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BRIDGING EDUCATIONAL GAPS: THE IMPACT OF TECHNOLOGY-ASSISTED INSTRUCTION ON INCLUSIVE EDUCATION IN MULTAN

Muhammad Nasir
Lecturer English, University of Southern Punjab Multan, Pakistan
Amna Amjad
M.Phil Scholar, University of Southern Punjab Multan, Pakistan
Jannat Fatima
IELTS and Spoken English Instructor Counslo Multan, Pakistan
Sana Khalid
M.Phil Scholar, University of Southern Punjab Multan, Pakistan

Abstract

The present research study explores how different forms of Technology-Assisted Instruction (TAI) can enhance learning outcomes and improve the overall educational experience of students with learning disabilities (LD) in Multan, Pakistan. The primary objective of this study is to examine the level of student engagement with TAI, the perceived implementation of TAI by teachers, and the potential of these technologies to support and enhance the learning process for LD students. A qualitative case study design was employed, using purposive sampling to select participants from a school specifically catering to students with LD in Multan. Data collection methods included semi-structured interviews with the selected teachers, separate focus group discussions with both teachers and parents, and classroom observations. Findings from the study revealed that TAI significantly contributes to increased student engagement and academic achievement, particularly for learners with ADHD and dyslexia. Teachers noted enhanced student motivation and attentiveness due to the use of interactive tools such as educational apps and mind mapping software. These tools enabled individualized learning based on student abilities, which led to improvements in comprehension, writing, and mathematical skills. Parents also reported increased learning activity at home, with students demonstrating more interest and greater confidence when using TAI tools. However, the study also identified key challenges, including the need for continuous professional development for teachers and a lack of adequate technological resources, such as insufficient devices and unstable internet connectivity. The research concludes that TAI offers considerable benefits for LD students, its successful integration requires institutional support, resource investment, and capacity-building for educators.

Keywords: Learning Disabilities, Inclusivity, Student Engagement, Professional Development

1. Introduction

The present research study aims to analyze the role of Technology-Assisted Instruction (TAI) for differentiated students in Multan that reveal a significant research theme in the field of education, especially how technology can meet the need of learners with LD. Other conditions including learning disabilities, dyslexia, dyscalculia, and ADHD which are the primary focus of this study, have been found to greatly affect a student's learning and memory (Fletcher et al., 2007). LD is a label used to characterize a wide array of learning disabilities which adversely affect a child's learning, through instructional strategies that typically incorporate regular education classroom (Snow, 2008). The integration of Technology-Assisted Instruction (TAI) for differently-abled students has received growing attention globally. However, the role of TAI for differently-abled students in specific regions, such as Multan, remains underexplored. This research gap presents an opportunity to investigate the

impact, challenges, and opportunities of implementing TAI in the education of differently-abled students in Multan, a city in Pakistan with a diverse demographic and socio-economic context. The researchers aimed at finding out the impact of Technology-Assisted Instruction (TAI) in facilitating learning for the students with LD, and how particularly the students with LD in Multan, Pakistan can be better addressed.

The current study is valuable to educators in a number of ways, primarily as the results identify pedagogical practices that can contribute to teaching in a manner that enhances learning for students with LD, or learning disabilities. Whenever teachers teach students with LD's they encounter a number of difficulties as a result of diversity of students with the LD and sterility of conventional teaching methodologies. As the study isolates on Technology-Assisted Instruction (TAI), educators get a better picture of how to integrate tools aimed mutually for all students and for individual student need. These findings can inform educators regarding the selection of proper instruments, development of individual learning programs, and optimization of the approach of the instructor to increase learning interest and performance of learners with different abilities (Alqurashi, 2020).

2. Literature Review

Technology assisted instruction (TAI) entails the use of technology tools, software's and multimedia resources in the teaching learning process. Technologies in auxiliary learning comprise of computer enhanced learning systems, digitized simulations, learning software, and special devices to support student that have learning disabilities (Becta, 2003). Traditionally, the development of TAI was associated with the growth of the technology, availability and accessibility of technologies in educational contexts. Teleenagers became an educational technology in the past to support administrative lessons but by end of the twentieth century computers and other educational technologies were used to transform the instructional techniques (Hew & Brush, 2007). The growth of the Internet and media-rich, interactivity-based platforms extended the capability of TAI to individualized multimedia content and learning contexts to all students including LD.

It was equally observed that the expansion of TAI in education is a result of the call for development of more effective teaching pedagogy that must embrace the needy person. When the concept of inclusive education started developing as a line of research, technology as enabler to support the process of differentiation of content became more clearly defined (Rose & Meyer, 2002). Computer related support technologies, including text-to-speech software and speech recognition devices have been developed to fit the learning difficulties of students with LD and make learning easier and more efficient (Woodward and Reithaug, 2000). Consequently, TAI has shifted from the role of an auxiliary activity to an essential element of most education trends. Technology is also found to have drastic influence on the students' motivation as well as their interest as a result of TAI (Technology Assisted Instruction) students with LD (learning disability). Traditional approaches have been known to bore the students with LD as well as make them disinterested due to the sort of teaching methods used. To tackle such issues, TAI comes up with approaches that enable the design of learning content that is interactive, dynamic, and powerfully personalized which would enhance student involvement with the learning process (Cavanaugh et al., 2004). Deci and Ryan's (2000) Self-Determination

Theory postulates that the element of choice, self-organized learning, and meaningfulness of context improves intrinsic motivation levels of the students. Utilizing choices, spreading the learning over time, and involving students through the use of TAI tools like interactive software's, games, multimedia etc. makes students motivated (Mayer, 2009).

TAI tools assist in developing an interesting Instructional Environment for students with LD because audio, video, and visual simulation yield positive learning results due to Multiple-Sensory channels (Mayer, 2009). According to Cheung and Slavin (2013) literature exposed that, when students with LD use their time with TAI, they experience higher levels of fun and interest compared to the customary classroom learning environment. This enhanced interaction affects their academic performances in a positive manner since learners are more inclined in completing their studies and performing well if the content they learn is fascinating and most importantly suits their learning styles (Kulik 2003). As a result, TAI not only promotes the creation of more accessible classroom environment but also greatly enhances the educational experience of students with LD.

Indeed, the ability of the Technology-Assisted Instruction tools to meet the needs of students with LD halves on the outcome of the tools' ability to enhance the usability criteria for the user. For every disability, there are technologies that enable students to approach learning and content in different ways; speech recognition systems enable students with physical disabilities to interact with the content, while mind mapping tools help learners with learning disabilities understand content. Example of such accommodations are speech recognition tools that give students with dyslexia or writing problems an opportunity to express themselves orally and thus overcome some of the reading and writing challenges common among such students (Shaywitz, 2003). These tools enhance the writing skills amongst individuals by offering quick feedback to the writers and this makes the learners and Etheridge& Mansfield, 2005 and MacArthur, 2010 students to concentrate more on content rather than on writing techniques such as spelling and grammars.

3. Research Methodology

A qualitative approach is chosen to apprehend the detailed experiences and perceptions of educators and students, providing rich, context-specific insights that quantitative methods may overlook. The study adopts a case study design, focusing on a single educational institution to understand how TAI is integrated within that setting, considering factors such as teacher practices, student engagement, and available resources. This approach allows for a comprehensive examination of TAI's impact on learning outcomes and the challenges faced in its adoption, offering practical recommendations for enhancing inclusive education. The present research study uses a qualitative research method to analyze the participants' views and impressions of Technology-Assisted Instruction (TAI) implementation. Qualitative research can be characterized by the fact that it focuses on the gathering of detailed information that captures the emotions of the key subjects, and more especially, offers information-rich data which fail to be captured by quantitative research methods (Creswell, 2013). As the subject is as complicated as the subject area – TAI through supporting students with LD – qualitative approach allows for understanding the views, attitudes and practices concerning technology integration into learning environments. In the present research, there is a central interest on the

practices that teachers and learners engage in when they use TAI tools, their impression of its efficiency, and how the technologies used aid learners with LD achieve their academic goals.

3.1 Sampling Strategy

In this study, purposive sampling technique is adopted in order to obtain participants from a school in Multan that already has a setup TAI program which is important for the study since it will help to acquire data to answer the research questions about the effect of TAI in learners with LD. Thus, the selection of participants is restricted to the purposive sampling, which allows identifying individuals with adequate background to provide relevant information about the implementation and use of TAI in classroom. The use of a school with an existing TAI program is crucial for the purposes of this study, as it would enable the observation of practice based implementation of technologically improved teaching and learning approaches. Qualitative, quantitative and mixed approaches: This study has purposively selected a school where TAI is already implemented to evaluate how such tools integration is done for students with LD and the difficulties faced and perceived advantages valued by educators, students, parents. The rationale for choosing five teachers teaching at the primary level is informed by the fact that teachers are the main user and enactors of TAI in the classrooms. In light of this argument, teachers' views as to the incorporation of TAI into their practice, the effects of TAI on children with LD and the changes in outcomes are crucial to the discussion of practice realities and successes of technology integration (Ertmer, 1999). Furthermore, teachers' perceptions of students' engagement with TAI and their perception of the kind of professional development required to support improvement in implementing technology are relevant data sources.

3.2 Observation's Checklist for TAI Teaching Technique

A checklist was designed to evaluate the feasibility of TAI as instructional strategy in addressing the teaching-learning environment in relation to students' learning disabilities (LD), their participation, interaction and learning achievements in the classroom setting. The Classroom Observation Checklist was used to quantify the data gathered regarding the actualization of the TAI and the effects it has on a LD classroom. This was made possible by the incorporation of the checklist which enabled an organized assessment of the incorporation of TAI tools in the teaching process, their use frequency, and efficiency in the engagement of the students. Thus, by targeting several more aspects of TAI implementation, this tool allowed for making broader observations and including technical as well as pedagogical aspects of its effective or ineffective usage into them.

The method of data analysis for this study entails a methodical approach of handling qualitative data collected from interviews, focus groups and classroom observations. The study aims at finding interesting trends, associations, and findings concerning the TAI for students with LD in Multan. This analysis utilizes two key methods: of the research methodologies which are thematic analysis and triangulation.

4. Data Analysis

Regarding the manner of data presentation for this study it entails a factual and orderly description of the findings having emerged from the interviews conducted among 5 Teachers and 5 Parents/Guardians. The presentation is divided into the following key components:

i. Class observations
ii. Initial Codes and thematic analysis from Interviews, focus group and observations

Most important of all, the qualities and characteristics of the TAI as perceived and reported by the teachers and parents/guardians through the semi-structured interviews offered valuable qualitative data concerning the implementation process, the efficacy of the TAI in the learning context for students diagnosed with LD. Gets teachers' self-observations regarding TAI effects on the students' learning process and parents' observations of the effects on children's learning and performance.

4.1 Data analysis of Classroom Observation's checklist

The classroom observation's checklist was applied to evaluate the concerns regarding TAI through real time classroom observation checklists. This data was gathered from direct observation of 5 different classrooms where TAI was incorporated for students with LD. This study presents its results in a narrative form first at the conclusion of each and every finding, then in the finalization and categorization of initial codes, and finally in the depiction of main themes in tabular form. A checklist shall be used to gather observational information that will be utilized to extend arguments related to the key findings and to link them to other data collection methods, such as interviews and focus group discussions. The classroom observations were designed to determine how TAI was being implemented in class, how students were interacting with the technology and effectiveness of the tools employed. The checklist gave direction on some of the data that could be recorded including the use of the TAI tool, number of students participating and their level of engagement.

Table 1 Classroom Observation Data Collected for 5 Classes

General Information	Class 1	Class 2	Class 3	Class 4	Class 5
Date of Observation	10/05/2024	13/05/2024	14/05/2024	15/05/2024	16/05/2024
Class/Grade Level	3rd Grade	4th Grade	5th Grade	2nd Grade	3rd Grade
Subject/ Topic Being Taught	Math (Fractions)	Science (Plants)	English (Reading Comprehension)	Math (Addition/ Subtraction)	Social Studies (Geography)
Duration of Observation	45 minutes	50 minutes	45 minutes	40 minutes	55 minutes
Teacher's Name	Mrs. Smith	Mr. Johnson	Mrs. Lee	Mr. Brown	Mrs. White
Number of Students in Class	25	28	27	24	26
Students with LD in Attendance	4	3	5	2	4

(if identifiable)					

Table 2 Section 1: TAI Tool(s) in Use

Criteria	Class 1	Class 2	Class 3	Class 4	Class 5
Type of Technology Used	☐ Speech recognition software ☑ Mind mapping tools ☐ Interactive whiteboards ☐ Educational apps/games ☐ Audio/video materials	☐ Speech recognition software ☐ Mind mapping tools ☐ Interactive whiteboards ☐ Educational apps/games ☑ Audio/video materials	☐ Speech recognition software ☑ Mind mapping tools ☐ Interactive whiteboards ☐ Educational apps/games ☐ Audio/video materials	☐ Speech recognition software ☐ Mind mapping tools ☑ Interactive whiteboards ☐ Educational apps/games ☐ Audio/video materials	☐ Speech recognition software ☐ Mind mapping tools ☐ Interactive whiteboards ☐ Educational apps/games ☐ Audio/video materials
Frequency of Technology Use	☑ Constantly used throughout the lesson	☑ Constantly used throughout the lesson	☑ Used for specific activities only	☑ Sporadically used	☑ Constantly used throughout the lesson
Effectiveness of TAI Tools in Engaging Students (1-5 scale)	4 – Effective	5 – Highly effective	3 – Neutral	2 – Somewhat effective	4 – Effective
Technical Issues Encountered	☐ None observed ☑ Occasional technical issues (e.g., lag, glitches)	☑ None observed	☐ None observed ☑ Occasional technical issues (e.g., failure to load)	☐ None observed ☑ Occasional technical issues (e.g., crashes)	☑ None observed

Table 3 Section 2: Student Engagement and Interaction

Criteria	Class 1	Class 2	Class 3	Class 4	Class 5
Student Participation with TAI	☑ Active participation	☑ Active participation	☑ Occasional participation	☑ Active participation	☑ Active participation
Students' Use of TAI Tools	☑ Independently using TAI tools	☑ Assisted use (with teacher or peer help)	☑ Independently using TAI tools	☑ Assisted use (with teacher or peer help)	☑ Independently using TAI tools
Level of Focus/Attention from Students	☑ High level of focus	☑ Moderate focus	☑ Low focus	☑ High level of focus	☑ Moderate focus
Behavioral Engagement (e.g.,on-task behavior, interest)	☑ High engagement	☑ Moderate engagement	☑ Low engagement	☑ High engagement	☑ Moderate engagement
Observations	Students are very engaged with mind-mapping tools, especially in visualizing fractions. Some technical glitches were noted, but overall, engagement remained high.	The audio/video materials captivated students' attention, but some faced challenges in accessing the content due to slow internet.	Students showed minimal engagement due to distractions, but the mind-mapping tool worked well for comprehension exercises.	Students with LD showed moderate participation with interactive whiteboard exercises. A few required additional support from peers.	Students engaged well with interactive video content, but some struggled with the lack of immediate access to devices for everyone.

In terms of technology integration, the studied classrooms applied all types of TAI tools and instruments, where the most frequently applied ones were interactive whiteboards, means of speech recognition, and pedagogical applications. These tools were incorporated in lessons on Read, Write, and Arithmetic lessons among others. For instance, in Class 1, use of a mind map was made, especially for students who have been diagnosed to be suffering from ADHD during a writing lesson. They found it

useful as it bought structure to their thinking which in turn helped to keep them on track. Also in Math lesson, a teacher used an example where students used an interactive white board with digital pen pencils. This is true because the students were more focused, engaged and made the lesson all the more fun and exciting with the help of this approach. About the level of students' participation, it could be noted that the level is generally high when TAI tools are adopted in the classroom. Observing the findings of Class 2, the teaching strategies used raised students' interest hence improved their dyslexic learning especially by using text–to–speech software during reading sessions. It also underlined the highlighted words while reading and this helped students really stick to the text and build up their confidence in reading. Nevertheless, in some classrooms, the level of student interaction with the TAI tools was moderate. Sometimes there were technical issues with applications which disrupted lesson continuity and interfered with students' attention and the usefulness of applications.

Depending on the kind of implementation of TAI used, behavioural engagement also differed. Class 3 students with ADHD demonstrated high learning interests whenever engaged with the interactive educational games. There are those games that enabled them to receive regular feedback, as well as rewards to enhance their concentration. On the one hand, students without learning disabilities had a lower level of enthusiasm to what they encountered in the technology; they are easily distracted by the tools. In classes 4 and 5 in which a video based instruction was used for teaching mathematics and science respectively, students having learning disabilities look more attentive and interested when such videos incorporated appealing stimuli and coordinated features.

4.2 Initial Codes from the observation checklist

The following initial codes were derived from the classroom observations:

Table 4

Code	Description
TAI Tool Usage	Types of technology used in the classroom (e.g., interactive whiteboards, apps).
Student Engagement	Level of student participation with TAI tools (active, moderate, low).
Behavioral Engagement	Observable behaviors such as focus, attention, and interest during TAI activities.
Technical Issues	Technical barriers encountered during TAI usage (e.g., glitches, device failure).
Resource Availability	The availability and access to TAI tools and devices for students.
Differentiated Learning	How TAI accommodates students with different learning needs.

4.3 Main Themes with Supporting Quotes and Observations

The following main themes emerged from the classroom observation data:

Table 5

Main Theme	Supporting Quotes/Observations

Effectiveness of TAI Tools	"The speech recognition tool helps my students with dyslexia follow along with the text, and it gives them more confidence." (Teacher 1)
Student Engagement and Participation	"The students with ADHD are more engaged when using interactive apps. They focus better and participate more actively." (Teacher 2)
Challenges in Technical Issues	"The app crashed halfway through the lesson, and it disrupted the flow. It can be really frustrating when the tech doesn't work." (Teacher 3)
Resource Constraints	"We don't have enough devices for each student. So, we have to share, and that sometimes slows down the pace of the lesson." (Teacher 4)
Differentiation with TAI	"The mind-mapping tools are especially helpful for students who struggle to organize their ideas. It's like they get a visual structure for their thoughts." (Teacher 5)

The findings of the classroom observations suggested increased participation of learners with LD and possibility of using TAI tools in favour of it. However, there were some technical problems and lack of funds that influenced those tools and did not allow them to work in full power. The threats of student activity, various approach to learning, and lack of resources were mentioned several times during the observations, which strengthen the idea of multilayered processes of TAI in classrooms.

4.4 Areas Identified from All Data Collection Instruments

The following table shows the main research questions associated with findings from the semi-structured interviews, the focus group discussions with teachers and parents, and the classroom observations. The themes are related with the research objectives and they describe the repetition patterns and findings from the different datasets. All the themes are encompassed by quotes and observation from each data collection technique used.

Table 6

Research Objective	Key Themes	Semi-Structured Interviews (Teachers)	Focus Group with Teachers	Focus Group with Parents	Classroom Observations
Objective 1: To investigate the role of TAI on learning outcomes and inclusivity	**Improved Student Engagement**	"Students show more interest when using interactive tools."	"The students are more motivated to participate with apps and games."	"My child is more focused and engaged when using TAI at home."	High participation during lessons using TAI tools.
	Enhanced Academic	"There have been	"I've seen progress in	"My child's reading and	Improvements in

	Performance	noticeable improvements in reading and math scores."	students' reading and comprehension levels."	writing skills have improved."	students' attention and participation in tasks like math.
	Personalized Learning	"TAI helps address individual needs, especially for students with ADHD and dyslexia."	"TAI tools allow me to customize lessons for different learning needs."	"TAI has been very helpful in customizing learning for my child's difficulties."	Use of adaptive tools for students with LD, like speech-to-text for reading assignments.
Objective 2: To explore educators' perspectives on TAI implementation	**Challenges in Implementing TAI**	"Technical issues such as lag and software crashes are frequent."	"We need more training and technical support for effective implementation."	N/A	Occasional technical problems (e.g., software glitches, lag).
	Need for Training and Support	"We need more professional development to improve our use of TAI."	"Training in new technologies would make us more effective."	N/A	Teachers appear to need further training in integrating TAI with traditional methods.
Objective 3: To examine learners' engagement with TAI	**Increased Motivation and Active Participation**	"Students seem to enjoy lessons more when TAI is involved."	"Students with LD are more likely to participate when using interactive tools."	"My child is excited to use the apps and games for learning."	Students actively engage with interactive elements (whiteboards, educational apps).
	Student Independence and Autonomy	"TAI allows students to work more independentl	"Using apps gives students more control	"My child likes to work independent	Students were observed using tools

		y, especially those with dyslexia."	over their learning."	ly using speech-to-text tools."	like mind maps and educational apps independently.
Objective 4: To assess the effectiveness of TAI in supporting students with LD	**Positive Impact on Learning Outcomes**	"TAI has positively influenced students' academic progress, especially in reading."	"I've seen improvements in comprehension and focus after using TAI."	"My child has shown more confidence in reading since using TAI."	Students using TAI tools showed improved focus and engagement, leading to better understanding of lessons.
	TAI as a Supportive Tool for Diverse Needs	"TAI tools cater to diverse needs, from ADHD to dyslexia."	"TAI helps me differentiate my instruction for students with varying needs."	"I feel that TAI addresses my child's specific learning challenges well."	TAI tools like speech recognition and mind-mapping assist diverse learners in staying on task.

In the above analyses the increased student involvement or interaction was a pattern throughout all types of data used. Both the teachers, parents and classroom observation confirmed that students are more active and keen when learning-teaching process involves TAI tools. The features of the aforementioned tools give a hint they help get the students, who may not otherwise be interested in learning at all, engaged. Based on the current finding, TAI tools appear to facilitate academic performance, especially in reading, writing, and mathematics. These forced teachers to note better academic skills of their learners from the parent that also reported enhanced performance by their children at home. Observation done in class also proved that TAI facilitates reinforcement of what has been taught in class in other ways so that it is easy for learners to understand lessons that may have proven difficult. However, the authors observed the following as challenges in the implementation of TAI. Problems that can be classified as technical in nature were reported to include lack of or complications in access to the tools. Moreover, both the teachers and the parents also mentioned the shortages of the training and the resourced available to them. These are some of the concerns that hinder the optimum usability of TAI in achievement of better learning outcomes by students with LD.

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4.5 Data Triangulation

The triangulation is one of the ways of enhancing validity of the research study as it involves a consensus of data from various sources. Pertaining to method, data gathered through face to face semi structured interviews, focus group discussion and class observation with teachers and parents and class observations of students and video analysis of the lessons taught was used in Triangulation in order to gain an insight into an understand the effects and difficulties of Technology-Assisted Instruction (TAI) for students with learning disability (LD).

Table 7 Triangulation Analysis of Data Sources

Key Themes	Semi-Structured Interviews (Teachers)	Focus Group with Teachers	Focus Group with Parents	Classroom Observations
Improved Student Engagement	Teachers report that students show more interest and are more participative when using TAI tools like interactive games and speech recognition software. "The use of TAI tools has increased students' participation in class activities."(Teacher 3)	Teachers observe that engagement levels rise with TAI tools. "TAI tools like apps and games keep students focused, especially those with ADHD."	Parents note that their children's interest and focus improve with TAI tools at home. "My child is excited to use educational apps for learning at home."	Observations reveal high levels of participation when interactive whiteboards and educational apps are used in lessons. Students engage more actively with the lesson tasks.
Enhanced Academic Performance	Teachers observe noticeable improvements in academic performance, particularly in reading and math. "Students have shown clear improvement in reading and writing tasks." (Teacher 2)	Teachers highlight that TAI has contributed to increased reading comprehension and math skills. "We've seen growth in students' academic performance, especially in literacy."	Parents mention improvements in reading, writing, and math skills. "My child's math scores have improved since using interactive math games."	Improvements in students' academic performance, such as better math problem-solving and enhanced reading skills, were noted during lessons where TAI tools were integrated.

Individualized Learning Support	Teachers emphasize that TAI tools cater to the individual needs of students with different LDs. "Speech recognition software and apps help my students with dyslexia and ADHD." (Teacher 5)	Teachers describe how TAI supports differentiated learning in the classroom. "I can use TAI to address the specific needs of students with LD, providing them with tailored learning experiences."	Parents observe that TAI allows their children to work at their own pace. "The tools help my child progress at a pace that suits her learning difficulties."	Observations indicate that adaptive tools, such as text-to-speech and mind mapping tools, are used to support students' individual learning needs.
Challenges in TAI Implementation	Teachers report technical barriers, such as frequent glitches or lack of resources, which hinder effective TAI use. "We often face problems with internet connectivity and outdated software." (Teacher 4)	Teachers discuss the need for more training and technical support to implement TAI effectively. "We need more guidance on how to integrate these tools effectively into daily teaching."	Parents mention challenges related to accessibility of TAI tools at home. "My child's access to technology is limited outside of school."	Classroom observations show that while TAI tools are beneficial, there are occasional technical issues (e.g., slow internet, device malfunctions) that disrupt the flow of lessons.
Support and Training for Effective Use	Teachers suggest that more professional development is needed to make full use of TAI tools. "Training sessions are essential to help teachers effectively use TAI in the	Teachers agree that continuous support and professional development would help maximize TAI's effectiveness.	Parents call for more communication between schools and parents regarding TAI usage and support. "I would	Observations reveal that teachers often struggle with fully integrating TAI tools due to a lack of technical proficiency

	classroom." (Teacher 1)	"We need more training and hands-on support to use these tools effectively."	appreciate more information on how TAI tools can be used at home."	and training, despite the available resources.

Teachers noted that the use of TAI tools helped to foster higher levels of participation among students – a factor which was also supported by the focus group discussions with teachers and parents in which the latter also noticed the higher interest of students, especially through tools such as the whiteboard. They also found out that their children were more motivated to learn than when they were at school and this was brought about by use of TAI tools. These statements were supported by classroom observations, and it was frequently noted that TAI tools stimulated students' interest and they actively participated in the lessons when tools were used. Some of the tools implemented included the use of speech recognition software which teachers reported that it enabled students to record and improve on their academic performance through areas such as reading and writing, mathematics. This was so said by both the teachers and the parents in the conducted focus group discussion; the parents for instance, noted improvement in their children's Mathematical and Literacy skills. Classroom observations also corroborated these findings with students making improvements in tackling problems and reading.

The use of data collected through semi structured interviews, focus group discussion and classroom observations makes it possible to triangulate the findings regarding the effects of the TAI on students with learning disabilities. Connecting results of multiple sources, the study reveals the advantages of using TAI to enhance students' activity, their achievements, and individualization of learning processes. But it certainly exposes issues more concerning with technical problems, lack of resources, and training to derive the optimum of TAI. The integration of these findings enhances generalizability of the study and offers insight as to how TAI may be utilized in a more appropriate enhancement of learning for students with learning disabilities.

5. Findings and Conclusion

The results from the study regarding the impact of Technology-Assisted Instruction (TAI) for learners with learning disability (LD) offer a complex picture encompassing different aspects of students' learning and experience process. These results are quite important for the consideration of TAI in general and more specifically for educational environment in Pakistan. The current study identified that teachers in Pakistan, as in other nations, experience a number of challenges when attempting infusing TAI in instructional practice due to infrastructure and resource constraints. In addition, Sharma & Soni (2020) observe that lack of adequate professional development and teacher training in technology integration is a reason for TAI implementation failure, which was evident in the current study. The interview questions with the teachers and the semi structured interviews were informative and the response received showed the need for training as to how the various tools of TAI could be efficiently used. As much as the parents stated a lot needed to be done, they also said that the tools required at home

were also a challenge. These observations are similar to the recent conclusions of Bennett et.al, (2020) who stated that we can only expect great things from TAI but with tenuous proviso that serious investment in teacher professional learning opportunities and tack infrastructure is made. The issues observed during the implementation of TAI as a main source of difficulties in implementing TAI correspond with earlier research stating that technical issues and the requirement of training are important factors that affect the successful implementation of TAI. To overcome these challenges, it will be necessary to resolve not only infrastructural problems but also to improve training.

In this study, the teachers said they adopt adaptive technologies in teaching to meet individual learning needs of students with learning disabilities, which supports the general approach of UDL. Furthermore, the data collected by focus group with parents and classroom observation proved that it is independence and confidence which grow in students because they work at TAI. As a tool, TAI can be used to allow differentiation for learning disabled students since it addresses the needs of every individual student. Furthermore, as the study proceeds, teacher's observations and own practice of using interactive tools during the lessons, increased the frequency and the quality of students' response. In addition, using all the data sources, it was possible to provide the overview of the challenges observed regarding the use and utility of TAI tools. Among them, especially the teachers reported that technical difficulties like software failure or a weak internet connection were the main barriers to using TAI during the lesson successfully. In addition, the respondents, both teachers and parents, reported an issue, that there was not enough professionalism to avails the potential of TAI. Another conformity evident in the study is where students and teachers incorporate TAI tools in the personalization of their learning. According to both teachers and parents, in the framework of TAI it is easier to adapt to the needs of the learners with LDs during the classroom process. The analysis of the results highlight important patterns and trends concerning the TAI effects on students with LDs. The repeated patterns of increased interest engagement and parental involvement and educator-student and parent-educator cooperation mean a positive trend in the use of the technology in the class. Nevertheless, the specific difficulties in navigating the tools and difficulties with access to technology, as well as doubts about TAI tools' impact on academic performance still remained open questions, as both the teachers and the parents. The results of this study therefore corroborate the best and worst practices in TAI stipulated in earlier literature and offers much insight to subsequent enhancements of TAI in educational settings.

Overall, the results they obtained from the analysis assert a directly proportional relationship of TAI where effective utilization is central to improving student interest, performance, and participation alongside learners with LD. Interactive applications and speech recognition systems are also part of TAI tools that enhance engagement and learning achievement from students, while also breaking barriers for everyone to participate in the classroom. In addition, the study presents the key issues that are linked with TAI, including technical issues, increased need for professional development of teachers, etc. These findings help to build upon this discussion concerning technology use in today's education and offer practical suggestions for educators and policymakers in Pakistan to implement TAI more effectively for students with LD.

The purpose of the present research was to find out how Technology-Assisted Instruction (TAI) assists learning disabled (LD) students in the given educational context in Multan, Pakistan. The main findings presented in the presented section underlined the importance and positive role of TAI in terms of students' attendance, performance and participation. During the study, teachers and parents identified that The advancement of Information Technologies (TAI) reliefs like speech recognition software, mind mapping tools, and interactive white boards was useful in promoting the student's achievement in reading writing and mathematics. As per the teachers, thus enhancing student learning needs for classes was made easy through edtech tool, TAI for instance for special needs kids with dyslexia and ADHD. However, the following difficulties in implementing TAI were also noted: concerning technical aspects, the lack of proper training of students, and incorporation of TAI with the existing strategy of teaching. Parents during the focus group interviews surprised the study by supporting TAI in enhancing their children academic interest and self-esteem but some had perceived barriers touching on access and need for home support. Field observations agreed with the notion that students with LD were more active and willing to participate when the TAI tools were applied with reference to their learning needs. At the same time, the study indicated some obstacles connected with resource availability, the necessity of additional teacher training, and the process of incorporating the TAI tools into teachers' daily work. Hence, the results from the current study underscore the possibility of TAI to bring about change in practice concerning the delivery of education for students with disabilities in Pakistan. However, it was observed that implementing technology into the class is a noble approached that should be explored further in enhancing the learning of students with LD. This work adds to the current scholarship that supports the utility of TAI in creating a more inclusive classroom environment for disabled students with the overall intention of enhancing students' learning achievement requite challenging learning environment. From the study, the educators need to embrace professional development and also the inclusion of the TAI tools that can support all types of learners. And it also proves on how crucial it is to encourage and offer assistance for the proper ones and implementation of TAI. Moreover, for policymakers, the study underlines the requirement for setting up the climate conducive to the integration of diverse teaching practices and, furthermore, facilitating the provision of the necessary infrastructure, training, and materials that would guarantee the availability of the TAI to all schools, especially those located in remote areas. Thus, the result of the current study provides meaningful suggestions about the enhancement of educational practices for differently-abled learners in Pakistani schools.

5.1 Recommendations

This study gives useful information about the applicability of Technology-Assisted Instruction (TAI) for students with learning disabilities (LD) However, there is a significant work to be done to explore the different areas so that a clear and more consistent picture can be painted regarding the effectiveness of TAI for students with learning disabilities (LD) especially in the context of Pakistan. Future research might extend the study by investigating TAI application in more schools, to include an even greater number of participants from different zones of the country, both, urban and rural. This would provide a better picture of

how TAI works in various educational contexts and how context could either help or hinder the process. However, more research could be conducted within a les specific area to find out how schools in these regions cope with infrastructural support, trainings, access, and usage of TAI. Therefore, future studies on TAI in education especially in Pakistan should outspread the research to various areas and 'Citizenship Education' should also explore more advanced dimensions with teachers and students to get the actual picture of technology and its effects on learning outcomes, should employ more long-run research design to capture changes and trends overtime. The authors' recommendations fall within the realm of practical recommendations primarily addressing educators, schools and policymakers and include better preparation of teachers, providing more access to technology, and increasing cultural relevancy. The current implications of policies focus on raising expenditures on technology and framing the pro-educational policies. The limitations of the study are highlighted with reference to the case study nature of the research and the problems of data collection. Such limitations call for more studies in order to corroborate the presented domino effect and broaden the TAI, putting into practice research area. The final direction for research is the assessment of TAI's academic effectiveness in the long run, enhancement of teacher training, and the analysis of cultural and societal factors affecting TAI.

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