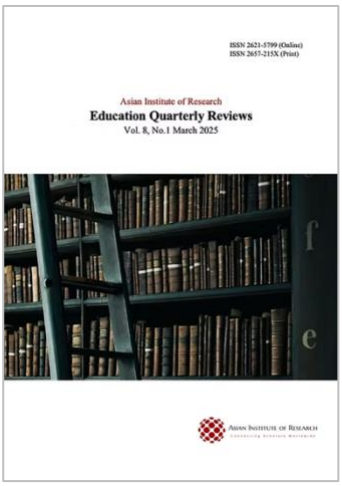

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Teachers' Perspectives on the Use of Holographic Teachers in Future Education

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Abstract
This study aims to examine the views of middle school teachers regarding the use of holographic teachers in future education through a qualitative approach. A phenomenological design was adopted for the research, and semi-structured interviews were conducted with 25 middle school teachers selected from the central district of Malatya. During the data collection process, the interviews were supported by audio recordings, and the data were categorized into thematic themes using descriptive analysis methods. The teachers indicated that holographic teachers could offer content tailored to each student's individual needs and make lessons more interactive thanks to artificial intelligence-supported algorithms. However, significant challenges such as high costs, lack of technological infrastructure, difficulties in teacher adaptation, and the weakening of student-teacher relationships were also identified. In conclusion, while holographic teachers present great opportunities for the potential in education, comprehensive planning, adequate resource provision, and support for teachers' professional development are necessary for successful integration.

Keywords: Holographic Teachers, Educational Technologies, Qualitative Research, Teacher Perspectives, Innovation in Education

1. Introduction

Three-dimensional (3D) technologies are increasingly being utilized as effective instructional tools to enhance students' knowledge levels on subjects and their participation in lessons (Annetta et al., 2009; Mellet-d'Huart, 2009). The ability to examine three-dimensional objects created with these technologies from different angles supports students' experiential and hands-on learning processes (Wu et al., 2013). Additionally, it is known that 3D technologies capture children's interest, increase attention, and make the learning process more engaging (Billinghurst, Kato & Poupyrev, 2001; Oh & Woo, 2008; Zhou, Cheok & Pan, 2004).

Hologram technology, which is among three-dimensional technologies, is a visualization tool that enables the creation of realistic three-dimensional images through holographic projection using coherent light sources such as laser light (Katsioloudis & Jones, 2018). This technology offers a strong alternative to traditional two-dimensional images, possessing the potential to enhance students' sensory perception, cognition, and memory capacities across

a wide range of educational levels, from primary to higher education (Mnaathr & Basha, 2013; Walker, 2013). Holograms, which are increasingly used in learning environments, attract students' attention, increase their motivation, and contribute to the development of positive attitudes towards lessons by providing realistic visual experiences (Işık et al., 2009; Lu et al., 2011; Walker, 2013). Furthermore, its qualities such as supporting personalized learning experiences, appealing to multiple senses, and being accessible and economical indicate that hologram technology will become one of the indispensable technologies in future learning environments (Aslan, 2017; Katsioloudis & Jones, 2018).

The development of hologram technology began in the 19th century when John Henry Pepper created a three-dimensional image in 1862 using optical projection and special light sources at a 45-degree angle with the aid of glass (Secord, 2002). In 1891, Gabriel Lippmann conducted studies aimed at producing color photographs and recording color information using the interference method. In 1947, Gabor introduced the theory of holography to utilize optical waves obtained from special glass to correct magnetic errors in electron microscopes, and in 1960, with the advent of He-Ne lasers by Leith and Upatnieks, three-dimensional holograms of desktop objects were produced (Ecevit, 2009). In 1962, Yuri Denisyuk named single-beam holograms "Lippmann's hologram" (Leonardo, 2001, as cited in Işık, 2012), and in 1964, the interdisciplinary potential of holographic techniques was demonstrated through stage applications at a conference. In 1968, transmissive holograms, and in 1972, the combination of white-light transmissive holography with cinema recording techniques, led to the emergence of moving three-dimensional cinema capabilities (Ecevit, 2009). In the 1980s, solid-state lasers increased the accessibility of hologram technology (Chin & Kim, 2015).

Holograms featured in an exhibition in Seoul in 2007 garnered international attention through virtual presentations using three-dimensional hologram technology by Bill Gates and Prince Charles in 2008. In 2010, moving three-dimensional holograms were developed, and in 2013, a company in Turkey produced a large hologram display device named HoloArc, subsequently establishing a hologram briefing room. In 2014, Apple patented a glasses-free interactive holographic touch screen. In 2016, Microsoft HoloLens enabled users to create three-dimensional holographic images using headphones and voice commands. This historical progression demonstrates that hologram technology has continuously evolved and found applications in various fields (Güntepe, 2020).

The increasing use of technology in education brings along a demand for innovative applications that enhance students' interest, motivation, and interaction in the teaching and learning processes. In this context, studies on the use of hologram technology indicate the enrichment of instructional environments through holographic teacher models (Mnaathr & Basha, 2013; Walker, 2013). Holographic teachers go beyond traditional two-dimensional presentations by offering realistic and multi-dimensional visual experiences through three-dimensional reflections created by laser-based coherent light sources, thereby enabling the enhancement of students' sensory perceptions and memory capacities (as cited in Ecevit, 2009, from Gabor, 1947; Katsioloudis & Jones, 2018; Wu et al., 2013). This technology can create a learning ecosystem that supports a student-centered approach, allowing learners to actively engage with and interact with learning materials. Specifically, the ability to create personalized learning experiences, appeal to multiple senses, and its accessibility position holographic teachers as one of the indispensable educational technologies of the future.

This study aims to examine middle school teachers' perspectives on the use of holographic teachers in future education through a qualitative research approach. The primary objective of the research is to assess the potential benefits of holographic teachers in education and the challenges that may be encountered from the teachers' viewpoints. By investigating the role and future potential of holographic teachers in education, this research will contribute to the development of necessary strategies for the effective integration of educational technologies.

2. Method

2.1. Research Model

This study is conducted within the framework of a qualitative research approach. Qualitative research allows for the natural examination of phenomena in their own context by utilizing various qualitative data collection methods

such as observation, interviews, and document analysis (Yıldırım & Şimşek, 2011). In this method, researchers are interested in the concepts created by individuals and the meanings associated with these concepts (Merriam, 2013). Additionally, qualitative research involves analyzing the meanings attributed to social issues and employing interpretive techniques to analyze research problems. Researchers perform thematic analyses on data obtained through deductive and inductive reasoning, demonstrating sensitivity to the human and environmental context. This approach enables the in-depth examination and interpretation of data (Creswell, 2013). In this study, the phenomenological design, one of the qualitative research patterns, was utilized. Phenomenology is a method aimed at gathering information about events by examining individuals' experiences (Kocabıyık, 2016). Events, experiences, perceptions, concepts, and situations encountered in our lives may manifest as phenomena with meanings that are not fully resolvable. The phenomenological design is preferred to better understand such phenomena. Phenomenology draws from the sources and diversity of individual experiences; it analyzes, evaluates, and compares these experiences. This method allows for a detailed examination of unknown or insufficiently understood phenomena, thereby providing a broader and deeper understanding (Yıldırım & Şimşek, 2011; Creswell, 2013; Patton, 2014).

In the phenomenological approach, data sources are generally individuals who experience the events. The primary data collection method for these studies is interviews. Additionally, the observation method is used as a supportive data collection tool. Since phenomenology is part of qualitative research methodology, it provides information that aids in the clearer and more detailed understanding of phenomena rather than offering generalizable or definitive results. Studies facilitate a better comprehension of the subjects by presenting case studies based on specific experiences and providing explanations (Yıldırım & Şimşek, 2011).

2.2. Participants

In this study, the convenient sampling technique, one of the purposive sampling methods, was employed. This method allows the researcher to select situations that are easily accessible and close to them, facilitating the progression of the research in a quick and practical manner. Convenient sampling is typically preferred in situations where other sampling methods are not applicable, as it is a low-cost and practical approach (Yıldırım & Şimşek, 2011; Büyüköztürk, 2016). Using this method, the study was conducted with a total of 25 middle school teachers, comprising 13 female and 12 male teachers working in middle schools in the central district of Malatya. The principle of easy accessibility was observed in participant selection. The data collection process continued until sufficient and satisfactory information was obtained, and the study group was completed after interviewing the 25th participant.

In this study, it was determined that sufficient data was provided and no new information was being obtained, leading to the completion of the study group. Participants were assigned codes such as P1, P2, P3, ..., P25 to maintain confidentiality. Additionally, the data obtained from the interviews were included in the findings section to support and provide evidence for the results.

Table 1: Sociodemographic Characteristics of the Teachers Forming the Working Group

Characteristic	Description
Gender	13 female, 12 male
Age Range	25-50 years
Professional Experience	5-25 years
Education Level	All teachers have at least a bachelor's degree, 11 teachers have a master's degree

2.3. Data Collection Tool

In this research, a semi-structured interview form containing open-ended questions prepared by the researcher was utilized as the data collection method. During the development of the interview form, the first step involved reviewing the relevant literature on the subject and establishing a framework that includes key points. Subsequently, the validity of the interview form was ensured by consulting experts. In this context, the opinions

of three faculty members from the Department of Turkish and Social Sciences Education at İnönü University were sought. Additionally, two social studies teachers and one Turkish teacher reviewed the questions. Necessary updates were made in accordance with the recommendations. After incorporating the required revisions and additions, this framework was finalized into the definitive interview form.

The questions expected to be answered in the interview form are as follows:

- Can you share your general views on the use of holographic teachers in education?
- How do you plan to integrate holographic teachers into your lessons?
- What are your thoughts on the impact of holographic teachers on students?
- What potential difficulties might you encounter in the use of holographic teachers?
- How do you think holographic teachers will affect the current roles of teachers?
- What are your expectations regarding future trends and innovations related to the use of holographic teachers in education?

2.4. Data Collection and Analysis

This study was conducted with 25 middle school teachers working in middle schools in the central district of Malatya during the 2023-2024 academic year. Throughout the research process, pre-scheduled interviews were conducted with the participants. The locations and times of the interviews were determined based on the availability of the participants. During the interviews, audio recordings were made to facilitate detailed analysis. The data analysis was performed using the descriptive analysis method. In the analysis process, thematic categories were first established based on the research questions and the theoretical framework. Subsequently, the obtained data were organized according to these categories. Finally, the data were presented with frequency values.

3. Results

In this section, the findings obtained from the research are presented and interpreted through tables.

Table 2: Participants' Views on “Can you share your general views on the use of holographic teachers in education?”

Theme	Frequency (f)
Revolution in Education	12
Accessibility and Overcoming Geographical Barriers	8
Personalized and Adaptive Learning	7
Interactive Learning	6
High Costs and Technological Infrastructure Requirements	5
Redefinition of Teacher Roles	5
Decrease in Human Relationships	4
Difficulty in Adapting to Technology	3
Change in Student-Teacher Relationships	2

- *P2: “We could call holographic teachers a revolution in education. Students can interact with holographic teachers from all around the world, creating a global learning environment.”*
- *P9: “However, the cost of this technology could be quite high. Establishing and maintaining the necessary technological infrastructure may require a substantial budget for schools.”*
- *P11: “Holographic teachers are evolving teachers’ roles. Instead of focusing on information transfer, we need to concentrate more on guidance and mentorship.”*
- *P17: “The adaptation process to this technology can be challenging for teachers. Comprehensive training programs are needed to effectively use this new technology.”*
- *P19: “The change in student-teacher relationships may weaken emotional bonds. Technology-based*

interactions completely replacing face-to-face communication could lead to undesirable outcomes."

In the research, participants' general views on the use of holographic teachers in education were categorized around various themes. The most prevalent theme, Revolution in Education (f=12), suggests that holographic teachers could bring about significant changes in the education system, enabling students to interact with experts worldwide and creating a global learning environment. For instance, having a holographic representation of Einstein participate in a history lesson could captivate students' interest. The second theme, Accessibility and Overcoming Geographical Barriers (f=8), highlights that this technology can provide quality education access to students in rural and remote areas. The third theme, Personalized and Adaptive Learning (f=7), emphasizes that holographic teachers, supported by artificial intelligence algorithms, can offer content tailored to each student's individual needs, making learning processes more efficient by adapting to students' learning speeds and styles. The fourth theme, Interactive Learning (f=6), indicates that holographic teachers can create more interactive learning experiences. For example, students might explore the three-dimensional structure of cells in a biology class with a holographic teacher, enhancing their learning engagement. The themes High Costs and Technological Infrastructure Requirements (f=5) and Redefinition of Teacher Roles (f=5) underscore the financial challenges and the need for teachers to evolve their roles towards more mentorship-oriented functions. Other themes include Decrease in Human Relationships (f=4), reflecting concerns that holographic teachers might negatively impact teacher-student relationships, Difficulty in Adapting to Technology (f=3), highlighting the challenges teachers may face in adapting to new technologies, and Change in Student-Teacher Relationships (f=2), which points to potential negative effects on students' emotional connections with teachers due to the shift to technology-based interactions. Overall, the participants' views on the use of holographic teachers in education encompass both innovative opportunities and significant challenges, emphasizing the need for balanced and comprehensive strategies for effective integration into the education system.

Table 3: Participants' Views on "How do you plan to integrate holographic teachers into your lessons?"

Theme	Frequency (f)
Animation of Historical Figures in History Classes	16
Geographic Simulations and Visualizations	12
Interactive Q&A and Discussion Sessions	10
Support for Art and Cultural Activities	8
Practice and Interaction in Language Learning	6
Applications in Science and Technology Classes	4
Virtual Field Trips and Explorations	3
Enrichment of Lesson Materials	1

- *P1: "By using holographic teachers in history classes, we can bring historical figures to life. For example, we could invite Atatürk holographically to our class and listen to his speeches."*
- *P3: "In geography classes, thanks to holographic teachers, we can show our students topics like the formation of mountains or the flow of rivers through 3D simulations."*
- *P7: "In art classes, through holographic teachers, we can teach the techniques of famous artists and provide live demonstrations for our students."*
- *P9: "In language learning, holographic teachers can engage in interactive dialogues with students, allowing them to practice and thereby improve their language skills."*
- *P15: "In student projects, holographic teachers can guide them during their research processes and support their presentations, thereby enhancing the quality of their projects."*

In the study, participants' views on integrating holographic teachers into their lessons were grouped around nine main themes. The highest frequency theme, Animation of Historical Figures in History Classes (f=16), suggests that holographic teachers can bring historical personalities and events to life, providing students with a more vivid and interactive learning experience. For instance, inviting a holographic representation of an important historical figure like Atatürk could significantly increase students' interest in history topics. The second most common theme,

Geographic Simulations and Visualizations (f=12), indicates that holographic teachers can utilize 3D simulations and visualizations in geography lessons to concretize natural processes such as mountain formation or river flow, aiding students in better understanding geographic concepts. The third theme, Interactive Q&A and Discussion Sessions (f=10), highlights the potential for holographic teachers to organize interactive sessions during lessons, encouraging active student participation and engagement with the lesson material. The fourth theme, Support for Art and Cultural Activities (f=8), suggests that holographic teachers can assist in teaching artistic techniques and providing live demonstrations, thereby helping students develop their artistic skills. The fifth theme, Practice and Interaction in Language Learning (f=6), emphasizes that holographic teachers can facilitate interactive dialogues, enabling students to practice and enhance their language abilities. Other themes include Applications in Science and Technology Classes (f=4), where holographic teachers can visualize complex experiments and theories to help students better grasp scientific concepts, Virtual Field Trips and Explorations (f=3), which involve holographic teachers organizing virtual excursions to different parts of the world, and Enrichment of Lesson Materials (f=1), indicating that holographic teachers can make lesson materials more diverse and interactive, offering richer content to students. Overall, the participants' perspectives on integrating holographic teachers into their lessons reveal a strong inclination towards enhancing engagement, interactivity, and the quality of education through innovative technological applications.

Table 4: Participants' Views on "What are your thoughts on the impact of holographic teachers on students?"

Theme	Frequency (f)
High Participation	18
More Interactive and Lively Lessons	9
Technological Curiosity and Interest	7
Attention Distraction and Technology Dependence	6
Technological Barriers to Learning Processes	6
Change in Teacher-Student Relationships	4
Development of Empathy and Social Skills	1

- *P3: "Students can have more interaction with holographic teachers. Through interactive activities, they can actively participate in classes."*
- *P9: "Students who are curious about technology may further increase their interest thanks to holographic teachers."*
- *P15: "Some students may become distracted because of holographic teachers. The risk of technology addiction should not be ignored."*
- *P17: "The lack of necessary infrastructure for using holographic teachers can create technological barriers for some students, negatively affecting the learning process."*
- *P19: "The change in teacher-student relationships with holographic teachers might create feelings of loneliness in some students. If technology completely replaces human interaction, it could adversely affect students' emotional development."*

In the research, participants' views on the impact of holographic teachers on students were categorized around eight main themes. The most frequent theme, High Participation (f=18), indicates that holographic teachers can enhance students' involvement in lessons through interactive activities, making them more willing to engage in the learning process. The second most prevalent theme, More Interactive and Lively Lessons (f=9), suggests that integrating technological innovations like holographic teachers can make lessons more dynamic and interesting, increasing students' motivation to learn by making lesson materials more engaging. The third theme, Technological Curiosity and Interest (f=7), observes that holographic teachers can further stimulate the motivation of students interested in technology, reinforcing their overall learning motivation by nurturing their interest in technological advancements. The fourth and fifth themes, Attention Distraction and Technology Dependence (f=6) and Technological Barriers in Learning Processes (f=6), highlight potential negative impacts. Some students might experience distractions during the use of holographic teachers, and there is a risk of technology dependence. Additionally, the lack of necessary infrastructure to effectively utilize holographic teachers can create

technological barriers for some students, adversely affecting their learning processes. The sixth theme, Change in Teacher-Student Relationships (f=4), suggests that the use of holographic teachers could reshape teacher-student relationships, potentially leading to feelings of loneliness among some students. If technology-based interactions completely replace face-to-face communication, it may negatively impact students' emotional development. The final theme, Development of Empathy and Social Skills (f=1), posits that holographic teachers could aid in developing students' empathy and social skills, even in a virtual environment, by providing opportunities for empathy-building interactions. The participants' expectations regarding the impact of holographic teachers on students encompass both the potential of making learning processes interactive through technology and some negative effects. In addition to positive effects such as high participation and interactivity, challenges like attention distraction, technology dependence, and changes in teacher-student relationships are also considered. These findings indicate that the use of holographic teachers in education carries both opportunities and risks, highlighting the necessity for a balanced approach to effectively integrate this technology.

Table 5: Participants' Views on "What potential difficulties might you encounter in the use of holographic teachers?"

Theme	Frequency (f)
Technological Infrastructure and Access Problems	14
High Costs	9
Teacher Adaptation	8
Students' Reactions to Technology	6
Reliability and Accuracy Concerns	4
Data Security and Privacy	3
Maintenance and Technical Support Requirements	2
Adapting Educational Materials	2

- *P5: "Establishing the necessary technological infrastructure for the effective use of holographic teachers can be quite costly. I'm concerned about whether schools will be able to cover these expenses."*
- *P7: "Teachers will need special training to be able to use this new technology. It may take time for current teachers to embrace the technology, and difficulties might be experienced during this process."*
- *P11: "Students' reactions to holographic teachers may vary. While some students may find this technology exciting, others may remain uninterested because they are not sufficiently technologically equipped."*
- *P16: "I have concerns about the accuracy of the information provided by holographic teachers. Incorrect…"*
- *P21: "It may be difficult for educational materials to adapt to holographic teachers. It could take time for the existing curriculum and materials to be integrated into this technology."*

In the study, participants' views on the difficulties they might encounter in using holographic teachers were grouped under eight main themes. The theme with the highest frequency, technological infrastructure and access problems (f=14), indicates that establishing the necessary technological infrastructure and ensuring access to these technologies are seen as the greatest barriers to effectively using holographic teachers. Participants expressed concerns about whether schools would be willing and able to make the required investments to adopt this technology. The second most common theme is high costs (f=9). The high cost of holographic teachers can place a significant burden on school budgets, making the widespread adoption of this technology more difficult. The third theme is teacher adaptation (f=8), highlighting that teachers need special training and ongoing professional development to effectively use this new technology. The process of current teachers embracing the technology may take time and could involve various challenges. The fourth theme, students' reactions to technology (f=6), shows that participants believe students' responses to holographic teachers may vary. While some students might find this technology exciting, others may remain indifferent due to insufficient technological preparedness. The fifth theme, reliability and accuracy concerns (f=4), points to worries about the accuracy of the information provided by holographic teachers. If incorrect information is presented, there is a risk of misguiding students. The

sixth theme, data security and privacy (f=3), reflects the importance of protecting students' personal information and ensuring data security when using holographic teachers. Thus, the implementation of strict policies and security measures is necessary. The seventh theme, maintenance and technical support requirements (f=2), indicates that the ongoing need for maintenance and technical support may increase teachers' workloads and necessitate additional resources. Lastly, the eighth theme, adapting educational materials (f=2), suggests that integrating existing curricula and materials with holographic teachers could be challenging and time-consuming. Overall, participants' expectations about potential difficulties in using holographic teachers include various factors such as technological and financial barriers, teacher adaptation, student reactions, and data security concerns. These findings underscore the importance of comprehensive planning, adequate funding, teacher training, and implementing security measures to effectively utilize holographic teachers in education.

Table 6: Participants' Views on "How do you think holographic teachers will affect the current roles of teachers?"

Theme	Frequency (f)
Changes in Teacher Roles	14
Decrease in Traditional Teacher-Student Interaction	8
More Guidance and Mentorship Roles	6
Digital Skills	5
Reduced Workload	4
Teachers' Professional Development	3
Development of Teaching Materials and Methods	2

- *P1: "Holographic teachers will lead traditional teachers like me to redefine our roles. We will have to engage more in guidance and mentorship since the basic transmission of information will be provided by holographic systems."*
- *P6: "The decrease in traditional teacher-student interaction is concerning. Our one-on-one communication with students may become more limited, which could make it harder to meet their emotional needs."*
- *P18: "We will need to develop our digital skills to integrate technology. Working with holographic teachers makes it essential for us to become more competent in effectively using technology."*
- *P19: "My workload may decrease because holographic teachers will take over some tasks. This will give me more opportunities to spend one-on-one time with the students."*
- *P23: "It might be challenging to align teaching materials with holographic teachers. We will need to dedicate time and resources to adapting our existing curriculum and materials to this technology."*

In the study, participants' views on how holographic teachers will affect current teacher roles were grouped under seven main themes. The theme with the highest frequency, changes in teacher roles (f=14), suggests that the use of holographic teachers will lead to a redefinition of traditional teacher roles. In this context, it is noted that teachers will focus more on guidance and mentorship rather than simply transmitting information. The theme of a decrease in traditional teacher-student interaction (f=8) reflects concerns that technology may limit face-to-face communication and make it harder to meet students' emotional needs. The theme of increased guidance and mentorship roles (f=6) indicates that, when working alongside holographic teachers, teachers will focus on providing individual support and motivation to students. The theme of digital skills (f=5) emphasizes that teachers need to enhance their digital competencies to effectively utilize holographic teachers. The theme of a reduced workload (f=4) suggests that, as holographic teachers take on certain responsibilities, teachers may have more time for one-on-one interactions, thereby easing their workload. The theme of teachers' professional development (f=3) highlights that, to effectively use holographic teachers, teachers must continually participate in professional development programs. Lastly, the theme of the development of teaching materials and methods (f=2) indicates that the use of holographic teachers may necessitate adapting existing curricula and materials to new technologies. Overall, participants' expectations regarding the impact of holographic teachers on current teacher roles include both positive changes—such as a stronger focus on guidance and mentorship, the enhancement of digital skills,

and a reduced workload—and certain challenges, such as decreased traditional teacher-student interaction and the need to adapt instructional materials to technology. These findings underscore the importance of teachers' professional development and the enhancement of their digital competencies as the role of holographic teachers reshapes the educational landscape.

Table 7: Participants' Views on "What are your expectations regarding future trends and innovations related to the use of holographic teachers in education?"

Theme	Frequency (f)
Combination of Artificial Intelligence and Emotional Intelligence	16
Global and Multicultural Classrooms	12
Empathetic and Human-like Behaviors	10
Biometric Feedback Systems	8
Real-time Language Translation and Multilingual Support	6
Holographic Educational Communities	3
Digital Art and Creativity Workshops	3
Global Project-based Learning	2

- *P3: "AI-supported holographic teachers should be able to understand students' emotional states and approach them with more empathy."*
- *P6: "Global and multicultural classrooms can allow students from different countries to learn together through holographic teachers. This increases cultural diversity and understanding."*
- *P8: "Biometric feedback systems that enable holographic teachers to instantly detect students' stress levels or attention spans and adjust the lessons accordingly would be very beneficial."*
- *P16: "Thanks to real-time language translation, holographic teachers can teach in different languages and provide multilingual support. This is a major advantage for international classrooms."*
- *P18: "Holographic teachers that develop empathetic and human-like behaviors can form more natural and sincere relationships with students."*

In the study, participants' expectations regarding the use of holographic teachers in education were grouped under eight main themes. The themes with the highest frequency—combining artificial intelligence and emotional intelligence (f=16) and global and multicultural classrooms (f=12)—stand out prominently. Participants expect holographic teachers to use artificial intelligence to analyze students' emotional states, thus demonstrating a more empathetic and human-like approach. This capability is anticipated to better meet students' emotional needs and support the learning process. The theme of global and multicultural classrooms aims to enhance cultural diversity and understanding by inviting expert holographic teachers from different countries into the classroom. In this way, students will have the opportunity to learn about various cultures and perspectives. Another significant theme is empathetic and human-like behaviors (f=10), which suggests that, thanks to advanced AI, holographic teachers could establish more natural and supportive relationships with students. The theme of biometric feedback systems (f=8) proposes that holographic teachers continuously monitor students' physical and emotional states in real-time, allowing them to adjust the lesson's pace accordingly. This feature is expected to improve learning efficiency by ensuring that students are in the most productive learning conditions. Real-time language translation and multilingual support (f=6) enable holographic teachers to teach in different languages, providing a crucial advantage, particularly for international classrooms. Among the themes with lower frequencies are holographic educational communities and networking (f=3), digital art and creativity workshops (f=3), and global project-based learning (f=2). The establishment of holographic educational communities encourages the exchange of knowledge and experience worldwide, while digital art and creativity workshops allow students to develop their artistic talents. Global project-based learning aims to increase collaboration skills and cultural interaction by having students work on projects with peers from around the globe. Overall, participants' expectations regarding the use of holographic teachers in education show a strong focus on integrating technology with humanistic and cultural dimensions to support students' emotional and academic development. These findings indicate that

holographic teachers may play a significant role in the future of education and enrich learning processes through various innovations.

4. Discussion and Conclusion

This study aimed to examine teachers' views on the use of holographic teachers in the education of the future. The findings obtained from interviews conducted with middle school teachers provide a comprehensive understanding of the potential of holographic teachers in education, methods of integration, their effects on students, possible challenges, their impact on current teacher roles, and future trends.

Research findings indicate that holographic teachers have the potential to lead transformative changes in the field of education by contributing to the development of innovative pedagogical practices. Teachers emphasized the capability of hologram technology to offer students a global learning environment. Notably, the most prominent opinion among participants regarding the integration of holographic teachers into lessons was the reenactment of historical figures. This method enables students to experience historical events and personalities more vividly. In this context, it reinforces the potential of holographic teachers to enrich lesson materials and provide students with more tangible and interactive learning experiences.

According to teachers' views, holographic teachers have positive effects on students, such as high engagement and more interactive lessons. The increase in students' technological curiosity and their heightened learning motivation highlight the advantages of hologram technology in learning processes. By making lessons more dynamic, holographic teachers can increase students' interest in the subject matter. However, some teachers pointed out that negative effects such as distraction and technology addiction should not be overlooked. Concerns that students may become distracted and risk developing a dependency on technology during interactions with holographic teachers suggest the need for a balanced approach to using this technology.

The greatest challenges in using holographic teachers include technological infrastructure and access issues, as well as high costs. Adapting teachers to this new technology and students' responses to the technology were also identified as significant challenges. Technological infrastructure and access issues stem from the high costs of the hardware and software investments required for the effective use of hologram technology. Moreover, the need for special training to help teachers adapt to this new technology will complicate the adaptation process. Students' reactions to technology indicate that while some may find this innovative method exciting, others may remain uninterested due to inadequate technological proficiency. These challenges underscore the necessity of infrastructure investments, as well as adequate training and support for teachers, in order for hologram technology to be widely adopted.

The research findings indicate that holographic teachers may redefine current teacher roles. Teachers noted that they would focus more on guidance and mentorship rather than simply transmitting information. This suggests that teachers need to improve their digital skills and participate in professional development programs. Additionally, concerns were expressed about a decrease in traditional teacher-student interaction. With the use of holographic teachers, it was suggested that teachers' one-on-one communication with students could become more limited, potentially making it harder to meet students' emotional needs. This situation requires teachers to enhance their digital competencies and continuously participate in professional development programs to use hologram technology effectively.

Among the participants' expectations, the combination of artificial intelligence and emotional intelligence, global and multicultural classrooms, and empathetic, human-like behaviors stand out. It is expected that AI-supported holographic teachers will be able to understand students' emotional states and approach them with greater empathy. This feature would better meet students' emotional needs, thereby supporting their learning processes. The theme of global and multicultural classrooms aims to increase cultural diversity and understanding by inviting expert holographic teachers from different countries into the classroom. Furthermore, innovations such as biometric feedback systems and real-time language translation enhance the potential of hologram technology to create more personalized and inclusive educational environments. These trends suggest that holographic teachers

can go beyond being mere tools for transmitting information and also contribute to students' emotional and social development.

Overall, it is concluded that the use of holographic teachers in education presents both significant opportunities and certain challenges. While the technology's innovative possibilities diversify students' learning experiences, issues such as cost, infrastructure, and adaptation need to be overcome. In this context, cooperation among educational institutions, policymakers, and technology developers is essential for the effective use of hologram technology in education.

In addition, future research could provide a more comprehensive understanding of the potential of holographic teachers in education by including the perspectives of teachers from different countries and educational levels. It is also recommended to employ quantitative research methods to evaluate the long-term effects of hologram technology. Such research would help assess the impact of hologram technology on education in a more generalizable manner.

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