alma süreçlerinde paydaşların aktif olarak bilgilendirilmesi ve katılımının sağlanmasının önemli olduğunu düşündüklerini göstermektedir. Ayrıca, dijital okuryazarlık eğitimi ve şeffaflık ile güven ortamının oluşturulmasının gerekliliğine inanmaktadırlar. Bu durum, öğretmenlerin YZ uygulamalarının şeffaf ve katılımcı bir şekilde yönetilmesinin, eğitimde güvenin ve etkin kullanımın sağlanması için önemli olduğunu düşündüklerini göstermektedir. Literatürde de benzer şekilde, YZ karar alma süreçlerinde paydaşların bilgilendirilmesi, şeffaflık ve açıklanabilirlik temel ilkeler olarak öne çıkmaktadır. Bhat (2024), uzman olmayan kullanıcılar arasında YZ okuryazarlığının artırılmasının, bu teknolojilerin eleştirel bir şekilde anlaşılmasına katkı sağladığını ve etik farkındalığı güçlendirdiğini vurgulamaktadır. Bu da öğretmenlerin özellikle kırsal kesimlerde dijital okuryazarlık eksikliği nedeniyle bilgiye erişimde yaşadıkları sorunlara değinmesini anlamlı kılmaktadır.

Araştırmanın yedinci ve sekizinci sorusundan elde edilen sonuçlar, sınıf öğretmenlerinin eğitimde YZ etiğine ilişkin özellikle ayrımcılık, yanlılık, fırsat eşitsizliği ve adalet gibi etik sorunlara yönelik ciddi endişeler taşıdıklarını göstermektedir. Bu durum, sınıf öğretmenlerinin YZ'nin eğitimde fırsat eşitliği, adalet ve ayrımcılık konularındaki etik

boyutlara duyarlı olduklarını, eğitimde YZ'nin etik risklerini bilinçli bir şekilde değerlendirdiklerini göstermektedir. Aynı zamanda, öğretmenlerin YZ uygulamalarının etkin, adil ve etik bir şekilde kullanılması için gerekli insan denetimi ve etik rehberlik ihtiyacını benimsediklerini ortaya koymaktadır. Bu sonuçlar, alan yazında yer alan eleştirel değerlendirmelerle örtüşmektedir. Örneğin, Williamson vd. (2023), YZ sistemlerinin kültürel önyargıları yeniden üretebileceğini ve sosyoekonomik eşitsizlikleri pekiştirebileceğini belirterek, bu bağlamda disiplinler arası ve etik odaklı yaklaşımların önemine dikkat çekmektedir. Araştırma sonuçlarına göre öğretmenler, YZ araçlarının öğrenci başarısını ve potansiyelini değerlendirirken tarafsız olamama riskine dikkat çekmiş, özellikle kırılgan grupların dışlanabileceği endişesini dile getirmiştir. Bu durum Ahmed vd. (2024) tarafından yapılan çalışmayla da örtüşmektedir. Söz konusu çalışma, öğretmenlerin teknolojiyi etik ve adil biçimde kullanabilmeleri için sürekli eğitim ve destek alması gerektiğini vurgulamaktadır

Araştırmanın dokuzuncu sorusundan elde edilen sonuçlar, öğretmenlerin büyük çoğunluğunun YZ'nin eğitim süreçlerine katkı sağlayacak şekilde geliştirilmesini önemli ve gerekli olduğunu düşündüklerini göstermektedir. Öğretmenler, YZ'nin öğretim sürecini zenginleştirme, verimliliği artırma, sürece destek olma ve zaman-mekân açısından tasarruf sağlama gibi katkılar sunduğunu belirtmektedir. Bununla birlikte, bazı öğretmenlerin pedagojik etkiler konusunda eleştirel yaklaşımlar sergilediği, bazı katılımcıların ise gerekçesiz olumlu ifadelerle yüzeysel ya da netleşmemiş algılar ortaya koyduğu da dikkat çekmektedir. Bu durum, YZ uygulamalarının sınıf ortamında etkili kullanılabilmesi için hem bilinçli değerlendirmelere hem de öğretmen eğitimine ihtiyaç olduğunu göstermektedir. Bu sonuçlar Wangdi'nin (2024) YZ'nin eğitime entegre edilmesinin kişiselleştirilmiş öğrenmeyi teşvik ettiği, üretkenliği artırdığı ve paydaşlar arası iş birliğini desteklediği yönündeki tespitiyle örtüşmektedir. Özellikle öğretmenlerin YZ'yi "öğretimi destekleyen rehber bir araç" olarak görmeleri, YZ'nin stratejik kullanımıyla değerlendirme süreçlerinin optimize edilmesi ve okul yönetimi verimliliğinin artırılması potansiyelini yansıtmaktadır (Patrizi vd., 2025). Ayrıca öğretmenler bu katkının etkili biçimde gerçekleşebilmesi için öğretmenlerin ve öğrencilerin önceden bilgilendirilmesi, teknolojik yeterliklerin geliştirilmesi ve etik denetimlerin yapılması gerektiğine işaret etmektedir.

Araştırmanın onuncu sorusundan elde edilen sonuçlar, öğretmenlerin büyük çoğunluğunun, YZ araçlarının eğitimde hatalı sonuçlar üretmesi durumunda nihai sorumluluğun insana ait olması gerektiğini düşündüklerini göstermektedir. Bununla birlikte, katılımcılar yalnızca bireysel sorumlulukla yetinmemekte, yazılım geliştiriciler, hizmet sağlayıcı şirketler, karar vericiler ve denetleyici kurumlar gibi teknik ve yapısal aktörlerin de bu sistemlerde hesap verebilir olması gerektiğini vurgulamaktadır. Bu durum, öğretmenlerin YZ sistemlerinin karmaşık ve çok aktörlü yapısını anlamalarından ve eğitim sürecinde yaşanabilecek hataların sadece kullanıcıya değil, aynı zamanda teknolojiyi geliştiren ve yöneten taraflara da bağlı olduğunu fark etmelerinden kaynaklanmış olabilir. Bu çok katmanlı sorumluluk algısı, Zainuddin'in (2024) YZ'den kaynaklanan hatalı sonuçların öncelikle geliştirici şirketlerin sorumluluğunda olduğu, ancak eğitim kurumları ve politika yapıcılarla iş birliği içinde kolektif bir denetim mekanizması kurulması gerektiği yönündeki görüşüyle örtüşmektedir. Katılımcıların "çoklu paylaşılan sorumluluk" ve "duruma bağlı sorumluluk" kavramlarını vurgulaması da bu konuda esnek ve bağlama duyarlı bir yaklaşım gerektiğini

ortaya koymaktadır. Bu durum, Ninaus ve Sailer'in (2022) savunduğu hibrit sorumluluk anlayışına paralel olarak hem YZ'nin öngörülerinin hem de insan yargısının birlikte değerlendirilmesi gerekliliğini gündeme getirmektedir. Sorumluluğun yalnızca yazılıma ya da kullanıcıya yüklenmesinin, karmaşık eğitim süreçlerinde etik ve adil sonuçlar üretmeyeceği açıktır.

Araştırmanın on birinci sorusundan elde edilen sonuçlar, öğretmenlerin büyük çoğunluğunun, sınıf içinde YZ kullanımına yönelik etik ilkelerin belirlenmesinin gerekli olduğunu düşündüklerini göstermektedir. Bu sonuç eğitimde YZ uygulamalarının yaygınlaştığı bir dönemde, öğretmenlerin yalnızca teknolojik yeterliliği değil, ahlaki yönetişim ihtiyacını da fark ettiklerine işaret etmektedir. Öğretmenler tarafından en çok vurgulanan etik ilkeler arasında ise "insan kontrolü ve denetimi", "toplumsal ve çevresel refah" ve "ayrımcılık yapmama/adalet" öne çıkmıştır. Bu durum, Şenocak vd. (2024), çalışmalarında YZ uygulamalarında şeffaflık, çeşitlilik, hesap verebilirlik ve mahremiyet gibi çok boyutlu etik yapıların küresel ölçekte kabul görmeye başladığını göstermektedir. Etik ilkelere verilen önem, yalnızca bireysel öğretmen hassasiyetini değil, aynı zamanda YZ'nin toplumsal etkileri üzerine düşünme gerekliliğini de ortaya koymaktadır. Meylani (2024), YZ sistemlerinin sınıflarda önyargı üretme potansiyeli ve veri gizliliği ihlalleri gibi olası risklerine karşı, öğretmenlerin etik yönergeler çerçevesinde donatılması gerektiğini savunmaktadır. Araştırma sonuçlarında yer alan "gizlilik ve veri yönetişimi" teması da bu endişelerin öğretmenler düzeyinde de paylaşıldığını desteklemektedir.

Öneriler

Araştırma bulgularına dayalı olarak, eğitimde YZ kullanımına yönelik açık ve bağlayıcı etik ilkelerin oluşturulması önerilmektedir. Öğretmenlere yönelik YZ okuryazarlığı ve etik farkındalık eğitimlerinin yaygınlaştırılması, bu teknolojilerin daha güvenli ve bilinçli kullanımını destekleyebilir. Ayrıca okullarda teknik altyapının güçlendirilmesi, veri güvenliği önlemlerinin artırılması ve YZ uygulamalarının düzenli olarak denetlenmesi önem taşımaktadır. Eğitim politikalarının, öğretmen görüşlerini merkeze alan ve insan denetimini esas alan bir YZ entegrasyonunu destekleyecek biçimde geliştirilmesi, etik ve sürdürülebilir bir eğitim ortamının oluşturulmasına katkı sağlayacaktır.