P-ISSN: 2790-6795	Annals of Human and Social Sciences	Jul-Sep 2024,Vol. 5, No. 3
O-ISSN:2790-6809	http://doi.org/10.35484/ahss.2024(5-III)43	[492-504]

Annals of Human and Social Sciences
www.ahss.org.pk

RESEARCH PAPER

Exploring the Role of AI-Driven Speech Recognition System in Supporting Inclusive Education for Hearing Impaired Students in Pakistan

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ABSTRACT

This study investigates how AI-driven speech recognition systems can make inclusive education better for hearing impaired students in Pakistan. The research, which uses a quantitative approach with a descriptive survey method, is based on teachers' opinions on the effectiveness of these technologies. We randomly selected 240 teachers from general schools to gather their perspectives on the advantages and challenges of AI-driven speech recognition systems. We gave rational people two options for answering the questionnaire, both in person and online, to ensure representation from a variety of educational settings. The results confirm that these technologies significantly improved class participation, listening to commands and other activities, and increased inclusivity for hearing-impaired students. Particularly the ones with more practice, mostly instructors in rural areas, showed a better reaction to the machines. The study is a sign that there is a need for specialized training and adequate strategies to make the most of AI systems in diverse educational settings. Suggestions include creating preferential training sessions, targeting distinct integration strategies based on individual school environments, and providing affixed support for these systems. Further, this research for information systems professionals will focus on conducting further investigation into the effects of AI-driven speech recognition on deafness, including the use of advanced technology in the development of future inclusive educational systems.

Keywords: AI-Driven, Hearing Impaired, Inclusive Education, Speech Recognition System

Introduction

Schools have acknowledged AI-powered speaking identification systems as a helpful device for the hearing impaired. These s These systems enable hearing-impaired students to listen, comprehend, and participate in classroom activities by instantly translating spoken language into text. Essentially, the classroom becomes a safe space not only for hearing-impaired students but also for their teachers. Namely, the AI-centered speech recognition once we gradually develop the related IT support, Smart Tools technology can overcome communicational roadblocks that cause students to not comprehend the information, thereby creating inequality (Lim, Tang, & Nam, 2017). According to Kumar and Nagar (2024), the use of only English in the education system disadvantages immigrant students and often leads to conflicts over their identity, isolating these learners, particularly in their early stages. As a result, AI is beneficial to all students, including those with disabilities.

Tremendous technological advances in speech recognition systems have dramatically increased their efficiency and reliability, especially in the educational sector.

Background noise and a variety of accents were major causes of misinterpretations in the early ages. However, the recent improvements in superior nanomaterials for printing have dealt with these problems. Khan (2024) notes that the accuracy of newer voice recognition AI programs has significantly improved, making them even more applicable in schools. Without a doubt, such developments create a more efficient learning environment for the hearing-impaired learners by providing them with more consistent access to verbal instructions and class discussions. Nevertheless, the advent of digital assistants named Alexa in 2014 and Apple's Siri in 2011 has given educational institutions some exposure to AI. Over the past years, multiple-purpose technological assistants have been increasingly on the rise in the learning and educational field in schools, as these systems of the future seem disillusioning with the current ones.

While the implementation of AI-based speech recognition systems in education represents a significant advancement, it also presents challenges, particularly in regions such as Pakistan. One of the main obstacles is the lack of AI systems that can work in the local language diversity, an issue noticed by Khan et al. (2023). There is a serious mismatch that calls for the development of AI models suitable for transcribing in regional languages and dialects, thus making the hearing-impaired students an integral part of the educational process. Moreover, the high cost of this technology and the requirement for teacher training pose significant obstacles to its widespread use. As such, the research aims to determine the most efficient use of various AI technologies within the educational system. This research aims to investigate the prominent issues and hidden opportunities presented by AI-driven machines in Pakistani schools, specifically focusing on children with hearing disabilities. The study primarily focuses on addressing the pressing need to provide the educational system with easily accessible AI solutions that can reduce educational inequalities and promote equity for all students, particularly those with hearing impairments.

Literature Review

The use of AI technology for speech recognition in schools has made a vital impact on the education of students with hearing loss. These mechanisms are the same as Kumar and Nagar (2024) describe, supporting real-time transcription of natural speech to text, which in turn makes it possible for the students with hearing impairments to participate in various classroom activities and discussions. This technology plays a critical role in facilitating communication channels, thereby fostering a more inclusive and student-centered learning environment that caters to students' diverse needs.

The evolution of speech recognition systems has seen a significant advancement in the development of natural language processing and machine learning. First, these speech systems were weak in terms of precision; they could not deliver the expected results, especially when it comes to processing the speech of students who speak with an accent. Khan (2024) reported that the latest technological advancements have improved the accuracy of these systems, thereby increasing their reliability and efficiency for educational purposes, including for students with hearing impairments.

The inclusive approach is a comprehensive educational strategy that prioritizes equal educational rights for all children, irrespective of their abilities. The AI speech recognition tools have proven their significance in mainstream classrooms as they help the hearing-impaired students who are in such classes. According to Fendji et al. (2022), the use of these technologies further compresses educational differences by making it possible for hearing impaired students to access the same content as their peers, resulting in inclusivity.

Because it is a new invention, some people may encounter difficulties when implementing AI-driven speech recognition systems in educational institutions. Abulibdeh et al. (2024) primarily addressed the high cost of the technology, the necessity of technical

support, and the potential resistance from teachers and students. Addressing these issues becomes essential for the successful integration of these systems into inclusive education.

This essay primarily addresses the effectiveness of speech recognition systems. Its ability to recognize and correctly transcribe people speaking in different languages and dialects is its basis. The multilingual environment in Pakistan presents a unique challenge. Khan et al. (2023) emphasize the need for AI models that can adapt to different environments and accurately convert speech. These will guarantee that students with hearing disabilities receive accurate and meaningful educational content.

Teachers must receive sufficient training in these technologies for AI-driven speech recognition systems to be meaningful in inclusive education. Mahmud (2024) asserts that programs designed for teachers' professional development in IT as a teaching aid are essential for their mastery of these methods. Such training not only makes teaching easier for teachers, but also enables them to provide the necessary support for hearing-impaired students.

Studies have shown that AI-driven speech recognition technology has a positive impact on the engagement and success of students, in particular those with hearing impairments. Students exposed to these systems outperformed their classmates in the classroom, according to Lee et al. (2023). Additionally, they demonstrated improved academic performance. This not only suggests that AI can aid in the learning process, but it can also boost grades and enrich the experience for students with hearing impairments.

The current discussion focuses on equality and accessibility, which are key issues in the conversation about inclusive education. Therefore, these systems provide services to individuals who are unable to actively participate in the educational process, enabling them to remain in their peer group. Saaida (2023) recommends that these systems help to bridge the gap, and all students should have the opportunity to achieve their academic goals, whether with their ears or not.

The prospects of artificial intelligence (AI)-based speech recognition technologies in education are auspicious. The trend of technology maturation would get even better in the future with the development of systems that incorporate additional natural language and are more context-aware. Therefore, technology's integration into the education system must become the norm rather than the exception. Artificial intelligence (AI) is one area that has blazingly achieved a learning breakthrough by employing speech recognition technology. The novel combination of technologies such as AI and speech recognition has indeed opened up new horizons for education and research, one of which is inclusion and involvement of disabled students. We anticipate that AI will further enhance the transitional learning experience in schools. It will involve the writing of a brief explanation, designing a mini-site, creating an API page, and then revealing the details on how to solve a given challenge.

The use of AI-powered speech recognition systems in learning coheres with student-directed learning methods in that it gives impaired students the capacity to rule their learning. Santoianni et al. (2022) contend in their venture platform that accessible educational technology can empower numerous students who would otherwise face exclusion. Children who use this technology have the opportunity to join the class. These are the children who have difficulty hearing and sometimes struggle to comprehend spoken information.

The solution is to connect speech recognition systems with support, such as visual aids, which will then serve as a backup for mentally handicapped learners. We establish a network that nourishes the brain, the central part of the process, by creating sensory poles. Proposals suggest integrating technology with other accessible methods, such as captions

and sign language, to improve these students' learning. This approach ensures the inclusion of students with various disabilities. What the business proposition of AI in automatic speech recognition means is that there is some provision for live translation and thus the efficient communication that is absolutely necessary between teacher and student.

The adoption of speech recognition systems based on AI in education gives rise to considerable policy corrections, especially in the area of educational equity. Neyem et al. (2024) are convinced that governments are to handle the technology implementation, and the first step is to assess the capacity for delivering inclusive educational programs. Technology's role in inclusive education should be a central part of the policy discussion. The colleges will allocate a portion of their stipend towards acquiring new facilities like computer labs, internet access, and projectors, while maintaining a significant focus on instructional methodologies. In today's society, individuals frequently access music, videos, video games, and other entertainment media via computers connected to a network, with numerous services and functions directly contributing to a digital lifestyle.

AI-based speech recognition systems' progress in education would rely mostly on teachers' evaluations of the technology's quality and their acceptance of it. Chen and colleagues (2022) revealed that educators generally appreciate these technologies because of their efficiency. However, they are also concerned about the dangers of such learning systems, which could undermine traditional teaching methods. This, in turn, is likely to give learners a negative connotation of the system, and they may also become less engaged.

Student feedback is the only way to improve AI-driven speech recognition systems. Besides Henri van Brummelen (2022), who investigated the issue in 2022, trial and error could win the day. Therefore, it's crucial to involve learners in the system evaluation process, as they may possess valuable ideas or information that could aid in enhancing the AI system. In addition to including these students, it's crucial to conduct feedback cycles for students with hearing impairments to ensure that the technology meets their needs and adapts to their evolving learning requirements.

As a result, the use of AI in education raises a lot of ethical questions, particularly regarding privacy and data security guarantees. The Indian writer Hovav Tamir (2023) argues that we must observe the mechanisms of collecting and using data on students' interactions with AI to ensure their privacy. Students are taking time off from their classes to work with AI, a move that concerns some teachers but could potentially lead to exclusion or disrespect towards hearing-impaired students, who are also benefiting from AI.

The cost-effectiveness of AI-driven speech recognition technology in schools and government institutions is quite significant. Even though Khan and others (2024) made a profit-benefit analysis that portrays the reality that the initial cost exceeds the expected gains, their first-year turnover did not dampen the enthusiasm of the next year's students who got the laptops. The researchers also made it clear that looking at AI integration as a long-term investment in educational equity is of key importance.

The success of the AI speech recognition systems is greatly dependent on the collaboration between technology developers and educators. According to Omar et al. (2024), these collaborations not only support hearing-impaired students but also assist educators in integrating these systems into their teaching practices, thereby creating the necessary technology. The best way to use AI technology in schools is through partnerships.

In many cases, AI-driven speech recognition systems have been successful in helping disabled students in education. Pegalajar Palomino et al. (2022) conducted a study in Pakistan that determined that the introduction of AI-driven speech recognition systems to a regular school led to increased academic performance and more active classroom

involvement for hearing-impaired students. These research studies demonstrate exactly, in action, the applications and benefits of machine learning technology in education.

Several countries are following the trend of universally applying AI-driven speech recognition systems in inclusive education. Berding et al. (2022) conducted a comparative analysis of the systems' use across various countries, revealing not only common problems but also each country's unique approach to addressing these issues. This analysis at the global level provides a better vision of the AI technologies for students with hearing impairments as part of the inclusive education policy.

At the end of the day, the purpose of AI-driven speech recognition systems in education is to decrease educational inequality and support all the students, regardless of their special needs. Ahmad et al. (2023) point out in their paper that these systems are the best choice for disadvantaged students because they provide them with the learning tools they need to perform well in their studies. The ongoing advancements in AI will further strengthen its role in inclusive education by assisting learners, thereby creating new opportunities for expanded student learning.

Research Methodology

Research Design

The present study's quantitative research design involved a descriptive survey method to investigate the role of AI-driven speech recognition systems in facilitating inclusive education for hearing-impaired students in Pakistan. The study used a quantitative approach because it allowed for the collection of tangible and objective data, which was critical in determining the teachers' attitudes towards the usefulness and difficulties of these systems. The primary survey method enabled the researcher to collect highly significant and reliable data because it involved a large number of subjects.

Population and Sample

The selected teachers of the study conducted in the education departments across the country were those who taught at educational institutions and previously had experience with hearing-impaired students. We chose this prodigious focus to ensure that the participants understood the unique technological and educational needs of hearing-impaired students within the framework of inclusive education. We selected a sample of 240 teachers through simple random sampling to avoid bias and ensure that every schoolteacher in the population had an equal chance to participate in the study. We achieved this by collecting simple random samples, which also ensured the inclusion of teachers from diverse teaching environments and experiences.

Research Instrument

The researcher himself developed the questionnaire for this study after conducting a thorough review of the relevant literature. The questionnaire employed a five-point Likert scale, featuring the options of strongly agree, agree, neutral, disagree, and strongly disagree. It allowed the participants to express their opinions and experiences on the topics in an intense and straightforward way. This tool collected the necessary responses for the questions.

Data Collection

We gathered data using both traditional and online methods, enabling individuals living far away and with varying levels of availability to participate. We collected physical data by hand-distributing the questionnaire to schools and educational offices. On the other

hand, we conducted online data collection using email and web surveys. This combination of the inclusion of two ways of acquiring data, that is, the mixed method of data collection, increased the number of responses and, in particular, meant that teachers from both urban and rural areas had been the ones to participate in the research. We gave the respondents ample time to complete the questionnaire and sent follow-up reminders to ensure a high response rate.

Validity and Reliability

We evaluated the instrument's validity by conducting content and construct validity checks. We achieved content validity with the assistance of experts in inclusive education and AI technology, who provided empirical input on the questionnaire items to ensure their completeness and comprehension. We checked the construct validity by using questions based on widely known theses and literature in the fields of education for children with disabilities and AI-integrated speech recognition systems. The Cronbach coefficient was calculated (0.87).

Ethical Considerations

This research study strictly adhered to ethical considerations at every stage, from design to completion. The research was conducted under the principle of informed consent, guided by the participants' knowledge of the study's objective, their freedom to quit at any time without repercussions, and the privacy of the information they provided. We ensured anonymity by not collecting any personal information from respondents and securely storing all the data. We summarized the outcomes to prevent respondent identification.

Data Analysis

We analyzed the data using the Statistical Package for the Social Sciences (SPSS). We summarized the demographic data and responses to the Likert scale questions using descriptive statistics like frequencies, percentages, means, and standards. We also implemented one-way ANOVA, t-tests, and other inferential statistics to confirm any significant differences in perceptions based on demographic factors like age, gender, teaching experience, and location. The goal of data analysis was to spot trends and patterns in teachers' perceptions of AI-driven speech recognition systems in inclusive education for hearing-impaired students.

Results

Table 1
Frequency Distribution for Demographic Analysis

Title	Description	Frequency	Percentage (%)
Gender	Male	77	32.1%
	Female	163	67.9%
		240	**100%**
Age of Respondents	21-30 Y	48	20.0%
	31-40 Y	86	35.8%
	41-50 Y	86	35.8%
	51-60 Y	20	8.3%
		240	**100%**
Designation	SSET	125	52.1%
	JSET	115	47.9%
		240	**100%**
Qualification	Master	201	83.8%
	M.Phil.	25	10.4%
	PHD	14	5.8%
		240	**100%**
Place of Posting	School	125	52.1%

	Center	115	47.9%
		240	**100%**
Area of Posting	Rural	125	52.1%
	Urban	115	47.9%
		240	**100%**
Experience	1-5 Y	72	30.0%
	6-10 Y	119	49.6%
	11-15 Y	26	10.8%
	>15 Y	23	9.6%
		240	**100%**

Table 1 is clear that the biggest part of respondents are female (67.9%), between the ages of 31 and 40 and 41 and 50 (71.6% combined), have a Master's degree (83.8%), and are SSETs (52.1%) who are posted in schools (52.1%), work in rural areas (52.1%), and have six to ten years of experience (49.6%).

Table 2
Frequency Distribution for Objective Analysis and Questions Asked

Sr.	Statements	SA	A	UD	DA	SDA	M	SD
1	AI-driven speech recognition systems improve classroom participation for hearing-impaired students.	37	188	15	0	0	4.09	0.46
		15%	78%	6%	0%	0%		
2	Speech recognition technology helps hearing-impaired students better understand spoken instructions.	65	174	1	0	0	4.27	0.45
		27%	73%	0%	0%	0%		
3	The use of AI-driven speech recognition systems fosters a more inclusive learning environment.	78	160	1	0	1	4.31	0.52
		33%	67%	0%	0%	0%		
4	AI-based speech recognition systems reduce communication barriers between teachers and hearing-impaired students.	67	164	5	4	0	4.23	0.56
		28%	68%	2%	2%	0%		
5	The real-time transcription feature of AI speech recognition enhances learning outcomes for hearing-impaired students.	31	196	8	5	0	4.05	0.49
		13%	82%	3%	2%	0%		
6	AI-driven speech recognition systems help hearing-impaired students access the same educational content as their peers.	93	142	5	0	0	4.37	0.46
		39%	59%	2%	0%	0%		
7	The implementation of AI-driven speech recognition in classrooms increases academic engagement among hearing-impaired students.	40	198	2	0	0	4.16	0.45
		17%	83%	1%	0%	0%		
8	Teachers are adequately trained to integrate AI-driven speech recognition systems into inclusive education practices.	59	174	4	3	0	4.20	0.52
		25%	73%	2%	1%	0%		
9	The accuracy of AI-driven speech recognition systems in transcribing local dialects is essential for inclusive education.	35	204	1	0	0	4.14	0.56
		15%	85%	0%	0%	0%		
10	AI-driven speech recognition systems help hearing-impaired students stay on track with classroom discussions.	67	164	8	1	0	4.24	0.49
		28%	68%	3%	0%	0%		
11	AI-based speech recognition technology has a positive impact on the social integration of hearing-impaired students.	93	142	5	0	0	4.37	0.52
		39%	59%	2%	0%	0%		
12	The use of AI-driven speech recognition systems reduces the need for additional human support, such as sign language interpreters.	93	142	5	0	0	4.37	0.39
		39%	59%	2%	0%	0%		
13	AI speech recognition technology is an effective tool for promoting equality in educational opportunities for hearing-impaired students.	40	198	2	0	0	4.16	0.39
		17%	83%	1%	0%	0%		
14	Cost-related challenges limit the widespread use of AI-driven speech recognition systems in inclusive education.	59	174	4	3	0	4.20	0.52
		25%	73%	2%	1%	0%		
15		35	204	1	0	0	4.14	0.36

	AI-driven speech recognition systems provide hearing-impaired students with greater autonomy in their learning process.	15%	85%	0%	0%	0%		
16	Teachers feel confident in using AI-driven speech recognition systems to support the educational needs of hearing-impaired students.	67	164	8	1	0	4.24	0.16
		28%	68%	3%	0%	0%		

Table 2 clearly demonstrates the significant agreement among respondents regarding the beneficial effects of speech recognition AI tools on classroom participation, understanding spoken instructions, inclusivity, and overcoming communication barriers for hearing-impaired students. This agreement is evident from the very high mean scores and low standard deviations, indicating the overall effectiveness of these systems in solving educational problems.

Table 3
Independent Sample T-test Analysis at the Basis of Gender

Gender	N	Mean	Std. Deviation	df	t	Sig. (2-tailed)
Male	77	67.74	3.02	238	0.82	0.416
Female	163	67.43	2.63			

The t-value of 0.82 and a p-value of 0.416 support the conclusion that there are no significant differences in the mean scores of male (M = 67.74, SD = 3.02) and female (M = 67.43, SD = 2.63) respondents, as shown in Table 3.

Table 4
Independent Sample T-test Analysis at the Basis of Designation

Designation	N	Mean	Std. Deviation	df	t	Sig. (2-tailed)
SSET	125	68.13	2.44	238	3.60	0
JSET	115	66.88	2.94			

The analysis of Table 4 demonstrates that there is a significant difference between the mean scores of SSETs (M = 68.13, SD = 2.44) and JSETs (M = 66.88, SD = 2.94), as evidenced by a t-value of 3.60 and a p-value of 0.00, which means the former get a higher mean score than the latter.

Table 5
Independent Sample T-test Analysis at the Basis of Place of Posting

Place of Posting	N	Mean	Std. Deviation	df	t	Sig. (2-tailed)
School	125	68.12	2.34	238	3.61	0
Center	115	66.78	2.89			

Table 5 demonstrates that the difference between respondents at schools (M = 68.12, SD = 2.34) and respondents in centers (M = 66.78, SD = 2.89) is significant using a t-value of 3.61 and a p-value of 0.00, which shows respondents at schools have higher mean scores than those in centers.

Table 6
Independent Sample T-test Analysis at the Basis of Area of Posting

Area of Posting	N	Mean	Std. Deviation	df	t	Sig. (2-tailed)
Rural	125	68.13	2.44	238	3.60	0
Urban	115	66.88	2.94			

The t-value of 3.60 and a p-value of 0.00 demonstrate a significant difference in the mean scores between the respondents posted to rural areas (M = 68.13, SD = 2.44) and the city (M = 66.88, SD = 2.94), indicating a higher mean score for the rural area respondents compared to the urban area respondents. Table 6 demonstrates a significant difference in mean scores between the rural area respondents (M = 68.13, SD = 2.44) and the urban area respondents (M = 66.88, SD = 2.94), as evidenced by the t-value of 3.60 and a p-value of 0.00, indicating a higher mean score for the rural area respondents.

Table 7
One-Way ANOVA Analysis at the Basis of Area of Age

Age	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	57.08	3	19.03	2.55	0.06
Within Groups	1758.72	236	7.45		
Total	1815.80	239			

Table 7 depicts the one-way ANOVA analysis for age groups, hitting no significant difference in the mean scores of the groups, as shown through an F-value of 2.55 and a p-value of 0.06.

Table 8
One-Way ANOVA Analysis at the Basis of Area of Qualification

Qualification	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	31.05	2	15.52	2.06	0.13
Within Groups	1784.75	237	7.53		
Total	1815.80	239			

Table 8 suggests that no considerable difference emerges in the mean scores derived from different qualification levels, as attested by an F-value of 2.06 and a p-value of 0.13.

Table 9
One-Way ANOVA Analysis at the Basis of Area of Experience

Experience	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	58.64	3	19.55	2.63	0.05
Within Groups	1757.16	236	7.45		
Total	1815.80	239			

With an F-value of 2.63 and a p-value of 0.05, Table 9 shows that the one-way ANOVA analysis for different levels of experience supports the small difference in mean scores between the experience groups.

AI-driven speech-in-context classifiers show that, out of all the problems that hearing-impaired students have in the classroom, most of the people who were interviewed think that they make things better. The majority of interviewees confirm that these platforms increase students' participation in the classroom, help them better understand given instructions, and create a learning environment where all students feel included. The belief in AI-driven technology's ability to break down communication barriers and simplify learning for deaf students accounts for the low mean scores and variance deviations in various areas. People who filled out the questionnaires clearly emphasized the instant transcriptions these systems can perform and their impact on equalizing educational opportunities, stating that these technologies enhance academic involvement and reduce the need for human assistance.

An average score analysis reveals significant differences in scores based on demographic indicators. There is no notable disparity in responses between the two genders, implying that both male and female respondents equally approve of the effectiveness of AI-driven speech recognition systems. However, we found differences between staff groups and types of schools. For instance, the senior special education teachers (SSETs) reported differences such that their mean scores were high and those of junior special education teachers (JSETs) were low, which tells us that demographic factors like age and seniority in teaching could influence the perception of the technology. In a similar vein, individuals teaching in schools and the Aegean Islands often achieved higher mean scores than those in centers and Athens, suggesting that the situation and surrounding environment could significantly impact the effectiveness of the technology.

The one-way ANOVA analysis on age, qualification, and experience regroups mixed results. There is no significant difference in mean scores based on age groups or

qualification levels, indicating that these variables do not contribute to the perception of AI voice-lock technology. However, a slight similarity emerged across various experience levels, indicating that diverse individuals perceive a particular technology differently. Consequently, the data demonstrated professional approval, albeit with some variances, shaped by various context-specific factors.

Discussion

The research shows the significant influence of AI-guided speech recognition systems in the betterment of study for pupils with hearing damage. The strong agreement among the individuals who participated concerning the efficiency of these systems in improving in-class participation, understanding of spoken instructions, and creating an inclusive atmosphere is in line with the current literature on the use of assistive technologies in the classroom. Hoogerwerf et al. (2021) have demonstrated the effectiveness of AI-based tools in enhancing engagement and learning for students with disabilities, as they offer immediate assistance and mitigate communication challenges. Similarly to the above findings, the majority of interviewees stated that these high-tech systems practically aid deaf students in staying in the flow of lesson discussions and getting hold of the audiovisual materials just as their non-hearing-impaired peers do.

Male and female teachers feel the same way about the role of AI systems in the classroom, demonstrating that both genders perceive AI similarly. It fits with the studies that show that technology adoption is uniform across genders when its benefits are clearly defined, according to both Marikyan and Papagiannidis (2020). Nevertheless, the differences in the views of educators with different positions and from diverse locations imply the fact that the context is very influential on the effectiveness of technologies in education. Senior Special Education Teachers (SSETs) reported higher scores than Junior Special Education Teachers (JSETs), suggesting that more experienced teachers may have a greater affinity for using these systems. Hu et al.'s (2020) research, which found that seasoned educators possess a high level of expertise and that new technologies can pique their interest due to their familiarity with the old methods and their potential outcomes, supports this.

Also, students who scored higher on the following surveys noticed AI-based speech recognition systems working more efficiently in schools and villages than in towns and cities. This indicates that the utilization of AI-driven speech recognition technologies may vary in the educational context. This speculation is also in line with the findings of previous works that affirm that situational aspects, including the site and type of educational institutions, can have a strong impact on educational technology adoption and usage efficiency (Faqih & Jaradat, 2021). Furthermore, the non-substantial differences in perceptions based on years of practice indicate that instructors with varying tenure may perceive the efficiency of these systems in different ways. This aligns with the findings of a study by Sharma & Srivastava (2020), which suggests that technologies can influence educators' perspectives and usage patterns.

Conclusion

This study has demonstrated how AI voice recognition systems aid in the learning process for deaf and hard-of-hearing students, enhancing their mobility in the classroom, improving their understanding of tutor-guided natural speech instructions, and promoting inclusivity. Most educators, regardless of gender, perceive these tools as beneficial and highly efficient in bridging the communication gap, based on their flat preliminary performance among staff. Specifically, educators with prolonged exposure to these tools, as well as those operating in schools or rural communities, reported higher levels of satisfaction, indicating that contextual factors and professional experience significantly influence the perceived impact of these technologies. This is consistent with the literature,

which underscores the need to adapt technological applications to the different educational settings and available resources. Furthermore, the study also discloses that AI-powered speech recognition systems looking into AI-based learning systems are ubiquitous. Thus, they have gained widespread acceptance in the educational landscape. These tools exemplified educational technology, which typically addresses issues related to the classroom, library, and similar settings. However, the data collected from educators reveals that, despite a shared belief in the tools' usefulness, opinions about their benefits varied based on the roles of teachers and administrative staff, as well as the educational contexts. This implies that the relevant users should receive specific training and support. By resolving these disparate facts, the systems will operate flawlessly, allowing everyone to benefit from their advantages.

Recommendations

- Ensure implementation of targeted training programs, which would help educators of all levels and locations do their duties effectively through AI-driven speech recognition systems.
- To meet the tech requirements, a teacher has to use software that has been adapted to his/her teaching topic, local situation, and learning environment to make it more efficient and successful.
- We are implementing software and human resources safely and continuously to facilitate the ongoing adoption and use of AI-driven speech recognition systems in inclusive education settings.
- Determine the potential impact on the academic performance and social involvement of deaf individuals across various educational settings if teachers utilize AI-facilitated speech recognition tools.

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