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Factors influencing K-12 teachers' experiences of using Generative AI Tools: opportunities and barriers

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Abstract

Artificial intelligence (AI) teaching is becoming an increasingly popular topic among educators and researchers. Its importance in the research field stems from its ability to process and analyze large datasets, identify patterns and trends, provide new insights, and automate complex tasks. Educational policies make serious plans to develop teachers' professional competencies and implement many in-service training. Concerns about the accuracy of the outputs produced by AI systems arise due to inaccuracies or biases that may be present in the data on which they are trained. The aim of the study was to identify teachers' views on their digital skills in research studies using AI tools. In this study, a qualitative research method was used to find answers to the research questions. The data of the study were collected through a semi-structured interview form. The obtained data were analyzed with content analysis. The study group consisted of 14 (female=8; male=6) secondary school teachers.

The findings of this study comprehensively examine the experiences of secondary school teachers using generative AI tools. The findings obtained in terms of opportunities and barriers reveal the importance of broad policy changes and supportive education programs to support the integration of technology in education. In addition, future expectations emphasize the need to strengthen the technological infrastructure and provide comprehensive training programs for teachers.

KEYWORDS: Generative AI Tools, Secondary School Teacher, AI Usage Experiences, Barriers and Opportunities.

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1. Introduction

Artificial Intelligence (AI) in K-12 education is a new and increasingly popular innovation. However, due to its limited scope, controversial interpretations, contextual irrelevance, and ethical issues, AI seems to have limited reference value for use (Akgün & Greenhow, 2022). In order to use AI successfully, planned and programmed educational steps need to be taken. In particular, educational programs need to be planned and implemented to facilitate teachers' skills development through professional development. AI literacy is widely accepted as a new set of skills that people use AI effectively and ethically in daily life. AI teaching is becoming an increasingly popular topic among educators and researchers. However, it seems that research on AI curricula in K-12 education is not sufficiently researched. AI is used to describe the use of machines to imitate human intelligence and perform human-like tasks. Building AI requires creating computer programs and algorithms with human-like cognitive abilities (Entezari et al., 2023). AI has become a growing focus of attention in various fields such as health, social sciences, academia, and research. Its importance in the research field stems from its ability to process and analyze large datasets, identify patterns and trends, provide new insights, and automate complex tasks. For example, artificial neural networks,

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which constitute a subset of deep learning models, aim to simulate the structure and functions of the human brain. In this context, Generative Pre-Trained Transformers (GPTs) are a type of deep learning models that are increasingly used in the qualitative research community for various purposes such as knowledge generation, translation, summarization, and analysis (Brown et al., 2020; Radford et al., 2019; Sharma et al., 2021). Text summaries of research publications can be automatically generated using GPTs, allowing researchers to quickly focus on the most relevant studies; However, this process may not always provide reliable or in-depth qualitative outputs (Hakam et al., 2024). In addition to generating research questions and suggesting relevant research topics, deep learning models can be used to support teachers' research skills in the research process (Alqahtani et al., 2023). However, the quality of the product produced through such models is debatable. As an example of these discussions, since the results are based on statistical patterns in large amounts of data rather than expert knowledge or critical analysis, they may not always provide accurate or reliable information (Kasun et al., 2024). Therefore, in order to ensure validity and reliability in research processes using AI, verification should be done by referring to different sources such as expert knowledge and digital content. In the research process, detailed and correct data should be entered into the AI for the solution of the problem addressed and it should be ensured that it produces results. The result produced by the AI should be checked and checked whether it produces a solution to the problem. The faulty and missing parts should be determined and the process should be continued by providing new data entry for the correction or rearrangement of these sections.

In an age where there is so much information, sifting through the data to find what you need can be daunting. AI has the potential to revolutionize your research skills by automating tedious tasks, providing insights from large data sets, and even predicting trends. Whether you're an academic researcher, a student, or a professional looking to stay ahead of the curve, understanding how to leverage AI can significantly improve your research capabilities. The goal of this article is to offer practical ways to use AI to improve the research skills of K-12 teachers.

1.1 Teachers' Research Skill

Educational policies make serious plans to develop teachers' professional competencies and implement many in-service training. Professional development has been expressed as improving teachers' mastery of knowledge and skills and providing teachers with opportunities to maintain or apply new knowledge (Nasir et al., 2024). However, lifelong learning has emerged as one of the biggest challenges for the future worldwide knowledge society. Educational researchers have shown the importance of professional development in improving teacher competence, school leadership, and student achievement. Both teachers and schools are constantly expanding their knowledge and skills to develop the best educational practices (Byrd & Alexander, 2020).

Teachers' research skills constitute one of the strongest characteristics among competency standards (Geerdink et al., 2016). An examination of studies on developing researchers' research skills has revealed some important research skills such as information seeking skills, writing skills, methodological skills, and data analytics (Gyuris, 2018).

1.2 Barriers Affecting Teachers' Use of AI

Concerns about the accuracy of the outputs produced by AI systems arise due to inaccuracies or biases that may be present in the data on which they are trained. This is a significant problem, especially in complex and sensitive research areas. In addition, the lack of access to certain specialized databases by AI tools limits the scope of information that can be provided and can negatively affect the accuracy of research outputs. The fact that these tools cannot fully grasp complex research queries and rely heavily on pre-existing data also creates limitations on the precision of the results obtained.

Teachers naturally encounter various obstacles when dealing with change when faced with innovation. Ertmer's (1999) typology, a widely accepted and used obstacle classification in the research literature, stands out to overcome these obstacles and design interventions. In these conceptual classifications, other typologies such as the Concern Stage (Hall, 2011) and the Technology Acceptance Model (Venkatesh & Davi, 2000) look at the barriers to innovation adoption from an individual perspective, while Ertmer's (1999) typology takes both teachers and institutional environments into account by addressing the barriers using a holistic approach. Using a holistic perspective typology can help researchers gain a more comprehensive understanding of the barriers in question. Ertmer (1999) divided the barriers that teachers face in technology integration into two main categories: first-order barriers and second-order barriers. First-order barriers are external factors that are beyond the control of teachers and usually include lack of access to resources, insufficient time, lack of support, and insensitive policies. In contrast, second-order barriers arise from internal factors such as teachers' attitudes, self-confidence, and beliefs (Dinç, 2019). Different types of barriers have been identified in the literature, and these barriers are likely to occur at various stages of integrating innovations into the teaching process. Therefore, it is necessary to develop appropriate strategies to cope with these barriers. For example, Dignath and others (2022) suggested that capacity building of teachers based on pedagogical

reasons can be an effective strategy, especially in overcoming barriers based on teachers' beliefs. With the increasing use of educational technologies in schools, many barriers defined as first-order have ceased to act as barriers. However, second-order barriers continue to have a stronger effect. Considering the problems experienced in the use of innovative AI in the field of education and the proposed studies to solve these problems, it becomes clear that more work needs to be done in this area.

The first-order barriers to the use of AI are classified as limitations in the curriculum guide and the uncertainty of hardware and learning tools. The second-order barriers can be summarized as controversial views on AI learning, insufficient teacher knowledge of AI, biased teacher attitudes, lack of confidence, and immature pedagogical understanding of AI-Enhanced Education (AIED) (Chounta et al., 2022).

1.3 Building research skills Using AI

AI plays an important role in the development of library and research skills, facilitating various stages of the research process from planning and design to data analysis and content production. Especially in the field of business education, the integration of AI into these skills leads to radical changes in the way students access and use information. AI-powered search engines increase the efficiency of information access, allowing students to access academic articles and business literature with higher precision (Kenchakkanavar, 2023). These tools also encourage students to examine topics in more depth by providing personalized recommendations based on their interests and reading habits.

AI-powered content summarization technologies help complex research findings to be more easily digested, while data analysis and visualization tools enable students to extract meaningful insights from large data sets. In generating research ideas, AI supports the process of narrowing down research focuses and generating innovative ideas by providing researchers with relevant keywords or phrases. In addition, AI tools provide an efficient literature review and information access process by curating articles, reports, and other resources related to researchers' areas of interest. AI can also generate automatic titles and concise abstracts for research articles, allowing researchers to effectively convey the essence of their work and capture the attention of readers (Venkatesh, 2022). These innovative capabilities provided by AI tools increase quality and efficiency at every stage of the research process, while enabling researchers to obtain more useful outputs with more specific, targeted, and context-sensitive prompts. Generative AI is capable of producing high-quality outputs in the form of code, reports, summaries, business communications, audio, video, and various other types of content, making it much easier to achieve the desired results. In this context, it is necessary to follow the right steps for AI applications to produce the desired results.

- Clearly define the problem or task; before approaching ChatGPT, the problem or task needs to be well defined. The more specific and detailed the problem situation or task, the better ChatGPT can understand and make relevant suggestions.
- Expressing input in natural language; when ChatGPT is asked a question or asked for code snippets, it is necessary to express the input in natural language, as if you were asking for help from a colleague. This ensures that ChatGPT can understand the problem and produce relevant and accurate output. For example, instead of entering "Python for loop", a better input would be "How can I use a for loop in Python to iterate over a list of integers?"
- Providing a comprehensive context; include information about the programming language or framework used, existing code or solutions that have been tried, or specific requirements or constraints.
- Improving and iterating the output; after receiving the output from ChatGPT, it should be reviewed and improved. To get better results, ChatGPT needs to be guided with additional context, feedback, and questions, and trained to train the AI tool. Instead of thinking of ChatGPT as an output machine, think of it as a peer being chatted with.
- Check the work; since ChatGPT can hallucinate and lie, verifying the output is critical. Instead of delegating judgment to the AI tool, researcher expertise should be brought into the chat.

The aim of the study was to identify teachers' views on their digital skills in research studies using AI tools. The following research questions were explored in this context.

Research Questions:

1. What are the most important factors that affect secondary school teachers' experiences using generative AI tools?
2. What are the opportunities and advantages that secondary school teachers face when using generative AI tools in the classroom?
3. What are the barriers and challenges that secondary school teachers face in the process of using generative AI tools?

2. Methods

In this study, a qualitative research method was used to find answers to the research questions. The data of the study were collected through a semi-structured interview form. The obtained data were analyzed with content analysis. The maximum diversity sampling method, which is one of the purposeful sampling methods, was used in the study. The study group consisted of 14 (female=8; male=6) secondary school

teachers (Table 1). The schools where the data were collected were randomly selected from among the accessible schools.

In line with the purpose of the research, semi-structured interview questions were prepared to be applied to 14 teachers working in secondary schools. Face-to-face interviews were conducted with the teachers to obtain their opinions about the factors affecting the use of AI and their digital skills in research studies using AI tools. The interviews were conducted on a voluntary basis. Each interview lasted approximately 40 minutes. The interviews were recorded. The identities of the teachers were kept confidential during the data collection process. The data obtained at the end of the interviews were analyzed.

In order to provide sample diversity, secondary education teachers from five different branches (science, math, English, social science, information technology) working in five different public schools in Turkey (Trabzon) were selected. Accessible schools located in the city center were preferred when selecting schools. In cases where the teachers to be interviewed are wanted to be directly related to the research topic, researchers generally tend to use the purposive sampling method (Karataş, 2015). Therefore, teachers who volunteered to participate in the research and used the Generative AI tool were included as the sample. In the first stage of the sample determination process, teachers who used the Generative AI tool were determined. In the determination process, a short online usage status survey including the questions "Do you use Generative AI tools in your research processes?" and "How long have you been using them?" was used. In the second stage, teachers who used them for at least one academic year were selected as a result of the survey and groups were formed from this group consisting of teachers in different fields.

According to Table 1, it is seen that there are secondary education level teachers working in five different fields who are determined to use generative AI tools from 5 different schools that can be reached to provide data diversity.

2.1 Data analysis

Qualitative data were obtained from the interviews conducted to determine the opinions of teachers regarding their digital skills in research studies using AI tools.

The data obtained through the interviews using a voice recorder were transcribed and analyzed. During the analysis of the answers given to the questions in the interview form, the field teachers working in secondary schools were coded as T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14. The concepts that emerged were coded and the cause-effect relationships between the findings were also taken into account and explained. The qualitative data that emerged during the data analysis process were checked by having two different field experts read them. The following steps were followed during the data analysis process.

Table 1 - Demographic Characteristics of the Research Group.

School Code	Participant Code	Field of Teachers	Gender	Work of years
S1	T1	Science	Female	25
S1	T2	English	Male	5
S2	T3	English	Female	21
S2	T4	Math	Female	13
S3	T5	English	Male	14
S3	T6	Information Technology	Female	13
S3	T7	Math	Female	19
S4	T8	Math	Female	13
S4	T9	Social Studies	Male	15
S4	T10	Math	Female	9
S5	T11	Social Studies	Male	29
S5	T12	Social Studies	Male	15
S5	T13	Science	Female	8
S5	T14	English	Male	20

2.1.1. Coding Process

In the interviews conducted with the sample group, a voice recorder and note-taking techniques were used together. The recordings were then analyzed. The obtained data were first transferred to the Office program and read several times, and coding was created within the scope of the research questions. Then, the codes were brought together, themes that would form the main lines of the research findings were revealed, and content analyses were conducted. Code examples are presented in Table 2.

Table 2 - Code Examples.

Code	Description
Insufficient Infrastructure	Problems experienced by teachers due to insufficient technological infrastructure.
Educational Needs	Training that teachers need to use AI tools more effectively.
Student Experiences	How students interact with these tools and how the tools provide feedback.
Purpose of Use of Tools	For what purposes teachers use these tools (e.g., providing feedback, creating learning materials).

The analyses were completed according to the code examples given in Table 2, and the data were processed according to the determined themes and the findings were interpreted with direct quotes. To ensure the

reliability of the data, the records and the transcription of the record were examined by another researcher other than the researchers and compared with the researchers' transcriptions and edits were made. After reviewing the codes, similar codes were combined and grouped to create broader categories.

- Technological Infrastructure and Access
- Pedagogical Integration
- Training and Support Needs
- Student Experience and Feedback

Based on the codes, main themes were determined within the scope of the research problems with the consensus of two different field experts.

3. Results

The analyzed data were examined depending on the research questions and are given separately below.

3.1. Research Problem 1: Factors affecting the experience of using AI tools

Within the scope of the first research problem, the results of the qualitative data analysis conducted to determine the experiences of secondary school teachers in using generative AI tools and the factors affecting these experiences are presented. The findings were divided into themes using the content analysis method, and details about the experiences of teachers under each theme are given together with the number of participants with similar views. Information on the themes and codes is provided in Table 3.

Table 3 - Factors affecting the experience of using AI tools.

Theme	Codes	f
Inadequacy of Technological Infrastructure and Resources	• Old computers • Inadequate internet connection • Inadequate hardware • Access to technology	8
Need for Professional Development	• Lack of education • Pedagogical guidance • Need for technical education • Educational programs	6
Student Experience and Feedback	• Student motivation needs • User friendly tools • Complex issues • Positive feedback	9
Pedagogical Appropriateness of AI Tools	• Course outcomes • Integration into the educational process • Pedagogical suitability • Limitations of AI Tools	3

Research results are presented under subheadings according to the themes presented in Table 3.

3.1.1. Inadequacy of Technological Infrastructure and Resources

As seen in Table 2, most of the participants (n = 8) stated that the current technological infrastructure limits the effective use of AI tools. Information Technologies Teacher T6 expressed this situation as follows:

> *"The computers in our school are quite old and our internet connection is often insufficient. This situation makes it difficult for us to use AI-based applications, especially those that require more processing power".*

Similarly, Mathematics Teacher T10 (n = 2) also drew attention to the infrastructure deficiencies and stated the following:

> *"I want to give instant feedback to students by using AI-based tools in Mathematics class, but our technological equipment does not allow this. We cannot use the full potential of these tools".*

These findings reveal that the inadequacy of the technological infrastructure limits teachers' capacity to use AI tools and that this problem needs to be resolved.

3.1.2. Need for Professional Development

More than half of the participants (n = 6) stated that they need professional development opportunities in order to use productive AI tools more effectively. English Teacher T2 (n = 3) stated the following on this issue:

> *"I want to use AI tools in the classroom, but we haven't received enough training on this subject. We need to learn how to integrate technology not only technically but also pedagogically".*

Similarly, Social Studies Teacher T12 (n = 2) stated the following:

> *"I understand the potential of the tools, but I don't know how to use them effectively in the classroom. I think more guidance and training should be provided".*

This finding reveals that teachers need sufficient training and guidance to use AI tools effectively.

3.1.3. Student Experience and Feedback

A large portion of the participating teachers (n = 9) stated that students' interactions with AI tools were

generally positive. English Teacher T3 (n = 3) summarized this situation as follows:

> *"Students find the language learning process more interesting using AI tools. In particular, applications that allow them to practice speaking motivate them".*

However, some teachers (n = 2) also stated that the complexity of these tools could be an obstacle for students. Mathematics Teacher T7 made the following comment on this issue:

> *"Some students find the tools complicated to use, which reduces their motivation. Simpler and more user-friendly interfaces can solve this problem".*

These findings show that AI tools are effective in increasing student motivation, but the complexity of the tools can create difficulties for some students.

3.1.4. Pedagogical Appropriateness of AI Tools

Some of the participants (n = 5) stated that AI tools are compatible with the course objectives. Social Studies Teacher T11 (n = 2) shared his view on how AI tools can be used in his courses as follows:

> *"In history classes, we use AI-based applications that simulate different outcomes of events. This helps students understand historical events more deeply".*

On the other hand, Mathematics Teacher T8 (n = 1) stated that the integration of tools into the teaching process may be limited:

> *"Some tools do not fit well into the flow of the course. For example, although they are suitable for in-depth analysis of a certain topic, they are not sufficient to teach basic concepts".*

The findings suggest that teachers should carefully evaluate the pedagogical suitability of AI tools and that they may not always be fully compatible with course objectives. The findings obtained in this study detail the challenges teachers face when using generative AI tools and the effects of these tools on educational processes. The findings show that factors such as technological infrastructure deficiencies, need for professional development, student experiences, and pedagogical suitability of tools shape how effectively teachers use these technologies. It was concluded that in order for teachers to use these tools more effectively, technological infrastructure should be improved and pedagogical integration should be supported.

3.2. Research Problem 2: Opportunities and Advantages of Using Generative AI Tools in Education

In this study, the findings obtained regarding the opportunities and advantages of secondary school teachers in using generative AI tools were evaluated according to the content analysis method. Table 4 provides detailed information about the main themes and related codes for these experiences.

Table 4 - Opportunities and Advantages of Using Generative AI Tools in Education.

Theme	Codes	f
Benefits of AI Tools in Education	• Improving the learning process • Personalized learning • Interactive content • Student participation	9
Opportunities	• Improving the teaching process • Student motivation • Reducing teacher workload	9
Supportive Strategies	• Additional training and guidance • Technical support • User-friendly tools • Good practice examples	7
Future Usage Expectations	• Increasing usage rate • Advanced vehicle features • Changes in education policies • Innovative education models	6

3.2.1. Benefits of AI Tools in Education

Table 4 is examined, it is seen that most of the participants think that AI tools make various contributions to the education process. Four main subthemes stand out: "improving the learning process, personalized learning, interactive content and student participation".

Under the theme of improving the learning process, teachers stated that AI tools make students' learning processes more efficient. For example, English Teacher T2 said:

> *"AI tools make students' language learning processes more effective. They are especially helpful in developing language skills".*

Similarly, the Social Studies Teacher T9 stated on personalized learning,

> *"Students can work at their own pace, and this allows them to learn according to their personal needs".*

It was emphasized that interactive content increases student participation. Social Studies Teacher T12 said on this subject,

> *"Interactive content increases students' interest in the lesson and ensures their participation".*

Regarding student participation, Information Technologies Teacher T6 commented,

> *"Students participate in the lesson more actively with AI tools. This makes them more interested in the lesson".*

3.2.2. Opportunities

Participants stated that AI tools offer various opportunities in education (Table 4). The opportunities are grouped under three main subthemes, improving the teaching process, student motivation, and reducing teachers' workload.

The theme of improving the teaching process emphasizes that AI tools contribute to making lessons more effective and interesting. English Teacher T5 said,

> *"AI tools make course content more attractive and make students' learning processes more effective".*

Increasing student motivation was also stated as an important opportunity. Mathematics Teacher T8 said,

> *"AI tools increase students' motivation and enable them to participate more in the learning process".*

In addition, reducing teachers'' T11 said,

> *"These tools reduce teachers' workload by automating some routine tasks and giving us more teaching time".*

3.2.3. Supportive Strategies

The supportive strategies suggested for the effective use of AI tools are grouped under four main subthemes as additional training and guidance, technical support, user-friendly tools and good practice examples. The need for additional training and guidance was emphasized. English Teacher T2 said,

> *"We need to receive more training and guidance to be able to use AI tools more effectively".*

It was stated that technical support services should be increased. Information Technologies Teacher T6 said,

> *"Technical support services need to be faster and more effective, otherwise it becomes difficult to deal with technical problems".*

It was stated that user-friendly tools should be developed. Mathematics Teacher T10 said,

> *"Making the tools more user-friendly will provide great convenience for both teachers and students".*

It was also stated that sharing good practice examples could be instructive for other teachers. Social Studies Teacher T12 said,

> *"Sharing good practice examples could be instructive for other teachers and facilitate the implementation processes".*

3.2.4. Future Usage Expectations

It is predicted that AI tools will be used more widely in education in the future. Participants stated that the tools will have more advanced features and that education policies should change to support AI tools. Mathematics Teacher T7 said,

> *"I think AI tools will be used more widely in education in the future".*

It is expected that the tools will have advanced features. English T3 said,

> *"I expect the features of the tools to develop further and offer more functions".*

It was stated that education policies should be updated to support AI tools. Social Studies Teacher T11 said,

> *"Updating education policies to support AI tools will be an important step".*

It was also emphasized that innovative education models should be developed. Mathematics Teacher T8 said,

> *"Developing new and innovative education models will support the effective use of AI tools".*

These findings comprehensively reflect the effects of AI tools on education and the challenges teachers face. The themes help us better understand the role of AI tools in education by systematically presenting teachers' experiences.

3.3. Research Problem 3: Barriers and challenges of Generative AI Tools in Education

In this study, the barriers and challenges regarding the experiences of secondary school teachers in using generative AI tools were evaluated through content analysis. The main themes of these experiences and the related codes are presented in Table 5.

Table 5 - Barriers and Challenges of Generative AI Tools in Education.

Theme	Codes	f
Challenges Encountered	• Technical issues • Tool complexity • Educational gaps • Student resistance	8
Barriers	• Technical issues • Low access and lack of infrastructure • High cost • Insufficient training	8
Future Expectations	• Increased accessibility • Supportive education policies • Improving technological infrastructure	6

3.3.1. Challenges Encountered

The difficulties encountered in the use of the tools are grouped under three main subthemes, technical problems, complexity of the tools, and lack of training. Technical problems cause the tools to encounter problems such as system crashes and malfunctions. Mathematics Teacher T7 said,

> *"Technical failures and system crashes disrupt our lessons, which affects students' motivation".*

The complexity of the tools causes difficulties for teachers and students. Mathematics Teacher T8 stated,

> *"The use of the tools can sometimes be complicated. This can be challenging, especially for students who are not familiar with technology".*

Lack of training causes teachers to use the tools without having sufficient knowledge. English Teacher T3 said,

> *"We did not receive sufficient training on how to use AI tools, and this makes our use process difficult".*

It was also stated that some students resisted new technologies, and this affected the teaching process. Social Studies Teacher T11 commented on this issue as,

> *"Some students are resistant to the transition to new technologies, and this negatively affects the teaching process".*

3.3.2. Barriers

The barriers of AI tools in education are grouped under four main subthemes, technical problems, low access and lack of infrastructure, high costs, and inadequate training.

Technical issues refer to the problems teachers encounter when using AI tools. Science Teacher T13 said,

> *"We often experience technical problems with the tools, and this disrupts our lessons".*

Low access and lack of infrastructure indicate that AI tools are not sufficiently accessible in some schools. Information Technologies Teacher T6 said,

> *"The school's infrastructure is insufficient to support these tools, so we cannot benefit from some features".*

High costs indicate that AI tools are expensive to procure. Science Teacher T1 said,

> *"The costs of these tools are quite high, which makes it difficult for them to be widely used in schools".*

Insufficient training indicates that teachers do not receive the necessary information to use these tools effectively. Social Studies Teacher T12 commented,

> *"We did not receive sufficient training on how to use AI tools, and this makes it difficult for us to use them".*

3.3.3. Future Expectations

The expectation that AI tools will be used more effectively in education in the future is prominent. Participants hope that these tools will become more accessible and that education policies will support the tools. English Teacher T2 said,

> *"I expect AI tools to be more widespread and accessible in the future".*

It was also emphasized that education policies should be updated to support AI tools. Social Studies Teacher T11 said,

> *"It will be important to update education policies to support AI tools".*

It was also stated that the technological infrastructure should be improved. Mathematics Teacher T7 said,

> *"Improving the technological infrastructure will enable these tools to be used more effectively".*

These findings comprehensively reflect the opportunities that teachers face in education with AI tools and the obstacles they face. The themes help us better understand the potential and challenges of AI tools in education by systematically presenting teachers' experiences.

4. Discussion

This study provides important findings about the effects of AI in education and the opportunities and obstacles that teachers experience with these tools by examining the experiences of secondary school teachers using generative AI tools in detail. These findings have the potential to expand and deepen existing understandings in the literature.

According to the findings, teachers evaluate the opportunities offered by AI tools in education quite positively. In particular, it is emphasized that AI tools make teaching processes more interesting and effective and support students' active participation in learning processes. Contents and interactive materials that can be adapted to students' individual needs provide great advantages in terms of personalizing the teaching process and creating targeted teaching strategies. These findings are consistent with the literature supporting the potential of technology to increase student motivation and participation in education (Moybeka et al., 2023; Mayer, 2009; Deci & Ryan, 1985). The fact that teachers stated that the rich content and adaptive learning materials offered by AI tools make teaching processes more effective concretizes the potential of these tools in education. Obstacles: On the other hand, technical problems and infrastructural deficiencies are among the obstacles experienced by teachers. Other obstacles such as high costs and insufficient training make it difficult to adopt AI tools more widely in education. In particular, it is seen that technical problems and limited access opportunities disrupt teaching processes and limit technology integration in education. These findings indicate that broader policy changes and supportive education programs are needed regarding the integration of technology in education. As studies such as Ertmer (1999) and Hew & Brush (2007) indicate, overcoming these obstacles is critical to realizing the potential of technology in education.

The findings of the study explain in detail the effects of artificial intelligence tools in education. In particular, the experiences of teachers while using these tools are important for understanding the role of artificial intelligence in education. The capacity of AI tools to monitor student performance, provide personalized feedback, and adapt teaching materials increases teachers' contributions to the educational process. These findings are consistent with existing literature (Luckin et al., 2016; Adıgüzel et al., 2023) that emphasizes the potential of AI in education to support student achievement. Teachers' statements about how personalized feedback provided by AI tools improves students' learning processes support the positive effects of these tools in education.

However, the barriers experienced by teachers include the inability to effectively integrate AI tools, the inadequacy of some teachers' technological skills, and the limited availability of existing infrastructure. These obstacles reduce the effectiveness of AI tools in teaching processes. This situation emphasizes the importance of support and infrastructure improvements required for wider adoption of technology in education.

The findings for future expectations reveal teachers' expectations regarding the future use of AI tools. Teachers want AI tools to be more widely available and for education policies to support these tools. These expectations highlight the necessary steps for effective use of technology in education. In particular, it is stated that technological infrastructure should be strengthened, and comprehensive training programs should be provided for teachers (Elsayary, 2023). These findings emphasize the need for educational policies to be updated and to support technological innovations. Teachers' hopeful expectations for the improvement of educational policies and infrastructure so that AI tools can be used more effectively in education reveal the importance of the changes necessary to strengthen the role of these tools in education.

5. Conclusion

The findings of this study comprehensively examine the experiences of secondary school teachers using generative AI tools. The data obtained on the opportunities offered by AI tools, the barriers encountered, and future expectations highlight the steps required to realize the potential of technology in education. The findings obtained in terms of opportunities and barriers reveal the importance of broad policy changes and supportive education programs to support the integration of technology in education. In addition, future expectations emphasize the need to strengthen the technological infrastructure and provide comprehensive training programs for teachers.

The results obtained in this study emphasize the potential of AI tools to improve the teaching process and increase student motivation, and the role of these tools in education. However, barriers such as technical problems, lack of infrastructure, and high costs make it difficult to use these tools effectively. In order for AI tools to be more widely adopted in education in the future, it is necessary to update education policies, strengthen the technological infrastructure, and provide comprehensive training programs for teachers. These steps are of critical importance to realize the potential of AI tools in education.

6. Recommendations

According to the research results, suggestions were made for practitioners and researchers.

- *Technical Support and Infrastructure Development*: Technical support and infrastructure should be strengthened to ensure the effective use of AI tools in schools. Continuous maintenance and support should be provided to minimize technical problems and improve the user's experience.
- *Reducing Costs*: Reducing the costs of AI tools can ensure wider adoption of these tools. Adjustments to be made in education budgets and financial support can increase the accessibility of these tools.
- *Education and Training Programs*: Creating comprehensive training programs for teachers will provide practical information on how to use AI tools. This will help teachers use the tools more effectively.
- *Policy Development*: Education policies need to be updated and support technological innovations. Developing policies that encourage and support the integration of technology in education can ensure that AI tools are used more effectively in education.
- *Future Research*: Research should be conducted that examines the effects of AI tools in education in broader and more diverse contexts. In addition, studies that offer solutions to the obstacles encountered will support the integration of technology in education. These studies can provide important information for understanding the effects of AI tools in different cultural and geographical contexts.

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