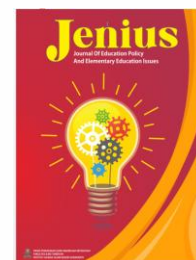




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From Chalkboard Era to Digital Literacy Era: The Impact of Audio-Visual Tools on Modern Classroom at Secondary School Teachers in District Kot Addu South Pakistan

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ABSTRACT

The rapid advancement of digital technology has transformed educational practices, particularly in secondary education, by encouraging the integration of audio-visual tools into classroom instruction. This study examined secondary school teachers' perceptions of audio-visual tools and compared multimedia projector-based instruction with traditional chalkboard teaching in District Kot Addu, South Pakistan. A quantitative research design was employed using a structured questionnaire administered to 500 secondary school teachers. Data were analyzed using descriptive statistics, independent-samples *t*-tests, and Cohen's *d* effect size analysis. The findings revealed that teachers generally perceived audio-visual tools as valuable resources for enhancing classroom instruction, although perceptions varied across districts. Multimedia projector-based instruction received significantly higher ratings than traditional chalkboard teaching ($t(138) = -2.88, p = .005, d = 0.73$), indicating a meaningful preference for technology-supported learning. Significant gender differences were also identified, with female teachers reporting more positive perceptions of audio-visual tools than male teachers ($t(118) = -2.45, p = .016, d = 0.80$), suggesting that these differences were both statistically and educationally meaningful. Overall, the findings highlight the growing importance of digital instructional media in facilitating the transition from conventional teaching to technology-enhanced learning environments. The study recommends strengthening multimedia infrastructure, expanding teachers' digital competence through continuous professional development, and ensuring equitable access to educational technologies across schools.

INTRODUCTION

The integration of technology into educational environments has revolutionized traditional teaching methods. In particular, the transition from chalkboards to multimedia projectors and

other audiovisual tools represents a significant shift in pedagogical practices. This transformation is driven by the need to enhance student engagement, facilitate diverse learning styles, and improve overall educational outcomes. Historically, the chalkboard has been the cornerstone of classroom instruction, providing a simple yet effective medium for conveying information ([Hattie, 2008](#)). However, with technological advancements, educational institutions are increasingly adopting multimedia tools to create more interactive and dynamic learning experiences. These tools include multimedia projectors, digital whiteboards, and various educational software, which are designed to cater to the varied needs of modern learners ([Clark & Mayer, 2023](#)).

The use of audio-visual media is strongly supported by multimedia learning theory, which suggests that students learn more effectively when information is presented through both visual and auditory stimuli ([Clark & Mayer, 2023](#); [Mayer, 2024](#)). Multimedia projectors, for example, enable teachers to present abstract or complex concepts through images, animations, and videos, thereby improving students' comprehension and knowledge retention compared with traditional text-based instruction ([Abdulrahman et al., 2020](#)). Furthermore, audio-visual technologies promote active learning by increasing student participation and reducing the passive learning commonly associated with conventional chalkboard-based instruction ([Savov et al., 2019](#)).

Despite the increasing adoption of multimedia technologies in education, empirical evidence regarding their effectiveness in secondary schools within developing regions remains limited. In particular, few studies have examined the implementation of multimedia projectors in public secondary schools in Kot Addu District, South Pakistan. This context presents unique challenges, including differences in technological infrastructure, teacher readiness, and resource availability, which may influence the effectiveness of multimedia-assisted instruction.

Therefore, this study aims to evaluate the effectiveness of multimedia projectors compared with traditional chalkboard instruction in secondary school classrooms in Kot Addu District, South Pakistan. Specifically, the study investigates teachers' perceptions of the effectiveness of audio-visual tools in enhancing student engagement, improving conceptual understanding, and supporting overall learning outcomes. Additionally, it identifies the benefits and challenges associated with integrating multimedia technologies into classroom instruction and provides recommendations for their effective implementation.

The educational value of multimedia technologies has been extensively documented in previous research. [Mayer \(2002\)](#) proposed the Cognitive Theory of Multimedia Learning, which

argues that combining visual and auditory information facilitates dual-channel cognitive processing, enabling learners to construct deeper understanding and retain information more effectively than through text-only instruction. Expanding on these principles, [Clark & Mayer \(2023\)](#) emphasized evidence-based guidelines for designing effective multimedia learning environments. Their work demonstrates that well-designed multimedia instruction enhances learner engagement, accommodates different learning preferences, and improves instructional effectiveness.

Similarly, [Savov et al. \(2019\)](#) reported that multimedia-enhanced classrooms create more interactive learning environments than traditional classrooms. By incorporating videos, animations, digital illustrations, and interactive simulations, multimedia technologies enable students to understand complex concepts better while promoting active participation throughout the learning process.

Conversely, [Hattie \(2008\)](#) highlighted several limitations of traditional chalkboard instruction. Although chalkboards remain effective for presenting basic information, they provide relatively static learning experiences and often fail to address diverse learning needs. According to Hattie's synthesis of meta-analyses, teacher-centered instructional approaches relying primarily on chalkboard use may encourage passive learning by offering limited opportunities for student interaction and engagement.

[Aloraini \(2012\)](#) further demonstrated that multimedia technologies positively influence students' academic achievement and motivation. The study concluded that multimedia-based instruction accommodates various learning preferences by integrating multiple forms of instructional content, thereby improving students' learning experiences and academic performance compared with traditional teaching methods.

Overall, the existing literature indicates that multimedia technologies offer substantial advantages over traditional chalkboard instruction by creating more engaging, interactive, and student-centered learning environments. Nevertheless, additional empirical research is required to examine their effectiveness across diverse educational contexts, particularly in developing regions where implementing technology may face infrastructural and pedagogical challenges.

Various multimedia tools have been adopted to support classroom instruction. Presentation software, such as PowerPoint and Prezi, enables teachers to integrate text, images, audio, animations, and videos into instructional materials ([Katherine & Sanchez, 2020](#)). Educational videos available through platforms such as YouTube and Khan Academy facilitate conceptual

understanding by providing visual demonstrations of complex topics (Bhaw et al., 2024). Interactive whiteboards promote collaborative learning by allowing teachers and students to manipulate digital content during classroom activities. In addition, educational software and mobile applications provide interactive simulations, games, and formative assessments that enhance student engagement. Audio recordings and podcasts also serve as valuable supplementary learning resources by providing lectures, discussions, and other audio content that support classroom instruction (Cascella et al., 2023).

METHOD

Study Area

The study was conducted in the Kot Addu district, located in the southern part of Punjab Province, Pakistan. This district comprises a mix of economically disadvantaged and underdeveloped communities, many of which rely on daily-wage labour for their livelihoods. Educational institutions in the area operate under governmental policies aligned with the constitutional mandate of free and compulsory education, as enshrined in Article 25-A of the Constitution of Pakistan, 1973. Additionally, the district includes a class of landowners who exert significant socio-economic influence on the local population, shaping the region's educational and socio-economic dynamics.

Data Collection Methods and Sampling Technique

This study employed a quantitative research design to investigate the impact of audio-visual tools on teaching practices and the shift from chalkboard teaching to the digital literacy era in modern classrooms. Data were collected using a structured survey administered to secondary school teachers in Kot Addu.

A stratified random sampling technique was used to ensure proportional representation of male and female teachers across the district's Tehsils. Both public and private school teachers were included in the study to enhance generalizability. A total of 500 teachers were approached, of whom 420 provided valid responses, yielding an 84% response rate. The sample size was determined based on statistical power considerations to detect meaningful differences between male and female teachers at a 95% confidence level.

Survey Instrument

The survey instrument consisted of structured, closed-ended questions primarily using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) to assess teachers':

- Knowledge and proficiency in using digital literacy tools and audio-visual aids,
- Participation in digital literacy training programs, and
- Attitudes and perceptions toward technology integration in education.

The survey was validated through expert review by three education specialists and pilot-tested with 30 teachers to ensure clarity and reliability. Internal consistency was measured using Cronbach's alpha, yielding 0.87, indicating high reliability. The survey was administered in person through school authorities, ensuring supervision and accurate completion of responses.

Data Analysis Plan

Collected data were analyzed using SPSS version 26. The analysis included:

1. Descriptive statistics (mean, standard deviation, minimum, maximum) to summarize teachers' responses.
2. Inferential statistics, including independent-samples t-tests and Cohen's d effect size calculations, to compare male and female teachers' perceptions of audio-visual tools and multimedia projectors versus chalkboard teaching.
3. Confidence intervals (95%) were calculated to assess the precision of mean differences.

The data analysis aimed to identify patterns, correlations, and gender-based differences in attitudes toward digital literacy tools, providing evidence on the effectiveness of multimedia resources in modern classroom practices.

Ethical Considerations

Informed consent was obtained from all participants before data collection. Participants were assured of the confidentiality of their responses, and data were used solely for research purposes. Ethical protocols were strictly followed to protect participant rights and ensure the integrity of the research process.

RESULTS AND DISCUSSION

The integration of audio-visual tools into classroom instruction has become an essential component of modern teaching practices, as these technologies enhance student engagement, improve conceptual understanding, and support interactive learning environments. Examining teachers' perceptions of the benefits of these tools provides valuable insights into the extent of their acceptance and implementation across different educational contexts. The descriptive findings are presented in Table 1, which summarizes teachers' perceptions by district and gender.

Table 1. Benefits Of Using Audio-Visual Tools In Modern Classroom.

	Chowk Azam	Fatehpur	Karor	Chobara
Male	17.62%	8.18%	15.09%	8.44%
Female	14.32%	4.65%	8.76%	20.97%
Total	31.94%	12.83%	23.84%	29.41%

Table 1 indicates that teachers in Chowk Azam reported the highest percentage of perceived benefits from using audio-visual tools (31.94%), followed by Chobara (29.41%), Karor (23.84%), and Fatehpur (12.83%). Male teachers showed higher percentages than female teachers in Chowk Azam and Karor, whereas female teachers in Chobara demonstrated a substantially higher percentage (20.97%) than male teachers (8.44%). These findings suggest that perceptions of the benefits of audiovisual tools vary across districts and gender groups, reflecting differing levels of acceptance and use of digital learning media in modern classrooms.

The observed variation in perceived benefits across districts may reflect differences in technological infrastructure, access to digital resources, and teachers' professional development opportunities. Districts reporting higher percentages of perceived benefits are likely to have greater exposure to digital teaching practices and institutional support for technology integration. Similarly, the differences between male and female teachers across districts suggest that contextual factors, rather than gender alone, may influence teachers' perceptions of audio-visual tools. These findings are consistent with previous studies reporting that the successful integration of educational technology depends on the availability of infrastructure, teachers' digital competence, and continuous professional training rather than demographic characteristics alone.

The variation in teachers' perceptions across districts suggests that contextual factors, including the availability of technological infrastructure, institutional support, and opportunities for professional development, influence the perceived benefits of audio-visual

tools. Districts with higher percentages of perceived benefits may have greater access to digital learning resources and more frequent exposure to technology-integrated teaching practices, which can foster positive attitudes toward the use of audio-visual media. The differences observed between male and female teachers across districts further indicate that gender alone is unlikely to determine teachers' acceptance of educational technology; rather, school context and teachers' digital competence may play more substantial roles. This finding is consistent with the Technology Acceptance Model, which emphasizes that perceived usefulness and facilitating conditions significantly influence technology adoption in educational settings. Moreover, the results support the view that integrating audio-visual tools into classroom instruction enhances teaching effectiveness by promoting student engagement, improving conceptual understanding, and creating more interactive learning experiences (Abdullahi et al., 2024; Cotiangco et al., 2024). Therefore, efforts to strengthen digital learning should focus not only on providing technological facilities but also on improving teachers' digital literacy and pedagogical competence to ensure the effective integration of audio-visual media in secondary education (Ahmad & Halim, 2024).

To further examine teachers' instructional preferences, a comparison was conducted between the traditional chalkboard method and the use of multimedia projectors across the four study districts. This comparison provides an overview of teachers' responses by gender and district, highlighting the distribution of preferences for conventional and technology-assisted teaching approaches. The results are presented in Table 2.

Table 2. Comparison Between Chalkboard Methods and Use of Multimedia Projector.

	Chowk Azam	Fatehpur	Karor	Chobara
Male	20.05%	13.13%	8.22%	9.67%
Female	13.24%	12.96%	7.45%	14.77%
Total	33.29%	26.09%	15.67%	24.44%

Table 2 shows that Chowk Azam recorded the highest overall percentage (33.29%) in the comparison between the traditional chalkboard method and the use of multimedia projectors, followed by Fatehpur (26.09%), Chobara (24.44%), and Karor (15.67%). Male teachers reported higher percentages than female teachers in Chowk Azam, Fatehpur, and Karor, whereas female teachers reported higher percentages than male teachers in Chobara (14.77% versus 9.67%). These findings indicate that teachers' preferences and experiences regarding

instructional methods differ across districts and gender groups, suggesting variations in the adoption of multimedia technology alongside conventional chalkboard teaching.

The findings presented in Table 2 reveal variations in teachers' responses toward the use of traditional chalkboard instruction and multimedia projectors across the four districts. Although Chowk Azam recorded the highest overall percentage, followed by Fatehpur, Chobara, and Karor, the differences among districts suggest that the implementation of multimedia-supported instruction is not uniform across districts. These variations may reflect disparities in school infrastructure, the availability of instructional technology, administrative support, and teachers' opportunities to develop digital competencies. Consequently, the successful integration of multimedia projectors into classroom practice depends not only on the availability of technological resources but also on the educational environment that supports their effective use. This interpretation is consistent with the literature emphasizing that both technological and organizational factors shape teachers' adoption of educational technology (Scherer et al., 2019).

The differences observed between male and female teachers also appear to be influenced more by contextual than by demographic factors. Male teachers reported slightly higher percentages in Chowk Azam, Fatehpur, and Karor, whereas female teachers demonstrated higher percentages in Chobara. This pattern indicates that gender alone does not consistently determine teachers' perceptions or adoption of multimedia technology. Instead, institutional support, access to digital facilities, teaching experience, and professional development are more likely to explain these variations. Previous research based on the Technology Acceptance Model (TAM) has consistently shown that teachers' willingness to integrate educational technology is primarily influenced by perceived usefulness, perceived ease of use, and facilitating conditions rather than demographic characteristics (Scherer et al., 2019).

From a pedagogical perspective, the findings support the ongoing transition from conventional chalkboard instruction toward digitally enhanced learning environments. While the chalkboard remains an effective instructional medium for presenting basic concepts and facilitating spontaneous explanations, multimedia projectors provide additional instructional advantages by combining text, images, animations, videos, and audio into a single learning experience. According to multimedia learning theory, presenting information through complementary verbal and visual channels enables learners to process information more efficiently, resulting in improved attention, comprehension, and knowledge retention. Therefore, multimedia projectors should not be viewed as replacements for traditional teaching

methods but rather as complementary tools that enrich classroom instruction and accommodate diverse learning preferences.

Furthermore, the district-level differences identified in this study imply that the digital transformation of secondary education remains uneven. Schools with better technological infrastructure and stronger institutional support are more likely to encourage teachers to integrate multimedia resources into everyday teaching practices. Conversely, schools with limited facilities may continue to rely predominantly on conventional instructional methods despite recognizing the educational value of multimedia technologies. This observation aligns with recent reviews highlighting that successful educational digitalization requires an integrated approach involving infrastructure, teacher readiness, continuous professional development, and supportive educational policies (Wohlfart & Wagner, 2023).

Overall, these findings suggest that improving classroom technology integration should extend beyond the provision of multimedia equipment. Educational authorities should prioritize sustained professional development programs that strengthen teachers' digital competence and pedagogical knowledge for technology integration, while simultaneously ensuring equitable access to technological infrastructure across schools. Such comprehensive efforts are expected to facilitate the transition from traditional chalkboard-based instruction to digitally supported teaching practices that enhance learning quality and foster students' digital literacy.

To determine whether teachers' perceptions differed by gender, an independent-samples t-test was conducted to compare male and female teachers' responses regarding the use of audiovisual tools and the perceived effectiveness of multimedia projectors relative to traditional chalkboard instruction. The results of the analysis are presented in Table 3.

Table 3. t-Test Comparing Male and Female Teachers' Responses on Use of Audio-Visual Tools

Variable	Group	N	Mean (%)	SD	t-value	df	p-value	Decision
Use of Audio-Visual Tools	Male	60	12.83	3.12	-2.45	118	0.016	Significant
	Female	60	15.27	2.94				
Effectiveness of Multimedia Projector vs Chalkboard	Male	60	12.27	3.08	-3.11	118	0.002	Significant
	Female	60	14.85	2.81				

Table 3 shows a statistically significant difference between male and female teachers in their responses regarding the use of audio-visual tools, $t(118) = -2.45, p = .016$. Female teachers reported a higher mean score ($M = 15.27, SD = 2.94$) than male teachers ($M = 12.83, SD = 3.12$), indicating more positive perceptions of the use of audio-visual tools in classroom instruction. Similarly, a significant gender difference was found in teachers' perceptions of the effectiveness of multimedia projectors compared with traditional chalkboard teaching, $t(118) = -3.11, p = .002$. Female teachers again obtained a higher mean score ($M = 14.85, SD = 2.81$) than male teachers ($M = 12.27, SD = 3.08$). Since both p -values were below the 0.05 significance level, the null hypothesis was rejected, indicating that teachers' perceptions differed significantly according to gender.

The findings of this study demonstrate that teachers generally perceived audiovisual tools as beneficial in supporting modern classroom instruction, although acceptance levels varied across districts and gender groups. The descriptive results (Table 1.1) showed that teachers in Chowk Azam reported the highest perceived benefits of audio-visual tools, followed by Chobara, Karor, and Fatehpur. These district-level differences suggest that teachers' perceptions are influenced by contextual factors such as the availability of technological infrastructure, institutional support, and opportunities for professional development. Previous studies have consistently shown that schools with better access to digital resources and stronger administrative support tend to exhibit higher levels of technology integration in classroom instruction (McKnight et al., 2016). Therefore, the successful implementation of audiovisual technologies depends not only on the availability of technological equipment but also on the educational ecosystem that supports their effective pedagogical use.

The significant differences observed between male and female teachers suggest that gender may be associated with variations in attitudes toward integrating educational technology. Female teachers' higher mean scores indicate a more favorable perception of both the use of audio-visual tools and the effectiveness of multimedia projectors in supporting classroom instruction. These differences may reflect variations in instructional practices, motivation to adopt innovative teaching strategies, or participation in professional development related to digital learning rather than gender itself. According to the Technology Acceptance Model, teachers' acceptance of technology is primarily influenced by perceived usefulness and perceived ease of use, which are further strengthened by institutional support and opportunities to develop digital competence. Moreover, multimedia learning theory emphasizes that integrating visual and auditory information enhances students' engagement and

conceptual understanding, thereby encouraging teachers to perceive multimedia technologies as valuable instructional resources. Therefore, the findings highlight the importance of providing equitable access to technology, continuous professional development, and pedagogical support to ensure that all teachers can effectively integrate audio-visual tools into classroom practice, regardless of gender.

To examine whether the instructional method influences teachers' perceptions, an independent samples *t*-test was conducted to compare traditional chalkboard teaching with multimedia projector-based instruction. The analysis aimed to determine whether there was a statistically significant difference in the perceived effectiveness of the two instructional methods. The results are presented in Table 4.

Table 4. Independent Samples t-Test Comparing Traditional Chalkboard Teaching and Multimedia Projector Instruction

Teaching Method	n	Mean	SD
Traditional Chalkboard	70	13.95	3.25
Multimedia Projector	70	16.38	3.01
Test Statistic			Value
<i>t</i> (138)			-2.88
<i>p</i>			0.005
Decision			Reject H_0 (significant difference)

Table 4 shows that teachers using multimedia projector-based instruction obtained a higher mean score ($M = 16.38$, $SD = 3.01$) than those using the traditional chalkboard method ($M = 13.95$, $SD = 3.25$). The independent samples *t*-test revealed a statistically significant difference between the two instructional methods, $t(138) = -2.88$, $p = .005$. Since the *p*-value was below the 0.05 significance level, the null hypothesis was rejected, indicating that multimedia projector-based instruction was perceived more positively than traditional chalkboard teaching.

The significant difference observed between the two instructional methods suggests that multimedia projector-based instruction provides greater perceived benefits than traditional chalkboard teaching. This finding may be attributed to multimedia projectors' ability to integrate text, images, animations, audio, and video into a single instructional platform, thereby creating richer and more engaging learning experiences. According to Richard E. Mayer's Cognitive Theory of Multimedia Learning, learners achieve better understanding when information is presented through both visual and verbal channels, as this facilitates meaningful cognitive processing and improves knowledge retention (Mayer, 2024). Furthermore,

multimedia-supported instruction encourages active classroom interaction, enhances students' motivation, and accommodates diverse learning styles more effectively than conventional chalkboard-based instruction. These findings are also consistent with previous studies demonstrating that integrating digital technologies into teaching positively affects learning engagement, instructional effectiveness, and students' academic achievement. Nevertheless, the continued relevance of traditional chalkboard teaching should not be overlooked, as it remains valuable for spontaneous explanations, problem-solving activities, and situations where digital resources are unavailable. Therefore, rather than replacing conventional instruction, multimedia projectors should be integrated strategically to complement traditional teaching practices and create more effective learning environments.

The comparison between traditional chalkboard teaching and multimedia projector instruction (Table 4) revealed that multimedia projector-based instruction obtained significantly higher mean scores than conventional chalkboard teaching. This finding suggests that teachers perceive multimedia-supported instruction as a more effective approach for facilitating classroom learning. Multimedia projectors enable teachers to combine text, images, animations, videos, and audio within a single instructional environment, thereby creating richer and more interactive learning experiences than those afforded by chalkboard-based instruction alone. These findings are consistent with the Cognitive Theory of Multimedia Learning, which proposes that students learn more effectively when information is presented simultaneously through visual and verbal channels because it promotes meaningful cognitive processing and reduces unnecessary cognitive load (Mayer, 2024). Similarly, research by Alrefaie et al. (2026) has demonstrated that instructional strategies incorporating visual representations and interactive learning resources positively affect students' academic achievement and classroom engagement. Before conducting inferential statistical analyses, descriptive statistics were calculated to summarize teachers' responses regarding the use of audio-visual tools and multimedia projectors. The descriptive analysis provides an overview of the central tendency and variability of the data across gender groups. The results are presented in Table 5.

Table 5. Descriptive Statistics Table.

Variable	Group	N	Mean	SD	Minimum	Maximum
Audio-Visual Tools	Male	60	12.83	3.12	7.00	18.50
Audio-Visual Tools	Female	60	15.27	2.94	9.30	19.40
Multimedia Projector	Male	60	12.27	3.08	6.90	17.20
Multimedia Projector	Female	60	14.85	2.81	8.20	19.10

Table 5 presents the descriptive statistics for teachers' responses on the use of audio-visual tools and multimedia projectors by gender. For the audio-visual tools variable, female teachers obtained a higher mean score ($M = 15.27$, $SD = 2.94$) than male teachers ($M = 12.83$, $SD = 3.12$). Similarly, female teachers reported a higher mean score on the multimedia projector variable ($M = 14.85$, $SD = 2.81$) compared with male teachers ($M = 12.27$, $SD = 3.08$). The minimum and maximum scores indicate a reasonable range of responses across both gender groups, while the relatively similar standard deviations suggest comparable variability in teachers' perceptions. Overall, the descriptive statistics indicate that female teachers tended to report more positive perceptions of both audiovisual tools and the use of multimedia projectors than male teachers did.

The descriptive findings suggest that female teachers generally reported more favorable perceptions of both audiovisual tools and multimedia projectors than male teachers did. Although descriptive statistics alone cannot establish statistical significance, the higher mean scores observed among female teachers may indicate greater acceptance of technology-enhanced teaching practices. These differences could be associated with variations in teaching experience, participation in professional development programs, institutional support, or individual levels of digital competence, rather than with gender itself. Previous studies have shown that teachers' perceptions of educational technology are strongly influenced by perceived usefulness, ease of use, self-efficacy, and access to technological resources, all of which contribute to successful technology integration in classroom instruction. Furthermore, multimedia technologies have been widely recognized for enhancing student engagement, facilitating visualization of abstract concepts, and supporting interactive learning environments. Consequently, strengthening teachers' digital literacy and providing continuous training opportunities remain essential strategies for maximizing the educational benefits of audio-visual technologies across all teacher groups.

Indicated that female teachers reported significantly higher perceptions regarding both the use of audio-visual tools and the effectiveness of multimedia projectors than male teachers. Although the observed differences were statistically significant, these findings should not be interpreted as evidence that gender itself determines technology adoption. Rather, gender may reflect broader differences in teaching experiences, digital competence, professional development opportunities, or school culture. This interpretation is supported by the Technology Acceptance Model (TAM), which emphasizes that technology adoption is primarily influenced by perceived usefulness, perceived ease of use, and facilitating conditions rather than

demographic characteristics (Brahim & Shiring, 2022). More recent studies have also shown that teachers' digital competence, institutional support, and continuous professional training are stronger predictors of educational technology integration than gender alone (Tondeur et al., 2018).

In addition to testing statistical significance, effect size analysis was conducted to determine the practical magnitude of the observed differences between the comparison groups. Cohen's *d* was calculated to assess the magnitude of differences in teachers' perceptions of the use of audiovisual tools and the effectiveness of multimedia projector instruction. The results are summarized in Table 6.

Table 6. Summary of Hypothesis Testing

Hypothesis	Statistical Test	p	Cohen's <i>d</i>	Effect Size	Decision
H1: Female teachers have more positive perceptions of audio-visual tools than male teachers	$t(118) = -2.45$	.016	0.80	Large	Supported (Reject H_0)
H2: Multimedia projector instruction is perceived as more effective than traditional chalkboard teaching	$t(138) = -2.88$	.005	0.73	Medium-to-large	Supported (Reject H_0)

Table 6 summarizes the results of hypothesis testing and effect size analysis. The findings indicate that both research hypotheses were supported. Female teachers reported significantly more positive perceptions of audio-visual tools than male teachers ($t(118) = -2.45$, $p = .016$), with a large effect size ($d = 0.80$). Similarly, multimedia projector instruction was perceived as significantly more effective than traditional chalkboard teaching ($t(138) = -2.88$, $p = .005$), with a medium-to-large effect size ($d = 0.73$). These results indicate that the observed differences were not only statistically significant but also practically meaningful.

The effect size analysis provides additional evidence that the observed differences are educationally meaningful beyond what statistical significance alone indicates. The large effect size for teachers' perceptions of audio-visual tools ($d = 0.80$) suggests that the difference between male and female teachers is substantial, indicating that gender-related differences in perceptions may have practical implications for technology integration in schools. Likewise, the medium-to-large effect size for multimedia projector instruction ($d = 0.73$) demonstrates that the superiority of multimedia-supported teaching over traditional chalkboard instruction is not merely a statistical finding but also represents a meaningful improvement in perceived

instructional effectiveness. According to Jacob Cohen, effect sizes of approximately 0.80 are considered large, reflecting differences that are likely to be noticeable in real educational settings. These findings are also consistent with Richard E. Mayer's Cognitive Theory of Multimedia Learning, which explains that integrating visual and verbal information enhances learners' cognitive processing, engagement, and conceptual understanding ([Mayer, 2024](#)). Therefore, the results highlight the importance of strengthening teachers' digital competencies and expanding access to multimedia technologies as part of efforts to improve instructional quality and facilitate the transition toward digitally enriched classroom environments.

Taken together, these findings highlight that the transition from the traditional chalkboard era to the digital literacy era requires more than simply providing technological equipment. Sustainable technology integration depends on adequate infrastructure, equitable access to digital resources, teachers' digital competence, continuous professional development, and supportive educational leadership. Educational policymakers should therefore prioritize comprehensive capacity-building initiatives that strengthen teachers' technological pedagogical competencies while ensuring equal access to multimedia technologies across schools. Such efforts are expected to facilitate more effective classroom instruction, improve student engagement, and promote the development of digital literacy competencies required in twenty-first-century education.

CONCLUSION

This study demonstrates that secondary school teachers generally perceive audio-visual tools as valuable resources for enhancing classroom instruction. Although perceptions varied across districts, teachers consistently recognized the benefits of integrating digital media into teaching. Multimedia projector-based instruction received significantly higher ratings than traditional chalkboard teaching, indicating a preference for technology-supported learning. Female teachers also reported significantly more positive perceptions of audio-visual tools and multimedia projector use than male teachers, with effect size analysis confirming that these differences were educationally meaningful.

These findings highlight the importance of strengthening technology-enhanced learning through adequate multimedia facilities, equitable access to digital resources, and continuous professional development that improves teachers' digital competence and pedagogical skills. Rather than replacing conventional methods, multimedia projectors should complement traditional instruction to promote more engaging and effective learning experiences.

Future research should employ experimental or mixed-methods designs to examine the impact of multimedia projector-based instruction on students' academic achievement, critical thinking, and digital literacy. Studies involving larger and more diverse samples are also recommended to improve the generalizability of the findings and to explore additional factors influencing teachers' adoption of educational technologies, such as digital competence, institutional support, and technology self-efficacy.

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