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The Future of Interactive Education: Exploring Teachers' Views on Integrating Holograms into the Learning Process

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Abstract

This study wanted to find out what Saudi teachers think about using holographic technology in their classes and how it could support learning and communication. Teachers who participated in the research numbered 570 and all were from public schools in Al-Ahsa Governorate, Eastern Province, during 2024-2025. A supported survey, assessed and approved by experts and pilots, was applied to obtain quantitative information. Information about teachers' demography (gender, age, education, experience) was collected in the first section and the second section focused on teachers' opinions about using holograms in schools. Findings revealed that while teachers understand holographic technology well, they struggle to implement it because of price, insufficient technical help and a scarcity of training materials. Regardless of these problems, teachers notice that holograms can help students stay engaged, understand topics better and become more motivated in school. Even so, it was pointed out that integrating holograms into standard subjects remains an issue and they highlighted the importance of special training for better use of the tool. The paper found that holograms can be successful if the main barriers—financial, technical and support—are solved. Suggestions are made to engage the private sector in funding new technologies and to organize broad teacher training courses. The purpose is to provide engaging learning spaces that help students handle today's challenges. We should keep exploring this area by studying many different areas and bringing in a variety of stakeholders to confirm and increase what we know now.

Keywords: *Holographic Technology, Interactive Education, Educational Innovation, educational challenges, and curriculum, Technological Integration, Professional Development.*

Introduction

The field of hologram projection is quickly rewriting pedagogical practices, particularly in the STEM subjects, through the interactive bring to life the 3D versions of the complex subjects no longer seem very complicated, such as an explanation of the molecular structure and engineering principles, which cannot be so easily visualized with two-dimensional images (Gangadi, 2024; Qazi et al., 2023). Research states that employing holograms significantly boosts student engagement and learning outcomes, with reports from studies based on 73% of architecture students that they were provided with better understanding through hologram technology compared to conventional methods (Qazi et al., 2023)

However, technology still has challenges in implementation, ranging from a lack of in-depth research regarding its effectiveness to the absence of safety protocols (Gangadi, 2024; Yoo et

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al., 2022). As advancements prevail since the acceptance of technology, holography, and its attributes are likely to evolve to become a staple in educational systems redefining the way students interact and perceive classroom workings in a revolutionary way (Lee, 2013; Zhu & Lou, 2022).

Holography is dynamic for educational environments, enabling learning experiences with three-dimensional views that reinforce immersion. It has also been evidenced that holographic media promote better understanding in all fields of education, such as in an art education setting, where multilingual holographic resources add value to students from different language backgrounds (Iriaji et al., 2024). Holograms in classrooms will fasten the learning process while improving retention capabilities, as demonstrated by the efficiency of experimental groups using holographic applications compared to traditional methodologies (Sertalp, 2024; Ramachandiran et al., 2019). Yet, subsequent studies are required to substantiate curriculum theory on holographic utility in education and ensure that effective utilization strategies are in place to enlarge their potential in different disciplines (Yoo et al., 2022; Gangadi, 2024).

The trend of educational institutions integrating holographic technologies is supported by immersive tools such as virtual reality (VR) and augmented reality (AR), with the aim of transforming the face of learning for 21st century students and providing them with immersive and interactive opportunities. While students envisage these technologies as tools for the future learning environment beyond the realm of conventional classrooms, Pitsikalis et al. (2024) stated that this is highlighted by frameworks like the European Qualification Framework in relation to engaging, motivating, and inducing critical thinking and creativity. However, concerns remain around equitable student access to technology due to hurdles such as accessibility, instructor training, and infrastructure requirements (Eden et al., 2024). Yet, moving forward in redefining 21st century learning, such technology will play significant roles in modern classrooms, and in this regard, efforts will continue in exploring the possibilities of effects using this method of instruction in both primary and higher education settings (Vashisht, 2024; Khamis et al., 2024).

Evidence shows that educational institutions that use three-dimensional holograms impact student involvement and learning, mainly in STEM areas. Learning with holograms is more interactive and engaging than learning from only 2D sources, because complex ideas can be easily pictured (Gangadi, 2024). According to Hakeem et al., (2024) studies of schools using 3D holograms found that nearly all teachers reported greater student comprehension (94.4%). When gesture recognition is used with holography, it becomes easier for students to interact more actively with the material (Hakeem et al.,2024) When learning is done with 3D holograms, both students and teachers find it more engaging which benefits their learning (Lee, 2013; Kaharuddin et al., 2023).

Teachers' beliefs and perceptions significantly affect technology implementation in education, as shown by comparative studies conducted in India and Tanzania. Indian teachers generally express satisfaction with administrative support and resources, which contribute to effective technology use; in contrast, Tanzanian teachers express dissatisfaction due to insufficient training and inadequate IT infrastructures, exhibiting the pressing need for systemic policy changes and resource allocations (Benjamin & Dangwal, 2025). Furthermore, teachers' pedagogical beliefs critically influence their instructional decisions related to technology, indicating that professional development needs to address such beliefs to support effective technology integration (Ertmer, 2005). Overall, unless these aspects are dealt with, technology adoption into the educational systems will remain unsuccessful (Naik et al., 2024).

AI integration in educational contexts is deeply influenced by teachers' levels of experience and support, necessitating the creation of training programs fit for purpose. It is pointed out by research that teachers frequently do not have the familiarity or confidence to utilize AI tools; this is reflected in only 5% stating that they have high confidence in the use of AI, while 40% have indicated some familiarity (Roshan et al., 2024). Barriers such as inadequate training and poor infrastructure are very much common, especially in regions like Pakistan and Jimma town, where prospective teachers meet limitations for an effective engagement of ICT (Kumar, 2024; Echave et al., 2024).

That's why sharing or participating in a lesson is not simple for students, and for this reason, we must now use more effective methods (Carmical & Nadelson, 2025; Janardhanan & Charles, 2024). There is evidence that using PBL and technology in teaching increases students' achievement in mathematics (Janardhanan & Charles, 2024; Humaira et al., 2024). Thus, with Professional Learning Communities, teachers find it much easier to teach using new strategies, but not having enough resources and fearing change can still be issues. Consequently, when introducing new ways to connect in schools, they support teachers, boost students, increase team spirit, and raise chances for students to perform well and achieve success (Yang, 2025). By introducing new teaching methods, a variety of learning settings can be achieved (Pirehbabi et al., 2024; Humaira et al., 2024).

Research Objectives

The purpose of the study was to discover teachers' opinions on using holograms in education and also to examine how it would benefit learning and communication in Saudi Arabia.

Research Questions

This study was based on the following research questions:

Q1. Do teachers fully understand holograms and want to introduce them into their teaching and classroom activities?

Q2. What differences could holograms make to learning at schools compared to regular lessons?

Q3. What difficulties do teachers meet or expect when using holograms, and what can be done to overcome them for future use?

Materials and Methods

Design

The research was based on a descriptive survey approach. By immediately observing things, this method allows for both numbers and descriptions of the effects to be created. Furthermore, the report describes how the research was carried out to keep things clear and logical.

Participants

This study included both male and female teachers in the public schools of the Al-Ahsa Governorate in Eastern Province, Saudi Arabia, during the academic year 2024-2025. We used a questionnaire to collect the quantitative data needed to answer the research questions. At the outset, a questionnaire was offered to 80 teachers to determine its reliability and validity. When the initial task was done, the final group consisted of 570 male and female teachers from the governorate's primary, intermediate, and secondary schools. To make sure everyone understood, the questionnaire was given in Arabic as well as in some other languages, together with simple

guidelines for filling out the form. Ethical standards were maintained throughout the process, with participants voluntarily agreeing to take part while retaining their autonomy. The questionnaire consisted of two groups of questions: the first focused on gender, age, previous studies, and how long the teacher has been teaching and the second focused on the courses being taught (Table 1). Ensuring they were effective, new medications were tested using study measures and initial research.

Demographic variables		The sample	The number	Percentage %
Gender	Male	570	279	48.95%
	Female		291	51.05%
Age	Under 25	570	118	20.70%
	26-35		182	31.93%
	36-45		174	30.53%
	Over 45		96	16.84%
Educational Qualification	Bachelor's degree	570	422	74.04%
	Master's degree		29	5.09%
	PhD		23	4.04%
	Other		96	16.84%
Teaching Experience	Less than 5 years	570	176	30.88%
	5-10 years		172	30.18%
	11-15 years		167	29.30%
	More than 15 years		55	9.65%
Subject Taught	Arabic	570	97	17.02%
	English		80	14.04%
	Social Studies		115	20.18%
	Science		97	17.02%
	Mathematics		97	17.02%
	Other		84	14.74%

Table 1. Presents The Demographic Characteristics of the Study Participants

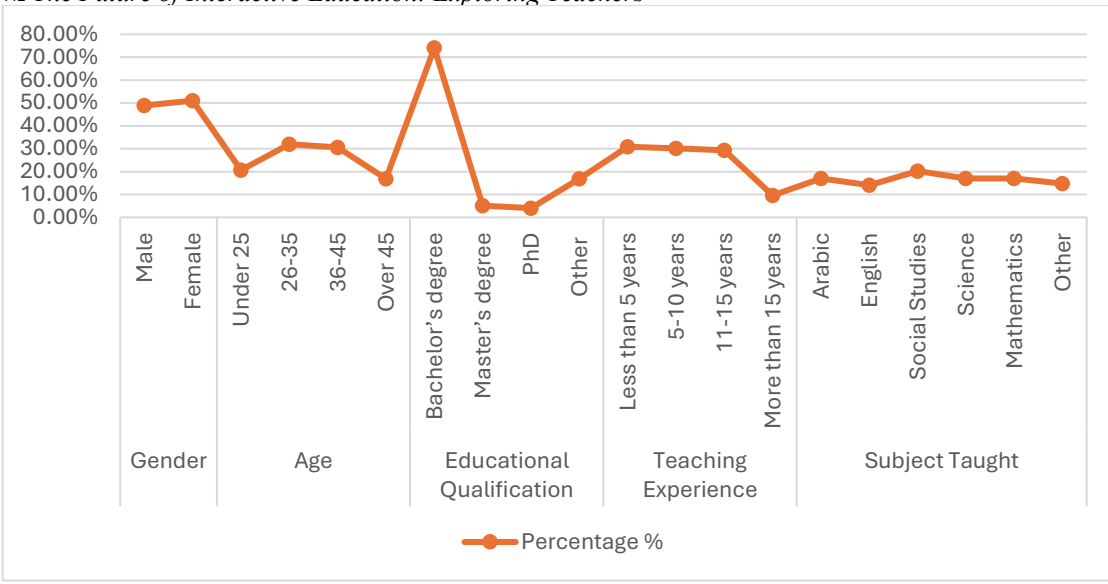

Figure 1. Participants In Each Group Were Recorded as Both a Count and A Percentage.

Instrument

The study aimed to explore teachers' perceptions and use of hologram technology in educational activities with their students. The research instrument was structured into two main sections. The first section collected demographic data from participants, including their experience and knowledge of hologram technology, and included an ethical consent form to ensure voluntary participation. The second section focused on participants' attitudes toward hologram technology, its educational applications, and the positive and negative factors they encountered during its implementation in classroom settings. The questionnaire was designed around three structural components that addressed hologram perception, application in the teaching environment, and challenges associated with its use. Each component consisted of ten statements, measured using a five-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5) (see Appendix A). Initially, the questionnaire included 37 statements distributed across the three domains. Experts reviewed these statements and made them clearer, more important, and more comprehensive by limiting them to 30 statements. Thanks to the expert review, the questions sought helpful answers and avoided questions that could be misunderstood during the survey. Reliability and simplicity were confirmed for the questionnaire by pilot testing it with 80 participants. The findings were checked using Pearson's correlation coefficient, and it was discovered that the relationships among the dimensions were strong to moderate. The first dimension ranged from 0.772 to 0.834, the second from 0.798 to 0.862, and the third from 0.688 to 0.802 in terms of correlations. Furthermore, the scores within each dimension and the total score showed adequate consistency from 0.711 to 0.795. With help from Google Drive, the questionnaire was both delivered and collected efficiently. Before the study was shared with participants, the Al-Ahsa Education Department authorized it so the research complied with required rules and ethics. Next, the questionnaires were sent to teachers at all three levels in the Al-Ahsa Educational District. The authors controlled both the sending and returning aspects to guarantee that the survey response rate was high. The data collection methods used were effective because 570 complete questionnaires were gathered. From September 30 to November

28, 2024, participants could take part in the survey and answer all questions.

Statistical Analysis

The researchers utilized IBM Statistical Package for the Social Sciences (SPSS version 26) as the primary tool for data analysis. The data analysis involved various statistical tools, including means, standard deviations, percentages, Pearson's correlation coefficient, Cronbach's alpha coefficient and chi-square. The techniques were used to provide detailed insight into the data and check for connections between variables and the reliability of the tools we measured them with. SPSS 26 helped make the study reliable by making it possible to analyze the data properly and accurately. Because of the advanced features, the results were accurate and could be repeated. To decide if the findings were significant, p was set to less than 0.05. Scientists use this method in all types of research to ensure that any apparent relationships found in data are not just the result of luck. In addition, the approach used for the research focused on ensuring it was both reliable and valid. Using strict statistical methods and filling the necessary criteria for significance, the authors ensured that the study results were both orderly and dependable. All these directives assured the legitimacy of the outcomes, supporting their accuracy and importance.

Ethical Considerations

The study was approved by the Al-Ahsa Educational District to meet ethical standards. It was after that the school principal gave the researchers permission to do the research in their schools. Before the study began, all participants were provided with information describing in detail what their participation involved and noting that ethical standards needed to be followed. Moreover, the University's Ethics Committee approved this research, assigning reference number KFU-REC-2024-Sep -ETHICS2514, demonstrating that ethical standards are followed in the study.

Results

Quantitative findings are discussed and interpreted in relation to the research questions.

Research Question 1. Do teachers fully understand holograms and want to introduce them into their teaching and classroom activities?

Figure 2 displays what teachers know about holograms and how they use them in their teaching practice. The results indicate that teachers have a moderate level of awareness, scoring on average 3.30 (66%). Results from the survey show that teachers have different levels of understanding about holography, with 56% showing the most and 72% the least knowledge.

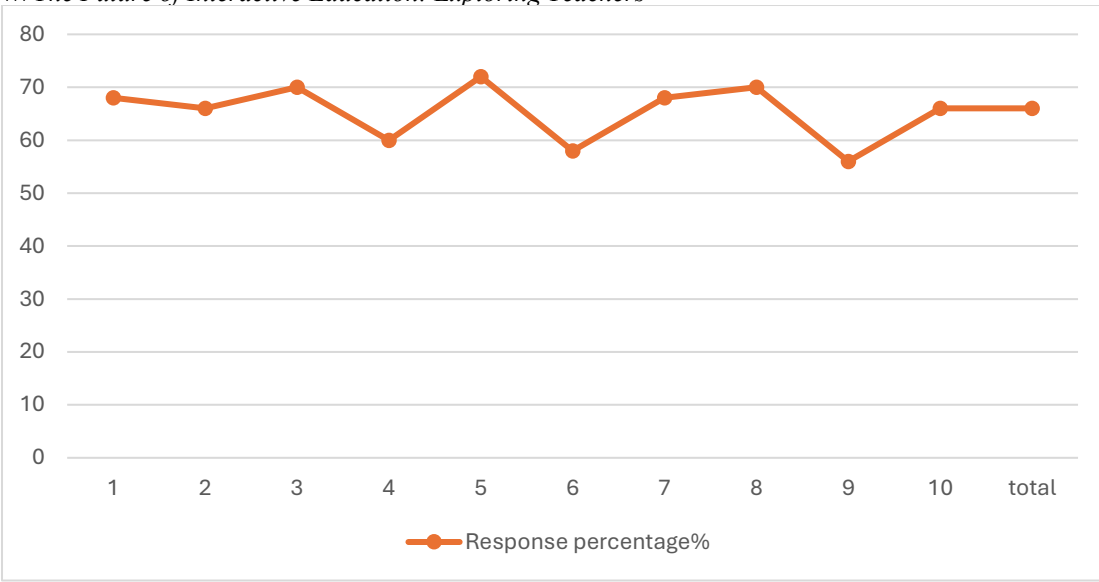

Figure 2. Response to Hologram Awareness and Integration

No.	Phrase	Mean	Std. deviation	Response percentage%	Chi-square	Sig.
Dimension 1: Awareness and Integration of Holograms in Teaching and Learning						
1	I acknowledge the potential of holograms to increase student engagement during lessons.	3.4	0.7	68.00	13.45	0.012
2	I believe holograms can make learning more engaging and enjoyable for students.	3.3	0.8	66.00	12.89	0.013
3	I understand how holograms can simplify the explanation of complex concepts.	3.5	0.6	70.00	14.12	0.010
4	I actively explore opportunities to integrate holograms into my teaching practices.	3.0	0.9	60.00	15.34	0.009
5	I consider holograms a valuable tool for delivering innovative educational content.	3.6	0.7	72.00	13.78	0.011
6	I feel confident using holograms as part of my instructional strategies.	2.9	1.0	58.00	16.21	0.007

7	I recognize the role of holograms in bridging the gap between theoretical and practical learning.	3.4	0.8	68.00	14.67	0.010
8	I believe holograms can accommodate diverse learning styles among students.	3.5	0.7	70.00	13.90	0.012
9	I regularly update my knowledge about the latest developments in hologram technology for education.	2.8	1.1	56.00	17.34	0.005
10	I view holograms as an essential component of modern educational tools.	3.3	0.8	66.00	14.23	0.011
	Total	3.30	0.85	66.00	KMO = 0.84	

Table 2. Teachers' Awareness and Integration of Holograms in the Educational Process.

The data presented in Table 2 highlights teachers' awareness and integration of holograms in the educational process, as measured through their responses to a series of statements. The mean scores for the ten items ranged from 2.8 to 3.6 on a five-point Likert scale, with an overall mean of 3.30, indicating a moderate level of agreement among participants regarding the potential benefits and challenges of using holograms in education. Statements such as "I consider holograms a valuable tool for delivering innovative educational content" (mean = 3.6) and "I understand how holograms can simplify the explanation of complex concepts" (mean = 3.5) received the highest agreement, reflecting teachers' recognition of holograms as effective tools for enhancing learning experiences. Conversely, items like "I regularly update my knowledge about the latest developments in hologram technology for education" (mean = 2.8) and "I feel confident using holograms as part of my instructional strategies" (mean = 2.9) scored lower, suggesting gaps in teachers' familiarity with hologram technology and their confidence in integrating it into their teaching practices. The standard deviations ranged from 0.6 to 1.1, indicating some variability in responses but generally consistent perceptions across the sample. The chi-square values and significance levels ($p < 0.05$ for all items) confirm the statistical relevance of the findings, while the Kaiser-Meyer-Olkin (KMO) measure of 0.84 demonstrates the adequacy of the sample size for factor analysis.

Research Question 2. What are the implications of using holograms for the educational process in school systems?

Responses from participants about holograms' effects on learning are displayed in Figure 3. On average, the results are very positive, scoring 3.8 or higher in every case. Most participants acknowledged the important educational use of holograms, confirming by their approval scores. Moreover, results show $p < 0.001$ in chi-square analyses, meaning the results are both reliable and robust.

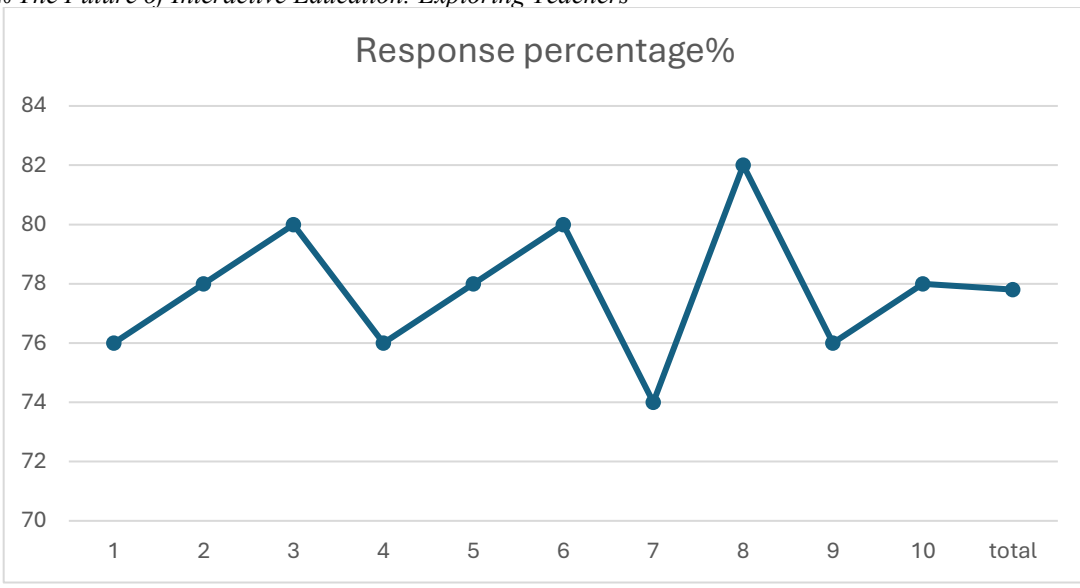

Figure 3. Response Rate to impact of Using Hologram Technology

No.	Phrase	Mean	Std. deviation	Response percentage%	Chi-square	Sig.
Dimension 2: Impact of Hologram Technology on Teaching and Learning						
1	The use of holograms significantly enhances students' motivation to engage in learning activities.	3.8	0.7	76.00	16.45	0.002
2	Holograms are effective in helping students grasp abstract or challenging concepts.	3.9	0.6	78.00	17.23	0.001
3	Incorporating holograms into lessons improves the overall quality of the learning experience.	4.0	0.7	80.00	18.12	0.001
4	The use of holograms supports better retention of knowledge among students.	3.8	0.8	76.00	16.78	0.002
5	Holograms foster creativity and innovation in students' thinking and problem-solving skills.	3.9	0.7	78.00	17.56	0.001
6	Holograms encourage active participation and	4.0	0.6	80.00	18.34	0.001

	collaboration among students during lessons.					
7	The integration of holograms reduces the dependency on traditional teaching methods.	3.7	0.8	74.00	15.89	0.003
8	Holograms create a more immersive and engaging learning environment compared to conventional tools.	4.1	0.6	82.00	19.45	0.001
9	Students demonstrate noticeable improvements in academic performance when holograms are used.	3.8	0.7	76.00	16.67	0.002
10	Holograms help connect theoretical concepts with real-world applications effectively.	3.9	0.7	78.00	17.34	0.001
	Total	3.89	0.71	77.80	KMO = 0.86	

Table 3. Teachers' Perceptions of the Impact of Holograms on the Educational Process

Table 3. show teachers giving positive assessments of the effects of hologram technology on teaching and learning. All the mean scores from the ten items were between 3.7 and 4.1 on a scale of one to five and the average score was 3.89, showing a strong agreement that holograms help in education. Survey participants agreed most with the points, "Holograms make learning more interesting and engaging for students" and "Learning with holograms boosts the learning experience" (both with means of 4.0). Markedly, educators also point out that holograms are beneficial in assisting students with hard-to-understand ideas and enhancing their creativity (mean = 3.9). It also looks like teachers may still appreciate how holograms can work along with conventional courses. Responses showed little or no extreme values, and all findings are confirmed by the chi-square and p-value results. Since the KMO value is 0.86, the data shows the sample is highly representative, confirming the results once more.

Research Question 3. What challenges do teachers face in using holograms as part of their curriculum?

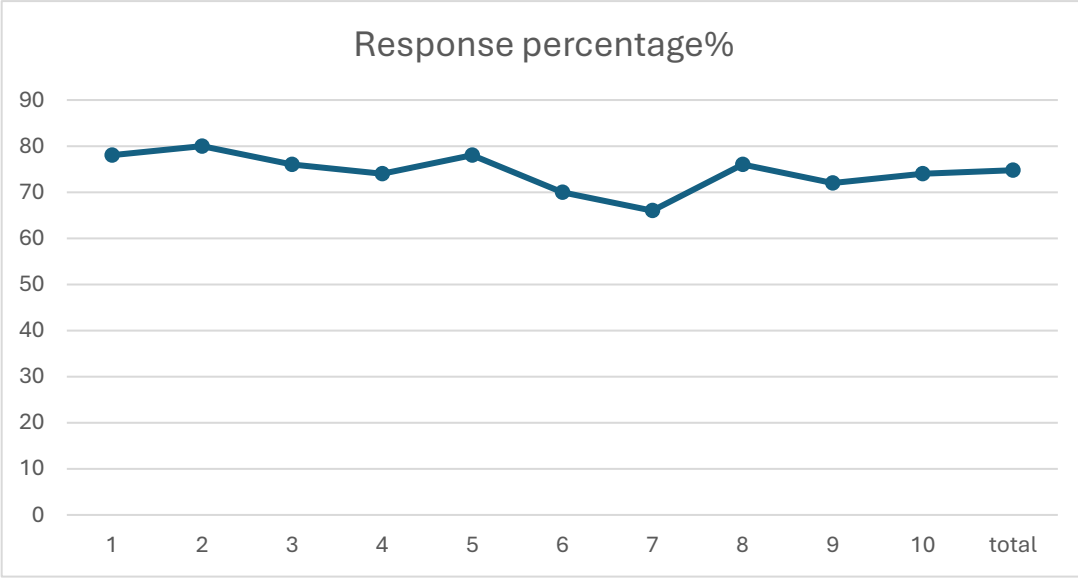

Figure 4. Teachers' Responses to Challenges Faced by Hologram Technology

No.	Phrase	Mean	Std. deviation	Response percentage%	Chi-square	Sig.
Dimension 3: Challenges Faced by Teachers in Adopting Hologram Technology						
1	Limited access to hologram technology due to insufficient resources poses a significant challenge.	3.9	0.8	78.00	15.45	0.002
2	The high cost of implementing holograms in education is a major barrier to adoption.	4.0	0.7	80.00	16.23	0.001
3	A lack of adequate training hinders my ability to effectively use holograms in teaching.	3.8	0.8	76.00	14.89	0.003
4	Insufficient technical support for using holograms in schools creates additional challenges.	3.7	0.9	74.00	13.78	0.004
5	Integrating holograms into existing curricula is perceived as complex and time-consuming.	3.9	0.8	78.00	15.45	0.002

6	Many students struggle to understand how to interact effectively with hologram technology.	3.5	1.0	70.00	12.34	0.006
7	Concerns exist that holograms may divert students' attention from the intended learning goals.	3.3	1.1	66.00	11.56	0.008
8	The complexity of hologram technology makes it difficult to implement in classroom settings.	3.8	0.8	76.00	14.89	0.003
9	Resistance from school administrators to invest in hologram technology is a notable obstacle.	3.6	0.9	72.00	13.23	0.005
10	There is a perceived lack of awareness about the educational benefits of holograms among stakeholders.	3.7	0.9	74.00	13.78	0.004
	Total	3.74	0.86	74.80	KMO = 0.87	

Table 4. Teachers' Opinions About Obstacles Related to Teaching with Holograms.

The data in Table 4 and Figure 4 illustrates that teachers encounter considerable difficulties when trying to use hologram technology in education. Participants gave average ratings of 3.74 of 5, suggesting that there was moderate to high agreement on the difficulties of hologram integration. It was widely acknowledged that holograms are not readily used because of the excessive cost and insufficient resources (means of 4.0 and 3.9). Similarly, teachers report difficulties in learning to use holograms and finding adequate support for using them in schools (mean = 3.77). Although issues about student involvement scored slightly lower ("Experts are worried holograms may make students pay less attention to the main objectives" with a mean score of 3.3), they demonstrate that it could affect students' ability to retain the main learning points. Standard deviations from 0.8 to 1.1 reflect moderate change in the answers and the chi-square and p-values (all below 0.05) prove the study results are reliable. Because the KMO value is 0.87.

Discussion

The research shows that while many teachers are aware of what holograms can offer, few are prepared to use them. The study shows a significant gap between teacher support for hologram use and their skills in using holograms. While 3D holographic technology can bring great benefits to education, not all educators who know its benefits can implement it easily in their teaching. The teaching staff knows that holograms are important for enriching educational material, judging from their score, but they demonstrate little practical understanding of the technology, as shown by their implementation and understanding scores (Lee, 2013; Yoo et al., 2022). Holograms were introduced in medical education and engineering first, yet there is not

enough research on their educational effects in different fields and age groups (Yoo et al., 2022; Sertalp, 2024). Holographic technology requires detailed preparation and official support since budgeting and resource problems often prevent its introduction (Safitri & Djuniadi, 2021; Jafari, 2023). Working together, educational institutions and technology companies can design a supportive environment that uses holographic technology for new teaching approaches (Lee, 2013; Jafari, 2023).

Educators have difficulty seeing the true educational value of holograms since many obstacles often hamper the practical use of holograms. Many educators say holograms improve both academic results and student interest, though they feel hesitant to use them because their understanding of the tool varies (Perifanou et al., 2022; Lee, 2013; Yoo et al., 2022). Current research indicates holographic technology may be useful, but problems with its cost and a shortage of digital skills and school support limit its use in classrooms (Sertalp, 2024; Orhak & Çağıltay, 2024). Holograms can only be used effectively in schools if professors have training, the right funding is available, and technical hurdles are clear (Perifanou et al. 2022; Yoo et al. 2022).

As shown by Table 4, teachers are largely in agreement that there are key barriers when trying to use holographic technology in education. Multiple obstacles to introducing holograms in education have been identified in many previous studies. Emerging findings are supported by recent studies which indicate that a lack of financial resources and insufficient educational resources make it challenging to use virtual reality and holograms (AlAli & Wardat, 2024; Škola et al., 2024). Many schools feel extra pressure due to teacher training gaps and not having enough resources to manage advanced technology (Francom, 2020). Because setting up hologram technology is challenging, implementing it correctly requires specific training plans and simpler processes for integration (Lee, 2013). To help schools use holograms in education at their best, it is necessary to address financial matters, resolve tech issues, and make sure people are always aware of them (Škola et al., 2024). These results highlight that schools, educators, and technology companies should join forces to provide suitable settings for the strong adoption of holographic technology.

Holograms can become valuable in education only if teachers are given proper training, funds are provided, and current technological problems are addressed. Interactive 3D images from holographic technology have been shown to assist students in learning and summarizing complex topics in science, technology, engineering, and math (Gangadi, 2024). Yet, bringing this technology into practice is challenging because researchers have to examine how it works and set up reliable safety precautions for it to be effective (Gangadi, 2024). Hologram-based learning helps students engage more and understand more, but teachers should also choose innovative learning approaches to support holographic educational objectives (Hakeem et al., 2024). Also, research should focus on different educational domains, as there is not enough knowledge about how holograms are used with children, adolescents, and adults in many educational areas (Yoo et al., 2022). It is necessary to work on the barriers to implementation and check how holograms affect learning in a range of educational environments.

Holography is helping to transform how students learn by using visuals that go beyond the norm. Using 3D holograms is being shown to help students learn more quickly, especially in geometry, as interactivity makes it easier to understand and remember (Sertalp, 2024; Kaharuddin, 2023). Based on research, students who use holographic applications do better and understand the lessons more thoroughly than students who are taught in the traditional way (Sertalp, 2024).

Nevertheless, the true value of holographic technology at schools is restricted by challenges, including setting up controlled study programs, securing proper funds, and working out technical problems (Lee, 2013; Gangadi, 2024). Additionally, we need more experiments to prove the educational value of holograms in different types of schools Suzanna, 2023; Gangadi, 2024). For this reason, the successful application of holographic technology in education will depend on finding ways to address these concerns.

Conclusions

The study investigated what teachers had to say about holograms and how they can be used to improve education in Saudi Arabia. By evaluating the difficulties and positive impacts of deploying holograms, the research explains what helps holograms fit in education contexts. The results suggest that educators feel holograms can greatly improve teaching, capture student interest, and help students achieve their objectives. Still, several challenges get in the way, for example, shortages of finance, limited teaching programs, and a gap between the potential usefulness of holography and what is put into practice in schools. To respond to these issues, the study recommends simply collaborating with private sector businesses and having the government give financial help to overcome financial and infrastructural hurdles. Private organizations working with the government can provide money for modernization in technology and digital systems, letting teachers make use of modern equipment like hologram sets. The system should focus on giving teachers broad "holo-training" to ensure they can comfortably start using holograms in their classes. Merging technology and professional development within a strategic framework will guarantee easy use and the greatest educational benefits from the new tool. With holographic technology, educators can create active learning environments where students interact a lot, develop innovative ideas, and gain necessary skills for the future. Proper organization of hologram-based initiatives, in agreement with government rules and connections, helps bring major reforms to teaching, so that education remains diverse and engaging for more students. Still, holography cannot reach its potential without continued funding and help from institutions to upgrade educational processes and address difficulties in current use. Even so, for this technology to be effective, existing issues should be addressed with the help of collaborators, additional investments, and solid training for everyone involved. They will support the creation of better and fairer learning environments for everyone, allowing both teachers and students to succeed in a technological world.

Limitations and Future Research

The investigation confirms that introducing holography into education is useful but still faces a series of limitations. Concentrating on the study on Al-Ahsa in the Eastern Province reduces the usefulness of our findings to other parts of the country, given the wide range of educational and technical backgrounds elsewhere. To test and confirm the results and how they can be applied, future analysis should consider additional regions, providing a wider picture of hologram use in different learning environments. In addition, weak internet connection and too little support for equipment tools were reported by some, which might have affected their evaluations of the usability and operation of holographic systems. They show that it is important to research and provide more support systems that overcome these challenges and allow teachers to use holograms in their teaching. Next, the group studied consisted only of educational staff; no students or school administrators were involved. Because of this limited viewpoint, it’s difficult to understand the wider results of introducing holographic technology into the education system. In the future, studies will benefit from the participation of students, teachers, and administrators

to understand the effects of holograms on learning, the policies of the institution, and how things function in the classroom. Because holographic tools are rarely used in education now, some educators may have developed biased thoughts about them based on inadequate training with the technology. Such programs should take precedence to strengthen teachers' skills and confidence with new technologies. Future research could aim to include more participants to explore the potential benefits for all users and thoroughly investigate the effects of holographic technology, mainly focusing on resolving technical issues related to its use.

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