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Technology Adoption in Special Education - A Pakistani Perspective

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"From the streets of Lahore to the lecture halls of Europe, this journey is proof that dreams don't recognize borders. I carry the colors of my homeland in my soul and the dreams of its daughters in my stride."

~ Hamna Asim (2025)

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Abbreviations

PEU	Perceived Ease of Use
PU	Perceived Usefulness
AT	Assistive Technology
ICT	Information and Communication Technology
MOOCs	Massive Open Online Courses
XR	Extended Reality
VR	Virtual Reality
AR	Augmented Reality
EVRGs	Extended Virtual Reality Games
LLMs	Large Language Models
AI	Artificial Intelligence
ASD	Autism Spectrum Disorder
ADHD	Attention Deficit Hyperactivity Disorder
PSL	Pakistan Sign Language
IEPs	Individualized Education Plans
UDL	Universal Design For Learning
TAM	Technology Acceptance Model
TRA	Theory of Resonable Action
TPB	Theory of Planned Behavior
P1, P2	Participant 1, Participant 2
NGO	Non-governmental Organization
ERP	Enterprise Resource Planning
JAWS	Job Access With Speech (software)
NVDA	NonVisual Desktop Access
LCD	Liquid Crystal Display

1 Abstract

This study explores how perceived ease of use (PEU) influences the intention of special education teachers in Pakistan to adopt technology in their teaching practices. This research is guided by the Technology Acceptance Model (TAM), and it addresses a notable gap in literature regarding PEU as a determinant of technology adoption in special education in the context of a developing country. A qualitative approach was employed, involving 17 semi-structured interviews with special education teachers in Lahore, Pakistan. The research participants taught children with psychical and intellectual disabilities, across public, private, and NGO-based schools. Data was analyzed using thematic coding in NVivo.

Findings revealed that PEU is determined by factors such as confidence, learning curve, simplicity of technology, technical support availability, and usage of tech in daily life. Additionally, participants pointed out systemic challenges at the state and institutional level, such as weak policy implementation and lack of adequate resources. Although these ancillary findings do not directly impact PEU, they are important to understand the broader context of technology integration in Pakistan. This paper contributes to the understanding of context-specific determinants of technology adoption in special education.

Keywords: *Perceived Ease of Use, Technology Acceptance Model, Special Education, Students with Disabilities*

2 Introduction

Technology has taken over every sector of the society, including education. While technology has the potential to bridge the gaps in special education, little is known about how teachers perceive and adopt technology in instructional practices. In this paper, the focus is on special education teachers in Pakistan, and the influence of perceived ease of use on their intention to adopt technology.

2.1 Background of the Study

Using technology in education to improve the learning outcomes of students is evolving into a norm around the world. For this purpose, schools are investing in educational technology, improving technology infrastructure, and putting guidelines and policies in place to direct the capital expenditure and implementation of technology integration (Njiku et al., 2019). As technology adoption becomes more prevalent, it is up to the educators to find feasible ways of including technology into their class activities and curriculum. If used effectively, technology has the potential to enhance student engagement, tailor learning experiences to meet the needs of each student, and increase access to educational content and resources (Luo et al., 2024).

Technology-led learning environments are pivotal in the academic process. New learning frameworks leverage digital tools, providing teachers access to expansive information and efficient means to communicate it to students (Balalle, 2024). This approach allows students access to a wide range of learning materials, personalized assistance, and more room for creative expression. Moreover, technology-enhanced learning models, including smart schools and blended-learning classrooms, have a favorable influence on students' impression of the classroom. Some studies support the notion of students interacting better through technology-based communication channels versus face-to-face, build better interpersonal relationships with those they would otherwise not speak with, and informal communication through technology-based forums results in stronger bonds among students (Balalle, 2024).

Technology has also proved to be a gamechanger for inclusive education. UNESCO categorizes special needs students as those who are impacted by physical or learning disabilities (Alzahrani, 2020). Inclusive education refers to students with special needs having the right to study alongside general education students in their age bracket. In Pakistan, special needs education became part of the government's agenda in 1959, with the National Commission on Education taking the initiative. Initially, the government decided to create vocational training centers for children and adults with special needs, and educators were trained to support differently-abled students (Kamran & Bano, 2023). In the 1980s, with a push from the United Nations, the Government of Pakistan began developing policies with regards to individuals with special needs.

Inclusive education institutions in Pakistan presently face some challenges, including limited infrastructure capacity, lack of properly trained teachers and administrative staff, few or no clinical services on educational campuses, and adequate learning models to support students with different intellectual and physical disabilities (Sajjad Hussain et al., 2020). A study conducted in South Punjab, Pakistan indicates that special education

institutions are plagued with deficient infrastructure, teaching schedules are stretched thin, and parental involvement is extremely limited (Muzafar Hussain & Nasreen Akhter, 2025). In low and middle income countries (LMICs), lockdowns during COVID-19 impacted education systems as a whole, but the most vulnerable were learners with disabilities, as the United Nations declared them the least likely to have internet accessibility or availability of appropriate educational software (Lynch et al., 2024).

The challenges faced by special education institutes in Pakistan make a strong case for utilizing technology to improve student outcomes and facilitate inclusive education. Educational technology (EdTech) contributes significantly towards the inclusion of special needs individuals in society, helping reduce the social and intellectual gap (Lynch et al., 2024). Adequately matched EdTech results in special needs students performing well at school, in addition to strengthening their self esteem. Computer-based tools and software have yielded positive results for students with disabilities, leading to improved learning outcomes and sharper social skills (Cheng & Lai, 2020). A growing body of literature suggests that educators should get on board with technology in special education, especially tablet devices, since they have proven to be helpful with instructional applications (Qahmash, 2018).

The willingness of educators to adopt EdTech as a learning tool must be examined in light of theoretical frameworks such as the Technology Acceptance Model (TAM), where a primary determinant of digital uptake is perceived ease of use (PEU). TAM was introduced in 1989 by Davis, which aims to identify factors that impact the acceptance and adoption of technology by users (Martin, 2022). Two principle variables of TAM are perceived usefulness and perceived ease of use (Al-Qaysi et al., 2020). Perceived usefulness refers to the potential use that individuals believe they can get from a certain technology, while perceived ease of use refers to how easy an individual believes it is to use technology (Chua & Yu, 2024).

2.2 Problem Statement

The Ministry of Human Rights in Pakistan claims that the population of disabled individuals in the country ranges anywhere between 3.3 million to 27 million (Government of Pakistan, 2020). On the other hand, the Pakistan Bureau of Statistics published disability figures in 2023, indicating that the total disabled population was 3,286,630: divided into rural (2,173,999) and urban (1,112,631) categories, respectively. However, the disabled population in Pakistan is enormously underreported, due to the intense social stigma related to disabilities (Sheikh, 2021).

These statistics underscore the importance of exploring tools like EdTech to overcome learning and accessibility gaps. While EdTech is trending globally, with significant investments in educational technologies, the uptake of technology in teaching is still rather limited (Siyam, 2019). Technology adoption is constrained by multiple factors, such as teachers' attitude towards technology integration, teaching and learning methodologies employed, and self-efficacy. In addition to that, the stance of EdTech incorporation is also affected by the accessibility of resources, professional development, external support, and time dedicated to technology training (Siyam, 2019).

Pakistan's challenges in the field of education also include insufficient availability of modern learning materials and lack of learning technologies, which impact teaching

quality (Muzafar Hussain & Nasreen Akhter, 2025). Moreover, there is understaffing in schools, lack of infrastructure including computer labs and libraries, inadequate curriculum, and gaps in teachers' competence when it comes to instructional technology (Muzafar Hussain & Nasreen Akhter, 2025). For the adoption of more complex technologies, digital literacy is an important factor to consider (Kabakus et al., 2023). Throughout all educational tiers, but especially in higher education, effort and performance expectations notably impact administrative staff and teachers' acceptance of digital tools (Kabakus et al., 2023).

While the literature clearly suggests the importance of assistive educational technology and its positive impact on special needs students, there is a lack of evidence of technology adoption in Pakistani special education institutions. The literature also indicates that teachers lack knowledge, training, and time to learn and adopt assistive technology. Overall, special education technology in Pakistan is an under-researched topic. There is also a significant gap in empirical research in the role of perceived ease of use in this specific context.

2.3 Purpose of the Study

In response to the identified research gap, this study aims to explore how perceived ease of use impacts teachers' intention to use technology in special education institutions of Pakistan. The idea is to contribute to existing literature and study to what extent perceived ease of use is a determinant of technology uptake by educators. This paper views the research question through the lens of the Technology Acceptance Model, which is its main theoretical framework. TAM, in the area of special education, and more specifically the Pakistani context, has been understudied by researchers previously, so there is room for significant contributions to the field.

Improving public service delivery through technology integration is a crucial area of research. This paper can amplify the academic research coming out of Pakistan, help institutions understand the challenges hindering their employees from tackling special education with modern tech, inform policy recommendations, and be a stepping stone for future research about the Technology Acceptance Model in the special education context. Research about digital uptake by educators in developing countries is also quite limited, which is another void in academic literature this study aims to bridge.

The results of this quantitative study will provide context-specific insights and empirical data from a Pakistani perspective. It will also assist educational policymakers by pinpointing barriers to technology adoption, offer actionable knowledge for professional development and training of teachers, and help investigate digital access across the country.

To conclude, this research aims to strengthen academic literature about perceived ease of use as a determinant of technology uptake, increase the understanding of TAM in the local Pakistani context, and on a larger scale, serve as a case study for technology adoption in special education within developing countries.

2.4 Motivation for the Study

The motivation for this research is deeply personal. Education is a privilege in Pakistan, a developing country, not a given right. Access to good primary, secondary, and higher education as a woman is even more of a privilege in most households. In my home, education has always been prioritized over every other luxury. Despite belonging to a decidedly middle-class family, my parents strived to send me and my sister to the best schools, colleges, and universities in Pakistan. My mother is also an educator, so are three of my uncles and aunts, which is why access to quality education is a subject close to my heart.

From a young age, I saw disabled and special needs children in close proximity to me. At least five of my second cousins have either autism, Down syndrome, or hearing impairment. The first thing I noticed was how embarrassed their parents were to send them to special needs schools, since they are still somewhat 'taboo' in high society and considered abnormal. They either ignored the very obvious disabilities in their children, chose to homeschool them, or were content with speech therapy sessions to improve their verbal and social skills. Another social stigma in Pakistan is that family resources are better spent on the 'normal' child, because no matter how much you invest in a differently abled individual, they will still be seen as a liability. So, parents either invest in their neurotypical children or put that money towards family expenses or business, rather than promoting education and care for special needs children.

This attitude deeply disturbed me as a child, but more so when I went to middle school and my sister had a classmate who was visually impaired. It was very unusual to see a differently abled student at school, but she was one of the brightest students who excelled in her school education, went to the most premier university in Pakistan, and was placed on the Dean's honor list. She is currently working as a HR Manager at a multinational in Pakistan, where she heads the inclusivity and diversity programs. Another visually impaired girl joined my high school, and she was also exceptionally smart. She is now a Rhodes Scholar and is pursuing her MPhil in London. Both these women rely on speech-to-text software, electronic visual aids, and braille keyboards.

These women made me believe that disability is only a crutch if you let it become one. Granted, some disabilities are easier to manage than others, but it is still possible for people to live a fulfilling life if special education becomes normalized. I have been a vocal advocate for the special needs children among my family for as long as I remember, nudging their parents to look into special education schools, and finding therapists by checking their credentials and credibility with patients for these children so it is one less task for the parents.

This is why I chose to study technology adoption in special education and how the perceived ease of use impacts the intention of special education teachers in Pakistan to utilize technology in their classroom. This topic focuses on the improvement of public service delivery in Pakistan, which is in line with the course content. Moreover, I plan to pursue educational policymaking as a career. I would like to advocate for special needs children, and this project will add experience and credibility to my portfolio.

2.5 Research Question

This paper is guided by the following research question:

How does perceived ease of use influence the intention of special education teachers in Pakistan to integrate technology into their teaching practices?

This is a significant question to look into, since perceived ease of use is a prominent determinant of technology acceptance according to TAM, the underlying theoretical framework this paper focuses on. Notably, academic literature in terms of special education is limited on a global scale, and this paper aims to contribute to make the field richer in information and insights. This research question opens an avenue for further studies, on topics including but not limited to inclusive pedagogy, attitudinal factors of TAM, institutional practices and barriers in special education, and professional training and development for educators.

2.6 Definitions

In this section, definitions of key terms used throughout the thesis are mentioned.

Perceived Ease of Use: PEU refers to how easy it is to comprehend, grasp, and implement a technological innovation (Dhingra & Mudgal, 2019). PEU reflects how effortless or complex a user believes deploying a digital system is. The term is linked directly to the word 'ease', which means not putting in a lot of effort.

Educational Technology (EdTech): EdTech includes applications, instructional platforms, learning games, and learning management systems that comprise the broader media sphere for children. In short, EdTech is the technology created with a learning objective (Brod et al., 2023).

Special Education: Special education is a differentiated learning approach grounded in diverse needs according to cognitive and physical disabilities, as they cannot adapt to the conventional instructional models due to difficulty in learning (Cheng & Lai, 2020).

Disability: A disability refers to a complex phenomenon, indicating the relationship between an individual's body and elements of the society they reside in. Some researchers describe a disability as a physical or mental defect, with different categories of disabilities including being crippled, hearing impaired, visually impaired, or mentally challenged (Pirzada, 2023).

Technology Integration: In the context of this study, technology integration is described as instructors implementing technology to carry out academic tasks with higher efficiency and these activities being restructured as a result. Technology integration is aimed at enhancing the learning environment (Ahmadi, 2018).

Information and Communication Technology (ICT): ICT is described as an amalgamation of computers, networks, and software that enables users to develop, analyze, access, share, and communicate by means of information, knowledge, and data (Barakabitze et al., 2019). ICT has propelled society into the modern era with its widespread prevalence.

Assistive Technology: Assistive technology (AT) refers to any object, equipment, system, or technology which can be purchased commercially and tailored to specific needs, in order to enhance, maintain, or strengthen the functional skills of an individual with disability (Khalil & Hantira, 2022).

3 Literature Review

This section is focused on studying existing academic literature across the themes of technology acceptance, technology integration in education, global trends in educational technology, and special education technology in Pakistan. A deep understanding of current literature is necessary to identify gaps in academic studies, build upon prior findings, and ground the present research in solid theoretical and empirical data.

3.1 Technology Acceptance and Digital Literacy

There has been a profound shift in society over the years, with economies rooted in commodities and manual labor now leaning more towards knowledge and competent human capital (Van Laar et al., 2020). Individuals are now honing their digital skills for flexible employment opportunities, and there is a high demand for IT-proficient workers worldwide (Van Laar et al., 2020). As technology takes over nearly every facet of life, the importance of digital literacy is being highlighted and its role is crucial to understanding and implementing new technologies (Ullah et al., 2022). Digital literacy is referred to as a modern and vital "life skill" in the present day and age.

UNESCO describes digital literacy as the capacity to identify, access, incorporate, express, and transmit information securely and efficiently via digital technologies and devices for engaging in economic and social aspects of life (Reddy et al., 2022). Whereas, the European Commission defines digital literacy as the ability to employ technology and the Internet for innovation, entrepreneurship, creativity, and gaining knowledge for the current world order (Reddy et al., 2020).

Digital literacy includes subcategories such as computer, ICT, information, data, and media literacy (Reddy et al., 2022). Information literacy and digital literacy have a positive influence on technology adoption. While information literacy is linked to the intention to use technology, digital literacy has an impact on performance and effort expectancy, proposing that higher digital literacy adds productivity and ease in utilizing digital tools (Nikou & Aavakare, 2021). The term technological literacy is another popular catchphrase from the 1980s, referring to the ability of individuals to effectively utilize computer and media-based technologies (Reddy et al., 2020). Despite multiple definitions in academic literature, researchers have strived to standardize the term digital literacy to make sure that it is measurable and comparable in a largely global stage (Pangrazio et al., 2020).

3.2 Technology Integration in Education

Information and communication technology (ICT) has redefined educational systems and learning practices to be more participatory and efficient (H. Akram et al., 2022). Technology-based teaching builds an engaging classroom atmosphere and improves the quality of education, allowing students to develop and strengthen their skills, increase motivation, and elevate knowledge and information (H. Akram et al., 2022). Technology offers a chance to shorten the gap between conventional and modern instructional models, as it increases inclusivity in education (Sarker et al., 2019). Digital technology provides

the means to influence the learning environment to meet the needs of the students and erase instructional barriers (Sarker et al., 2019).

The pedagogical approach of educators also plays a notable role in technology integration (Mertala, 2019). The implementation of technology results in improved teaching and better learning in the classroom, providing more opportunities to connect students and instructors with educational content both locally and worldwide (Ahmadi, 2018). Innovative technologies, including the Internet of Things, smart devices, artificial intelligence, virtual and augmented reality, blockchain, and educational software have paved the way for sophisticated teaching models (Timotheou et al., 2023). An effective digital transformation is possible if educational institutions bolster their digital capabilities, setting up the required culture and policies as well as technological fluency of teachers and students to promote the proper integration of technology in education (Timotheou et al., 2023).

Evidence from scholarly literature suggests that technology-based education notably enriches learning capacity, enhances attitudes towards academia, raises motivation and class engagement, and improves assessment performance across all grade levels, including higher education (Olateju Temitope Akintayo et al., 2024). For instance, social media has been recognized as a meaningful learning tool. Many teachers and students utilize social media and believe it improves the educational experience (Haleem et al., 2022). It is deemed an important channel for knowledge exchange, due to the ability to communicate efficiently. Social media forums also enrich networking and allow for more social activities (Haleem et al., 2022). Similarly, the integration of artificial intelligence in education has proved to be a revolutionary influence, transforming traditional pedagogical models and reshaping the idea of personalized education (Oyebola Olusola Ayeni et al., 2024). Artificial intelligence enables personalized learning, developed by AI algorithms, while reducing the scope of conventional and standardized educational approaches (Oyebola Olusola Ayeni et al., 2024).

Artificial intelligence is an interdisciplinary field that focuses on using AI to help the instructional flow, facilitate the learning process for students, and advance the evolution of the education system (Xu & Ouyang, 2022). In addition to strengthening knowledge delivery, AI enables a tailored approach to education and improves the relationship between students and instructors. AI also has the capacity to improve educational design and instructional advancement, forecast results for academically weak students, evaluate and track performance, and offer tailored tutoring (Xu & Ouyang, 2022). Additionally, smart AI chatbots, which are programmed to align with the behavior of both students and educators, also elevate learning practices (Labadze et al., 2023). AI chatbots offer tailored tutoring, assistance with home assignments, concept mapping and explanations, test preparation, discussion and feedback, and emotional support (Labadze et al., 2023). Artificial intelligence can figure out who the slow learners are in a classroom full of students based on performance analysis, and provide personalized tutoring for improved results (Fahimirad & Kotamjani, 2018). Similarly, teachers can utilize AI to assess their instructional material, to figure out gaps in their content and make it more engaging for students (Fahimirad & Kotamjani, 2018).

While AI continues to reshape learning practices, another technology with solid potential in the field of education is immersive virtual reality (IVR). IVR creates interactive environments to enrich surroundings, and offers an engaging virtual reality for users from

a first-person perspective (Di Natale et al., 2020). The most well-known IVR technologies include head-mounted displays, headsets worn by individuals to enable binocular vision, 3D projected images, and 360° visors. IVR can be employed in educational settings effectively, since its immersive features can facilitate a range of learning exercises that may positively impact student outcomes (Di Natale et al., 2020).

Similar to immersive virtual reality, augmented reality (AR) is another popular educational tool that supports the notion of interactive learning, higher student engagement, and visualization of abstract concepts (Sırakaya & Alsancak Sırakaya, 2022). AR has been part of mainstream academic research for the last decade, with literature suggesting that it can be employed across all grade levels, from preschool to university. AR technology enables virtual elements to be superimposed on real images, which increases student attention, boosts class participation, and makes learning easier (Sırakaya & Alsancak Sırakaya, 2022).

One more notable tool in the field of education is robots. As learning aids, robots can be used collaboratively in higher education to conduct experiments, lab work, project-based learning, problem solving, and critical thinking (Hernandez-de-Menendez et al., 2020). Albeit on the simpler side, a widely adopted example of educational technology is smartphones. In today's world, most teachers and students utilize smartphones and the internet is readily available to them (Latif et al., 2019). Smartphones are accessible to about 80% to 100% of students, making them a viable option for learning. Students across all grade levels can benefit from smartphones, since they offer enhanced learning by providing online textbooks, podcasts, calculators, lecture slides, and note taking apps (Latif et al., 2019).

3.3 Technology Adoption in Education and Perceived Ease of Use

During the Covid-19 pandemic, teachers had different experiences related to the integration of technology into teaching processes. However, because the nature of online and blended learning meant that they absolutely had to use technology, teachers were on board and also showed positive inclination towards tech in 2021 when they had gotten more used to it (Wohlfart & Wagner, 2024). They started to accept the lasting role of technology in education. Teachers credited external factors such as the effort required to learn new technology, technical support from fellow teachers, and fully functional computers and digital tools as reasons they were able to get onboard with the new teaching environment (Wohlfart & Wagner, 2024). Since necessity drove teachers to use technology extensively in their classrooms, they engaged more with digital teaching aids and eventually the perceived ease of use (PEU) and perceived usefulness (PU) of technology increased (Wohlfart & Wagner, 2024).

Perceived usefulness of technology has a primary influence on the intention to adopt technology. It is thus proposed that teachers' professional development workshops should contemplate solidifying perceived usefulness as well as perceived ease of use (Scherer et al., 2019). Perceived ease of use and perceived usefulness, along with educators' attitudes, shape the intention to use technology for education, which validates the positive relationship between technology integration and adoption (Ibrahim & Shiring, 2022). Perceived usefulness and perceived ease of use are the main factors when it comes to the acceptance or rejection of more advanced teaching technologies among teachers and students alike. For example, Metaverse in education will be accepted as a teaching

pathway or entirely rejected based on ease of use and perceived impact on learning (Chua & Yu, 2024).

Studies indicate that the factors leading to technology acceptance differ from country to country. For example, students' acceptance of technology was gauged by the ability to self learn, netiquette, and overall technological preparedness in Thailand. While in Oman and the UAE, the attitudes of students and teachers directed towards technology were the key determinants impacting their use of educational technology. Similarly, students' attitudes regarding learning technology were largely shaped by self-sufficiency, enjoyment level, and perceived control. These factors heavily influenced the perceived ease of use of technology for Chinese students. In line with that, Moroccan students amid the Covid-19 pandemic indicated that student satisfaction, perceived usefulness, and perceived ease of use were the critical variables of online learning acceptance (Feng et al., 2025).

In a different study, 274 pre-service special education teachers were interviewed in China and asked about the impact of perceived ease of use and perceived usefulness when it comes to integrating artificial intelligence in education. These teachers were receptive to the idea of AI in education, but despite their positive attitude towards digital adoption, they were not familiar with specific AI education tools. This reflects a linear relationship between digital literacy and perceived ease of use, as it largely impacts teachers' intention to use technology (Yao & Wang, 2024). Similarly, other academic papers have observed that perceived ease of use and computer self-efficacy are two factors which directly impact the intention of teachers to adopt assistive technology, while perceived usefulness is not a significant factor (Opoku et al., 2023).

3.4 Factors Impacting Teacher Adoption of Technology

Technological innovations often present unique challenges in classrooms, and educators need to redesign pedagogical approaches, reshape learning content, manage cognitive load, and work on professional development (E. Carpenter et al., 2023). Academic literature suggests that although teachers might be hesitant about using technology initially, they do rise up to the occasion if they believe that it would improve student learning outcomes. If they believe in the perceived usefulness of educational technology, teachers are more likely to adopt an optimistic approach to integrate said methods in their classrooms (E. Carpenter et al., 2023). Educators believe that technology also paves a path for higher development of cognitive skills in students, in addition to greater creativity, the ability to study independently, improved self-esteem, and sharper motor skills (Abel et al., 2022).

Apart from digital literacy and knowledge, the attitudes of both teachers and students massively influence the adoption of technology in education (Barakabitze et al., 2019). In the African context, while ICT has been introduced in the educational setting, widespread adoption remains soft because of ineffective government policies and lack of proper technology infrastructure, teacher capacity, and monetary constraints (Barakabitze et al., 2019). The integration of educational technology in fact has the potential to increase the digital divide in African schools based on location, socioeconomic class, and gender. Learners from low-income families, under-resourced areas, and isolated rural lands can possibly lag behind their peers, creating inequality in education (Haleem et al., 2022).

Several recent studies point to the fact that teachers lack proper training and are not digitally competent (Fernández-Sánchez et al., 2022). Empirical evidence suggests that teachers do not have adequate knowledge, experience, or demonstration regarding digital tools. There is also the absence of mentorship for teachers when it comes to pedagogical advice for developing technology-based learning resources, as well as limited access to peer support and collaboration (Fernández-Sánchez et al., 2022). Another reason for the lag in extensive technology adoption is the poor motivation of instructors, lack of incentives, and time constraints to efficiently integrate educational technology in the curriculum. Research has shown that the level of digital literacy and skills is low in basic education teachers (Fernández-Otoya et al., 2024). This is because of the inadequate institutional support, lack of time and resources, and the absence of training programs. Another reason noted was the laziness of teachers themselves, which hinders their progress in developing higher digital competencies. According to Fernández-Otoya et al (2024), the inadequate institutional training consists of sporadic one-time or very short courses, rather than a solid plan for continuous professional development. Most literature prevalent on the subject points to the need for teachers to receive specialized training, as well as emphasizing on the importance of developing policies that will prepare pre-service teachers for a digital learning model.

More literature demonstrates that individual characteristics of teachers, including self-efficacy and social anxiety, also have an impact on the perception and adoption of technology (Timotheou et al., 2023). Underconfidence, aversion to change, and pessimistic attitudes towards new teaching technologies are notable contributors to the degree of technology uptake by teachers. To rise above these barriers to ICT integration, teachers need to be provided with technical support, motivation by peers and management, and training on how their class methodologies can be enriched by technology (Timotheou et al., 2023). Moreover, teaching models largely align with an instructor's pedagogical beliefs. Hence, technology use is massively related to perceptions about the nature of teaching and learning that is beneficial in a class setting (H. Akram et al., 2022).

3.5 Global Trends in Educational Technology

Despite massive investment in educational technology over the years, the penetration and integration of technology in classrooms remains low. Some contributors towards this phenomenon include the perspectives of educators regarding technology integration, teaching and learning methodologies, and self-efficacy (Siyam, 2019). Other factors include lack of resources, limited professional development, absence of technical support and training, and time constraints.

A web scraping study shows that between 2000 and 2018, the terms trending in EdTech were interactive learning, MOOCs, open education resources, and flipped classrooms (Dağhan & Gündüz, 2022). Interactive learning refers to digital learning models that break down traditional classroom practices, encouraging students to work independently and rely less on an instructor. Interactive learning aims to provide a consistent flow of learning for students without constant feedback which can derail their motivation and performance. The role of teachers in interactive learning environments is to oversee the emotional states of students, react and reset the class environment accordingly, and build the activity pace that is inclusive of all learning styles (Arguel et al., 2019). Another innovation that stands out in modern educational environments are MOOCs, short for

Massive Open Online Courses. These have been notably trending in higher education over the last decade. MOOCs refer to web-based open access courses that are developed and rolled out by higher education institutions where individuals with internet connectivity can enroll, with no consideration for age, location, or previous education (Deng et al., 2019).

A somewhat similar concept is open educational resources, abbreviated as OER, which are described as educational, teaching, and research resources that are open for the public to access, or are released with licenses that allow free use, reuse, and derivative works (Hilton, 2020). Lastly, the flipped classroom model necessitates students to be in charge of their learning and decision making during and after class. This way, the knowledge students gain is used to reflect and communicate better throughout the learning process. Students are meant to read up on study resources before class, so they have an idea of the class content and can focus on learning activities like discussions and group work with minimal teacher intervention. After class, students take assignments and tests to check their knowledge from the prior activities (Al-Samarraie et al., 2020).

Educational virtual reality games (EVRGs) are another bandwagon that the world is hopping on. EVRGs are defined as learning games that utilize the 3D stereoscopic display, along with wearable headsets to instruct students or help teachers deliver certain topics (Oyelere et al., 2020). Similarly, extended reality (XR) technology is gaining traction in education as it meets the latest educational requirements. Given the interactive and immersive elements of XR, new pedagogical models are developed which encourage continuous learning that students find more engaging, enjoyable, and motivating. XR technologies offer a composition of mixed, virtual, and augmented realities (Lampropoulos & Kinshuk, 2024). Another innovative approach to education is gamification, where conventional educational models are mixed with game elements to develop intriguing, enjoyable, and interesting while fostering student-centered learning (Lampropoulos & Kinshuk, 2024).

In the context of specific countries, China initiated the Electronic Book Bag project in 2002. Until recently, it did not gain sufficient traction because advanced wireless technology and smart devices were not as popular in the early 2000s. The Electronic Book Bag project aims to distribute educational context, provide real-time performance feedback, and enrich relationships between teachers, students, and parents (Mao et al., 2019). The Chinese government is also very keen on developing MOOCs to solve issues pertaining to educational access, digital equity, and facilitating learners with special needs. In the case of Germany, the country is lagging behind the Western world when it comes to technology adoption and digital literacy. However, in German higher education systems, focus is shifting towards learning analytics to promote a solid student retention rate by offering tailored and adaptive learning, flexible teaching opportunities, and immediate feedback for instructors. These educational institutions do face data handling and privacy issues when they enforce learning analytics, especially finding it hard to stay aligned with German's data protection policies (Mao et al., 2019). Moreover, Italy commenced a program named 'National Digital School Plan' as part of the 2015 educational reform. It pushed schools to direct all gathered funds on one digital transformation project to deal with the harsh economic crisis that plagued Italy recently. This program motivated Italian educationists and policymakers to launch notable programs to equip classes with modern technology and invest in the latest hardware and software (Mao et al., 2019).

On the other hand, Japan is upgrading its K-12 educational system by introducing subjects like computational thinking, programming, and English language. The aim is to develop technical skills in children from a young age so they can compete in global markets. However, Japanese teachers lack proper training and experience for these subjects, which is why the government is emphasizing the need for educational technology researchers to assist students and teachers alike (Mao et al., 2019). Lastly, in the United States, computer studies, tailored learning, and professional development for teachers is being largely prioritized. In K-12 education, the United States favors inquiry-based learning, gamification, blended learning, flipped classrooms, and maker education. In higher education, the US is focused on artificial intelligence, machine learning, extended reality, and interactive learning for the coming years (Mao et al., 2019).

3.6 Technology Use in Special Education

Assistive technology can support children with learning and physical disabilities, offering adaptive and rehabilitative outcomes. Assistive technology includes a wide range of elements, including mobility devices like wheelchairs and canes, as well as hardware and software that help people with disabilities in utilizing computers (Khalil & Hantira, 2022). Latest academic literature emphasizes the importance of technology-based learning in special education to enhance learning processes. This refers to the use of computers, tablets and smartphones, whiteboards, and learning management systems in classrooms (Siyam, 2019). Technology in special education has been linked to positive student outcomes in terms of behavioral development, academic performance, learning motivation, improved communication, and sharper cognitive skills (Siyam, 2019).

Multiple review studies indicate that the use of mobile devices have the capacity to offer continuous assistance and instruction to special needs students, regardless of them being home or at school (Olakanmi et al., 2020). The widespread reach of mobile devices has not been replicated by many other technologies.

Researchers have debated back and forth about the integration of mobile devices into special education, noting that they have largely transformed the instructional models for students with special needs (Qahmash, 2018). The development of mobile technology, especially hand-held tablet devices, have paved a new path for special education teachers to modernize the classroom experience for students beyond conventional teaching methodologies. Tablets and the applications on them were not developed solely as assistive tools for disabled learners. However, instructors have adapted these technologies to facilitate special education learning models (Qahmash, 2018). The advanced features of tablet devices, which include sufficient storage space, sizable screen, mobility, wide range of applications, and internet connection, offer multiple benefits to students with disabilities and serve as impressive instructional tools.

Moving on to more advanced technologies, one of the most researched topics over the years in special education is game-based learning, which aims to enhance learner motivation and make classes more enjoyable (Olakanmi et al., 2020). Gamification provides a practical and hands-on learning experience that can be greatly advantageous for individuals with disabilities. The structure of enhanced learning models via gamification enables special needs students to develop social and cognitive skills (Hussein et al., 2023). Moreover, gamification reduces the academic burden on special

needs students compared to conventional pedagogical approaches. Elements like scores, badges, and leaderboards in game-based learning environments also encourage students and lead to better class performance. Literature suggests that gamification has also provided the necessary attention to disabled students in class settings, in addition to stimulating their curiosity about learning tasks (Hussein et al., 2023).

Cutting-edge technologies, including large language models (LLMs), virtual reality (VR), and augmented reality (AR) may also function simultaneously as assistive technologies to facilitate the inclusion of students with special needs (Voultsiou & Moussiades, 2025). LLMs have been researched extensively in terms of autism, since the software allows improvement in social skills, offer speech-to-text conversion, and LLM-based systems even diagnose and detect autism in individuals. Similarly, virtual learning environments are designed to cater to specific disabilities, including autism, ADHD, cognitive and developmental disorders, and dyslexia (Voultsiou & Moussiades, 2025).

With specific reference to artificial intelligence (AI), it has been a game changer in special needs education. AI learns the requirements and targeted needs of students with disabilities, and personalizes educational content for optimal learning (Voultsiou & Moussiades, 2025). Research shows that AI has the capacity to offer emotional support and empower disabled students, which in turn reduces feelings of social isolation. For visually impaired students, AI tools are designed as instruments to support cognitive function, helping them engage with their external surroundings. AI has also been useful for detecting and diagnosing autism spectrum disorder (ASD), and AI speech analytics assist with speech therapy, build language accuracy, and analyze behavioral markers for better intervention (Voultsiou & Moussiades, 2025).

Special education continues to evolve as emerging technologies take center stage, with the concept of metaverse sparking the interest of researchers. Metaverse is a virtual world with digital avatars, where people from around the world come together to work, attend lectures, shop, play, and communicate (Altinay et al., 2024). Metaverse incorporates elements from the real and virtual worlds to create a post-reality universe, where education can be accessible to all and inclusive for learners with different needs. Educational content can be personalized in the metaverse to target the educational gaps and challenges of disabled students. Many researchers have come to the conclusion that a truly inclusive educational environment can be achieved via the metaverse (Altinay et al., 2024).

3.7 Special Education in Pakistan

This section focuses on special education literature in the Pakistani context, including challenges faced by special needs individuals in the country and technology in special education within Pakistan.

3.7.1 Challenges for Special Needs Individuals

The United Nations' '2030 Agenda for Sustainable Development' outlines that basic human rights are undeniable and must be upheld for all individuals, regardless of their disabilities (Hussain et al., 2022). The Director General of Special Education oversees the welfare and needs of people with disabilities in Pakistan. However, the accuracy of

information regarding this segment of Pakistani society is questionable at best. People with disabilities are a marginalized group in Pakistan, hence their needs are often overlooked and the budget allocated is never fully utilized for their well-being (Hussain et al., 2022).

Accessibility remains a huge challenge in rural Pakistan, as there are no special education institutions located in these areas and people have to travel to big cities to get their child the education they need (Hussain et al., 2022). Literature also suggests that teachers are not properly trained to deal with different impairments, there is no specifically designed curriculum for learners with disabilities, poor institutional infrastructure, and many students frequently drop out of school. The private sector, on the other hand, is inaccessible in terms of tuition fees for most families of disabled children in Pakistan. Poverty plaguing the country, negative attitudes and views about disabilities, and discrimination against differently abled individuals is a norm in Pakistan and it adversely impacts their life. Disability is a stigma in Pakistan, especially for young girls, since their parents want to keep them hidden and not expose their neurodivergence to the world. This is because they believe it will be harder to marry their disabled daughters off if everyone knows about their limitations (Hussain et al., 2022).

In a study focusing on hearing impaired children in Pakistan, the author remarks that deaf children are socially isolated since they are separated in the schooling systems and can only attend special schools (B. Akram & Bashir, 2012). The curriculum for deaf students resembles that of general education, but with more focus on auditory training, speech therapy, and Pakistan Sign Language (PSL). However, there have been reports that suggest only 2% of deaf students and 5% of parents are satisfied by the curriculum in Pakistani schools for the hearing impaired. Another study dating back to 2003 indicates that around 72% of the deaf students and 57% of the parents interviewed reported that teachers were not proficient at PSL, not utilizing finger spelling in classes, and not using cued speech for lectures (B. Akram & Bashir, 2012). Similarly, in a survey of 13 schools for the hearing impaired in major cities of Pakistan, 53% of teachers reported that less than 10% of students utilize hearing aids despite regular instructions on how to use them. Another reason for such low use of hearing aids is the exponential cost of buying them and no support from the government (B. Akram & Bashir, 2012).

In Pakistan's special institutions for learners with disabilities, there are many challenges including inadequate curriculum, deficient teaching methodologies, and lack of equipment, which hinder the students' capacity to operate properly in general or inclusive settings (Pirzada, 2023). Some low vision students cannot effectively view the whiteboard in case they sit far from the front of the class, and hard of hearing students are often not allowed to record lectures, making it difficult for them to follow the lessons. Another issue is the minimal enrollment and massive dropout rates in special education institutions, due to the inaccessibility of these locations for most students and parents. These institutions also lack the assistive technologies needed for special needs learners, which is why they do not find much benefit from enrollment. Campus infrastructure also remains inadequate, since students cannot use stairs and need ramps, elevators, and wheelchair friendly classes (Pirzada, 2023).

Current literature has demonstrated that many countries, including Pakistan, suffer from ineffective policy implementation and enforcement when it comes to special education measures. Although the government provides basic necessities like transport, monetary

allowances, and textbooks, there is still a shortage of faculty and support staff, limited access to computer labs and libraries, and inadequate curriculum to meet the needs of differently abled students (Muzafar Hussain & Nasreen Akhter, 2025). This, in turn, causes stress, anxiety, and burnout for special needs teachers. The lack of teacher training on latest assistive and instructional technologies also adds to the burnout. Lastly, studies have shown that active parental involvement improves learning outcomes for special needs students. However, poverty, tribal systems, and illiteracy in Pakistan act as barriers to active parenting of differently abled students, leading to relatively poor academic performance (Muzafar Hussain & Nasreen Akhter, 2025).

3.7.2 Technology in Special Education

Overall, the education system in Pakistan remains at a considerable disadvantage, particularly in reference to limited educational access, inadequate educational infrastructure, socioeconomic and cultural norms hindering equal schooling opportunities for boys and girls, and low quality curriculum (Muhammad Rafiq-uz-Zaman et al., 2025). Only a couple of schools in the country provide professional teams of special education instructors, speech therapists, physiotherapists, and psychologists (B. Akram & Bashir, 2012). The country also faces a significant shortage of medical professionals, audiologists, speech therapists, and qualified special education teachers. In Pakistani special education institutions, teachers stand at the epicenter of change, driving innovation and inclusive practices.

Personalized tutoring and individualized education plans (IEPs) are considered important in the Pakistani special education context. IEPs involve more than one teacher per class, with the aim of better content selection, time management, and student assessment (Muhammad Rafiq-uz-Zaman et al., 2025). Co-teaching is known to deliver improved student outcomes, because instructors are focused on small groups of students, helping them get in extra practice and offer personal attention.

Secondly, universal design for learning (UDL) is another technique employed by Pakistani special education teachers, where syllabus, instruction, and assessment is flexible and tailored to the needs of students (Muhammad Rafiq-uz-Zaman et al., 2025). UDL utilizes multimedia devices to make learning and classroom activities more enjoyable, relatable, and accessible for students with differentiated needs. This gives learners a relatively equal ground to stand on when it comes to education. In UDL, teachers make use of multiple learning aids, including white boards, role play, visualization aids, game-based activities, demonstrations and manipulatives, and building objects. Teachers also adopt positive reinforcement to assist different learning impairments (Muhammad Rafiq-uz-Zaman et al., 2025).

Four studies regarding students' inclinations towards assistive technologies and social media showed that there were some improvements in learning processes, but no notable enhancements in student outcomes were attributed to school curriculum (Lynch et al., 2024). A different study comprising 362 deaf and hard of hearing Pakistani students in the age group of 10 to 20 years old revealed that around 50% of them use Skype, Facebook, text messages, and email for communication at school. The study also observed marked differences between hearing impaired students who utilize high-tech AT like smartphones, compared to those who use low-tech AT like sign language cards (Lynch et al., 2024). A separate study conducted across two special schools in Islamabad,

Pakistan suggests that 192 deaf students aged 5 to 10 years demonstrated improved performance when they learned the basics of mathematics in a mobile app using sign language. In Pakistan, parental involvement and approval is a cultural norm, so their positive perception about using assistive technologies yielded favorable effects on the academic performance of their children (Lynch et al., 2024).

3.8 Research Gaps in Literature

There is ample research on general education, whether its global literature or specific to Pakistan. However, academic research worldwide and in a Pakistan-specific context significantly lags behind when it comes to special education. There is an overemphasis on general education, educational technology, and adoption of technology by both teachers and students. There are also plenty of studies highlighting the barriers to successful technology integration in education, and the benefits of doing so for learning outcomes and overall teaching methodologies.

However, academic literature so far is very inadequate about special education in Pakistan. There are not enough studies which gauge the effectiveness of current pedagogical approaches employed by special education institutions in the country. Moreover, there are not enough papers which discuss the assistive technologies in place within Pakistani special education institutions, and how they impact learning outcomes. Little to no quantitative research has been carried out comparing student performance using high-tech assistive technologies versus low-tech assistive technologies or analogue study materials.

There have been a few papers that discuss the shortcomings of Pakistan's special education institutions, but none that discuss how to actually overcome them. Teachers have rarely been the focus of studies conducted across special education institutions, with most papers focusing on differently abled students and their parents. It is imperative to study teachers of special education in depth to understand how the current learning practices can improve.

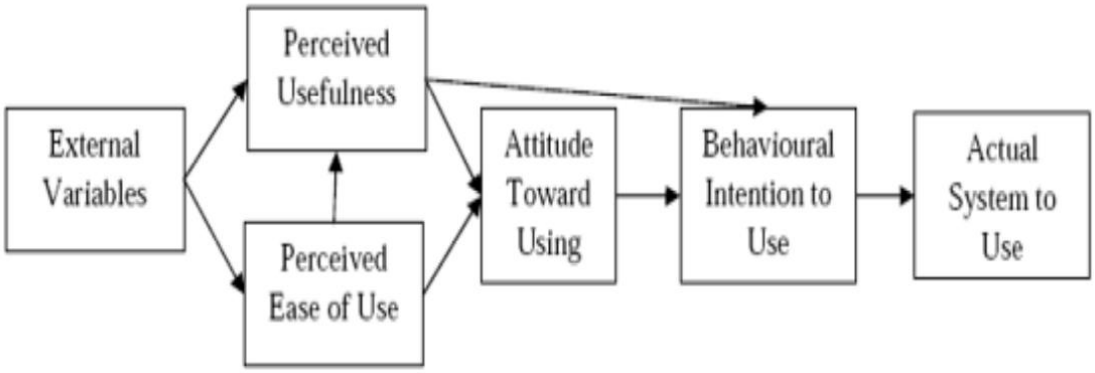
It is also imperative to note that while some studies did touch upon the Technology Acceptance Model in reference to the adoption of educational technology, they did not shed light on perceived ease of use specifically. A handful of papers referred to perceived ease of use being an indicator of technology adoption in educational settings. However, none of the Pakistani literature mentioned perceived ease of use or even the Technology Acceptance Model. This is where the gap in research becomes quite apparent, and this thesis aims to bridge that imbalance in literature. Additionally, most research on special education is focused on developed countries, while data from low-income or developing nations has not been thoroughly analyzed by researchers. In this study, the focus is on Pakistan's special education institutions and how behavioral drivers like perceived ease of use work in a developing economy.

4 Theoretical Framework

This section aims to present the theoretical approach to study how the perceived ease of use influences the intention of special education teachers in Pakistan to incorporate technology in their instructional models. The underlying theoretical framework which guides this research is the Technology Acceptance Model (TAM).

4.1 Introducing TAM and Related Theories

TAM was introduced by Fred Davis in 1986 and it became a prominent framework to examine factors impacting the acceptance of technology by individual users (Marangunić & Granić, 2015). TAM has two major variables: perceived usefulness, which measures the extent to which users see a correlation between a new technology and enhanced productivity and efficiency; and perceived ease of use, which assesses an individual's perception of the time and effort it would take to become familiar with a new technology. These variables evaluate a user's attitude towards technology (Hendricks et al., 2023). TAM is rooted in two psychology-based theories: theory of reasonable action (TRA) and theory of planned behavior (TPB) (Marangunić & Granić, 2015).

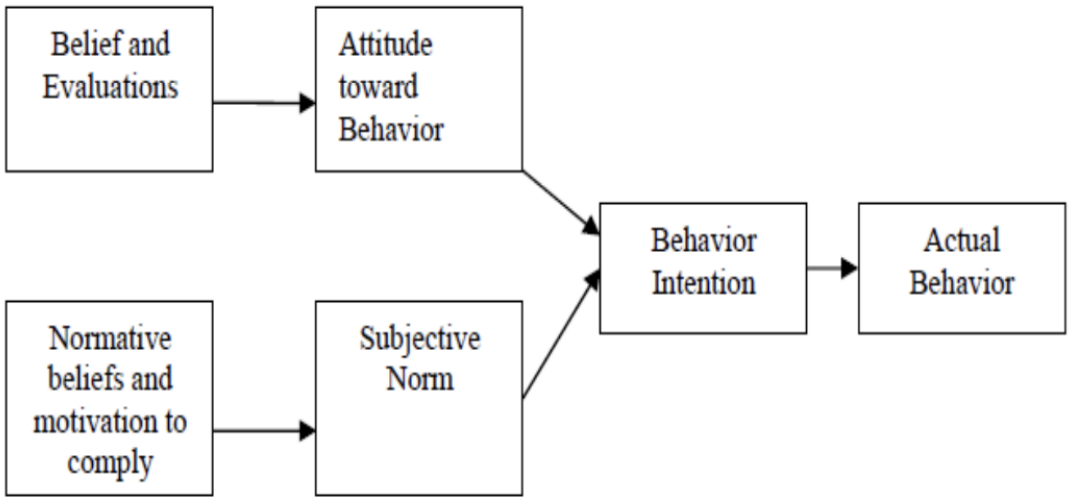


Source: (Alshammari & Rosli, 2020)

Figure 1: Technology Acceptance Model

To understand TAM, it is imperative to look into the two theories that the model was derived from. The theory of reasonable action (TRA) observes behavioral intentions as the primary indicators of behavior, rather than focusing on attitude. The theory suggests that an individual's behavior can be assessed by monitoring their actual intention, as well as the reasons that the person would exhibit that certain behavior. Thus, TRA concludes that the key predictor of behavior is the intention, while the impact of attitude on behavior is channeled through intention (Marangunić & Granić, 2015). As TRA became the focus of many scientific observations, its limitations came to light. Most importantly, it was observed that some people have little to no control over their behaviors and attitudes. To account for that discrepancy, the theory of planned behavior (TPB) was introduced as an extension of TRA. The additional element which differentiates TPB from TRA is perceived behavioral control. TPB basically assesses a person's intention to exhibit a certain behavior (Marangunić & Granić, 2015). The perceived behavioral control is based on an individual's beliefs regarding the opportunities and means to perform the behavior.

Hence, TPB proposes a direct relationship between perceived behavioral control and behavioral achievement.



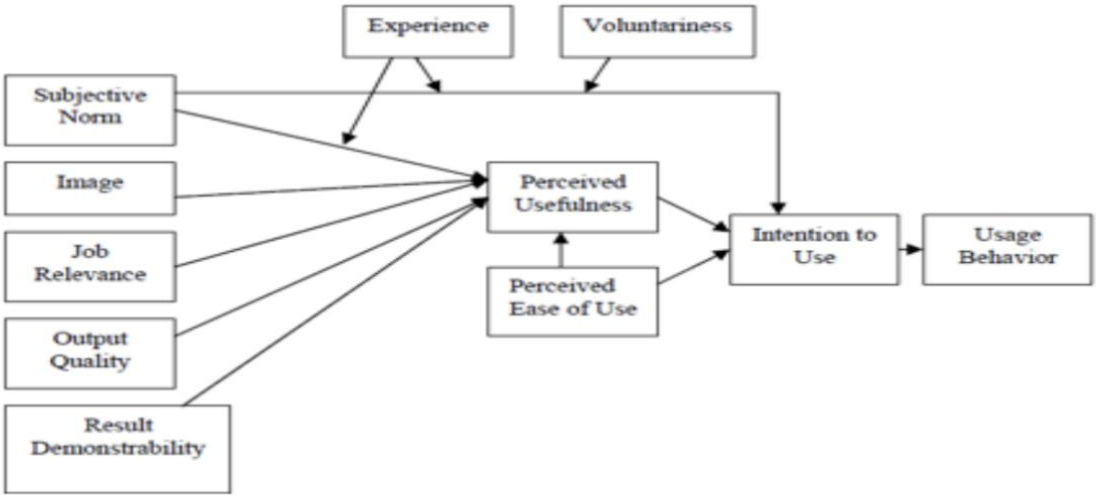
Source: (Alshammari & Rosli, 2020)

Figure 2: Theory of Reasoned Action Model

In 2000, Venkatesh and Davis created TAM2, which includes the basic elements of TAM: perceived usefulness (PU) and perceived ease of use (PEU). However, TAM2 is a more sophisticated model that further breaks down PU in terms of two extrinsic variables: social influence processes and cognitive instrumental processes (Putra, 2018). The idea is that these two new variables notably impact user acceptance of technology. The variable of social influence includes elements such as subjective norms, voluntariness, social influence, image, and experience. While cognitive instrumental processes can be divided into categories such as job relevance, quality of output, result demonstrability, and PEU (Putra, 2018).

In the social influence processes, the sub-categories can be defined as (1) Subjective norms refer to an individual's perception of those who are closest to them and whether they think he/she should perform a certain behavior or not; (2) Voluntariness can be described as the level to which users perceive the technology adoption to be non-compulsory (3) Social influence refers to the credibility or belief in a person and the information provided by them without checking for evidence (4) Image can be defined as the extent to which the use of technology is perceived to bolster the user's status in the society (Putra, 2018).

Similarly, the working definitions for the subcategories of the cognitive instrumental processes include (1) Job relevance is described as a person's perception about how much the new technology is pertinent to their job; (2) Output quality refers to how effectively a technology or system can perform a task and if these results match the job requirement; (3) Result demonstrability simply explains the concreteness of the results using a certain innovation (Putra, 2018).



Source: (Alshammari & Rosli, 2020)

Figure 3: TAM2 Model

While further theories such as the Unified Theory of Acceptance and Use of Technology (UTAUT) and UTAUT 2 were developed to build more concretely on the Technology Acceptance Model, this thesis will focus on TAM and PEU.

4.2 TAM as the Theoretical Framework for this Study

Almost every paper studied for the literature review mentioned TAM or one of its variants as the basic framework for technology acceptance in the field of education. TAM consists of multiple variables that inform behavior intentions to use technology either directly or indirectly. These variables include perceived usefulness, perceived ease of use, and attitudes toward technology. TAM has become a very popular model, which is largely credited to its applicability in several contexts and domains, its potential to describe differences in the intention to use technology, and its simplicity as a theoretical framework. TAM is a solid model to explain technology adoption by teachers compared to other available frameworks (Scherer et al., 2019).

TAM is quite functional and applicable in the field of education, especially for e-learning and mobile learning (Zaineldeen et al., 2020). TAM has been tested in several studies over time, investigating the attitudes of school faculty and their uptake of e-learning models. In terms of investigating school administration, TAM has received widespread support from researchers and scholars through practice, applications, and successful interventions. TAM has also proven to be robust over the years, as it is easily adaptable to different communities, environments, and technologies (Zaineldeen et al., 2020).

Since this paper aims to study how the perceived ease of use affects the intention of special education teachers to use technology in Pakistan, TAM is a relevant framework to apply, without any added variables since they are not relevant to the research question. Perceived ease of use is particularly relevant in the Pakistani context since technology adoption and penetration is relatively low in the country compared to the world. The exposure to educational technologies is rather limited, for both teachers and students, which is why perceived ease of use is a critical factor to explore. TAM can also help uncover other behavioral intentions of teachers, which can be used as stepping stones by

the government or school administrations to improve the availability of resources available to instructors.

5 Methodology

This section will explore the research methodology that guides this thesis. A qualitative study was carried out to investigate the impact of perceived ease of use on technology adoption by special education teachers in Pakistan. This section includes the research design and setting, selection of participants and sampling strategies, data collection process, data coding and thematic analysis, ethical considerations, and research limitations.

5.1 Research Design

The main objective of this thesis is to study how the perceived ease of use (PEU) impacts the intention of special education instructors to incorporate technology in teaching practices in Pakistan. For this purpose, a qualitative approach was employed and semi-structured interviews were conducted with special education teachers in Lahore, Pakistan to collect primary data that helps analyze the influence of PEU on Pakistani teachers' intention to use technology in special education.

For the extensive literature review, we used a funnel paradigm, which is a conceptual tool for analyzing heterogeneous literature. The funnel paradigm consists of dividing the available literature in four categories, where each level represents a certain understanding of the topic. Beginning from very broad, measurable, and explicit information at the first level and finishing with latent and unobservable data (De Moya & Pallud, 2017). However, we did not stick to four levels of the literature review, but instead divided it into seven different categories: Technology Acceptance and Digital Literacy, Technology Integration in Education, Technology Adoption in Education and Perceived Ease of Use, Factors Impacting Teacher Adoption of Technology, Global Trends in Educational Technology, Technology Use in Special Education, and Special Education in Pakistan. The last category was further divided into two subcategories to capture the essence of the Pakistani context properly: Challenges for Special Needs Individuals and Technology in Special Education.

The literature review served as the initial foundation for this thesis, identifying different themes in technology adoption, educational trends around the world, critical factors impacting behavioral intention to adopt technology, and the situation of special education teachers, students, and institutions worldwide and in Pakistan. The review of multiple academic papers also shed light on the gaps in literature, highlighting the underexplored themes in special education.

The review process included an in-depth systematic search of academic literature across different research platforms including Google Scholar, Web of Science, Scopus, ScienceDirect, Wiley Online Library, and SpringerLink. The relevant literature was extracted by using a series of keywords and targeted searches using phrases such as "technology adoption and digital literacy", "role of digital skills in technology adoption", "perceived ease of use and technology acceptance", "technology acceptance model in education", "assistive technologies in special education", "teacher adoption of technology", and "assistive technologies in Pakistan". For the literature review, we made sure to select only review articles dated between 2015 to 2025, in order to get credible

academic papers which are recent and exempt from outdated information. These papers were either open access, or KU Leuven institutional access was provided.

For this thesis, a qualitative research approach was adopted. Qualitative methods can be utilized to address questions about experience and perceptions of a research candidate.

This data is usually subjective, and cannot be quantitatively measured. Qualitative research techniques can consist of *discussions with focused groups* to examine beliefs, norms, and attitudes; *semi-structured interviews* to gauge opinions on a particular topic, get insights from focal participants, or gather institutional perspectives; *in-depth interviews* to discern a phenomenon, experience, or occurrence from an individual's first-hand perspective; and *analysis of texts and documents* including but not limited to official reports, media pieces, websites, or personal diaries to understand scattered or private data (Hammarberg et al., 2016). Qualitative research consists of systematic accumulation, arrangement, description, and comprehension of written, audio, or visual data. Scientific rigor and integrity are crucial to uphold the credibility of qualitative studies. The research fraternity agrees that the tenets of qualitative research are ethics, smart and intelligible descriptions, and accurate and sound processes (Hammarberg et al., 2016).

For this thesis, semi-structured interviews were the preferred medium of data collection. Semi-structured interviews are utilized when the research objective is to deeply investigate and understand the participants' personal insights rather than a standardized look into an event (Adeoye-Olatunde & Olenik, 2021). The main advantage of semi-structured interviews is that they allow the questions to be focused while allowing the interviewer to guide the investigation and shape ideas as they come along during the course of the discussion. This flexibility enhances understanding and increases the autonomy of the interviewer (Adeoye-Olatunde & Olenik, 2021).

5.2 Research Setting

For the semi-structured interviews, the location of special education institutions was narrowed down to Lahore, Pakistan. Lahore is the largest and most populated city in the province of Punjab, Pakistan, with roughly 14.5 million inhabitants. Lahore was not only selected because it is logistically feasible to conduct interviews there. Lahore is the 27th largest city in the world, and the second largest metropolitan city in Pakistan. The Lahore Division is divided into four districts: Lahore, Kasur, Sheikhupura and Nankana Sahib. Moreover, Lahore is surrounded by nearly 1800 villages. Since accessibility to special education institutions in rural settings remains a looming challenge in Pakistan (Hussain et al., 2022), these people need to travel to big cities in their nearest vicinity to get the education they require.

Given that Lahore is central and the most metropolitan area in the province of Punjab, there is an abundance of special education schools and vocational training institutes for disabled individuals in Lahore. In these institutes, students not only from Lahore, but from smaller cities, towns, districts, and villages around Lahore are enrolled as well. Some families go as far as shifting to Lahore to get their special needs children the education and medical facilities they need, while others send their children to live in hostels associated with some special education centers.

Since teachers in Lahore will potentially be working with students from diverse economic, financial, and demographic backgrounds, their experiences can also paint a more comprehensive picture. This can possibly add to the external validity of the study, since teachers will not only focus on students from Lahore, but from surrounding vicinities as well. As mentioned previously, a lot of individuals migrate to Lahore from all over Pakistan in search of better work opportunities, access to better medical and educational institutions, and an urban lifestyle. So it is possible that some teachers have experienced working in different cities of Pakistan before moving to Lahore, and they can relate and compare their experiences to Lahore. This can provide deeper insights into technology adoption and the perceived ease of use as a behavioral factor across different locations and demographics.

5.3 Participants and Sampling

The data collection process was initiated in February 2025. The first step to collecting data was shortlisting different special education institutions in Lahore where interviews could be conducted. The idea was to reach out to public, private, and non-governmental organizations handling special education in Lahore. We reached out to an equal ratio of visual and hearing impaired institutions. It is interesting to note that there were a very limited number of dedicated schools or centers for intellectual disabilities, and they were run privately and on an extremely small scale.

After narrowing down institutions that could potentially be included after an extensive internet search, calls were placed to these places to inquire about the possibility of research and interviews. 3 out of 12 institutions were unreachable on phone, and 3 more straightforwardly declined to allow interviews with teachers, citing upcoming exams, short school timings because of the month of Ramadan, and a busy schedule. Following that, 9 institutions that did not refuse interviews outright were visited, and the thesis and consequent research process and interviews were explained to the heads of these institutions in person. Applications which detailed the thesis and affiliation with KU Leuven, purpose of the research, and the length and nature of interviews were submitted to 9 institutions, along with a separate letter guaranteeing the anonymity of the teachers and institutions during the interview process. The institutions took an average of 2 weeks to grant permission and access to premises for interviews, and email/telephonic correspondence was maintained throughout.

A total of 17 face-to-face interviews were conducted, out of which 16 were recorded to be transcribed later, and one was transcribed as the interview went on, since that participant did not want to be recorded. Each interview lasted for an average of 20 to 30 minutes, and it was conducted in a private room in different schools to ensure that participants were comfortable and forthcoming about information. About 4 to 5 teachers at most were interviewed from one institution, since answers reached saturation at that point. All interview transcripts, along with the interview questionnaire, are available in the appendices.

Even though the institutes allowed the interviews, they did not assign more than one or two teachers for the interviews at first. After interviewing them, these teachers suggested more participants who would be fit for interviews – making sure these new candidates brought something to the table: teaching different subjects, interacting with different disabilities and different assistive technologies, handling separate grade levels, and

having varying lengths of service. This refers to snowball sampling, which is a method to access interview participants with desired statistics. In snowball sampling, the initial study candidates refer to future subjects from their network and sampling goes on until data saturation is achieved (Naderifar et al., 2017).

5.4 Data Collection

The data collection process, from contacting institutions, getting permission to interview candidates, traveling to different schools and centers and taking interviews, and transcribing interviews, took a total of 2 months (from February 2025 to mid-April 2025). All interviews were conducted in-person, lasting an average of 20 to 30 minutes, with 16 teachers allowing recorded interviews while 1 did not consent to recording. 3 of the 17 participants were visually impaired themselves, and they had specific insights into the questions which were helpful. The candidates were verbally informed of the consent form before the start of each interview. One candidate was interviewed at a time to ensure that results were not biased or skewed, and everyone participated comfortably, honestly, and with transparency.

The preliminary literature review led to the interview questions being formed, and the questions were also guided by the chosen theoretical framework: Technology Acceptance Model, with specific focus on perceived ease of use and behavioral intention. The questionnaire consists of 23 questions in total, and the questions were divided into seven categories: (1) Background Information (2) Classroom Setup and Technology Availability (3) Teacher's Experience and Use of Technology (4) Perceived Ease of Use and Adoption of New Technologies (5) Challenges and Facilitating Conditions (6) Perceptions and Psychological Factors (7) Final Thoughts. The interviews were carried out mostly in Urdu, and were later translated and transcribed manually in English.

Teachers were informed and ensured of their anonymity when conducting interviews, as well as the fact that the collected data would only be used for academic purposes.

5.5 Data Analysis Techniques

This thesis followed a qualitative research design, by developing, conducting, and analyzing 17 semi-structured interviews of teachers at special education institutions in Lahore, Pakistan. These teachers deal with visually impaired, hearing impaired, and mentally challenged students. The data collected through interviews was broken down into several codes using Nvivo, and will be explained in dialogue with the literature review in the Discussion chapter.

All the interviews were translated from Urdu to English and transcribed manually. After transcriptions were completed, the data was imported to Nvivo to begin the coding process, which was extremely laborious due to the in-depth analysis of 17 qualitative interviews. Coding often follows an inductive approach, which means codes emerge from the data as you sift through the pages. Coding starts by describing small phrases, sentences, and paragraphs, and at a later stage, you reduce and combine the codes and relate the data to past literature for analysis (Deterding & Waters, 2021). Hence, some codes were developed by going through the data, while others were guided by current literature and the theoretical framework. A codebook was developed and refined throughout the coding process. Codes with very little data were eventually discarded

when they added no value to the study and did not contribute towards the research question.

For data analysis, we relied on thematic analysis. Thematic analysis refers to a technique for identifying, analyzing, and presenting patterns or themes within data (Lochmiller, 2021). This means that the researcher has a basic understanding of coded data based on the repetitive themes and patterns. The frequency of the same code appearing across the dataset increases the likelihood of that code being the basis of a theme (Lochmiller, 2021). After deducing themes from codes and subcodes, data was discussed and analyzed in reference to the extensive literature review and the theoretical framework.

The coding process generated 14 specific codes and underlying subcodes for the 17 semi-structured interviews. These are presented in Table 1:

Main Code	Definition	Subcodes
Disability	Description of the type of disability.	• Intellectual Disability • Physical Disability
Education	Description of the level of education of each teacher.	–
Facilitators of Technology Use	Factors that facilitate or promote the use of technology in special education institutions.	• Institutional Funding • Institutional Support • Peer Collaboration • Self Learning • User Interface
Infrastructure	Whether the infrastructure at special education institutions is adequate and disability-friendly.	• Sufficient • Insufficient
Motivation	Motivation of teachers to enter the field of special education.	• Extrinsic • Intrinsic
Perceived Ease of Use	Factors influencing the perceived ease of use of technology among special education teachers.	• Confidence • Learning Curve • Simplicity of Technology • Technical Support Availability • Usage of Tech in Daily Life
Perceptions of Technology	The perceptions and attitudes of teachers towards the use of technology in special education.	• Inclusivity and Accessibility • Perception of Usefulness • Views on Student Engagement

Policy and Systemic Initiatives	Description of policy and school administration initiatives and their impact on special education.	• Government Policies • School Leadership Initiatives
Recommendations	Recommendations by teachers to improve special education in Pakistan.	–
Regional Differences in Technology Access	Teachers' experiences or perceptions about differences between special schools in Lahore vs other areas in terms of technology access.	–
Teaching Experience	Number of years of teaching experience.	• Over 10 Years • Under 10 Years
Motivation for Technology Use	Describing why teachers feel motivated to employ technology in their instructional models.	–
Technology Use	Describing the challenges in technology integration and the types of technologies used.	• Challenges in Integration • Types of Platforms
Willingness to Adopt Technology	Describing the willingness of teachers to use technology.	–

Table 1: Codes Identified from the Interviews

5.6 Ethical Considerations

To collect data for this thesis, an application was sent to private special education institutions and NGOs, describing the purpose of research and the academic credentials of the researcher. The Punjab Special Education Department was also contacted for permission to interview teachers in public special education schools. After receiving verbal consent from institute administrations, they were also informed and assured of KU Leuven's stance on ethical interviews and data collection, in line with the General Data Protection Regulation (GDPR).

Willing participants were familiarized with the thesis, in both English and Urdu, while clearly outlining the purpose of the study and the measures that will be taken to ensure confidentiality. Potential interviewees were ensured that their participation was entirely voluntary and that they were free to withdraw any statement or opt out of the study at any point during data collection. Most of the teachers were more comfortable with conversing in Urdu, so interviews were primarily conducted in Urdu and transcribed and translated later into English. The interviews were transcribed word for word manually, without the use of AI or any online tools.

The names of participants and any institutions included in the study were kept anonymous, and any information that could identify them or their location was removed. Data was used purely for academic purposes and recorded in a secure Google Drive folder, with access granted only to the researcher and her supervisor. Moreover, teachers'

physical and emotional cues were observed and if they seemed hesitant to talk about any aspect, they were not probed for answers.

Lastly, AI tools such as ChatGPT were used sparingly during the course of this thesis, to allow clarity in academic writing at times and exploring synonyms. No AI tool was used to formulate the research question, interview questionnaire, literature review, methodology, coding, and data analysis. All conceptual paradigms, critical analysis, reasoning, and interpretive work was done independently by the researcher, without the use of AI tools. The use of AI was for menial tasks and in adherence to university standards, ensuring full transparency and integrity by the researcher.

5.7 Research Limitations

While the study provides significant insights into the factors influencing the adoption of technology by special education teachers in Pakistan, there are some limitations to consider as well. First of all, 17 participants across different special education institutions in Lahore were interviewed in total. However, their opinions might not reflect the overall voice of special education teachers in Pakistan, which reduces the external validity of the study. External validity refers to the applicability of research findings to be implementable on a broader scale. The term is sometimes used synonymously with 'generalizability' to emphasize whether results of the study can be applied to a larger population. External validity matters if results can potentially differ due to different characteristics of the wider population (Avellar et al., 2017).

Secondly, researcher and subjectivity bias is a problem encountered in most qualitative studies. Despite conscious effort to remain impartial and unbiased, it is possible to interpret subjective data from interviews with preconceived notions on part of the researcher. Moreover, the interviews might have been guided by the interviewer in a way that could potentially change the answers of the participants. Moreover, since each participant was only interviewed once, it is possible that some of them did not open up properly and deeper insights could have been extracted had the interviews been conducted in phases or over a couple of days at least.

In addition to that, the geographical constraints are an unavoidable research limitation. In Pakistan, it is almost impossible to get access to educational institutions without formally introducing yourself in person, writing and submitting applications, and signing confidentiality agreements in some cases. School administrations are unwilling to use Zoom as the interview mode, which made it necessary to confine the interviews to one city: Lahore. Moreover, there are very few functional schools and centers for mentally challenged students in Pakistan, so most of the interviews conducted were from teachers of visually or hearing impaired students. This means a whole category of teachers of mentally challenged students was missed out on, and it could have added deeper insights to this thesis. However, it remains an area of study for the future.

Lastly, since teachers were assigned for interviews by school administrations, it is possible that they were briefed about the interviews beforehand and their answers were tailored to align with what they thought was expected of them. Similarly, since the interviews were recorded, it is possible that teachers held back on their critiques of the school management, institutional support, and provision of infrastructure/resources.

6 Background to the Case

This section seeks to set a tangible background to the special education landscape in the province of Punjab, Pakistan. Developmental and cognitive disabilities have demonstrated continuous growth over time. Individuals are diagnosed with these disabilities from birth and they are often lifelong, impacting physical, emotional, and mental development (Olakanmi et al., 2020). The increase in disabilities warrants an improvement in the educational pathways provided to students with special needs.

Since this study will focus on Lahore, which is the biggest metropolitan city in the province of Punjab (2023 population: approximately 14.5 million), we will take a look at the special education facilities in the province. According to the Special Education Department of the Government of Punjab, the following institutes cater to special needs children and special education teachers:

- **Institutes for Visually Impaired Children** – **18** institutions in total, with 2 dedicated especially to visually impaired girls. Children who are 4 to 9 years old and suffer from visual impairment are eligible for admission in these institutes, and they are offered education free of cost, including free Braille books, skills training, therapy, mobility training, and housing facilities.
- **Institutes for Mentally Challenged Children –** A total of **14** institutes are available for training and educating mentally challenged children who range from 5 to 14 years old.
- **Institutes for Hearing Impaired Children – 49** institutes in total are working to educate hearing impaired children, with 2 institutes dedicated solely to hearing impaired girls. The age range of special children admitted to these institutes is 4 to 9 years old. For students with financial hardships, lodging and hearing aids are offered free of cost.
- **Institutes for Physically Disabled Children – 5** institutions are providing education and vocational training to physically disabled children ranging from 4 to 10 years old.
- **Institutes for Slow Learners – 36** institutions cater specifically to slow learner children who range from 5 to 10 years old. These children usually display an IQ level of 70 to 95.
- **Special Education Centers** – At the town level, a total of **171** special education centers are catering to disabled children. These children face visual impairment, mental instability, hearing impairment, and physical disabilities.
- **Degree Colleges – 7** degree colleges are available for disabled students, with the facility of free education and pick & drop services to those who face financial constraints.
- **Teachers Training College –** Currently, **2** training colleges are available for teachers who require professional training in special education. They are offered degrees including B.Ed. in Special Needs, M.Ed. in Visual Impairment, Teachers of Deaf. Speech & Languages, and M.A Special Education.
- **In-Service Training College –** This college provides professional training and latest teaching methods to special education teachers through teaching aid.

Despite information about the number of schools, colleges, special education centers, and teachers' training colleges, there is a lack of transparency in the government database. There is no 'last updated' date available on the website of the Special Education

Department of the Government of Punjab, which means these figures for the number of schools and colleges could be outdated. Some of these branches might not be functional currently, some more centers may have been launched, yet the details remain unavailable. Secondly, this data does not specify whether all of these institutions mentioned are owned, operated, and managed by the government or do these include private, trust, and non-governmental organizations as well.

Private or NGO-based special education institutions do need to register with the Special Education Department of the Government of Punjab if they seek to receive grants, funding, and donations from parent organizations, affiliate NGOs, or donors abroad. However, the Special Education Department has no real authority over these private institutions, and their practices remain unchecked at the government level. They are only accountable to their own board of directors and trustees, and donors in some cases.

7 Results

This section will present the findings from the 17 semi-structured interviews conducted with special education teachers in Lahore, Pakistan. The data was analyzed using Nvivo, where several major themes were identified to explain the different influences on special education teachers when it comes to adopting technology.

7.1 Participants' Demographics

From the 17 participants, the gender ratio was skewed in favor of women. 4 out of 17 participants were men, while 13 were women. Of these candidates, 8 teachers mentioned having over 10 years of experience in special education, while 7 teachers had under 10 years of experience. When asked about their background and experience, 9 teachers mentioned holding master's degrees in special education, while the rest did not answer specifically about their educational achievements. However, a bachelor's degree was inherently implied since they cannot be employed at a school without it. Moreover, 14 out of 17 teachers commented that they teach students with physical disabilities like hearing or visual impairment, while 3 stated that they deal with intellectual disabilities like autism, Down syndrome, and ADHD. In the table below, the participants' demographics are summarized, with N/A mentioned where the code wasn't applicable or the question remained unanswered.

Participant ID	Gender	Type of Institution	Years of Teaching Experience	Education Level	Type of Disability Taught
P1	Male	Public	N/A	N/A	Intellectual
P2	Male	Public	Over 10 Years	N/A	Physical
P3	Female	Public	N/A	N/A	Intellectual
P4	Male	Public	Under 10 Years	N/A	Physical
P5	Female	Public	Under 10 Years	N/A	Physical
P6	Female	Public	Over 10 Years	N/A	Physical
P7	Male	Public	Over 10 Years	N/A	Physical
P8	Female	NGO	Over 10 Years	Master's	Physical
P9	Female	NGO	Under 10 Years	Master's	Physical
P10	Female	Private	Under 10 Years	N/A	Physical
P11	Female	NGO	Over 10 Years	Master's	Physical
P12	Female	NGO	Over 10 Years	Master's	Physical
P13	Female	Private	Under 10 Years	Master's	Intellectual
P14	Female	Private	Over 10 Years	Master's	Physical
P15	Female	Private	Over 10 Years	Master's	Physical

P16	Female	Private	Under 10 Years	Master's	Physical
P17	Female	Private	Under 10 Years	Master's	Physical

Table 2: Participants' Demographics

7.2 Facilitators of Technology Use

This section aims to break down the factors that promote technology use at special education schools in Pakistan. This category was further divided into 5 subcodes: Institutional Funding, Institutional Support, Peer Collaboration, Self Learning, and User Interface.

7.2.1 Institutional Funding

3 out of 17 participants touched upon institutional funding as a facilitator of technology use. According to participant 1 (P1), budgeting is a crucial issue for institutions. He noted that there are several digital libraries, but they often require paid memberships or institutional access. An individual cannot realistically afford individual memberships, which is why teachers do not have access to academic literature to improve their instructional models and pedagogical approaches. If institutions paid for these memberships, teachers could access "a wealth of information, learn new things, and explore articles and suggestions".

Participant 3 (P3) commented that while technologies are accessible to a certain extent, schools face financial limitations that stop them from meeting the needs of students and teachers completely. Teachers cannot afford to buy these tools on their own, and schools are constrained by their budgets. Similarly, participant 4 (P4) said that schools have limited resources, which lead to budgetary constraints. Teachers are offered training by the Special Education Department of the Government of Punjab in assistive technologies. However, due to lack of proper budget, P4 mentioned that students with disabilities are not provided with adequate resources. P4 also commented that if proper resources are made available at central training institutes, as well as at school and college levels, adoption of technology in classrooms would become easier. Here, proper resources refer to institutional funding, rather than infrastructure or equipment itself.

7.2.2 Institutional Support

11 out of 17 participants discussed institutional support as a facilitator of technology use. P1 noted that schools are not providing teachers with training at the grassroots level. One central government training institution is responsible for training teachers, where training sessions last a week at most, and teachers are also afforded two-day refresher workshops. Now that the government is focusing on the establishment of autism schools and centers, the Special Education Department is arranging extensive training programs for teachers. A few years ago, such resources were not available at the government level. Moreover, for hearing impaired students, P1 commented that the Special Education Department provides hearing aids to students. Further mentioning the institutional support offered by the Special Education Department of the Government of Punjab, P1 said:

> "The department also has audiologists and audiometrists who assess the students' needs and set the frequency of these devices. Sometimes, audiologists or audiometrists are available at the divisional level to monitor and support schools as well."

P3 also confirmed what P1 mentioned, that schools individually do not provide training support for teachers, and it is a task delegated to the Special Education Department. P4 mentioned that the main issue lies in the inadequate provision of resources. If resources are available centrally at training institutes, as well as at schools and colleges individually, it would become much easier to adopt and implement new technologies. P5 also noted that proper training is key, highlighting that screen reading software like JAWS is readily available at schools, but guidance is needed from a computer instructor. Similarly, training and technical support by institutions is critical to make technologies more accessible to teachers. P5 stated that AI is another growing trend in education, and teachers need guidance and institutional support to integrate it efficiently into their teaching practices. P6, a teacher at a public special education school, also observed that the Special Education Department provides training to teachers whenever a new technology is introduced and needs to be rolled out. She commented:

> "The institute offers training courses that can last for several days, depending on how complex the new technology is. However, this training is only provided at the central level, not within individual schools."

P6 also mentioned that the government in-service college offers training in new methodologies, or if a foreign team of specialists visits the college, the government invites teachers to attend their lectures in order to improve instructional approaches. P7 commented on the in-service teacher training college by the Department of Special Education of Punjab as well, noting that training programs differ in length, and teachers are guided about pedagogy, curriculum development, student psychology, and the latest digital technology in their field. In terms of institutional support, P8 said that schools arrange workshops and meetings with experts for teachers where new technologies are discussed. A trainer is present at these workshops to guide teachers on how to use new tools more effectively, making it easier for instructors to implement them in their classes. P9 commented that upon her appointment at the school for the visually impaired, teachers are trained in reading and writing English, Urdu, and Math in braille. Teachers also receive mobility

Training, by wearing blindfolds to experience navigating the world without sight. As P9 is a computer teacher, she was also trained by a computer expert at the school. P10 also confirmed that the school offers training for three months when a teacher joins, which includes Braille, orientation and mobility, as well as familiarization with the school curriculum.

7.2.3 Peer Collaboration

8 out of 17 participants commented that peer collaboration is a facilitator of technology use. During a discussion about learning new technologies, P1 mentioned that although he

learned many things from self learning and attending training programs for more advanced tools, talking to colleagues about different tools is really helpful. Similarly, P2 being a visually impaired teacher, accredited peer support as a big facilitator when it comes to using new tools and technology. P7 was also a visually impaired teacher, and he recalled the accident that took his sight. He joined a high school for visually impaired students and his peers helped him to get the hang of things. P7 commented:

> "Like I told you before, I became blind after a road accident. When I was in high school, I got admitted to a special education school where my classmates taught me basic AT since they were blind by birth and had mastered these tools already. My teachers also guided me and it was their efforts which led me to use a smartphone and a laptop as a visually impaired person."

P10 claimed that when a new tool or methodology is introduced, a more experienced member of the faculty hosts training sessions for the rest of the colleagues. She added that the school is currently exploring the potential integration of AI to "enhance learning beyond traditional theoretical content". Once AI is tested by the senior and more experienced teachers in their instructional approaches, the school will move forward with implementation. P10 added that she herself does not find technology difficult to use since she is technologically trained. However, if she has to clarify a concept, peer support by senior teachers is readily available.

P11 disclosed that she is already familiar with technology because of prior work experience at a bank, where she encountered such tools. However, in the beginning of her career as a teacher, preparing exam papers by converting text into braille was challenging for her. That was when P11 relied on experienced teachers for support. P11 said:

> "Thankfully, the experienced teachers were very helpful whenever I encountered any difficulty. Additionally, the school organizes summer camps to train us in the use of different tools."

P14 mentioned that teachers are properly trained by the school. Peer support is a part of the team culture, because when a teacher comes across something interesting, they share it in the teacher's group so everyone can access the new resource or tool. In her own words, "peer learning is also very prevalent in this place". P16 confirmed that in addition to formal training and self-learning, teachers often discuss with colleagues about different tools, which really helps in clearing up confusion about concepts. P17 also mentioned peer support as one of the ways she learned about technology, new tools, and innovative learning methodologies.

7.2.4 Self Learning

11 out of 17 participants attributed self learning as a facilitator of technology use. P2, a visually impaired teacher, commented that he mostly relies on self-learning. He stated:

> "I started learning AT in bachelor's since I needed them myself, being a visually impaired person. I also joined

> some classes to learn computer skills but didn't find them very helpful. However, I got taped lessons from those classes and I used them later to practice on my own."

In reference to another question, P2 mentioned:

> "I think I mostly self-learn, so I have never relied on training by the institution."

P3 noted that she learned mainly through self-learning. While formal training was available, she did not find the tools particularly difficult to understand or work with. Similarly, P4 accredited her technological knowledge to self learning as well, saying:

> "I did not receive any formal training; it was my own interest that led me to learn these tools. So, it was largely self-learning."

P8 highlighted that if a technology is available in the school, she tries to pick it up quickly. However, lack of accessibility makes it difficult to learn new tools. In her own words, P8 said:

> "I feel it is my personal responsibility, almost a moral duty, to learn how to use it so I can make it beneficial for my students."

P9 shared that she explored the NVDA (NonVisual Desktop Access) software on her own, since it does not require a paid membership. However, JAWS is a paid software, so she only used it after joining the school and with some guidance from the computer expert. However, she mostly learned the ins and outs of the software via self learning. She also mentioned:

> "I have always enjoyed learning new technologies, so whenever I come across something new, I try to explore it on my own right away. That is why it usually does not take me much time to pick up a new tool or software."

The 12th participant (P12) said that she mostly learns about new technologies via self-learning, "by exploring the internet and watching video tutorials". P12 admitted that she is personally interested in tech, so she actively seeks out new tools which can assist her students and make learning easier for them. Similarly, P13 shared that she researched a lot about new tools and hot trends in edtech, and "self-learned a lot". However, P13 acknowledged that formal training makes technology easier to use as compared to self learning, which takes more time and effort. Her exact comment was:

> "Obviously if you're trained properly, it would be easier to use technology, while self learning makes it comparatively difficult."

Participant 14 talked about formal training and peer support as facilitators of technology use, but she concluded her statement by saying that self-learning is essential if someone

wants to perfect a skill. Otherwise, you cannot rely only on one-time training sessions to master your craft. Participants 15, 16, and 17 all alluded to self-learning being an important element of technology use, while also crediting formal training and peer support.

7.2.5 User Interface

4 out of 17 participants referred to user interface being a facilitator of technology use. According to P1, the user interface plays a crucial role in ease of use and consequent technology adoption. He referred to websites having scattered and boring designs, while they should actually "clearly guide you to the specific information you are looking for". He commented:

> "If it is not user-friendly, accessing the necessary content becomes difficult. The more intuitive and clear the instructions are, the easier it is to use the technology or tool."

The second participant (P2) noted that user-interface is extremely important when it comes to using new technology. As a blind person, P2 emphasized that "the app needs to support speech-to-text and screen-readers for me to conveniently use and implement it." Likewise, P7 also stressed upon the importance of user interface. He noted that as a visually impaired person, most instructions are available in printed form, which makes it a hassle to read and he has to ask for assistance. Another thing he mentioned is that most technologies are foreign (Chinese/Japanese/Korean) and their instructions or interface also comes in their native languages sometimes, which creates a barrier as well. Participant 9 (P9) also expressed that accessibility and a user-friendly interface are the main factors that facilitate technology use.

7.3 Infrastructure

This section aims to discuss how infrastructure at schools impacts technology adoption and use. This category was further divided into 2 subcodes: Insufficient and Sufficient.

7.3.1 Insufficient

4 out of 17 participants alluded to the school infrastructure being insufficient, which hinders the use of technology. P1, a teacher of individuals with intellectual disabilities, observed that no specific applications or tools are available to aid students who are mentally challenged. He commented:

> "They have to rely on the same tools used in general education, such as computers, projectors, among others. There isn't any tool or application to help develop individualized educational plans for these students in a time-saving way. Teachers have to work with the limited resources that are meant for regular students. Even applications that allow you to download flashcards for teaching are often paid, so they are not easily accessible."

As a result, P1 discussed that teachers have to design, print, and laminate flashcards themselves, and they also have to develop worksheets and workbooks themselves. He noted that while some apps can be downloaded, most of the good content is paid, pointing to the insufficient infrastructure and equipment availability.

Participant 3 (P3) shared that technologies are available to some extent, although financial limitations often prevent schools from completely meeting the needs of students and teachers. She mentioned:

> "As teachers, we cannot afford to purchase these tools ourselves, and schools have to work within their budgets. However, there has been noticeable improvement in Special Education centers over time. Centers in urban areas are generally better equipped compared to those in rural areas."

P3 also asserted that while she was trained in some technologies, they were not available at schools, which lacked proper infrastructure and equipment. She said that this was not just the case in her field, other areas of special education also face the same issue. In her own words, she stated:

> "It is a major flaw in the system. Our schools often lack the resources and tools we really need, which becomes a big barrier."

P3 acknowledged that the most notable infrastructure issue in special education schools is that most of them are located in rented buildings that are not disability-friendly. This creates mobility challenges for students, and even though teachers and the administration want to provide all necessary facilities, they are unable to do so because of these limitations. Similarly, P4 shared that although some assistive technologies and digital tools are available in classrooms, there is a significant lack of resources, "especially in Pakistan, and more so in Punjab". He noted that while teachers can recommend the most suitable assistive technologies for their students, they often do not have the means to provide them directly, and it is up to the school administration to provide proper facilities. P4 also criticized the lack of proper resources being made available to students with disabilities in schools. He went on to conclude his remarks in the following words:

> "I believe the key issue is the provision of proper resources. If resources are available at training institutes, as well as colleges and school levels, it would become much easier to adopt and implement new technologies through proper training."

Participant 7 (P7) pointed out the lack of accessibility in schools, noting that there is only one LED screen for the entire school. That causes a hindrance and it is used for entertainment rather than educational purposes. For example, teachers play a movie during break hours for the students rather than utilizing a single screen per class for learning. If these screens and projectors were available in all classes, teachers could use them effectively to deliver their lessons.

7.3.2 Sufficient

9 out of 17 participants mentioned that infrastructure at their institutions was sufficient, which acts as a facilitator of technology use. P4 commented that for students with hearing impairments, hearing aids are available at the school, although the process to get them issued is a bit time taking. However, she noted that cochlear implants are quite expensive, although some organizations and NGOs do provide cochlear implants for students with hearing impairments – either free or at subsidized rates. P4 shared that the Special Education Department of the Government of Punjab is planning to provide wheelchairs, braces, and other assistive devices to students with physical disabilities. P5 added that assistive technologies are available in most schools across Punjab and their use has been rising over time. She also commented that assistive tools were rarely used in the past, but now there is "gradual improvement and greater adoption".

P6 noted that technology is easily available for both students and teachers, with all schools being equipped with computer labs. She mentioned that each school and special education center has access to speech therapists. If an ophthalmologist is not available, an assessment kit is always present on campuses for student evaluation. Special education schools also focus on the mental health and wellbeing of students, which is why a psychologist is available on campus at all times. While psychiatrists are not commonly available, students who need support are helped on a case by case basis.

Participant 10 (P10) claimed that adequate infrastructure was available at her institution, with everything from a braille dictionary, geometry tools, and braille textbooks for English, Math, and Quran. She also asserted that their school has well-equipped computer and science labs. She commented:

> "In my opinion, no other school offers the same level of technological accessibility – this is one of the best institutes for visually impaired students. The canes used by students are even manufactured within the school itself. We have an embosser, and for students who cannot afford materials, the school provides books free of cost. Each student has a Perkins Brailler at their desk, and the library is stocked with a variety of storybooks and audiobooks."

P12 also reiterated that the technology and infrastructure at their school is fully accessible. She said that it is up to the teacher to decide which tools are needed for the concept they are introducing in class. She further stated that if something is not available at school, teachers can put in a request and the school administration tries to arrange it based on the school's budget. Likewise, P13 mentioned that all the schools she has taught at have had sufficient technology infrastructure. However, whether the infrastructure is being used properly remains to be seen.

Referring to computer labs, P15 shared that technology is easily accessible in the school, since every class follows a timetable. This means there are no overlaps or conflicts in computer lab time, allowing all teachers to use the required tools as needed.

P16 pointed out that assistive technologies are presently accessible for teachers at school. She also shared a future project of the school, which is to establish a smart room or a resource room. She explained:

> "The goal is to create a more advanced and supportive classroom environment by integrating technology. In this room, teachers will be able to provide students with specific tools during lessons, based on their needs."

P17 agreed with P15, confirming that there is a proper timetable followed by all classes, so both students and teachers have access to the available tools according to that schedule. However, class activities need to be pre-planned, where teachers have to inform the administration in advance about the multimedia or computer room that is required, get a permission slip from the school management, and then everything proceeds accordingly.

7.4 Motivation

In response to the interview questions about what led teachers to join the field of special education, participants referred to intrinsic desires for growth and helping people to extrinsic incentives. This section illustrates the theme in two parts: Extrinsic and Intrinsic

7.4.1 Extrinsic

P1 mentioned that money was the main motivator behind him joining this field. At the beginning of his career, he worked with adults but that did not pay very much. When he began working with special needs children, the compensation was better. Moreover, he mentioned that he works at a public school so it is a government job, which provides stability and that was the main reason he took the role. P1 is a psychologist who mentioned that people in this field were earning well when he started because it was an emerging field, which is why he chose to pursue psychology.

Similarly, P10 also mentioned extrinsic motivation to join the field of special education. She mentioned that it was not exactly her plan to join this field, and she had applied to multiple programs like law, BBA, and special education. She said that she got accepted into the special education program before the results for the other fields came out, so she joined it. But it has been a positive experience for her, and P10 is now pursuing a specialization in Autism.

7.4.2 Intrinsic

There was overwhelming agreement among teachers that they were intrinsically motivated to join the field of special education. 15 out of 17 teachers alluded to intrinsic motivation being the reason they took up these roles. Participant 2 (P2), a visually impaired student, said that he lost his sight when he was a bachelor's student. The vision loss was gradual until he became completely blind. He shared that his peers encouraged him to pursue special education because it was a newly introduced subject at the time and they thought he could succeed in this field as a visually impaired man himself. When he joined the field, P2 said it felt like "the perfect fit for me".

P3 mentioned that she joined the field of special education by chance but remained in the profession by choice. She enjoyed working with special children, and being a lecturer she felt like she could make a real difference in their lives. P4, another visually impaired special education teacher, reiterated some tragic events from his life that led to his appointment as a teacher. He said:

> "I experienced some sudden events in my life. In the past, I served in the Pakistan Navy as a Marine Commando, and at that time, everything was fine. During my service as a Naval officer, I suddenly lost my eyesight. After retiring on medical grounds, I decided to continue my studies in the field of special education. A friend of mine suggested that I join special education and serve individuals with disabilities. After completing my Master's degree in Special Education from Bahauddin Zakariya University, Multan, I realized that this was the most relevant field where I could make a meaningful contribution–and that is where my journey began."

P5 referred to her background in psychology, and as psychologists, she said that they naturally gravitate towards working with special needs individuals and contributing to their well-being. P6 mentioned that her goal is to assist differently-abled children become independent, to help them use their abilities to the fullest so their future becomes secure, free of any sense of inferiority or complexes. P6 also highlighted that teacher morale needs to be boosted, which in turn impacts their dedication and willingness to improve their teaching methods. She commented:

> "I don't think money is a major motivator in this field. It is all about self-motivation and availability of resources. I think religion is also a big factor, since Islam teaches you to help those in need."

P7, another teacher who was visually impaired, said that his motivation stems from his personal journey as a visually impaired person. P7 lost his eyesight unexpectedly when he was in high school, and even prior to that, his goal was to become a teacher. He explained:

> "I think fate led me to this point, and visual impairment made it easier for me to enter the field of special education. My parents were extremely supportive and my teachers guided me towards this field. I think being a special needs person myself has really helped me bond and connect with my students, and help them more effectively."

On the other hand, P8 shared that she always wanted to donate her eyes when she passed, and upon discussing the possibility with her family, they absolutely refused to do so. That event motivated her to help visually impaired children when she was alive, since donating her eyes would be beyond her control. P9 mentioned that one of her teachers had a physically disabled son and she used to carpool with them to school. That experience became the source of her motivation to join this field. P11 relayed a similar experience from her youth. She talked about a young girl in her neighborhood who had special needs.

She would often hear the girl crying or screaming, and whenever she called out to the child through walls, she would calm down. That experience left a lasting impression on P11, who said:

> "Even though I never really liked the idea of teaching in general, I did feel a strong desire to work with special children. So, when I came to know about this school, I applied."

P12 said she wanted to do something different in life, which became her motivation. She stayed in special education because she genuinely enjoys working with these students, and she feels compelled to help them become independent and confident members of the society. P13 also said that she enjoys a sense of fulfillment when she helps her students learn and grow. On the other hand, P14 had a more personal reason to join the field. She was motivated to enter this field because she has two hearing-impaired children.

P15 listed two personal reasons that influenced her decision to join the special education field. First, she mentioned one of the cousins being mildly mentally challenged. She visited a special education center with him where students with different disabilities were taught in the same building. Although it seemed quite complicated at first, this experience ultimately motivated her to pursue this field. Secondly, P15 found it inspiring how teachers used sign language to interact with the students. She also sees her work in this field as Sadqah Jariyah, which is an Islamic concept of ongoing charity.

P16 shared that her motivation to join the field of special education came from her father, who had learned the braille system for visually impaired individuals. She was fascinated by how he used braille to communicate with blind people. This fascination and curiosity led her to pursue a career in special education, where she joined a school for the hearing impaired. Additionally, her brother is currently pursuing a degree in special education, so her entire family is involved in the field of special education. The 17th participant (P17) said that her motivation to join this field came from a personal experience. Her cousin's son was deaf, and she really struggled to teach him. She mentioned how there is not much awareness regarding the education of differently-abled children in Pakistan. P17 taught her cousin's son herself, even though she had little understanding of special education back then. She then explored teaching methodologies on the internet, learned sign language, and that sparked her interest in the field.

7.5 Perceived Ease of Use

The category of perceived ease of use is aligned with the Technology Acceptance Model, which is the underlying theoretical framework for this thesis. The category was broken down into many subcodes, including: Confidence, Learning Curve, Simplicity of Technology, Technical Support Availability, and Usage of Tech in Daily Life.

7.5.1 Confidence

All 17 of the teachers acknowledged that confidence in their skills and self-efficacy made technology easier to use. P1 said he believes he is quite in touch with technology, so he feels confident about incorporating it in his instructional methodologies. He agreed that it is quite beneficial for special students, though it can be a bit challenging to use with

intellectually challenged children. P1 agreed that if he feels confident about using a certain technology, he is more willing to integrate it into his lessons, and if he isn't comfortable with a tool, he tends to avoid using it. He added:

> "There are times when I simply don't know how to use something, and that lack of familiarity can be discouraging. Of course, this experience varies from person to person."

P2 said he believes he is "quite confident and skilled", and he has learned everything to his maximum capacity. He also trains fellow special education teachers. He also agreed that confidence does impact willingness to learn, which is a natural phenomenon. The third participant (P3) mentioned that while she wasn't an expert at using technology, she is "fairly confident and capable". She added that if she feels uncertain about a certain tool, she makes the effort to learn more about it until she is fluent and comfortable. She also agreed that if she feels confident about using technology, she is naturally more willing to use it. The fourth candidate (P4) reiterated that technology "reduces the challenges of disability by about 70-80%". He said that technology is quite beneficial in special education and he feels confident about using it. He commented:

> "I do not think I can teach a technology to my students unless I am confident in my own ability to use it first. So yes, my confidence in using a tool directly impacts my willingness to integrate it into my teaching."

The fifth interview participant (P5) commented that she has gotten more confident and comfortable in using technology over time with experience. She pointed out that newer teachers mostly find it easier to adopt educational technology. P5 also said that confidence plays a major role in the willingness to integrate technology into teaching. She expressed her opinion in the following words:

> "For instance, if we observe senior staff, not just in education, but in other professions like banking, we often find that they are more hesitant to use technology and tend to rely on verbal or traditional methods instead. Similarly, if teachers lack confidence in using a particular tool, we are less likely to incorporate it into our classrooms effectively."

Participant 6 (P6) said that it takes a while to become confident when you face a new concept, but as teachers it is our responsibility to convey new ideas to students. According to P6, while she feels a bit reluctant at the beginning, she gets a hang of the new technology after practicing and then "it becomes easy and natural to use new tools". She added that she is in touch with technologies via education, formal training, and years of experience. P6 also confirmed that being confident in a technology increases her willingness to use it. P7 asserted that without technology "teachers are incomplete", and they cannot convey knowledge without the presence of technology. He also agreed that someone who is an expert in technology will be more confident about using it. He added:

> "Students will not be engaged with a teacher who uses only manual tools, since tech is way more interactive. I think

> technology facilitates teachers as well, and it makes them more effective as instructors. So yes, I feel very confident about using technology."

Participant 8 shared her thoughts, saying that she feels the need for more training to become confident about using technology. She explained:

> "I feel that my skills need further improvement so that I can teach more efficiently in less time. While I am willing to incorporate technology into my teaching, there are times when I lack the proper training. Gaining more confidence in using these tools would certainly make it easier for me to teach them effectively."

The 9th participant said she feels confident and there is no hesitation on her part, but sometimes it takes time for students to grasp certain technological aspects. She agreed with the consensus that the more confident she feels about using technology, the more willing she is to integrate it in lessons. Participants 10, 11, and 12 all confirmed that feeling confident about their technological skills increases their willingness to utilize it in classrooms. P13 said that she only uses tools she is confident about in her classes, which are beneficial and relatable for her students. She added:

> "I would say there are very good mediums for learning and understanding technology, and since they have significantly improved learning outcomes for my students, I feel very confident about using tech."

The 14th participant said she feels "100% confident about technology that I have mastered" and she uses those tools daily. For example, she uses her laptop every day to make lesson plans, prepare monthly planners, and powerpoint lectures for her classes, which is why she is in touch with most digital platforms and apps. This results in P14 feeling confident in her skills. However, she referred to an ERP system her school uses to tabulate results twice a year, which makes her feel hesitant about using it. Comparing the ERP system to all other apps she uses on a daily basis, P14 acknowledged that there is a massive difference in comfort and confidence. As per the 15th participant, she now feels pretty confident in her technical skills since it has been a while she has been using technology for teaching. She said that using technology was difficult for her initially, "but you get better with practice". She also commented:

> "We are willing because it is a necessity now. We are also confident in our skills, and yes that increases willingness to use."

P16 said that she feels confident while using the technologies that she is familiar and comfortable with. If she comes across a technology that is unfamiliar, she makes an effort to learn about it, "usually by seeking guidance or asking someone who is more experienced". P16 stated:

> "If we know how to use technology, we naturally feel confident using it, and that confidence makes us more willing to integrate it into our teaching."

P17 said that she was not very confident about using technology because many tools were new and unfamiliar for her. However, after getting proper training, she now feels fully confident about utilizing technology. She believes that effective teaching happens when an instructor is confident in their own abilities. When asked whether confidence impacts the willingness to integrate technology in classes, P17 mentioned:

> "It has a significant impact. If I am not confident in using a particular technology, I know the students won't be able to grasp it properly either. Confidence is important. When I understand a tool completely, from A to Z, that confidence naturally reflects in my teaching. And when I feel confident I am definitely more willing to use that tool in the classroom."

7.5.2 Learning Curve

16 out of 17 participants referred to the learning curve improving the perceived ease of use of technology. The first participant, P1, said that he has learned a lot via self-learning, and has attended training programs to understand more advanced tools. However, he still feels like he is "learning something new every day". He said that learning a tool is a "gradual process" for him. He described it as:

> "It requires consistent practice, and sometimes it can take up to weeks before I feel fully comfortable using a new tool in my teaching. If the tool is simpler, I can usually learn it in just a few days. Trainers typically train for about a week, and then you are expected to use the tool independently. However, they do check in regularly or monitor progress through the system to ensure you are on track."

The 2nd participant said that assistive technology became easy once he got the hang of it himself. He noted that modern assistive technologies are easier for the younger generation to grasp but traditional assistive tools like braille are difficult. He added that it is likely because braille is hard to understand, manual, and learned over the years. P3 acknowledged that sometimes hesitation about certain technologies stems from lack of knowledge. Referring to using technology, she said it depends on how difficult the tool is and how long the training lasts. P4 acknowledged that with proper guidance and training, any technology becomes easier to use, citing a learning curve over time. He noted that it does not take him long to become comfortable with new digital tools, just a few days are enough.

P5 added that her own interest, combined with how easy or complex a technology is, plays a big role in how rapidly she can learn it. According to her, sometimes it takes a few days, while other times it can take up to a month to understand a new concept. She added:

> "Tools like Meta AI have really simplified the learning process these days. In fact, the students we teach, belonging to this digital generation, are often more familiar with certain digital tools than we are. However, with proper training and guidance, it usually does not take long to become comfortable with new technologies."

When P6 was asked about her average learning curve when it comes to new technologies, she replied that it depends on the complexity of the tool. She said that if a tool is completely different from the regular tech and software used every day, it takes more time to learn. However, she said that no matter how difficult a technology is, patience and resilience are key, and having the will to learn is important. Participant 7 said that the average learning curve to understand a new tool and employ it effectively is two to three weeks. On the other hand, P8 said she still doesn't consider herself an expert and is constantly learning by using the internet, exploring new tools, and taking training courses to understand and use different technologies effectively. About her average learning curve, P8 said:

> "It varies, sometimes I am able to learn something new in a day, other times it takes a week. But I stay committed."

The 10th participant mentioned how she was already familiar with some tools due to her specialization in special education. She admitted that she wasn't very efficient at first, but she learned a lot during her three-month training period at the job. She said that she has been working in this field for a while now, and many aspects are now much clearer. About the learning curve, P10 added:

> "I only faced some difficulty with it in the beginning and had to confirm a few things, but now I use it without any trouble."

P11 said that in the start, everything feels daunting, but "with regular use, it becomes easier to handle." She also said that when a new tool is introduced and she already has some prior knowledge about it, she quickly gets comfortable using it. Once familiarity is established, using it in classes becomes easy. Regarding the learning curve, she mentioned that "learning anything requires effort, but it is manageable with practice." Likewise, P12 said that getting the hang of a new technology depends on its complexity. Regarding the learning curve, she commented:

> "If a tool is easy to use, I can usually learn it within 2-3 days. However, if it is more complex, it may take a week, 10 days, or even 15 days, depending on how often I practice and engage with it."

The 13th participant added that if she is already familiar with the tool, it would take less time to learn and execute it. Similarly, the 14th interviewee said that although using new technology feels daunting at first, it becomes easier with time and practice. She mentioned how getting the hang of online classes during Covid-19 took her about a week, from setting meeting links, preparing online lectures, and communicating effectively via sign language on camera. P15 explained her learning curve in the following words:

> "Depends on the type of technology. It was easy for me to learn Microsoft Word, but we needed a 3-month online training session to fully understand Microsoft Excel. Similarly, ERP was a bit harder to learn since it was an entirely new concept and we use the platform very infrequently for maintaining grades, so there is less practice and familiarity."

P16 shared similar views to P15, saying that new technologies can be a bit challenging in the beginning, but gradually things become easier as she becomes used to it. Lastly, P17 mentioned that they were recently trained in using Microsoft Office along with ERP. She commented:

> "Initially, it was difficult to use these tools, but with time and practice, we became comfortable and can now use them with ease."

7.5.3 Simplicity of Technology

6 out of 17 participants mentioned simplicity of technology as a contributor to perceived ease of use. P2 mentioned that traditional AT like braille is harder for newcomers to learn, because it is complex, manual, and best learned gradually over time. However, P2 pointed out that these newcomers quickly pick-up digital assistive technologies, due to simplicity of technology and familiarity with digital tools in daily life. The 6th participant said that the time taken in learning a new tool depends on its complexity. A technology that is completely unique compared to the everyday apps and platforms used will take more time to perfect.

P12 mentioned that if a technology is more complex, it would require "additional training and practice to use it effectively". However, simpler technology would be quicker to learn. Regarding simplicity of technology, P12 compared two different assistive technologies and explained:

> "The two apps, Seeing AI and Be My Eyes, serve different purposes. Seeing AI is easier to use and does not require much learning, allowing users to operate it independently. On the other hand, Be My Eyes often involves live calls, which may not always be convenient, especially when you are not in a position to take a call or do not have the time for it. While Be My Eyes is a good app, I personally prefer using and teaching Seeing AI because of its simplicity and ease of use."

Participants 14, 15, and 16 had similar opinions regarding simplicity of technology. They compared an easy software like Microsoft Word to relatively more complex platforms like ERP or Microsoft Excel. They all agreed that simpler technology is easier to learn and implement, while more advanced technology requires a longer training period.

7.5.4 Technical Support Availability

13 out of 17 interviewees discussed technical support availability as a determinant of perceived ease of use of technology. The first participant noted that training for teachers is only provided at a central level, and schools themselves offer no technical support. The second participant also confirmed that there is a government training institute for special education teachers, that "trains them to interact with students, latest AT introduced in their fields, and gives them revision courses on basics of special ed". This shows that technical support is available but at the government level, rather than at each public school. P4 emphasized the need for proper guidance and training as well, noting that any tool becomes easier to use with a competent trainer providing clear instructions.

Participant 5 also shared that teachers are sent to a provincial-level in-service training centre to get trained on new technologies. She further explained:

> "Whenever a new tool is introduced in schools, teachers are first trained at the centre. However, the schools themselves do not provide any such training. Even teachers from other districts have to travel here (to Lahore) to attend. I believe there should be at least one training centre in every district to make it more convenient for teachers. It can be challenging, particularly for female teachers, to travel to a different district just for training."

P5 added that she is quite capable of using basic technology, and as a PhD scholar, she already has access to many tools. If she encounters tools she is unfamiliar with, the school has computer instructors available to assist them. Meanwhile, P6 said that training is promptly provided by her school whenever a new technology is introduced and needs to be executed. However, she mentioned that training happens only at the central level, not within public schools internally. P9 said that she self learned NonVisual Desktop Access (NVDA) software since it is free to use, but JAWS is a paid program for the visually impaired. Once she got institutional access, a computer expert at school guided her with some aspects of JAWS, although no formal training was offered. She noted that if proper training is available, learning new software becomes easier.

P10 said that technical support and training is available when a teacher first joins the school, where they receive comprehensive training for three months. She added that although the school has not introduced new technologies since she joined, the management is now planning to integrate new tools in the future. She said that training will be offered for these tools before widespread implementation. Regarding technical support, she commented:

> "While I do feel a bit hesitant when a new technology is introduced, proper training helps me become comfortable using it."

P11 acknowledged that her school offers proper training. She said they learn some tools via hands-on experience, while others are taught in workshops and training sessions hosted by the school. She noted the importance of a competent trainer who is well-versed in the subject. She said:

> "Even when a new technology or software is introduced, the school ensures that training sessions are arranged for the staff."

Participant 12 agreed with P11, highlighting that training or discussion sessions are arranged for teachers when a new software or technology is introduced. She said that the "IT experts here guide us through the process". P13, who has worked at different private special education schools, commented:

> "Some mainstream schools I've worked at do provide training sessions, since they have a proper network and a system that they follow. They guide teachers with hands-on experiences when it comes to learning new technologies. However, most smaller schools don't have this training structure and you're pretty much on your own."

P13 credited her current knowledge of most tools and technologies to her first job placement at a private autism care center, since "they made sure to provide proper training sessions". She also added that training and support makes it easier to use new technology, since self-learning requires a lot of time and practice, and " it would be a bit difficult if you're left to your own devices". Meanwhile P14 mentioned that her institution provides a month-long course to teachers when they join where they properly learn Pakistan Sign language. She also mentioned that teachers were trained on how to conduct online classes during the pandemic, and the IT experts also trained them on the ERP system the school uses for grading. She said:

> "Another example is the ERP system we use for grading. It was a new technology so everyone was hesitant at first, but the IT experts gave us demos on how to use it and remained available if we had any issues until we eventually got the hang of it."

Participant 15 also shared that the school offers technical support, especially during the pandemic when online learning was implemented widely. She remarked:

> "Although we come from a background in special education and are familiar with certain elements, many things are still new when we step into the practical field. To support us, the school organizes developmental days during summer and winter vacations. These sessions are focused on training us in the use of different tools, such as Microsoft Office and ERP, which we were recently trained in. Teachers now enter student results directly into the ERP system. So, training is regularly provided to teachers based on the needs of our students."

P16 reiterated that training is certainly essential. When she first joined her school, she had very limited knowledge about using technology to communicate with children, as the

learning environment is completely different from general education. She noted that teachers often have to translate the text into Urdu to communicate it effectively to students. Regarding technical support availability, she added:

> "Fortunately, our administration has provided us with proper training on how to use assistive technology to communicate with these students more effectively. After that, I started applying what I had learned in my classroom. I also had to prepare worksheets and exam papers, which required additional understanding of the students' needs. The school calls teachers in 15 to 20 days before the academic session begins for workshops, training sessions, and refresher courses."

P17 also confirmed that the school offers training, referencing recent training sessions for Microsoft Office and ERP systems. She responded:

> "Practice and frequent use definitely make it easier to use a tool, and discussing it with peers also helps a lot. But training is a must. When a tool is just placed in front of you without any guidance, it becomes difficult to understand, just like how parents often struggle with social media because it is unfamiliar to them. Once we receive proper training, though, it becomes much easier to use and to teach with."

7.5.5 Usage of Tech in Daily Life

All participants reported using social media apps including Facebook, Instagram, and WhatsApp, using smartphones, laptops, and tablets. Participant 1 said that he likes using technology in ways that support his work, so he watches informational videos, reads digital articles, and uses AI for assistance. He also uses LinkedIn to stay connected with peers and informed about the job market. P2, a visually impaired teacher, mentioned using "Jaws, a cane, Be-My-Eye software, braille, and NVDA software" to make his life easy and accessible. He said he prefers using accessibility and knowledge apps. P4, another visually impaired teacher, commented:

> "I use screen readers and other assistive tools and software to make my laptop and mobile phone accessible for me. These tools help me prepare lectures, write articles, and even work on my book, which I am currently writing. I am not much of a social media person, so I do not use it very often."

Similarly, P7 is another visually impaired teacher who said:

> "I use a smart phone and all smartphone-based apps for orientation & mobility, learning, reading/writing, and accessibility. I also use social media."

Many teachers highlighted the use of AI tools like ChatGPT, Meta AI, DeepSeek, and Gemini. The 11th participant mentioned using the internet to explore creative and artistic activities for her students, while P13 shared that she uses "streaming services like Netflix and health apps like MyFitnessPal", in addition to social media and AI using her smartphone and laptop.

7.6 Perceptions of Technology

This section sheds some light on how special education teachers perceive the role and value of technology in their instructional approaches. The section is divided into three categories: Inclusivity and Accessibility, Perception of Usefulness, and Views on Student Engagement.

7.6.1 Inclusivity and Accessibility

8 out of 17 teachers mentioned that technology improves inclusivity and accessibility within education systems. P1 said that students benefit a lot from technology in the field of special education. Students learn well through roleplay, so teachers put on videos of roleplaying and students learn from those actions and behaviors. He commented:

> "In a regular classroom setting, it can be challenging for a teacher to manage the class and demonstrate something at the same time. But with videos, it is much easier to show them exactly what to do and give clear instructions on how to act."

P2, a visually impaired teacher, said that technology was created to help those with disabilities. It increases student engagement, "makes it easier for them to learn, and is overall a way for differently abled students to catch up with their 'normal' peers". Similarly, P5 agreed that technology has a "natural appeal" since it draws attention and makes the learning experience fun. As a psychology major, she acknowledged that technology has its downsides and we should never be overly dependent on it, but for children with special needs, technology offers very meaningful learning opportunities that far exceed relying on textbooks for theoretical knowledge.

The 7th participant added that technology enhances learning outcomes for special needs students since it makes educational text "accessible for visually impaired students". On the subject of accessibility, P8 mentioned:

> "The technologies are quite accessible, and whenever we face any difficulty, we make an effort to learn how to use them better so that the students can benefit more. We have one computer lab and a language lab in the institute. Since each classroom has fewer than 11 students, we have enough computers and other tools available for everyone to use comfortably during class."

While discussing inclusivity and accessibility, P8 also said:

> "Whatever they cannot see, they can listen to, and they can explore with the help of computer skills."

Participant 10 mentioned that their school for the visually impaired is one of the best in the country in terms of access to braille notebooks, braille dictionaries, and braille geometry tools. She stated:

> "In my opinion, no other school offers the same level of technological accessibility – this is one of the best institutes for visually impaired students. The canes used by students are even manufactured within the school itself. We have an embosser, and for students who cannot afford materials, the school provides books free of cost. Each student has a Perkins Brailler at their desk, and the library is stocked with a variety of storybooks and audiobooks."

However, P10 was quick to point out that accessibility remains a major issue in Pakistan. She said that her current school is a private institution so technology is readily available, but her experience at other institutions has been different. She explained:

> "In some places, even basic tools like the Perkins are not truly accessible – often kept locked away in cupboards just for show. At present, the availability of technology across the country is quite limited. However, awareness is beginning to grow, and I hope the situation will improve in the coming years."

The 11th participant said that tools are "quite accessible for both teachers and students, and they are also easy to use". She talked about how different nursery rhymes are today, compared to the 90s. She noted that the internet has made learning for children quite easy. Especially for blind students, "audio tools are incredibly effective in helping them learn rhymes and phonics", referring to inclusivity via technology. On the subject of inclusivity, P11 mentioned that technology does improve learning outcomes and their blind students can use mobile phones properly since they have learned to navigate technology. Meanwhile, the 12th interview candidate (P12) shared that technology in her school is "fully accessible". Both teachers and students are allowed to use school equipment and the administration is supportive.

7.6.2 Perception of Usefulness

An almost unanimous agreement was found across all participants regarding technology being useful. P1 mentioned how intellectually challenged students benefit from roleplay, and teachers can play relevant videos for them to learn from. Instead of roleplaying physically, teachers rely on technology, which is much more engaging for students. Agreeing with the usefulness of technology, P2 noted that technology "is overall a way for differently abled students to catch up with their 'normal' peers". P4 also acknowledged the usefulness of technology when it comes to student outcomes. He observed that technology is a gamechanger for students with special needs. He added:

> "If schools provide students with the right technological tools, such as MP3 or MP4 players for visually impaired students, or access to computers, along with sufficient time and guidance from teachers, it can significantly support their development."

P5, a teacher trained in psychology, accepted that while we should not have an over reliance on technology, it provides "meaningful opportunities" for children with disabilities, by making learning more engaging and enjoyable compared to traditional theoretical textbooks. P6 explained the usefulness of technology with an example, saying that a low vision student can read the screen easily if the text size is increased. This will boost student satisfaction and help them achieve their academic goals. Thus, she acknowledged the role of technology in improving student outcomes. P7 was in agreement with P6, when he mentioned that technology is useful since it "makes educational text accessible for visually impaired students". In line with these teachers, P8 commented:

> "Whatever they cannot see, they can listen to, and they can explore with the help of computer skills."

P9 observed that technology is quite useful as students can now explore platforms like Google and AI tools to help them understand and clarify concepts. P10 shared the same view as the other participants, and said:

> "Technologies like audio tools make life easier for visually impaired students by allowing them to access information they cannot see. It is also important for us to make lessons engaging–if we speak for too long without any interaction, students tend to lose focus. Integrating technology into learning helps keep them attentive and makes learning more accessible. Students especially enjoy visiting labs and participating in hands-on activities."

P11 held the same opinion as others, saying how technology helps special needs students learn rhymes quicker through screens, and how audio tools are incredibly effective in helping blind students. She mentioned that her students can use smartphones without assistance since they have gotten the hang of using them. P12 claimed that technology makes storytelling more engaging, and she experiments to make her lessons more interesting by using ChatGPT and then adding voice overs. P13, a teacher of intellectually challenged children, mentioned that technology does improve academic performance. She said:

> "For special needs children, it is very useful, since using Gemini in my speech therapy sessions gave me brilliant outcomes."

P14 confirmed the usefulness of technology, noting that concepts are clearer when students can see visuals on screens, and it is easier to engage them in class activities if they're in digital form. She added that "children relate more to videos and images than just PSL/words". P15 held the same opinion as P14, stating:

> "Deaf students need visual aids to memorize better. If you see something, you're less likely to forget it. So yes, it definitely improves student outcomes."

The 16th and 17th participants were of similar views that technology makes learning more engaging and enjoyable for special needs students, and it boosts their confidence while giving superior learning outcomes. P17 mentioned:

> "I would like to share that, from what I have observed and implemented in my class, technology yields great results. We also report these outcomes to our institution and suggest that more technologies be introduced. The decision to create a smart room was a collective one made by our staff. I have high hopes for the future in terms of students' education and growth."

7.6.3 Views on Student Engagement

11 out of 17 participants agreed that student engagement in classroom activities increased when using technology as a learning medium. P1 mentioned how intellectually challenged students learn better with roleplaying, so it is always useful to put on videos so they can imitate and learn from gestures on the screen. P2, a blind teacher, said that "technology was created to help people like us" and it strengthens student engagement by making it easier for them to learn and giving them a chance to catch up with general education students. P7 also referred to the need for technology since it is immersive and interactive, saying that students will not be engaged with a teacher who uses only manual tools.

P10 talked about how technology helps students focus and engage with the lesson, and only manual lessons would make them lose interest. She commented:

> "Integrating technology into learning helps keep them attentive and makes learning more accessible. Students especially enjoy visiting labs and participating in hands-on activities."

P11 agreed with P10 about student engagement increasing with technology-based learning, and shared:

> "While we do teach them ourselves, we have noticed that students learn better and enjoy the process more when we incorporate internet-based and audio resources into our lessons."

P12 observed that storytime becomes more engaging and fun with AI-generated voice overs, and P14 mentioned that visual aids help students learn quicker and engage more in classes. Similarly, P15 noted that deaf students need visual aids to memorize things, because "if you see something, you're less likely to forget it". P16 and P17 agreed that

students tend to get bored when they're taught with conventional textbooks and sign language. Adding technology to lessons increases their content retention. P17 stated:

> "These are special children, and they respond much better to visual aids than to traditional, manual teaching methods. So I design my lesson plans with that in mind. Using technology in the classroom has proven to be quite beneficial for them."

7.7 Policy and Systemic Initiatives

This section discusses the reflections of participants regarding broader government policies and the initiatives of school leadership pertaining to special education.

7.7.1 Government Policies

6 out of 17 interview participants discussed government policies and the role of government with reference to special education. P4 suggested that technology can reduce the hindrances faced by disabled individuals by 70% to 80%. This makes assistive technology really valuable in special education schools. Referring to the state, P4 commented:

> "If the government makes an effort to provide these technologies at the school level – particularly for use in the teaching and learning process – it would be a great support for both students and teachers. It would help students develop their learning skills and allow teachers to improve their teaching strategies through the use of technology."

P4 went on to discuss that "there is certainly room for improvement at the policy level". He said that policies related to technology integration in special education schools should be developed and strengthened. He added:

> "Equally important is the effective implementation and consistent follow-up of these policies. As we know, Pakistan is an over-legislated country – there is no shortage of policies, but the real challenge lies in their implementation and oversight."

P6 expressed her dissatisfaction with the policies in place regarding special education. She noted:

> "I think our policymakers don't consult special education teachers and experts while designing policies. They cannot assess the needs of teachers and students properly since they're laymen. It feels like they just consult Google and make policies, which leads to a significant gap."

The 7th participant was also quite disgruntled when he discussed government policies. He believes special education policies are just developed "for the sake of it".

Policymakers often "just copy foreign policies in terms of special education, which aren't compatible with our ground realities and resources, and this hampers implementation". He added that policymakers are not in touch with the problems of middle class families and special needs children, which is why policies are not "practical and inclusive". Moreover, P7 mentioned that even if policies are formed, there is no way to implement them properly and track the progress.

On the other hand, P11 said that there are no government policies that interrupt or limit the way teachers integrate technology into their classes. P14, agreeing with the earlier participants, commented that the government likes to showcase policies set for special education to get praise, but in reality, these policies are not functional or implementenable. P15 was also skeptical about the existence of special education laws and policies, saying that "they are not followed properly so there is no implementation".

7.7.2 School Leadership Initiatives

All of the participants talked about school leadership and the role they played in technology integration. P1 mentioned that he had a mixed experience with school management over his career. In some cases, the administration was supportive and understood the usefulness of technology, which is why they provided adequate resources and encouraged teachers to integrate technology in their lessons. However, P1 mentioned that there have been instances where the management locks up the computer labs, thus restricting access for intellectually challenged students to prevent the infrastructure from being damaged. He noted that these resources are present for the students, and they should make full use of them, even at the risk of potential damage.

The 2nd participant shared that the management is very supportive about integrating tech. Being visually impaired himself, P2 recalled how the principal issued him a laptop so he could easily access his speech-to-text software to deliver lessons successfully. He added that the school admin is very supportive, and resources are available for all teachers – it is up to them to use them efficiently. P3 agreed with P2, noting that the school management does their best to support teachers while maintaining their budget.

However, P4 had a less desirable interaction with school management. He commented:

> "In addition to the issues I mentioned earlier, the lack of consistent administrative support further adds to the challenges we face. When the administration actively supports the integration of technology into teaching practices for special education students, it encourages teachers to enhance their skills and adapt more confidently. Administrative backing is especially crucial from a financial perspective, as they are responsible for approving the budgets required to acquire essential teaching resources. However, more often than not, we find ourselves working in a restrictive environment, with limited flexibility and support."

P5 made an interesting observation about school leadership. She said that it depends on "how young and interested the administration is in integrating technology and

recognizing its importance". She explained that older staff leaders are usually resistant to change and believe in following the status quo. She recalled that at a previous school, the principal was nearing retirement and she did not understand the need to implement technology. However, when her role was taken over by a younger principal, "things changed quickly and new tools were integrated smoothly". P5 emphasized that school management also needs to be properly educated so they can be aware about the role of technology in improving learning outcomes. On the other hand, P6 highlighted that technology integration is the responsibility of both the teachers and the admin, and commented:

> "It depends on the honesty, dedication, and diligence of the admin – how loyal they are to their profession. Sometimes teachers want to implement new ideas but admin isn't receptive to these efforts, and at other times, admin does the best they can but teachers are unwilling to utilize resources."

P7 shared that it is unfortunate that school principals were once teachers, but back then they had no interaction with technology so they are either "hesitant or entirely uninterested when it comes to technology integration". This leads to no additional support by the admin, and in that case teachers have to manage with the resources they can individually provide. She concluded her remarks by saying:

> "However, times are changing, and management positions are now filled with younger and more energetic individuals, who understand the need for technology and encourage it as much as they can."

P8 acknowledged that the school leadership at her institution encourages teachers to use technology, and P9 shared that their school is now going to utilize AI in classrooms soon. P9 further added:

> "The administration is very supportive and values our input. For instance, as we prepare to launch a program to integrate AI into our teaching, our head has asked us to provide written notes on how to implement it for the students, its potential benefits, and which websites and apps we can install on our computers. All teachers have contributed their thoughts on the matter, and work is currently underway. Another meeting will be held before we proceed with the implementation."

P10 mentioned how the admin at their school encourages teachers to use technology, and works with those teachers who are hesitant to implement new techniques until they feel comfortable. P11 and P12 also agreed that the admin is quite supportive, providing resources and training so technology integration can be done smoothly.

P13, a private teacher, mentioned that she has free reign to design her sessions to the best of her capabilities, which means the admin is supportive. However, explaining her past experiences, she said:

> "In my previous institutes, they preferred to micromanage a bit and wouldn't allow a teacher to implement their own methods without submitting a proper plan/proposal to the admin. So I would say they weren't too supportive. It is a very parent and administrator-oriented environment, not a teacher and student-friendly one. Majority of the institutes in Pakistan are business hubs. They only care about making money, so they're not interested in applying new tech as it takes time, money, and training, so they'd rather stick to traditional methods. I also think most schools don't know the meaning of 'inclusivity' in Pakistan."

P14 acknowledged that the admin is very supportive, and they are planning to create smart classrooms with LCDs and multimedias in each room. Similarly, P15 also mentioned that the admin is going to approve a 'model resource room' to host interactive science and maths lessons to make it visually stimulating for students. P16 agreed that the admin does the best to support teachers within their budgetary restraints. P17 also touched upon the approval of smart rooms in the school by the school leadership. She also conveyed that their institute hosts 'developmental days' for teachers with refresher courses to revise the tools they are already familiar with.

7.8 Recommendations

All teachers spoke from experience and had some interesting recommendations. P1 said that training for teachers should be available at school level, since teachers all over the province of Punjab have to travel to Lahore to get trained at the in-service training institute, which creates logistical issues. He stated:

> "Not everyone can easily travel to another city, and adjusting to a new environment is not easy either. If the training lasts only a week, there is a limit to how much they can actually learn in that time."

P1 also had suggestions regarding the employability of differently abled students. He added:

> "Technology must be integrated into work with special children. If we introduce targeted technologies and arrange specialized courses for hearing-impaired individuals, we can significantly improve their chances of employment. Similarly, physically disabled students can also be trained through different courses to build skills that allow them to earn a decent income. The ultimate aim of special education is to support the rehabilitation and independence of students. This can only be achieved if we focus not just on academic education, but also on building their vocational skills."

P2 also agreed with P1, noting that training for teachers should be provided by each school to make the process smoother and more convenient. He also added that parents need to be more involved at home, since students need emotional and educational support after school hours too. The third participant talked about how schools need to ensure availability of technological equipment and resources. She shared that if teachers are technologically trained but schools have no proper infrastructure, then their training goes to waste as well. P4 also talked about how one central in-service training college for teachers is inadequate, since it puts a lot of pressure on a single institution. He suggested monthly training courses for teachers at their respective institutions, held by field experts, so it can enhance their quality of teaching and confidence. P4 went on to say:

> "There should be a specialized department within the Special Education Department dedicated to technological training. Moreover, I believe the Special Education Department Punjab should not limit its efforts to the province alone. It should collaborate with other provinces to ensure that no region is left behind, and as a nation, we can stay competitive in today's rapidly evolving world."

P5 pointed out that the internet is not accessible to everyone yet in Pakistan. Although it is a developing country, P5 noted that basic facilities should be provided, and this includes internet availability at educational institutes. P7's recommendations were aligned with P5. He said that all apps and tools should be available at schools, just like "the developed world". He explained:

> "This will help learners with mobility, accessibility, and education. For blind children, we should have AI-based smart canes, for physical disabilities we should have robotic wheelchairs. These will facilitate teachers and students alike and improve the learning experience for everyone."

P7 recommended that the government and relevant stakeholders should introduce low cost technology that is easy to use and can be accessible across the country, stressing that the government should "play its role in the facilitation" of resources. P8 suggested better salary packages for teachers and field experts, so they remain committed to their jobs and improve the lives of special needs students. On the other hand, P9 advocated for digital inclusion, saying:

> "I would like to emphasize that while we often talk about social inclusion, it is equally important to focus on digital inclusion. Whether it is social media or AI, persons with disabilities, including those with visual impairments, should be fully included in the digital space. Unfortunately, many individuals with disabilities still lack access to digital tools, and even when they do have devices, they often do not know how to use them effectively."

P10 recommended timely training and support for teachers so they quickly integrate the latest technologies into their learning models. P11 also mentioned that teacher training

could be more elaborate and more frequent. She added that students should be provided with all the necessary tools, such as tablets, computer labs, and other resources to strengthen their learning. P12 acknowledged the massive presence of AI in today's world, and recommended using it actively to improve the educational performance and day-to-day lives of special needs students.

P13 added that teachers can especially benefit from "collaborative and hands-on workshops" where they can learn from each other and share feedback. P14's stance also aligned with P13 when she mentioned the need for interactive workshops and training to make their teaching more effective.

P15 recommended that all classrooms should be equipped with LCDs so teachers can use visual aid to enhance student learning. P16 added that active parental involvement is quite necessary, since they usually do not even learn sign language to communicate with their children.

7.9 Regional Differences in Technology Access

12 out of 17 teachers discussed how technology access differs across regions in Pakistan. P1 explained the differences in technology access in the following quote:

> "There is a huge gap in technology access and ease of use between schools in Central Punjab – like those in Lahore, Gujranwala, Faisalabad, and Rawalpindi divisions – and schools in South Punjab, such as Multan, DG Khan, and Bahawalpur. Some teachers in rural areas still do not even have access to basic technology. I remember one of my colleagues from DG Khan had to buy an Android phone only after moving to Lahore, and we helped him learn how to use it. So yes, teachers in different regions have very different levels of exposure to and familiarity with technology."

P2 noted that there is a significant disparity in technology adoption across schools in different regions. He mentioned that he has trained teachers from remote areas when they visit Lahore for training, and they were not even familiar with mobile phones and laptops. They are used to teaching entirely manually, as their institutions provide no technology access. P3 agreed that teachers in urban schools quickly learn and implement new technologies, while in rural areas it is difficult to adopt technology due to limited technological access and scarce resources. Similarly, P4 mentioned his experience of working at a school in a less developed locality. He noted that his current school has significantly better "infrastructure, accessibility of assistive tools, and the overall quality of teaching staff". P5, who has previously taught at schools in South Punjab – which is a relatively underdeveloped region, commented:

> "My current school is significantly better than others when it comes to accessibility of technological tools. In many other schools, especially those located in backward areas or in South Punjab, such resources are not readily available. Both teachers and students there face far greater challenges

> in using technology than we do here. That is why I believe it is important to place more focus on these areas. I personally belong to South Punjab and have taught in schools there, so I have seen firsthand the contrast between schools in that region and those in cities like Lahore. There is a major gap in accessibility that needs to be addressed."

P6 mentioned that she has visited other schools as part of training sessions and commented that "government-run institutions lack a lot of resources, especially technological, compared to private and trust schools". P7 added that students who come to Lahore from rural areas have no understanding of technology, and it takes some time for them to get the hang of things, alluding to regional disparity in technology access. The 10th participant added that her current school has better technology available than any other school she knows of. P15 related her experience with regional differences in technology access in the following quote:

> "I previously worked in government schools before 2011. At that time, technology was non-existent in those institutions. As you know, technology has taken center stage after COVID, and if I compare this institution with public schools now, I'd say this is way ahead in terms of tech adoption and accessibility. Funding is easily available to private schools, and there is a check and balance/accountability by donors."

The 17th participant also alluded to huge differences between technological access across different areas. She mentioned that before joining her present school, she was employed at a government school, and while the government "might have been providing resources on paper", they were actually not accessible. She added:

> "For instance, there were computer labs, but no computers. We had to rely entirely on traditional teaching methods. In comparison, my current school is one of the best in terms of special education and the use of technology. Students here are facilitated in every possible way. We have psychologists, speech therapists, art instructors, and other specialists available. In the government school, there was no proper system in place."

7.10 Motivation for Technology Use

All participants discussed what motivated them to use technology. The first participant said that if technology is interesting and supports his pedagogical approach, he makes an effort to learn it. He commented that he doesn't hesitate to learn new technologies, even if they are not entirely useful to him. However, P1 noted that some people tend to hesitate when a technology might create problems, referring to the biometric attendance system that marks teachers late if they reach even 5 minutes late. The second participant, who was visually impaired himself, shared:

> "I am motivated about using technology because it is designed to help people like me, and I want to impart that knowledge to my students who face similar visual struggles. I won't say I'm hesitant about using it."

P3 mentioned that if a new technology is introduced, she is automatically inclined to learn how it works. While P4 discussed how "healthy competition" among teachers is motivating when it comes to integrating new tech. He mentioned that in a school of 12 teachers, if 4 to 6 are actively taking the initiative to incorporate technology, it naturally creates a "sense of competition". So, the desire to be "among the 'good teachers' who are using modern methods" is a great motivator. P6, on the other hand, mentioned how accessibility of technology plays a major role in motivation. She said that educational systems must evolve, and teachers and students both should have access to resources. Internet availability is limited in many areas presently, which is a major contributor towards tech motivation according to P6. She also added that motivation comes from within. If a teacher is sincere with their profession and dedicated to their students, they will pick up any tools that improve student outcomes. In her own words, she said:

> "I think student response is the best motivator. Other than that, the dedication of the teacher will always motivate or demotivate them."

P7 shared that teachers who have some know-how of technology are mostly motivated to use it, and hesitation usually stems from resistance to change and wanting to maintain the status quo. P8, a teacher at an NGO school, commented:

> "I genuinely like helping these students. What motivates me the most is knowing that if they learn computer skills, they will be able to compete with their sighted peers. However, there are times when I feel I should be more competent with technology myself."

Similarly, P9 mentioned how rapidly the world is advancing, and technology integration has become inevitable, which means it can no longer be avoided. She added how visually impaired students needed to be part of the "digital inclusion". P10 acknowledged that technology makes the job of teachers significantly easier. She referred to Duxbury, a braille translation software, and without that teachers would have to manually type worksheets and exam papers in braille. How technology makes their job easier becomes a great motivator, as per P10. Similar to a few other participants, P11 added that anyone with genuine passion can learn technology. P12 also had the same thoughts regarding motivation to use technology, and she commented:

> "The first factor is interest. If you are interested in using technology, you will pick things up more quickly. Secondly, the support and encouragement provided by the administration play a crucial role in how effectively you can learn and use technology. Additionally, if a technology proves to be effective and delivers positive outcomes, we are more likely to incorporate it into our teaching."

P13's thoughts aligned with other participants, as she mentioned technology provides opportunities for development of new skills, and it also improves students' engagement. These act as good motivators for technology use. However, she mentioned that technical issues and insufficient training can result in hesitance at times. The 14th participant mentioned that she loves to learn new things, which acts as a motivator and pushes her to absorb the latest concepts in her field. P15 also agreed that technology helps special students to thrive, which motivates her to use it. The 16th participant added:

> "I genuinely enjoy teaching speech, helping students learn how to talk, and I feel especially motivated to use any tools that support this process. I even create many of the models myself and am always exploring ways to integrate technology into my teaching practices."

The 17th participant also agreed with the sentiment that motivation to use technology stems from the desire to teach her students, prepare them to move confidently in society, and to make sure they know how to utilize technology positively.

7.11 Technology Use

This section explores how teachers engage with digital tools in special education environments. The section is divided into two subcategories: Challenges in Integration and Types of Platforms.

7.11.1 Challenges in Integration

15 out of 17 teachers shared their experiences about challenges when it comes to technology integration. P1 mentioned that the student to teacher ratio in schools is an important factor. Many students struggle with behavioral challenges in schools for the intellectually disabled, and this makes it difficult for teachers to handle them effectively. While international standards suggest a teacher to student ratio of 1:3, P1 commented how Pakistan has a shortage of staff and one teacher is responsible for "10, 20, or even 40 students in a class". He further added that even using a projector to show visual aids becomes hard in such a setting, since class discipline is compromised at times. Time constraints were another challenge in technology integration mentioned by P1.

The third participant explained that lack of resources make it challenging to use technology. She mentioned how good schools in Lahore have LEDs for students to study with visual aids, but in smaller cities like DG Khan or Rahim Yar Khan, these tools are not available easily. Similarly, in some areas of Punjab, internet access is also a hindrance. She recalled that during Covid, students had to attend class online and she was unable to reach a few students because they had no internet back home. P3 also mentioned how she is trained in a few technologies but they are not available at her school, which in itself is a barrier in technology integration. P4 had similar thoughts and he commented:

> "If I were to count the challenges on my fingertips, the first would be the lack of adequate resources for teachers. Secondly, many institutions do not have proper internet access. Third, there is a gap in teachers' training when it comes to using technology effectively. Fourth, the socio-

> economic background of most students makes it difficult to familiarize them with technological tools."

P5 agreed with the other participants regarding challenges in integration, noting particularly how power cuts and short circuits affect the use of technology in classrooms. She also added that teachers have to make do with the resources they have at hand, which hinders proper technology adoption. P6's opinion was aligned with the others, who mentioned inadequate internet access as a huge challenge in technology integration. Her exact statement was:

> "The weak internet is the biggest hindrance. For example, if the school internet isn't working, and my mobile data runs out, my digital lecture gets disrupted. So I'd say infrastructure issues are the biggest challenges when using technology."

P7, a visually impaired teacher, gave a personal example about challenges in technology integration. He observed that data analysis programs like SPSS and Nvivo are not compatible with screen readers, so after trying to use them for quite some time, he had to give up because of lack of inclusivity and accessibility. He also pointed out concerns about power outages like the other participants. P7 mentioned that some students have no prior knowledge or experience with technology because of lack of availability at home, which makes it difficult to integrate technology in classes since these students are quite daunted by the prospect. P9 also chimed in that power cuts are a big hurdle when it comes to effective technology integration, and P10 commented that sometimes students without sight find it hard to grasp computer settings, which makes it difficult to use technology.

Likewise, P12 reiterated the same issue in the following statement:

> "There is a lack of access to technology. Some students do not have any access to technology at home. So even if we teach them how to use a tool at school, they cannot really use it outside. Many students cannot afford a mobile phone or internet. Affordability and access are big issues. Also, many parents do not know how to use braille or help their children at home."

P13 mentioned that expensive paid apps which are useful for special needs children yet inaccessible to most Pakistani teachers create challenges in integration. Additionally, she referred to technical glitches in the system and internet connectivity issues as hurdles. Participants 15 and 16 also agreed with connectivity issues and technical errors in computer systems creating challenges in technology integration.

7.11.2 Types of Platforms

In this subsection, teachers mention the kinds of platforms they use in classes for special education. P1 noted that there are no specific apps or tools targeted towards children with intellectual disabilities. They have to use the same tools used in general education, which includes computers and projectors. He further explained:

> "There isn't any tool or application to help develop individualized educational plans for these students in a time-saving way. Teachers have to work with the limited resources that are meant for regular students. Even applications that allow you to download flashcards for teaching are often paid, so they are not easily accessible. As a result, teachers have to design, print, and laminate flashcards themselves, and they also have to create their own worksheets and workbooks. While some apps can be downloaded, most of the good content is paid."

However, P1 mentioned that he uses all the tools at his disposal for his students, including computers, LCDs, projectors, as well as his personal phone and laptop. P2 shared that assistive technologies like white canes, braille, speech-to-text software, and screen readers are available in his institutions, and they are provided by most special institutions in the province of Punjab. P3 commented that she uses mainly hands-on teaching, and for autistic children, she utilizes TEACCH and PECS methods, along with other tools depending on the severity of the disability – whether it is mild, moderate, or severe. She mentioned that she uses multimedia mostly, making the learning experience more engaging for her students, as well as a mobile phone or laptop occasionally.

P4 said that if students with visual impairment need a laptop or computer for their learning, teachers are there to guide them with assistive technologies like screen readers, which are easily downloadable from the internet. Another useful website he mentioned is blindhelp.net, which assists students with screen readers like JAWS or NVDA. He added that he uses AI as well, in addition to braille for both personal and professional needs. Similarly, P5 had a similar statement:

> "It depends on the type and level of disability. For example, with visually impaired students, we use assistive technologies that enhance their listening abilities, such as speakers. Since they cannot see, tools like slides and projectors are not useful, so we rely on audio-based methods instead. For hearing-impaired students, we focus on visual aids. However, projectors are not commonly used in schools due to limited resources. So, as teachers, we create realistic handmade models for students to identify, or we draw visuals and even arrange educational visits. I personally feel that projectors should at least be available to help provide visual support to students. Even when projectors are not available, computer labs are still accessible."

P6 commented that visually impaired students are equipped with white canes either by schools or via donors. Additionally, digital compasses and screen-reading software are also used. She added that these tools are quite common in special education schools. P6 commented that they use maximum technology that is accessible to assist students, teaching braille and orientation and mobility from the start of school. The 7th participant was in agreement with P6, and added:

> "For students with visual impairment, we use braille technology. For that, we provide a braille frame and stylus, and we have a few Perkins braillers available as well for older students. However, that is expensive so we don't have Perkins braillers for all students. For hearing impaired students, we use visual aids like flashcards, multimedia, and videos to offer them interactive learning and a hands-on learning experience. I wouldn't say the digital tools are too advanced in Pakistan for now, just multimedia, audio and video, and braille."

P7 further mentioned that being visually impaired himself, he uses his laptop to prepare online lectures and delivers them via multimedia. Explaining his classroom dynamics further, he said:

> "I give them soft copies of notes and class materials, and my students use screen readers to access them. We also encourage students to take exams however they're more comfortable, either on paper with braille or they can type it out on their laptops."

P8 acknowledged that their institution has an embosser, which is a special printer for braille textbooks. Students and teachers can access multimedia tools, and low vision students are given special glasses that can enhance their vision. She also mentioned using JAWS and NVDA software. P9 shared that her institution has computer labs equipped with JAWS and NVDA for accessibility by visually impaired students, and they use the Perkins Brailler in classes for writing in braille. Additionally, she said that they use frames, white canes, and computers. She also mentioned that the school has IrisVision, an assistive device for individuals with retinal issues, including degenerative disorders like macular degeneration.

Describing her school structure, P10 commented:

> "We do not keep all tools in the classrooms; instead, they are placed in separate designated rooms. Each room – like the model room (with stuffed animals), the computer lab, the language lab, and the music room – has specific days when students visit. The computer lab is used more regularly, while the others are accessed as per schedule. Students attend their regular classes in the classrooms, but for practical learning, they go to these specialized rooms. Braille tools like the Perkins Brailler are available in the classrooms. If teachers need to play audio content, they can use their phones, and for multimedia use, we set up the equipment in the library whenever required. We even have software called Duxbury that translates text into braille."

P11 and P12 emphasized the use of technology for visually impaired students, noting that they use smartphones and computers. P12 shared that she uses Duxbury, Braille Blaster,

and ChatGPT to teach mathematics. She said she develops tactile sheets, and uses a fraction kit to teach students fractions. P12 further elaborated:

> "In Orientation and Mobility, the cane is essential. For self-betterment, we use original models, and we also have a model room for that purpose. Additionally, we have tools in the recreation and exercise rooms. For advanced students, some of them use apps like Seeing AI, Be My Eyes, and other similar software. In addition to the tools mentioned, I also use screen readers like JAWS to assist with teaching."

P13 added that she uses Gemini and IXL for teaching intellectually challenged students, since it gives her new and creative ideas for lessons. She said that they save time since she doesn't have to make old-school notes. P14 commented that she mostly uses her tablet since the screen is bigger than a smartphone and she can easily show visual aids in class. P15 also confirmed that she uses a laptop and sometimes her mobile phone, mostly making use of visual aids. P16 detailed her school's use of technology platforms in the following statement:

> "Different teachers here are trained in different tools and skills, depending on their roles. We use different technological tools such as LEDs, and we have a computer lab upstairs where we also conduct art classes, according to a set timetable. For speech lessons, we use FM systems to improve the hearing ability of students who are hard of hearing. These systems help them pick up sounds more clearly, which gradually support their speech development. We also have iPads, specifically provided for teachers to aid student learning. For example, when teaching rhymes, we play the video and use gestures to help students understand and engage. Hearing-impaired students require a lot of individual attention. They already find learning more challenging, and when we introduce abstract or imaginative content, it can sometimes confuse them even more."

P17 also reiterated that she personally uses a laptop to make lesson plans, design worksheets, and conduct activities with students. She also uses the laptop or multimedia as a visual aid for students whenever needed.

7.12 Willingness to Adopt Technology

This section discusses participants' attitudes towards adoption of technology, as well as the factors that influence them to accept technological change. P1 said that if he feels confident about using a specific technology, he is willing to integrate it into his teaching. However, if he feels uncomfortable with a tool, he tends to avoid teaching it, as the lack of familiarity can be discouraging. P2 mentioned that students belong to Gen Z, so they are very accepting of technology but its teachers that need to brush up on their technological skills. He noted that older teachers find it harder to incorporate assistive technologies because they are usually not tech savvy. P2 added that he teaches braille

courses for teachers who aspire to join special education, as well as parents, and he categorized it as the most difficult assistive technology to learn. He also added that confidence impacts willingness to adopt technology, an opinion that was common across all participants.

Participant 4, a visually impaired teacher, said that he relies on technology since it greatly minimized the challenges of his disability. Hence, he is always willing to adopt technology even when it seems too complicated at times. However, he added that more experienced teachers are at times hesitant to adopt technology because it shakes up the status quo and they are often resistant to change. Meanwhile, P5 noted that sometimes the willingness to take up technology reduces because of constant power outages that disrupt lessons and waste time. P8 added that sometimes she slows down if new technology feels overwhelming, but she does not give up just because it takes time to learn. P9 shared similar thoughts. P10 mentioned that technology is a necessity in the modern world, so everyone should implement it so students can benefit as much as possible. P11 had the same opinion, noting that whenever a new technology is introduced and it is deemed valuable for students, teachers learn it and incorporate it into learning models.
The 12th participant added:

> "We should use more technology in special education. I have taught many things to my students with the help of technology at the initial level. That is why I think all teachers should use it, and it should be available in every classroom. It helps make teaching easier and more interesting. There are so many tools we can use for this."

Participants 15 and 16 both agreed that they actively seek out knowledge, so they are open to adopting technology when it is newly launched. Confidence in their skills also increases willingness to use technology.

8 Discussion

This chapter discusses the main findings of the thesis in reference to the research question and current literature. The results are interpreted with the intention of understanding how special education teachers in Pakistan perceive and adopt technology in their instructional models.

8.1 Interpretation of Findings and Comparative Analysis with Past Literature

Firstly, the demographic data of 17 interview participants, who were teachers at special education institutions in Lahore, Pakistan, was collected and listed to identify similar traits of individuals from literature and compare actions and perceptions accordingly. This study had 4 male participants, 3 of whom were visually impaired themselves. Of these 4 male participants, 2 had teaching experience spanning over a decade, while 1 of them joined the field under 10 years ago, and 1 did not mention his years of teaching. 3 male participants cater to students with physical disabilities, while 1 of them teaches students with intellectual disabilities. All 4 men taught in public schools for special education. None of the male participants disclosed their educational background, but all of them have at least a bachelor's degree, which is a requirement to join the teaching profession. 13 of the 17 participants were women, with 6 of them having an experience of under 10 years, 6 with over 10 years of teaching experience, and 1 who did not reveal her years in the field. 2 of the female participants taught students with intellectual disabilities, while 11 catered to physical disabilities. 9 out of 13 women who participated in the study had master's degrees, while the remaining 4 had at least a bachelor's. Lastly, 3 female teachers belonged to the public sector, 4 worked at NGO-based special education schools, and 6 female participants were from the private sector.

This study identifies Institutional Funding, Institutional Support, Peer Collaboration, Self Learning, and User Interface as facilitators of technology use. A majority of interview participants (11 out of 17 participants) agreed that institutional support is a significant facilitator of technology use. Participants pointed out the availability of a central training institute for teachers at the government level, which provided adequate training sessions whenever a new technology was introduced and needed to be rolled out across special education schools. However, participants agreed that having training sessions individually at schools was very important. We also noticed that only public school teachers are reliant on the central training institute, while private and NGO-based special education teachers have trainers and support staff on campus. The need for institutional support as a facilitator of technology use was validated by Fernández-Sánchez et al. (2022) as they reported empirical evidence that teachers lack knowledge and adequate training, and Fernández-Otoya et al. (2024) also mentioned that basic education teachers have a low level of digital literacy. This is where institutional support is important, because training and professional development of teachers is the primary responsibility of associated institutions.

Similarly, this study indicates how teachers were reliant on peer collaboration and support as a facilitator of technology use. Many teachers mentioned that they would ask their peers for help if they were confused about different concepts, more experienced teachers would demonstrate the use of technology to new colleagues, and peers would support visually impaired teachers when they got stuck with different applications or software. 8

interview participants talked about peer collaboration, and all of them had positive experiences. Peer support is an important theme in academic literature as well. Wohlfart & Wagner (2024) mentioned peer support as one of the external factors that led teachers to accept technology in the workplace during the Covid-19 era. Fernández-Sánchez et al. (2022) also touched upon this theme, noting the lack of mentorship for teachers when it comes to developing technology-led learning models, and limited availability of peer support and collaboration to promote technology adoption. Timotheou et al. (2023) also discussed how teachers need encouragement by peers to reduce the barriers to ICT. Surprisingly, there were no mentions of institutional funding, self learning, and user interface as facilitators of technology use in the literature reviewed for this thesis.

Moving on to infrastructure, 4 participants alluded to the lack of adequate infrastructure in Pakistan's special education schools. A teacher of intellectual disabilities complained that his institution did not provide proper software or tools that were specifically targeted to complement intellectually disabled students, and most programs have expensive membership fees so they are not accessible to teachers. Other teachers pointed out the lack of financial resources that result in poor school infrastructure, which creates learning and mobility challenges for students with special needs. This feedback was validated by Sajjad Hussain et al. (2020), who mentioned the limited infrastructure capacity of inclusive schools in Pakistan. Similarly, Muzafar Hussain & Nasreen Akhter (2025) also observed that special education schools in South Punjab, Pakistan were saddled with insufficient infrastructure, referring to the lack of computer labs and libraries, mostly due to budgetary constraints. Barakabitze et al (2019) also cited monetary constraints as the reason African schools were experiencing deficient technology infrastructure. Hussain et al. (2022) also referred to poor infrastructural capacity at Pakistani special education schools, which is one of the reasons many students drop out eventually. Pirzada (2023) acknowledged that special education institutions in Pakistan lack proper equipment to cater to different disabilities, which impacts the students' ability to function properly in general or inclusive environments.

Next, we explored whether teachers were intrinsically motivated to join special education as a career, or were their motivations extrinsic. A large majority of teachers pointed out intrinsic motivation for joining this field. Some of them had experienced a disability themselves, which made them champions for the cause and they wanted to improve lives of special needs students, while others had witnessed special needs children in their life being ignored by schools and their parents, which resulted in these teachers choosing their current path. Others see it as a humanitarian effort and a moral responsibility to help marginalised sections of the society. The results of this study were in line with Yasmeen et al. (2019), who mentioned that teachers are mostly motivated intrinsically to enter the field of special education. Yasmeen et al. (2019) listed factors such as feeling a sense of fulfilment by helping special students, self-motivation, feelings of achievement by following a gratifying profession, and seeing special education as a noble career path that motivated teachers intrinsically. Alternatively, very few teachers in this study mentioned extrinsic motivators for joining the field of special education, citing better compensation, gazetted government posts, and merit selection. However, this contradicts with the research of Yasmeen et al. (2019), who mentioned that salary packages are not attractive for special education teachers, and promotion in government ranks is really hard to come by.

Referring to inclusivity, participants in this study mentioned how technology develops inclusive learning opportunities for students with disabilities by offering visual and audio aids, multimedia lessons, and using computers and smartphones with screen readers like JAWS and NVDA. The participants mutually agreed that technology increases student engagement, strengthens learning outcomes, helps them catch up to general education peers, and makes life easier for them. This is in line with Sarker et al. (2019), who wrote that technology bridges the gap between traditional and modern learning approaches, as it boosts inclusivity in education. Digital technology meets the needs of students and removes hindrances in education. Similarly, Altinay et al. (2024) added that technology can be used to personalize education and tailor the learning models to remove educational gaps and address the challenges of disabled students.

Building on this, the next theme explores how the perception of usefulness impacted teachers' adoption of technology. There was a unanimous agreement among interview candidates that technology is extremely useful in special education. It provides "meaningful opportunities" to disabled students, makes learning fun and engaging, helps them memorize concepts that would otherwise be difficult to theorize without sight or sound, and offers a way to be at par with the world. The work of Scherer et al. (2019) is in line with these results, as the authors emphasized that perceived usefulness of technology has a significant influence on the intention to adopt technology. In lieu of that, Scherer et al. (2019) recommended that teachers' training and professional development should stress upon the usefulness of technology, since perceived ease of use and perceived usefulness, as well as the attitudes toward technology, shape the intention to integrate technology. Chua & Yu (2024) also confirmed that perceived usefulness is one of the main factors that impact the adoption of technology by students and teachers alike. E. Carpenter et al. (2023) agreed that teachers who believe in the perceived usefulness of technology are more likely to have an open mind about integrating technology in their classes.

Another significant theme that emerged was the impact of technology on student engagement. 11 out of 17 participants in this study agreed that technology increases student engagement, makes classes fun and enjoyable, raises attention and learning spans, and makes education more accessible for disabled students. Similar findings were discovered in the reviewed literature as well. For instance, H. Akram et al. (2022) discussed how technology-based teaching increases classroom engagement and adds to knowledge and information retention. Similarly, Sarker et al. (2019) added that technology removes instructional barriers and focuses on meeting the needs of students. Fahimirad & Kotamjani (2018) also noted that AI could be used to make content more engaging for students, meanwhile Sırakaya & Alsancak Sırakaya (2022) mentioned how technologies like augmented reality increases interactive learning, boosts student engagement, and helps them visualize abstract concepts for better learning. Likewise, Lampropoulos & Kinshuk (2024) talked about extended reality (XR) technology that offers a continuous learning model which is engaging, enjoyable, and motivating for students.

Another important theme in this study is the role of government policies in special education. Most participants in this study were of the opinion that policies in Pakistan regarding special education must be improved. The participants observed that if policies are in place, they are either too unrealistic to implement, or they do not match the ground realities in Pakistan and need to be adjusted. Moreover, participants discussed how policy

implementation in the country is abysmal, with no accountability and transparency by the government. In the current literature, Muzafar Hussain & Nasreen Akhter (2025) observe that Pakistan is one of the countries that suffers from ineffective policy implementation and enforcement in the domain of special education. While the government provides basic monetary allowances, transport, and textbooks to special needs schools, it needs to address staff shortages, inadequate curriculum, and poor infrastructure across public schools for the disabled.

Challenges in technology integration was another theme common in literature and this study. Teachers mentioned that lack of equipment available at schools, power cuts, inadequate infrastructure and school buildings not being disability-friendly, bad internet connectivity, and students not having access to technology or parental support at home were the main hindrances in technology integration. In line with these results, Pirzada (2023) reflected on the many challenges that Pakistani special education institutions are facing. The author mentioned improper curriculum for disabled students, inefficient teaching approaches, and lack of equipment as the main challenges faced by special needs schools. Pirzada (2023) also explained how classrooms are built without keeping special needs individuals in mind, since some visually challenged students cannot focus on the instructions if they are seated too far from the front of the class, while some hearing impaired students are prohibited from recording lectures, which makes it difficult for them to keep up with the course content. The school campuses are also not disability friendly, since they have stairs, while most disabled students could benefit from elevators and ramps.

To summarize, comparing the major findings of this study to previous research underscores the multifaceted nature of technology adoption in special education. While some patterns were consistent, others needed contextual understanding and further reflection.

8.2 Insights on Perceived Ease of Use in Special Education

This section focuses on the results of this study pertaining to perceived ease of use and the insights related to Pakistani special education institutions. Perceived ease of use was broken down into the following subcategories: Confidence, Learning Curve, Simplicity of Technology, Technical Support Availability, and Usage of Tech in Daily Life. This section will discuss the main findings regarding perceived ease of use in reference to the research question and current literature. The research question focuses on the influence of perceived ease of use on the intention of special education teachers in Pakistan to adopt technology.

The first category is confidence. All 17 participants acknowledged the role confidence and the consequent self-efficacy play in making technology easy to use. Most teachers referred to their technology skills being at par with the requirements of their role, and they take regular training sessions and collaborate among peers to keep themselves updated. All of them agreed that the more confident they are in their technology skills, the more willing they are to integrate it into their instructional models. Timotheou et al. (2023) mentioned that underconfidence in their computer skills is one of the factors that impacts the uptake of technology among teachers. Surprisingly, no other literature that was reviewed mentioned confidence as a determinant of perceived ease of use of

technology. Further research can be conducted on the relationship between teacher confidence and perceived ease of use of technology.

The second category is the learning curve. There was almost unanimous agreement among participants of this study that the learning curve improves the perceived ease of use of technology. Learning curve refers to how teachers build their skills over time, through trial and error, training, and continuous learning. All teachers who were part of this study acknowledged that learning a new tool or technology is a gradual process which takes time to perfect. The visually impaired teachers who were interviewed commented that they have been learning and using assistive technologies ever since they lost their sight to different tragedies in their youth, and now they have perfected their grip on assistive technologies like braille, white canes, screen readers, and screen-to-text software. Teachers also emphasized how training and peer support help them learn new tools in an average of 2 to 3 weeks. Some teachers added that they felt like technology was difficult in the beginning, but over time, their opinions have shifted and with practice they have gotten better. After an exhaustive search, it is apparent that the learning curve has not properly been studied as a factor influencing the perceived ease of use of technology in literature. This is an opportunity to study this topic extensively and this paper can contribute to future research regarding learning curves in this context as well.

Another key theme identified in this research is the simplicity of technology as a contributor to perceived ease of use. Six interview participants discussed the simplicity of technology. One of the participants mentioned how digital assistive technologies (AT) are easier for new teachers to grasp, yet manual and older ATs like braille seem difficult for them. This is because digital technologies are familiar, there are lots of online tutorials, and they are quick to understand because most teachers use technology in everyday life as well. Another participant talked about how more complex technologies require more training compared to simpler ones, and if given the choice between similar technologies but one is simpler to use, they would pick the simpler one because of ease of use. Teachers also mentioned that learning simpler apps like Microsoft Word was easy, yet getting the hang of Microsoft Excel and ERP was more time taking and confusing. Aligning with this concept, Chua & Yu (2024) talk about Metaverse as a learning environment, and how it can potentially be accepted or rejected as a teaching model based on ease of use and perceived usefulness. Apart from this one paper, no others mentioned simplicity of technology as a factor that impacts perceived ease of use. Upon more research, no concrete papers were found to support this theme. This represents another gap in literature that could be addressed in the future, using the findings of this study as a stepping stone.

76% of participants in this study agreed that technical support availability is a determinant of perceived ease of use of technology. Teachers discussed the availability of training at provincial-level and centralized at the government level, yet they were of the opinion that each school should have training facilities at their campuses, to reduce logistical roadblocks. The teachers at private and NGO-based schools had training sessions at their individual campuses, unlike public schools. Participants also said that computer experts at schools are available to guide them through any hurdles while using technology, and schools offer refresher courses on different softwares that are frequently used. The participants agreed how useful technical support is to their knowledge and consequent integration of technology, since it increases ease of use. In the current literature, Siyam (2019) mentions how EdTech integration is hindered because teachers do not have dedicated time for training and professional development, in line with our findings.

Fernández-Sánchez et al. (2022) also list lack of training as a reason for low digital competence, which in turn affects technology adoption. Fernández-Otoya et al. (2024) pointed out low digital skills in teachers and credited it to inadequate and short training courses which don't serve their purpose. Timotheou et al. (2023) added that to combat barriers to technology integration, it is important to provide technical support to teachers and offer them training on modern learning models. The literature is in line with our results, which suggest that technical support availability will boost ease of use.

The last subcategory in this section is Usage of Tech in Daily Life. The idea behind this category was that everyday exposure to technology inherently increases the digital fluency of users, which results in them perceiving new technologies as easier to use. All interview participants mentioned using social media apps including Facebook, Instagram, and WhatsApp, using smartphones, laptops, and tablets in their personal lives. Those participants who were visually impaired shared that they use braille, screen readers, and speech-to-text software to make their lives more convenient, also adding that they utilize platforms like Be-My-Eye for mobility. The theme of familiarity with technology of digital fluency and its impact on perceived ease of use has not been extensively researched, and it is a gap in the literature which could be bridged by future researchers.

8.3 Contribution to Literature and TAM

This study has revealed some notable gaps in existing literature. First and foremost, this paper focuses on perceived ease of use and its influence on special education teachers in terms of technology adoption. The existing literature focuses mostly on TAM and its variables in general education rather than special education. If the research parameters are narrowed down more, there is no concrete literature on perceived ease of use in the Pakistani context, whether it is general education or special education. This study has divided perceived ease of use into five subcategories to understand the subject deeply, which adds enriching details to the current literature. Moreover, three subcategories of perceived ease of use – Learning Curve, Simplicity of Technology, and Usage of Tech in Daily Life – are largely underexplored in the literature, in both global and local Pakistani context. This paper gives future researchers a good starting point and many gaps that they could potentially bridge. Moreover, TAM and its extended models are usually described by variables such as perceived usefulness, perceived ease of use, subjective norms, voluntariness, and social influence. However, this paper has broken down perceived ease of use into five categories which could be individually studied and the overall literature on TAM could also be enriched.

This paper also discusses elements like self learning and user interface, which act as facilitators of technology use according to several interview participants. The literature available on these factors as facilitators of technology use is quite sparse as well, which means this paper adds to the discussion and acts as a stepping stone for future researchers. Another contribution of this study is the insights into types of technology platforms used in Pakistan's special education institutions. For now, the current research mostly touches upon the lack of infrastructure and accessibility within the country, but none of the papers delve into which technologies are being utilized on the ground level in Pakistan. These include assistive technologies white canes, braille, Perkins Brailler, Duxbury, cochlear implants, hearing aids, screen readers, speech-to-text software, and more.

Lastly, this paper investigates the motivation of special education teachers to adopt technology, as well as insights into the willingness to adopt technology. These factors have been studied in the context of general education quite extensively, but in special education, the research remains thin. Specifically in the Pakistani context, a handful of papers about technology in special education are published, and none of them focus on the motivation and willingness of teachers in Pakistan to adopt technology in this field. This work extends the current body of knowledge and provides a foundation for future research.

9 Conclusion

This study set out to explore the influence of perceived ease of use on the intention of special education teachers in Pakistan to integrate technology into their teaching practices. The primary findings related to perceived ease of use were divided into five categories: Confidence, Learning Curve, Technical Support Availability, Simplicity of Technology, and Usage of Tech in Daily Life. A majority of interview participants confirmed that the higher their confidence in their own technological skills, the easier it is to integrate technology into their instructional models. Teachers also acknowledged that more confidence in their own technological knowledge increased the willingness to adopt technology. Secondly, almost all participants mentioned the learning curve as one of the determinants of perceived ease of use. The insights from interviewing special education teachers reflected that most of them found technology difficult to use when it was first introduced to them, but over time, with practice, training, and experience, they got the hang of it and now utilize technological resources and assistive technologies in their classes. Due to the learning curve, perceived ease of use of technology increases.

In addition to that, technical support availability is one of the identified factors that positively influence perceived ease of use. All participants agreed that the availability of technical support at campuses, training sessions, and the government in-service training college for special education teachers aided their understanding of technology, which in turn led to higher integration of technology in classrooms. The existing literature also discusses the impact of training and support on perceived ease of use of technology, further validating the results of this study. Moreover, the participants of this research indicated that the simplicity of technology allows them to learn it quicker, and thus implement it easily, while more complex technologies require extensive training and the time to roll them out across the school increases. This is another factor that influences the perceived ease of use, and thus shapes the intention of special education teachers to integrate technology in their classes. Moreover, the theme of Usage of Tech in Daily Life was assessed as a driver of perceived ease of use. This is because the more people use technology in day-to-day life, the more digitally fluent they become, which impacts perceived ease of use of technology. It is important to note that while current literature supports that confidence and technical support availability are determinants of perceived ease of use, the themes of learning curve, simplicity of technology, and usage of tech in daily life require in-depth investigation by future researchers.

The study also revealed ancillary findings, which, while not directly answering the research question, warrant consideration. First, the interview results identified multiple drivers that facilitate technology use. These include institutional funding, institutional support, peer collaboration, self learning, and user interface. Institutional funding and institutional support refers to allocation of proper budget, infrastructure, and training that makes it easier for teachers to access, learn, and implement technology in their classrooms. Most participants agreed that institutional support is crucial as a facilitator of technology use, since teachers independently do not have access to enough resources to integrate technology. Both of these factors (instituional funding and instituional support) were supported by relevant literature, validating the presented results. Similarly, prior studies are also consistent with the theme of peer collaboration as a facilitator of technology use. The more support individuals receive from their colleagues, the easier it is for them to learn and accept technology. However, self learning and user interface as drivers of technology use were not sufficiently investigated by researchers. Our data

suggests that many teachers learn about new tools and technologies by themselves, by watching tutorials online or trial and error. Some teachers confirmed that they self learn and have never received formal training, and if they are stuck, they consult with peers until the problem is resolved. However, self learning as a facilitator of technology use has not been fully explored in the past literature. Similarly, four participants identified user interface as a facilitator of technology use, noting that they are quick to adopt tools and apps that are user-friendly and easy to navigate, while complex interface makes accessibility difficult. Prior research on user interface as a facilitator of technology use is still in its infancy, and it could be explored thoroughly in the future.

The participants of this study are special education teachers, who are central to the field, and their recommendations carry significant weight. Most teachers agreed that training for public special education teachers should not be carried out at the central level, where one in-service training college is responsible for training teachers throughout the province of Punjab. This creates logistical issues for teachers who do not reside in Lahore, and short training seminars are at times insufficient. They suggested that teachers should be trained at their respective schools by a team of experts, which promotes continuous learning as well. The participants of this study also pointed out that in order to improve the educational environment in Pakistan, the government must provide basic facilities such as internet connectivity, electricity, and proper school infrastructure suited for special needs. Currently, Pakistan faces power outages regularly and most rural areas do not have internet access, which greatly hinders technology-based learning. Another recommendation by the teachers was for the government and relevant stakeholders to introduce low cost technology which could be widely implemented in Pakistan without budgetary limitations.

Teachers also suggested that each special education institution must have ‘smart classrooms’, with LCDs and multimedia projectors available so teachers do not have to wait for the computer lab to be available in order to teach with visual and audio aids. Lastly, the participants observed how most government policies for special education imitate foreign policy guidelines, which are unrealistic and unimplementable in the local context of Pakistan. They advised that the government must ground their policies in reality, understand the plight of lower and middle income people, and connect with special education teachers and experts to gain insights on the field so realistic and feasible policies are developed. The participants questioned the implementation of current policies regarding special education as well, noting that they are just gimmicks to appeal to the public, and the current state of affairs is rather abysmal and unchecked.

To conclude, this thesis emphasizes the importance of perceived ease of use in the adoption of technology by special education teachers in Pakistan, while paving the way for further research in the identified determinants of perceived ease of use.

References

Abel, V. R., Tondeur, J., & Sang, G. (2022). Teacher Perceptions about ICT Integration into Classroom Instruction. Education Sciences, 12(9), 609.

Adeoye-Olatunde, O. A., & Olenik, N. L. (2021). Research and scholarly methods: Semi-structured interviews. JACCP: Journal of the American College of Clinical Pharmacy, 4(10), 1358–1367.

Ahmadi, Dr. M. R. (2018). The Use of Technology in English Language Learning: A Literature Review. International Journal of Research in English Education, 3(2), 115–125.

Akram, B., & Bashir, R. (2012). Special Education and Deaf Children in Pakistan: An Overview. Journal of Elementary Education, 22, 33–44.

Akram, H., Abdelrady, A. H., Al-Adwan, A. S., & Ramzan, M. (2022). Teachers' Perceptions of Technology Integration in Teaching-Learning Practices: A Systematic Review. Frontiers in Psychology, 13, 920317.

Al-Qaysi, N., Mohamad-Nordin, N., & Al-Emran, M. (2020). Employing the technology acceptance model in social media: A systematic review. Education and Information Technologies, 25(6), 4961–5002.

Al-Samarraie, H., Shamsuddin, A., & Alzahrani, A. I. (2020). A flipped classroom model in higher education: A review of the evidence across disciplines. Educational Technology Research and Development, 68(3), 1017–1051.

Alshammari, S. H., & Rosli, S. (2020). A Review of Technology Acceptance Models and Theories. Innovative Teaching and Learning Journal, 12–22.

Altinay, F., Tlili, A., Altinay, Z., Dagli, G., Adedoyin, O. B., Huang, R., Xu, L., Jemni, M., Mogavi, R. H., & Metwally, A. H. S. (2024). Meta-In or Meta-Out of Students with Special Needs: A Systematic Review on the Use of Metaverse in Special Education. In D. Liu, R. Huang, A. H. S. Metwally, A. Tlili, & E. Fan Lin (Eds.), Application of the Metaverse in Education (pp. 111–128). Springer Nature Singapore.

Alzahrani, N. (2020). The development of inclusive education practice: A review of literature. International Journal of Early Childhood Special Education, 100–100.

Arguel, A., Lockyer, L., Kennedy, G., Lodge, J. M., & Pachman, M. (2019). Seeking optimal confusion: A review on epistemic emotion management in interactive digital learning environments. Interactive Learning Environments, 27(2), 200–210.

Avellar, S. A., Thomas, J., Kleinman, R., Sama-Miller, E., Woodruff, S. E., Coughlin, R., & Westbrook, T. R. (2017). External Validity: The Next Step for Systematic Reviews? Evaluation Review, 41(4), 283–325.

Balalle, H. (2024). Exploring student engagement in technology-based education in relation to gamification, online/distance learning, and other factors: A systematic literature review. Social Sciences & Humanities Open, 9, 100870.

Barakabitze, A. A., William-Andey Lazaro, A., Ainea, N., Mkwizu, M. H., Maziku, H., Matofali, A. X., Iddi, A., & Sanga, C. (2019). Transforming African Education Systems in Science, Technology, Engineering, and Mathematics (STEM) Using ICTs: Challenges and Opportunities. Education Research International, 2019, 1–29.

Brod, G., Kucirkova, N., Shepherd, J., Jolles, D., & Molenaar, I. (2023). Agency in Educational Technology: Interdisciplinary Perspectives and Implications for Learning Design. Educational Psychology Review, 35(1), 25.

Cheng, S.-C., & Lai, C.-L. (2020). Facilitating learning for students with special needs: A review of technology-supported special education studies. Journal of Computers in Education, 7(2), 131–153.

Chua, H. W., & Yu, Z. (2024). A systematic literature review of the acceptability of the use of Metaverse in education over 16 years. Journal of Computers in Education, 11(2), 615–665.

Dağhan, G., & Gündüz, A. Y. (2022). Research trends in educational technology journals between 2000 and 2018: A web scraping study. Education and Information Technologies, 27(4), 5179–5214.

De Moya, J.-F., & Pallud, J. (2017, October 6). Quantified self: A literature review based on the funnel paradigm. ECIS 2017 Proceedings. 25th European Conference on Information Systems (ECIS), Portugal.

Deng, R., Benckendorff, P., & Gannaway, D. (2019). Progress and new directions for teaching and learning in MOOCs. Computers & Education, 129, 48–60.

Deterding, N. M., & Waters, M. C. (2021). Flexible Coding of In-depth Interviews: A Twenty-first-century Approach. Sociological Methods & Research, 50(2), 708–739.

Dhingra, M., & Mudgal, R. K. (2019). Applications of Perceived Usefulness and Perceived Ease of Use: A Review. 2019 8th International Conference System Modeling and Advancement in Research Trends (SMART), 293–298.

Di Natale, A. F., Repetto, C., Riva, G., & Villani, D. (2020). Immersive virtual reality in K-12 and higher education: A 10-year systematic review of empirical research. British Journal of Educational Technology, 51(6), 2006–2033.

E. Carpenter, R., R. McWhorter, R., Stone, K., & Coyne, L. (2023). Adopting Virtual Reality for Education: Exploring Teachers' Perspectives on Readiness, Opportunities, and Challenges. International Journal on Integrating Technology in Education, 12(3), 27–36.

Fahimirad, M., & Kotamjani, S. S. (2018). A Review on Application of Artificial Intelligence in Teaching and Learning in Educational Contexts. International Journal of Learning and Development, 8(4), 106.

Feng, J., Yu, B., Tan, W. H., Dai, Z., & Li, Z. (2025). Key factors influencing educational technology adoption in higher education: A systematic review. PLOS Digital Health, 4(4), e0000764.

Fernández-Otoya, F., Cabero-Almenara, J., Pérez-Postigo, G., Bravo, J., Alcázar-Holguin, M. A., & Vilca-Rodríguez, M. (2024). Digital and Information Literacy in Basic-Education Teachers: A Systematic Literature Review. Education Sciences, 14(2), 127.

Fernández-Sánchez, M. R., Garrido-Arroyo, M. D. C., & Porras-Masero, I. (2022). Curricular integration of digital technologies in teaching processes. Frontiers in Education, 7, 1005499.

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. Sustainable Operations and Computers, 3, 275–285.

Hammarberg, K., Kirkman, M., & De Lacey, S. (2016). Qualitative research methods: When to use them and how to judge them. Human Reproduction, 31(3), 498–501.

Hendricks, J. W., Smith, A., Peres, S. C., & Sasangohar, F. (2023). Workers' Acceptance of Digital Procedures: An Application of the Technology Acceptance Model. IISE Transactions on Occupational Ergonomics and Human Factors, 11(1–2), 59–68.

Hernandez-de-Menendez, M., Escobar Díaz, C., & Morales-Menendez, R. (2020). Technologies for the future of learning: State of the art. International Journal on Interactive Design and Manufacturing (IJIDeM), 14(2), 683–695.

Hilton, J. (2020). Open educational resources, student efficacy, and user perceptions: A synthesis of research published between 2015 and 2018. Educational Technology Research and Development, 68(3), 853–876.

Hussain, S., Alam, A., & Ullah, S. (2022). Challenges to Persons with Disabilities in Pakistan: A Review of Literature. Journal of Social Sciences Review, 2(3), 35–42.

Hussein, E., Kan'an, A., Rasheed, A., Alrashed, Y., Jdaitawi, M., Abas, A., Mabrouk, S., & Abdelmoneim, M. (2023). Exploring the impact of gamification on skill development in special education: A systematic review. Contemporary Educational Technology, 15(3), ep443.

Ibrahim, A., & Shiring, E. (2022). The Relationship between Educators' Attitudes, Perceived Usefulness, and Perceived Ease of Use of Instructional and Web-Based Technologies: Implications from Technology Acceptance Model (TAM). International Journal of Technology in Education, 5(4), 535–551.

Kabakus, A. K., Bahcekapili, E., & Ayaz, A. (2023). The effect of digital literacy on technology acceptance: An evaluation on administrative staff in higher education. Journal of Information Science, 01655515231160028.

Kamran, M., & Bano, N. (2023). A systematic review of literature on inclusive education with special emphasis on children with disability in Pakistan. International Journal of Inclusive Education, 1–19.

Khalil, A. I., & Hantira, N. Y. (2022). Special Education Teachers' Knowledge and Attitudes toward the Use of Assistive Technology for Disabled Children Management: Impact of an Educational Intervention. Creative Education, 13(03), 821–845.

Labadze, L., Grigolia, M., & Machaidze, L. (2023). Role of AI chatbots in education: Systematic literature review. International Journal of Educational Technology in Higher Education, 20(1), 56.

Lampropoulos, G. & Kinshuk. (2024). Virtual reality and gamification in education: A systematic review. Educational Technology Research and Development, 72(3), 1691–1785.

Latif, M., Hussain, I., Saeed, R., Qureshi, M., & Maqsood, U. (2019). Use of Smart Phones and Social Media in Medical Education: Trends, Advantages, Challenges and Barriers. Acta Informatica Medica, 27(2), 133.

Lochmiller, C. (2021). Conducting Thematic Analysis with Qualitative Data. The Qualitative Report.

Luo, Z., Abbasi, B. N., Yang, C., Li, J., & Sohail, A. (2024). A systematic review of evaluation and program planning strategies for technology integration in education: Insights for evidence-based practice. Education and Information Technologies, 29(16), 21133–21167.

Lynch, P., Singal, N., & Francis, G. A. (2024). Educational technology for learners with disabilities in primary school settings in low- and middle-income countries: A systematic literature review. Educational Review, 76(2), 405–431.

Mao, J., Ifenthaler, D., Fujimoto, T., Garavaglia, A., & Rossi, P. G. (2019). National Policies and Educational Technology: A Synopsis of Trends and Perspectives from Five Countries. TechTrends, 63(3), 284–293.

Marangunić, N., & Granić, A. (2015). Technology acceptance model: A literature review from 1986 to 2013. Universal Access in the Information Society, 14(1), 81–95.

Martin, T. (2022). A Literature Review on The Technology Acceptance Model. International Journal of Academic Research in Business and Social Sciences, 12(11), Pages 2859-2884.

Mertala, P. (2019). Teachers' beliefs about technology integration in early childhood education: A meta-ethnographical synthesis of qualitative research. Computers in Human Behavior, 101, 334–349.

Muhammad Rafiq-uz-Zaman*, Ijaz Ashraf, Huma Shah, & Naveed Farah. (2025). Educational Environment and Teacher Performance in the Context of Special Education Institutions in Pakistan: A Review Paper. Social Science Review Archives, 3(2), 17–35.

Muhammad Rafiq-uz-Zaman, Ijaz Ashraf, Huma Shah, & Naveed Farah. (2025). Educational Environment and Teacher Performance in the Context of Special Education Institutions in Pakistan: A Review Paper. Social Science Review Archives, 3(2), 17–35.

Muzafar Hussain & Nasreen Akhter. (2025). Enhancing Teacher Performance and Educational Environments in Special Education Institutions: A Study of Challenges and

Opportunities in Pakistan. The Critical Review of Social Sciences Studies, 3(1), 1318–1332.

Naderifar, M., Goli, H., & Ghaljaie, F. (2017). Snowball Sampling: A Purposeful Method of Sampling in Qualitative Research. Strides in Development of Medical Education, 14(3).

Nikou, S., & Aavakare, M. (2021). An assessment of the interplay between literacy and digital Technology in Higher Education. Education and Information Technologies, 26(4), 3893–3915.

Njiku, J., Maniraho, J. F., & Mutarutinya, V. (2019). Understanding teachers' attitude towards computer technology integration in education: A review of literature. Education and Information Technologies, 24(5), 3041–3052.

Olakanmi, O. A., Akcayir, G., Ishola, O. M., & Demmans Epp, C. (2020). Using technology in special education: Current practices and trends. Educational Technology Research and Development, 68(4), 1711–1738.

Olateju Temitope Akintayo, Chima Abimbola Eden, Oyebola Olusola Ayeni, & Nneamaka Chisom Onyebuchi. (2024). Evaluating the impact of educational technology on learning outcomes in the higher education sector: A systematic review. Open Access Research Journal of Multidisciplinary Studies, 7(2), 052–072.

Opoku, M. P., Elhoweris, H., Alhosani, N., Mustafa, A., Alkhateri, T., & Nketsia, W. (2023). Factors influencing the intention of trainee special education teachers to integrate assistive technology into teaching students with disabilities in the United Arab Emirates. Heliyon, 9(12), e22736.

Oyebola Olusola Ayeni, Nancy Mohd Al Hamad, Onyebuchi Nneamaka Chisom, Blessing Osawaru, & Ololade Elizabeth Adewusi. (2024). AI in education: A review of personalized learning and educational technology. GSC Advanced Research and Reviews, 18(2), 261–271.

Oyelere, S. S., Bouali, N., Kaliisa, R., Obaido, G., Yunusa, A. A., & Jimoh, E. R. (2020). Exploring the trends of educational virtual reality games: A systematic review of empirical studies. Smart Learning Environments, 7(1), 31.

Pangrazio, L., Godhe, A.-L., & Ledesma, A. G. L. (2020). What is digital literacy? A comparative review of publications across three language contexts. E-Learning and Digital Media, 17(6), 442–459.

Pirzada, M. G. I. (2023). Challenges and Prospects of Vocational Education and Training for Specially-abled Students in Pakistan. VFAST Transactions on Education and Social Sciences, 11(3), 01–08.

Putra, I. D. G. R. D. (2018). The Evolution of Technology Acceptance Model (TAM) and Recent Progress on Technology Acceptance Research in ELT: State of the Art Article. Yavana Bhasha: Journal of English Language Education, 1(2).

Qahmash, A. I. M. (2018). The Potentials of Using Mobile Technology in Teaching Individuals with Learning Disabilities: A Review of Special Education Technology Literature. TechTrends, 62(6), 647–653.

Reddy, P., Chaudhary, K., Sharma, B., & Chand, R. (2022). Talismans of Digital Literacy: A Statistical Overview. The Electronic Journal of eLearning, 570–587.

Reddy, P., Sharma, B., & Chaudhary, K. (2020). Digital Literacy: A Review of Literature. International Journal of Technoethics, 11(2), 65–94.

Sajjad Hussain, Dr. Uzma Shahzadi, & Itbar Khan. (2020). Challenges to Learners with Disabilities in the Higher Education Institutions in Pakistan: A Review. Research Journal of Social Sciences and Economics Review (RJSSER), 1(3), 12–19.

Sarker, M. N. I., Wu, M., Cao, Q., Alam, G. M., & Li, D. (2019). Leveraging Digital Technology for Better Learning and Education: A Systematic Literature Review. International Journal of Information and Education Technology, 9(7), 453–461.

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. Computers & Education, 128, 13–35.

Sheikh, M. A. (2021, October 24). Persons with disabilities in Pakistan. Business Recorder. https://www.brecorder.com/news/40128603

Siyam, N. (2019). Factors impacting special education teachers' acceptance and actual use of technology. Education and Information Technologies, 24(3), 2035–2057.

Sırakaya, M., & Alsancak Sırakaya, D. (2022). Augmented reality in STEM education: A systematic review. Interactive Learning Environments, 30(8), 1556–1569.

Timotheou, S., Miliou, O., Dimitriadis, Y., Sobrino, S. V., Giannoutsou, N., Cachia, R., Monés, A. M., & Ioannou, A. (2023). Impacts of digital technologies on education and

factors influencing schools' digital capacity and transformation: A literature review. Education and Information Technologies, 28(6), 6695–6726.

Ullah, S., Kiani, U. S., Raza, B., & Mustafa, A. (2022). Consumers' Intention to Adopt m-payment/m-banking: The Role of Their Financial Skills and Digital Literacy. Frontiers in Psychology, 13, 873708.

Van Laar, E., Van Deursen, A. J. A. M., Van Dijk, J. A. G. M., & De Haan, J. (2020). Determinants of 21st-Century Skills and 21st-Century Digital Skills for Workers: A Systematic Literature Review. Sage Open, 10(1), 2158244019900176.

Voultsiou, E., & Moussiades, L. (2025). A systematic review of AI, VR, and LLM applications in special education: Opportunities, challenges, and future directions. Education and Information Technologies.

Wohlfart, O., & Wagner, I. (2024). Longitudinal perspectives on technology acceptance: Teachers' integration of digital tools through the COVID-19 transition. Education and Information Technologies, 30(5), 6091–6115.

Xu, W., & Ouyang, F. (2022). The application of AI technologies in STEM education: A systematic review from 2011 to 2021. International Journal of STEM Education, 9(1), 59.

Yao, N., & Wang, Q. (2024). Factors influencing pre-service special education teachers' intention toward AI in education: Digital literacy, teacher self-efficacy, perceived ease of use, and perceived usefulness. Heliyon, 10(14), e34894.

Yasmeen, Z., Mushtaq, I., & Murad, M. (2019). Intrinsic and Extrinsic Motivation of Teachers in Special Education Secondary School: A Qualitative Study. Journal of Educational Research, Vol 22(2), 15–30.

Zaineldeen, S., Hongbo, L., Koffi, A. L., & Hassan, B. M. A. (2020). Technology Acceptance Model' Concepts, Contribution, Limitation, and Adoption in Education. Universal Journal of Educational Research, 8(11), 5061–5071.

Appendix

A Declaration of Authorship

I hereby declare that, to the best of my knowledge and belief, this Master Thesis titled "**Technology Adoption in Special Education - A Pakistani Perspective**" is my own work. I confirm that each significant contribution to and quotation in this thesis that originates from the work or works of others is indicated by proper use of citation and references.

Münster, 02 June 2025

Hamna Asim

B Informed Consent Form for Interview Participants

Informed consent for master's thesis research

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Title of the master's thesis: Technology Adoption in Special Education - A Pakistani Perspective

Name + contact details of supervisor, advisor and student researcher(s)
Supervisor: Prof. Dr. Steven Van De Walle
Contact: steven.vandewalle@kuleuven.be

Aim and methodology of the master's thesis research:
It is a qualitative study to understand the influence of perceived ease of use on the intention of special education teachers in Pakistan to integrate technology in their teaching practices.

Period/duration of the study: 1 semester

- I have received sufficient information about the purpose of the research.
- I understand what is expected of me in the study.
- I am aware that I will participate in the following survey / interview(s) / experiment:
- I consent to the interview(s) being audio (video) recorded.
- I understand that my participation may involve risks or inconvenience:
- Taking part in the study may provide the following benefits to me or others:
- I understand that my participation in this study is voluntary. I am aware that I can discontinue my participation at any time. I will not have to provide a reason for this and I will not suffer any disadvantages.

  Under the GDPR, the data collected during the study will be processed on grounds of public interest. This means that if I withdraw from the study, any previously collected data can still be lawfully processed and do not need to be deleted by KU Leuven.

  I understand that some of the data collected for the purposes of this study are classified as 'sensitive personal data' under the General Data Protection Regulation. I hereby expressly consent to the collection of these data for the purposes of this study.
- The findings may be used for research purposes and may be published. My name will not be published; anonymity and confidentiality is guaranteed at every stage of the research project. The complete dataset can be made available to the research community in the anonymised manner described.

- I understand that I will receive no/the following payment for participating in the research.
- I would like to be informed of the results of this research. The student researcher may contact me at the following e-mail address:
- I understand that I can contact steven.vandewalle@kuleuven.be for any questions or to exercise my rights (access to or correction of data, ...) after participating in the study.
- For any complaints or other concerns about ethical issues relating to this study, I can contact KU Leuven's Social and Societal Ethics Committee: smec@kuleuven.be.

I have read and understand the information above and have received answers to all my questions regarding this study. I agree to participate in the study.

Date:

Hamna

Name and signature of the respondent/participant	Name and signature of the student researcher

C Interview Questionnaire

Interview Questions – PEU & Special Education

Research Question: How does the perceived ease of use (PEU) influence the intention of special education teachers in Pakistan to integrate technology into their teaching practices?

Background Information

1. Can you tell me about your teaching experience in special education? (Years of experience, subjects taught, types of students you work with)
2. What motivated you to become a special education teacher?

Classroom Setup and Technology Availability

3. How are students with different needs categorized and placed in classrooms in your school?
4. What types of assistive technologies (AT) or digital tools are available in your classroom for special education? [tell them about AT if they don't know]
5. How accessible are these technologies for teachers and students?
6. Does your school provide training or resources for using these technologies? If yes, can you describe what kind of support is provided?

Teacher's Experience and Use of Technology

7. What technologies do you personally use in your teaching?
8. How did you learn to use them? (Formal training, self-learning, peer support)
9. How confident do you feel about using technology in your teaching?

Perceived Ease of Use and Adoption of New Technologies

10. When a new technology is introduced in your school, how easy or difficult is it for you to start using it?
11. What factors make a technology easy or difficult for you to use? (e.g., interface, instructions, training, support)
12. How much time do you usually need to learn a new digital tool before you feel comfortable using it in your teaching?
13. Have you ever chosen not to use a technology because it seemed too complicated or time-consuming? Can you share an example?

Challenges and Facilitating Conditions

14. What challenges do you face when using technology in your teaching? (e.g., lack of training, technical issues, student engagement, time constraints)
15. How supportive is your school administration in helping you integrate technology into your teaching?
16. Are there any policies, licenses, or infrastructure issues that limit your ability to use technology effectively?
17. If you have worked in different schools or regions, how does your current school compare in terms of technology access and ease of use?

Perceptions and Psychological Factors

18. What makes you feel motivated or hesitant about using technology in your teaching?

19. Do you think using technology can improve learning outcomes for your students? Why or why not?
20. How does your confidence in using technology impact your willingness to integrate it into your teaching?

Final Thoughts

21. In an ideal situation, what kind of support or training would help you integrate technology more effectively into your teaching?
22. What kind of technology do you use in your daily life? (Social media, smart phones etc?)
23. Is there anything else you'd like to share about your experiences with technology in special education?

D Codes from Interviews

Motivation	
Code: Extrinsic	Transcription 1 You could say that money was the main reason I joined the field. When I first started working, I worked with adults. That paid too, but not very much. Later, when I started working with children, the pay was better. Since this is a government job, it also gives me stability, which was my main reason for choosing it. In Pakistan, psychological issues weren't really highlighted before, but the people who had expertise in this field were earning well. It was an emerging field when I started. For the past 5 to 7 years, it has become quite popular. That is why I chose psychology.
Code: Extrinsic	Transcription 10 It was not exactly my plan to join this field. I had applied to several programs–law, BBA, and Special Education. I got accepted into Special Education before the results for the other fields came out, so I ended up joining it. But since then, it has been a great experience, and now I am even pursuing a specialization in Autism.
Code: Intrinsic	Transcription 11 When I was younger, there was a girl in our neighborhood who was a special child. I would often hear her crying or screaming, but whenever I called out to her, she would calm down. That experience left an impression on me. Even though I never really liked the idea of teaching in general, I did feel a strong desire to work with special children. So, when I came to know about this school, I applied.
Code: Intrinsic	Transcription 12 I wanted to do something different—that was my motivation. I stayed because I genuinely enjoy working with these students, and I want to help them become independent and confident members of the community. If we can help them live their lives just like anyone else, then I feel I have succeeded.
Code: Intrinsic	Transcription 13 I enjoy a sense of fulfilment when I help my students learn and grow.
Code: Intrinsic	Transcription 14 I was motivated to enter this field because I have two hearing-impaired children.
Code: Intrinsic	Transcription 15 There are two reasons for my decision to join the special education field. Firstly, one of my cousins was mildly mentally challenged, and I visited a special education center with him where students with different disabilities were taught in the same building. Although it seemed quite complicated at first, this experience ultimately motivated me to pursue this field. Secondly, I found it fascinating to see how teachers used sign language to interact with the students. These factors inspired me to join special education. I also see my work in this field as Sadqah Jariyah (ongoing charity).
Code: Intrinsic	Transcription 16 My motivation came from my father, who had learned the Braille system used for visually impaired individuals. I was fascinated by how he used this tool to communicate with blind people. This curiosity led me to pursue a career in the hearing impairment field. Additionally, my brother is currently

	pursuing a degree in special education, so our entire family is involved in the field of special education.
Code: Intrinsic	Transcription 17 My motivation to join this field came from a personal experience–my cousin's son, who is deaf. She really struggled to teach him, and as you know, there is not much awareness in society about how to teach differently-abled children. I ended up teaching him myself, even though I had very little understanding of special education back then. I explored the internet, learned some sign language on my own, and worked with him. That is what sparked my interest in the field.
Code: Intrinsic	Transcription 2 It is kind of a touchy subject but when I was a bachelor's student, I experienced vision loss. It was gradual until I became fully blind. My peers encouraged me to pursue special education because at that point it was a newly introduced subject and they thought I could succeed in this field. When I studied and eventually joined special education, it felt like the perfect fit for me.
Code: Intrinsic	Transcription 3 I joined the field of special education by chance, but I chose to continue by choice. I was selected as a lecturer, and this was my first posting. I ended up really enjoying working with special children, so I decided to stay. I liked being a lecturer and also felt that I could make a difference in the lives of special children.
Code: Intrinsic	Transcription 4 I experienced some sudden events in my life. In the past, I served in the Pakistan Navy as a Marine Commando, and at that time, everything was fine. During my service as a Naval officer, I suddenly lost my eyesight. After retiring on medical grounds, I decided to continue my studies in the field of special education. A friend of mine suggested that I join special education and serve individuals with disabilities. After completing my Master's degree in Special Education from Bahauddin Zakariya University, Multan, I realized that this was the most relevant field where I could make a meaningful contribution–and that is where my journey began.
Code: Intrinsic	Transcription 5 I come from a background in psychology. As psychologists, we naturally feel drawn to working with individuals with special needs and contributing to their well-being. My initial aim was to stay focused on the psychological side of things.
Code: Intrinsic	Transcription 6 My goal and mission is to help differently-abled children become independent, to help them use their abilities to the fullest so they can secure their future, and so they do not have to live with a sense of inferiority or complexes. I hope to change people's mindset in a positive direction, especially when it comes to sighted individuals.
Code: Intrinsic	Transcription 6 I think teacher morale needs to be improved, which targets their dedication and willingness to enhance their teaching methods. I don't think money is a major motivator in this field. It is all about self-motivation and availability of resources. I think religion is also a big factor, since Islam teaches you to help those in need.
Code: Intrinsic	Transcription 7 My motivation stems from my personal journey as a visually impaired

	person. I lost my eyesight unexpectedly when I was in matriculation, but even before that, I always aspired to become a teacher. I think fate led me to this point, and visual impairment made it easier for me to enter the field of special education. My parents were extremely supportive and my teachers guided me towards this field. I think being a special needs person myself has really helped me bond and connect with my students, and help them more effectively.
Code: Intrinsic	Transcription 8 One day, I discussed with my family that some people donate their eyes, and I wanted to do the same. But they told me they would never allow it, saying, "You'll be gone by then." That made me realize it was something beyond my control. So, I decided that instead, I would help visually impaired children while I am alive.
Code: Intrinsic	Transcription 9 I had a teacher who had a physically disabled son. I used to pick them up for school and drop them off at home. That experience became the source of my motivation to join this field.

Type of Disability	
Code: Intellectual Disability	Transcription 1 I work with children with intellectual disabilities, down syndrome, autism spectrum disorder, and other neurodevelopmental disorders.
Code: Intellectual Disability	Transcription 3 In the field of intellectual disability, there are many subtypes like ADHD, Autism, and others.
Code: Intellectual Disability	Transcription 13 (Hamna) At my current job, I work as a one-to-one aide with an autistic child.
Code: Physical Disability	Transcription 12 I have been teaching at this institute for visually impaired students for about 17 years.
Code: Physical Disability	Transcription 14 Our classrooms are sound proofed, and children sit in a semi-circle based on their hearing needs.
Code: Physical Disability	Transcription 15 In 2011, I joined my current institution for hearing-impaired children, where I have been for the past 14 years.
Code: Physical Disability	Transcription 16 I have been working at this school for deaf children for the past six years.
Code: Physical Disability	Transcription 17 I have been teaching at this school for children with hearing impairment for around three years now.
Code: Physical Disability	Transcription 2 I have 12 years of teaching experience. I started my career by teaching slow learners and students with intellectual disabilities. Then, I moved on to visually impaired students.

Code: Physical Disability	Transcription 4 I serve in a school for visually impaired children and have taught various classes of visually impaired students.
Code: Physical Disability	Transcription 5 I started working in 2016 and began my career teaching at a school for slow learners, where I worked for about a year and a half. After that, I taught at a school for students with hearing impairments for 10 months. In my current position–which I have held for the past six years–I work with students with different types of disabilities.
Code: Physical Disability	Transcription 6 I first served at another school for about 6–7 months before being appointed to my current position in 2007 as a lecturer in Orientation and Mobility. I have been working in this role ever since. Orientation and Mobility is a field within visual impairment that focuses on helping visually impaired children understand where they are, where they want to go, and how to get there.
Code: Physical Disability	Transcription 7 I have been serving as a lecturer, teaching students with visual impairment across different grade levels.
Code: Physical Disability	Transcription 8 I also taught visually impaired students, similar to my role here.
Code: Physical Disability	Transcription 9 This school is specifically for visually impaired students.
Code: Physical Disability	Transcription 10 I started by teaching English in braille to Grade 2. Later, I worked with Pre-1 students, helping them build basic concepts like orientation, independent movement, pre-cane and cane techniques.
Code: Physical Disability	Transcription 11 For these older students, we often have special classes where they are taught Braille, as it can be challenging for them to interact with much younger students at the same stage.

Education Level	
Code: Education Level	Transcription 11 My academic background includes an MBA and an M.Ed.
Code: Education Level	Transcription 12 I have a B.Ed degree, a Master's in Special Education, and have completed four additional courses.
Code: Education Level	Transcription 13 I did my bachelor's in applied psychology, majoring in clinical psychology and child development. I attended Riphah International University for my master's in special education, and I also have a diploma in speech therapy.
Code: Education Level	Transcription 14 I have a master's degree in special education.

Code: Education Level	Transcription 15 I hold a Master's in Special Education as well as a B.Ed.
Code: Education Level	Transcription 16 I hold a Master's degree in Special Education with a specialization in hearing impairment
Code: Education Level	Transcription 17 I pursued a Master's in Special Education and also completed a few courses in sign language.
Code: Education Level	Transcription 8 I was fortunate enough to be offered a Master's degree focused on teaching and training visually impaired children.
Code: Education Level	Transcription 9 I hold a Master's degree in Special Education and currently teach Computers and Quran at this school.

Facilitators of Tech Use	
Code: Institutional Funding	Transcription 3 Technologies are available to some extent, but financial limitations often prevent schools from fully meeting the needs of students and teachers. As teachers, we cannot afford to purchase these tools ourselves, and schools have to work within their budgets. However, there has been noticeable improvement in Special Education centers over time. Centers in urban areas are generally better equipped compared to those in rural areas.
Code: Institutional Funding	Transcription 4 I do not think schools are providing these kinds of resources. As I mentioned earlier, we face limited resources, or you could say, budgetary constraints. The Special Education Department does provide training to teachers, and then we guide students and the community about the use and importance of assistive technologies. However, I do not see any proper resources being made available to students with disabilities in schools.
Code: Institutional Funding	Transcription 4 I believe the key issue is the provision of proper resources. If resources are available at training institutes, as well as colleges and school levels, it would become much easier to adopt and implement new technologies through proper training.
Code: Institutional Funding	Transcription 1 Budgeting is a significant issue. For example, there are many online libraries available, but they often require paid memberships, which can be difficult for an individual to afford. If the institute could provide memberships, it would allow teachers to easily access a wealth of information, learn new things, and explore articles and suggestions. Currently, those who are using these resources are doing so on their own initiative, but it is not really being promoted at the department level.

Code: Institutional Support	Transcription 1 Schools are not providing any training. There is a centralized institution that handles training. The institute offers different training courses, including field-specific courses that typically last a week, as well as one or two-day refresher workshops. Specifically, with the recent establishment of Autism schools and centers, the special education department is now arranging extensive training sessions on autism. Prior to this, such resources were not available at the government level. There is also an online system called the Training Management System (TMS), which allows teachers to track our training progress. As for resources, in the field of hearing impairment, the Special Education Department provides hearing aids to students. The department also has audiologists and audiometrists who assess the students' needs and set the frequency of these devices. Sometimes, audiologists or audiometrists are available at the divisional level to monitor and support schools as well.
Code: Institutional Support	Transcription 10 Yes, we are provided training. When a teacher first joins, they receive comprehensive training during the initial three months, which includes Braille, orientation and mobility, as well as familiarization with the school curriculum.
Code: Institutional Support	Transcription 14 The teachers who join this intuition usually know only the basics of sign language when they apply, but they are trained for a month in PSL before they can start teaching. We offer online and in-person courses for PSL. We have two books and three workbooks to learn sign language, developed by our institution. Teachers are also tested on sign language every year to check if they're up to date.
Code: Institutional Support	Transcription 16 These technologies are currently accessible for teachers. Looking ahead, we have a future project to establish a smart room in our school, commonly referred to as a resource room. The goal is to create a more advanced and supportive classroom environment by integrating technology. In this room, teachers will be able to provide students with specific tools during lessons, based on their needs.
Code: Institutional Support	Transcription 3 The school itself does not provide training. Instead, the Special Education Department offers training through a dedicated institution specifically established for training special education teachers in Punjab.
Code: Institutional Support	Transcription 4 I believe the key issue is the provision of proper resources. If resources are available at training institutes, as well as colleges and school levels, it would become much easier to adopt and implement new technologies through proper training.
Code: Institutional Support	Transcription 5 Proper training is the key. For instance, we have screen reading software like JAWS installed on our computers, but to use it effectively, we need guidance from a computer instructor. Their support helps us navigate the interface more easily. So yes, training and technical support play a crucial role in making any technology accessible and user-friendly. With the growing presence of AI in

	education, we will need similar guidance from experts to integrate it into our teaching practices.
Code: Institutional Support	Transcription 6 One of the strengths of our department is that training sessions are provided whenever a new technology is introduced and needs to be implemented. The institute offers training courses that can last for several days, depending on how complex the new technology is. However, this training is only provided at the central level, not within individual schools.
Code: Institutional Support	Transcription 6 It was part of our education, and there was certainly effort on our own part. There is also a government in-service college which trains teachers in new technologies, or if a foreign team is here to deliver lectures, they invite us to attend so we can improve our teaching methods. Resources are available, and teachers are willing to learn.
Code: Institutional Support	Transcription 7 There is an in-service teacher training college by the Department of Special Education of Punjab, and we have professionals and expert lecturers who train special education teachers. These programs vary in length, and teachers are guided about pedagogy, curriculum development, student psychology, and latest digital technology in their field.
Code: Institutional Support	Transcription 8 Workshops and meetings are arranged for teachers where new technologies are discussed. A trainer is usually present to guide us and help us understand how to use these tools more effectively, making it easier for us to access and implement them in our teaching.
Code: Institutional Support	Transcription 9 When we are first appointed here, we are trained in reading and writing English, Urdu, and Math in braille. We also receive mobility training–like wearing blindfolds to experience what it is like to navigate the world without sight. Since I teach computers here, I was also trained by a computer expert at the school.
Code: Peer Collaboration	Transcription 1 A lot of it has been self-learning, though I have also attended training courses to understand more advanced tools. Talking to colleagues about different tools also helps a lot. Honestly, I still feel like I am learning something new every day.
Code: Peer Collaboration	Transcription 10 If a new tool or method is introduced later on, a more experienced staff member sets up the multimedia and conducts training sessions for the rest of the team. We have many knowledgeable teachers here. For instance, we are currently exploring ways to introduce AI to enhance learning beyond traditional theoretical content. Research is underway, and all staff members are contributing their input. Once it has been thoroughly tested by experienced teachers, we will move forward with implementation.
Code: Peer Collaboration	Transcription 10 I do not need much time. Since I already have training in technology, I can easily use it. If I need to clarify something, I consult a senior, but overall, I am able to use the technology without difficulty.

Code: Peer Collaboration	Transcription 11 I was already familiar with most of these tools because of my previous experience working in a bank. However, when it came to tasks like preparing exam papers, I did consult experienced teachers for support. Converting text into braille was initially challenging for me, as I had no prior knowledge of braille before joining this school. Thankfully, the experienced teachers were very helpful whenever I encountered any difficulty. Additionally, the school organizes summer camps to train us in the use of different tools.
Code: Peer Collaboration	Transcription 14 Mostly we are trained properly by our school. If a teacher finds something interesting, they share it in our teacher's group so we can all access the new resource or tool. Peer learning is also very prevalent in this place. But I'd say to perfect a skill, there is some level of self-learning involved. Otherwise, you can't depend on only one-time training to become a master at your craft.
Code: Peer Collaboration	Transcription 16 I learned to use these tools through a combination of methods. For instance, there were certain apps like Zoom or Microsoft Office that I was not familiar with at first, and for those, we were given formal training. There were also tools I picked up on my own, like I already had some basic understanding of Microsoft Word. Besides that, we often have discussions with our colleagues about different tools, which really helps to clear up confusion.
Code: Peer Collaboration	Transcription 17 I have learned through self-learning, formal support, and peer support.
Code: Peer Collaboration	Transcription 2 I think the right training, peer support, and a user-friendly interface are most important when it comes to using new tech. Being blind, the app needs to support speech-to-text and screen-readers for me to conveniently use and implement it.
Code: Peer Collaboration	Transcription 7 Like I told you before, I became blind after a road accident. When I was in high school, I got admitted to a special education school where my classmates taught me basic AT since they were blind by birth and had mastered these tools already. My teachers also guided me and it was their efforts which led me to use a smartphone and a laptop as a visually impaired person.
Code: Self Learning	Transcription 12 Yes, if a new technology or software is introduced, we can learn it through self-learning, and training or discussion sessions are also arranged for teachers. The IT experts here guide us through the process. All the teachers here are familiar with technology and also try to explore things on their own.
Code: Self Learning	Transcription 12 I mostly learned through self-learning by exploring the internet and watching video tutorials. Since I have a strong interest in these technologies, I actively look for tools that can assist my students and make their learning easier.

Code: Self Learning	Transcription 13 However, I researched a lot and interacted with other teachers on social media and found out about the latest tools and tech. I then self-learned a lot.
Code: Self Learning	Transcription 13 Obviously if you're trained properly, it would be easier to use technology, while self learning makes it comparatively difficult.
Code: Self Learning	Transcription 14 Mostly we are trained properly by our school. If a teacher finds something interesting, they share it in our teacher's group so we can all access the new resource or tool. Peer learning is also very prevalent in this place. But I'd say to perfect a skill, there is some level of self-learning involved. Otherwise, you can't depend on only one-time training to become a master at your craft.
Code: Self Learning	Transcription 15 Mostly self-learning and training at the job. Month-long training at the start when teachers join, and workshops when some technology or tool needs to be integrated.
Code: Self Learning	Transcription 16 I learned to use these tools through a combination of methods. For instance, there were certain apps like Zoom or Microsoft Office that I was not familiar with at first, and for those, we were given formal training. There were also tools I picked up on my own, like I already had some basic understanding of Microsoft Word. Besides that, we often have discussions with our colleagues about different tools, which really helps to clear up confusion.
Code: Self Learning	Transcription 17 I have learned through self-learning, formal support, and peer support.
Code: Self Learning	Transcription 2 I mostly rely on self-learning. I started learning AT in bachelor's since I needed them myself, being a visually impaired person. I also joined some classes to learn computer skills but didn't find them very helpful. However, I got taped lessons from those classes and I used them later to practice on my own.
Code: Self Learning	Transcription 2 I think I mostly self-learn, so I have never relied on training by the institution. Other than that, if I myself am skilled and sure about my teaching methods, there will be no challenges anywhere else. If I face technical issues, the school has IT experts to resolve them.
Code: Self Learning	Transcription 3 I learned mainly through self-learning. While formal training was provided by the department, I did not find the tools I use particularly difficult to understand or work with.
Code: Self Learning	Transcription 4 I did not receive any formal training; it was my own interest that led me to learn these tools. So, it was largely self-learning.
Code: Self Learning	Transcription 8 If the technology is available at the institute, I try to learn it quickly. But when it is not easily accessible, it becomes harder for me to pick it up. Still, I feel it is my personal responsibility, almost a moral duty, to learn how to use it so I can make it beneficial for my students.

Code: Self Learning	Transcription 9 Since NVDA is a free software, I was able to access and explore it on my own beforehand. But JAWS is a paid program, so I got the chance to learn it after joining this school. A computer expert here guided me with some aspects, and I picked up the rest through self-learning. There was not any formal training provided.
Code: Self Learning	Transcription 9 I have always enjoyed learning new technologies, so whenever I come across something new, I try to explore it on my own right away. That is why it usually does not take me much time to pick up a new tool or software.
Code: User Interface	Transcription 1 The user interface plays a crucial role in the ease of use. For example, when you open a website, its front page should clearly guide you to the specific information you are looking for. If it is not user-friendly, accessing the necessary content becomes difficult. The more intuitive and clear the instructions are, the easier it is to use the technology or tool. Additionally, proper training is essential, particularly with assistive tools, as it further simplifies the process of using them.
Code: User Interface	Transcription 2 I think the right training, peer support, and a user-friendly interface are most important when it comes to using new tech. Being blind, the app needs to support speech-to-text and screen-readers for me to conveniently use and implement it.
Code: User Interface	Transcription 7 It depends on the format or interface of the app. The instructions are usually in printed form, which being visually impaired is a hassle for me to read. So, I need a peer to read it out to me so I can understand the instructions. Most technologies are foreign (Chinese/Japanese/Korean) and their instructions or interface also comes in their native languages sometimes, which creates a barrier as well.
Code: User Interface	Transcription 9 It is all about accessibility–the more accessible and user-friendly the interface is, the easier it becomes to use.

Infrastructure	
Code: Insufficient	Transcription 1 There are no specific applications or tools available for children with intellectual disabilities. They have to rely on the same tools used in general education, such as computers, projectors, among others. There isn't any tool or application to help develop individualized educational plans for these students in a time-saving way. Teachers have to work with the limited resources that are meant for regular students. Even applications that allow you to download flashcards for teaching are often paid, so they are not easily accessible. As a result, teachers have to design, print, and laminate flashcards themselves, and they also have to create their own worksheets and workbooks. While some apps can be downloaded, most of the good content is paid.

Code: Insufficient	Transcription 3 Technologies are available to some extent, but financial limitations often prevent schools from fully meeting the needs of students and teachers. As teachers, we cannot afford to purchase these tools ourselves, and schools have to work within their budgets. However, there has been noticeable improvement in Special Education centers over time. Centers in urban areas are generally better equipped compared to those in rural areas.
Code: Insufficient	Transcription 3 As I mentioned earlier, there are some technologies I was trained in but could not actually use because they were only available at the training institute, not in our schools. This is not just the case in my field–other areas of special education face the same problem. It is a major flaw in the system. Our schools often lack the resources and tools we really need, which becomes a big barrier.
Code: Insufficient	Transcription 3 The biggest infrastructure issue in schools is that most of them are in rented buildings and are not disability-friendly. This creates mobility challenges for students, and the classrooms are not designed the way they should be for special children. Sometimes, even though teachers and the administration want to provide all necessary facilities, they are unable to do so because of these limitations.
Code: Insufficient	Transcription 4 There are various assistive technologies and digital tools available in classrooms, but I believe there are significant resource limitations, especially in Pakistan, and more so in Punjab. While teachers can recommend the most suitable assistive technologies for their students, they often do not have the means to provide them directly.
Code: Insufficient	Transcription 4 I do not think schools are providing these kinds of resources. As I mentioned earlier, we face limited resources, or you could say, budgetary constraints. The Special Education Department does provide training to teachers, and then we guide students and the community about the use and importance of assistive technologies. However, I do not see any proper resources being made available to students with disabilities in schools.
Code: Insufficient	Transcription 4 I believe the key issue is the provision of proper resources. If resources are available at training institutes, as well as colleges and school levels, it would become much easier to adopt and implement new technologies through proper training.
Code: Insufficient	Transcription 7 I think there is a lack of accessibility. For example, there is only one LED screen for the entire school. So that causes a limitation and it is used for entertainment rather than educational purposes. For example, we play a movie during break hours for the students rather than utilizing a single screen per class for learning. If these screens and projectors were available in all classes, teachers could use them effectively to deliver their lessons.
Code: Sufficient	Transcription 10 Everything from Braille dictionaries, geometry tools, and braille textbooks

	for English, Math, and Quran is readily available. We also have access to well-equipped labs. In my opinion, no other school offers the same level of technological accessibility–this is one of the best institutes for visually impaired students. The canes used by students are even manufactured within the school itself. We have an embosser, and for students who cannot afford materials, the school provides books free of cost. Each student has a Perkins Brailler at their desk, and the library is stocked with a variety of storybooks and audiobooks.
Code: Sufficient	Transcription 12 The technology we have here is fully accessible. It is up to the teacher to decide which tools are needed for the concept they are teaching. All tools at school can be used by both teachers and students. The administration is supportive. If something is not available, we can request it and they try to arrange it based on the school's budget.
Code: Sufficient	Transcription 13 I think the schools I've worked at have had sufficient technology infrastructure, but whether they're being used efficiently is another story.
Code: Sufficient	Transcription 15 Technology is easily accessible here, as each class follows a set timetable. This ensures there are no conflicts, allowing us to use the required tools as needed, according to our allotted time.
Code: Sufficient	Transcription 16 These technologies are currently accessible for teachers. Looking ahead, we have a future project to establish a smart room in our school, commonly referred to as a resource room. The goal is to create a more advanced and supportive classroom environment by integrating technology. In this room, teachers will be able to provide students with specific tools during lessons, based on their needs.
Code: Sufficient	Transcription 17 There is a proper timetable set for all classes, so both students and teachers have access to the available tools according to that schedule. Everything has to be preplanned–we inform the administration in advance about the room or tool we will need, get their permission, and then everything proceeds accordingly.
Code: Sufficient	Transcription 4 When it comes to students with hearing impairments, hearing aids are available through the department, although the process takes some time. Cochlear implants, on the other hand, are quite expensive. Some organizations and NGOs do provide cochlear implants for students with hearing impairments. For students with physical disabilities, I have recently learned that the Special Education Department is making efforts to provide wheelchairs, braces, and other assistive devices.
Code: Sufficient	Transcription 5 These technologies are available in most schools across Punjab. Over time, their use has been increasing. In the past, such tools were rarely used, but now we are seeing gradual improvement and greater adoption.
Code: Sufficient	Transcription 6 The technologies are easily accessible for both teachers and students. Computer labs are available in all schools. Every school, including the centres, also has access to a speech therapist. Even if an ophthalmologist is not available, an assessment kit is always present. A psychologist is also available at the school level. While psychiatrists are

	not commonly available, students who need support are often helped through the school head or with assistance from donors.

Perceived Ease of Use	
Code: Confidence	Transcription 1 I think I am quite in touch with technology, so I feel confident using it in my teaching. It is definitely beneficial in special education, though it can be a bit challenging to use with intellectually challenged children. Still, that does not stop me from incorporating it.
Code: Confidence	Transcription 1 If I feel confident using a particular technology, I am definitely more open to integrating it into my teaching. But if I am not comfortable with a tool, I tend to avoid teaching it. There are times when I simply don't know how to use something, and that lack of familiarity can be discouraging. Of course, this experience varies from person to person.
Code: Confidence	Transcription 10 I do not need much time. Since I already have training in technology, I can easily use it. If I need to clarify something, I consult a senior, but overall, I am able to use the technology without difficulty.
Code: Confidence	Transcription 10 Yes, it would definitely increase my willingness to integrate technology into my teaching.
Code: Confidence	Transcription 11 I feel quite confident when it comes to teaching my students how to use technology.
Code: Confidence	Transcription 11 I am confident in using technology and I incorporate it into my classrooms. It is true that the more confident I am, the more willing I am to utilize it.
Code: Confidence	Transcription 12 I feel very confident in using technology. It plays an important role in making learning easier and more engaging for students, so it should definitely be utilized.
Code: Confidence	Transcription 12 Yes, it does. The more confident I am in using technology, the more likely I am to use it in my teaching.
Code: Confidence	Transcription 13 I would say there are very good mediums for learning and understanding technology, and since they have significantly improved learning outcomes for my students, I feel very confident about using tech.
Code: Confidence	Transcription 13 I only use tools which I am confident about, which are beneficial and relatable for my students.
Code: Confidence	Transcription 13 I'll answer somewhat generally. Being confident with technology will allow you to experiment with new tools and platforms, allowing you to develop better lessons. So yes, confidence does impact willingness.

Code: Confidence	Transcription 14 I feel 100% confident about technology that I have mastered, and that I use every day. For example, I use my laptop at home every day to prepare lesson plans, monthly planners, and powerpoint slides for my classes, so I am in touch with most digital platforms and apps. That is why I feel confident.
Code: Confidence	Transcription 14 For example, the ERP system is used only to tabulate results twice a year, so I feel hesitant about using it. When I compare that to all other apps and platforms I use on a daily basis, there is a massive difference in comfort and confidence.
Code: Confidence	Transcription 14 Yes, confidence does enhance my willingness to use technology.
Code: Confidence	Transcription 15 I'd say now I feel pretty confident since it's been a while that I've been using technology for teaching. It was difficult at the beginning, but you get better with practice.
Code: Confidence	Transcription 15 We are willing because it is a necessity now. We are also confident in our skills, and yes that increases willingness to use.
Code: Confidence	Transcription 16 I feel confident using the technologies I am familiar and comfortable with, ones that I have developed skills in. If I come across something I am not familiar with, I make an effort to learn more about it, usually by seeking guidance or asking someone who is more experienced.
Code: Confidence	Transcription 16 If we know how to use technology, we naturally feel confident using it, and that confidence makes us more willing to integrate it into our teaching.
Code: Confidence	Transcription 17 Initially, I was not very confident in using technology since many tools were new to me. However, after receiving proper training on different tools, I now feel fully confident in using them. I believe that effective teaching comes with confidence in your own abilities.
Code: Confidence	Transcription 17 It has a significant impact. If I am not confident in using a particular technology, I know the students won't be able to grasp it properly either. Confidence is important. When I understand a tool completely, from A to Z, that confidence naturally reflects in my teaching. And when I feel confident I am definitely more willing to use that tool in the classroom.
Code: Confidence	Transcription 2 I believe I am quite confident and skilled. I won't say I'm 100% confident but I've learned everything to my maximum capacity. I also train fellow special education teachers.
Code: Confidence	Transcription 2 Confidence does impact willingness to learn, it is a natural phenomenon.
Code: Confidence	Transcription 3 I would not say I am an expert in using technology, but I am fairly confident and capable. If I ever feel unsure about using a certain tool, I make the effort to learn more about it until I feel comfortable.

Code: Confidence	Transcription 3 Definitely. If I feel confident using a technology, I am naturally more willing to use it in my teaching.
Code: Confidence	Transcription 4 As I mentioned, assistive technology reduces the challenges of disability by about 70-80%. I believe technology is extremely beneficial in this regard, and I feel confident in using it.
Code: Confidence	Transcription 4 I do not think I can teach a technology to my students unless I am confident in my own ability to use it first. So yes, my confidence in using a tool directly impacts my willingness to integrate it into my teaching.
Code: Confidence	Transcription 5 Over time, I have grown more confident and comfortable in using technology through my experience in the field. That said, I have noticed that newer teachers often find it even easier to adapt to technology.
Code: Confidence	Transcription 5 Confidence clearly plays a major role in our willingness to integrate technology into teaching. For instance, if we observe senior staff, not just in education, but in other professions like banking, we often find that they are more hesitant to use technology and tend to rely on verbal or traditional methods instead. Similarly, if teachers lack confidence in using a particular tool, we are less likely to incorporate it into our classrooms effectively.
Code: Confidence	Transcription 6 It takes some time to become confident when you face a new concept, but as teachers it is our responsibility to convey new ideas to our students. I feel a little reluctant at the start, but after practicing and getting a hang of it, it becomes easy and natural to use new tools.
Code: Confidence	Transcription 6 Any teacher at school or college level is specialized in their field, via education or experience. They are up to date about technologies in their field, and so am I.
Code: Confidence	Transcription 6 Confidence in using technology does make me more willing to use it.
Code: Confidence	Transcription 7 I believe without technology teachers are incomplete, and they can't convey knowledge without the presence of technology. Students will not be engaged with a teacher who uses only manual tools, since tech is way more interactive. I think technology facilitates teachers as well, and it makes them more effective as instructors. So yes, I feel very confident about using technology.
Code: Confidence	Transcription 7 Definitely, if a teacher is an expert in technology, he will be confident and willing to use it.
Code: Confidence	Transcription 8 I feel that my skills need further improvement so that I can teach more efficiently in less time. While I am willing to incorporate technology into my teaching, there are times when I lack the proper training. Gaining more confidence in using these tools would certainly make it easier for me to teach them effectively.

Code: Confidence	Transcription 9 I do feel confident and there is no hesitation on my part, but sometimes it takes time for students to grasp certain technological aspects.
Code: Confidence	Transcription 9 Yes, obviously. The more confident I am with using technology, the more willing I am to incorporate it into my teaching.
Code: Learning Curve	Transcription 1 A lot of it has been self-learning, though I have also attended training courses to understand more advanced tools. Talking to colleagues about different tools also helps a lot. Honestly, I still feel like I am learning something new every day.
Code: Learning Curve	Transcription 1 For me, learning a tool is a gradual process, and it becomes easier with TMS. It requires consistent practice, and sometimes it can take up to weeks before I feel fully comfortable using a new tool in my teaching. If the tool is simpler, I can usually learn it in just a few days. Trainers typically train for about a week, and then you are expected to use the tool independently. However, they do check in regularly or monitor progress through the system to ensure you are on track.
Code: Learning Curve	Transcription 10 I already had some familiarity with the tools due to my specialization in the field. While I was not highly proficient at first, I learned a great deal during my initial three months here. Now that I have been working in this field for some time, many aspects have become much clearer to me.
Code: Learning Curve	Transcription 10 I only faced some difficulty with it in the beginning and had to confirm a few things, but now I use it without any trouble.
Code: Learning Curve	Transcription 11 I was already familiar with most of these tools because of my previous experience working in a bank. However, when it came to tasks like preparing exam papers, I did consult experienced teachers for support. Converting text into braille was initially challenging for me, as I had no prior knowledge of braille before joining this school. Thankfully, the experienced teachers were very helpful whenever I encountered any difficulty. Additionally, the school organizes summer camps to train us in the use of different tools.
Code: Learning Curve	Transcription 11 In the beginning, everything feels challenging, but with regular use, it becomes easier to handle.
Code: Learning Curve	Transcription 11 If a new tool is introduced and I already have some prior knowledge of it, I can quickly get comfortable using it. Once I am familiar, teaching it becomes easy. So, learning anything requires effort, but it is manageable with practice.
Code: Learning Curve	Transcription 12 It depends on the complexity of the technology being introduced. If the technology is more complex, I would require additional training and practice to use it effectively. However, if it is simpler, I would be able to learn it more quickly.

Code: Learning Curve	Transcription 12 If a tool is easy to use, I can usually learn it within 2-3 days. However, if it is more complex, it may take a week, 10 days, or even 15 days, depending on how often I practice and engage with it.
Code: Learning Curve	Transcription 13 So if I am familiar with the tool, it would take less time to learn and execute it. However, high quality training and support make this process faster. I'd day it would take three to four days since I take sessions daily and I would make it a point to implement the new tech in my classes so I can be comfortable with it quickly.
Code: Learning Curve	Transcription 14 Of course it feels a bit daunting to use a new technology at first, but with time and practice, it feels easier.
Code: Learning Curve	Transcription 14 It depends on the complexity of the tool. For example, it took me around a week to get the hang of online classes from A to Z, including setting meeting links, shifting between classes, preparing online study material, remaining in frame and communicating via PSL effectively on screen etc.
Code: Learning Curve	Transcription 15 Depends on the type of technology. It was easy for me to learn Microsoft Word, but we needed a 3-month online training session to fully understand Microsoft Excel. Similarly, ERP was a bit harder to learn since it was an entirely new concept and we use the platform very infrequently for maintaining grades, so there is less practice and familiarity.
Code: Learning Curve	Transcription 16 Whenever a new technology is introduced at our school and we are expected to start using it in the classroom, I usually begin by looking it up online to understand it better, just like anyone would. At first, it can feel a bit challenging, but once I start using it, things gradually become easier as I get more comfortable with it.
Code: Learning Curve	Transcription 17 Yes, the school does provide training. Recently, we were trained in using Microsoft Office along with ERP. We also received instructions on how to use the task sheet where we log all the tasks and activities conducted with our students. Initially, it was difficult to use these tools, but with time and practice, we became comfortable and can now use them with ease.
Code: Learning Curve	Transcription 17 Initially, I was not very confident in using technology since many tools were new to me. However, after receiving proper training on different tools, I now feel fully confident in using them. I believe that effective teaching comes with confidence in your own abilities.
Code: Learning Curve	Transcription 17 It can be quite challenging to use new technology when it is first introduced. Although we have often heard about or seen it, the real difficulty comes when we have to implement it in the classroom. However, over time, as we receive training and become more familiar with it, it becomes easier to use.

Code: Learning Curve	Transcription 17 Practice and frequent use definitely make it easier to use a tool, and discussing it with peers also helps a lot. But training is a must. When a tool is just placed in front of you without any guidance, it becomes difficult to understand, just like how parents often struggle with social media because it is unfamiliar to them. Once we receive proper training, though, it becomes much easier to use and to teach with.
Code: Learning Curve	Transcription 17 It really varies from person to person. Some people can pick up a new technology very quickly, while others take a bit more time to understand it. Personally, when I focus on learning a tool and proper training is being provided, it usually takes me just 3–4 days to get a good grasp of it. As I mentioned earlier, I initially learned sign language on my own through YouTube videos, so when I later enrolled in formal courses, I was able to pick it up quite quickly.
Code: Learning Curve	Transcription 2 For me, all AT is easy once I've gotten a grip of it myself. I've noticed that technology-based AT are easier for the younger generation to grasp but traditional AT like braille is difficult. I think it's hard to learn, manual, and learned over the years.
Code: Learning Curve	Transcription 3 It depends on how difficult the tool is and how long the training lasts. For example, a six-week training gives enough time and practice to get comfortable with a new tool. But if the training is only three days or a week long, that is usually not enough time to properly learn a tool I am not already familiar with.
Code: Learning Curve	Transcription 3 My hesitation in using certain technologies comes from a lack of knowledge about them.
Code: Learning Curve	Transcription 4 I believe that with proper guidance and training, any technological tool becomes easier to use. If a competent trainer provides clear instruction, using the technology should not be too difficult.
Code: Learning Curve	Transcription 4 It does not take me long to become comfortable with a new technology–just a few days are usually enough. If a proper training plan is in place, even a one-day training session can be effective.
Code: Learning Curve	Transcription 5 My own interest, along with how easy or complex a technology is, plays a big role in how quickly I can learn it. Sometimes I grasp a new tool within a few days, while other times it can take up to a month. Tools like Meta AI have really simplified the learning process these days. In fact, the students we teach–belonging to this digital generation–are often more familiar with certain digital tools than we are. However, with proper training and guidance, it usually does not take long to become comfortable with new technologies.
Code: Learning Curve	Transcription 6 It depends on the complexity of the tool. If it is completely different from the regular tech and software we use, it might take more time for me to grasp it. But if you're patient and resilient, and have the will to make life easier for your students, you buckle down and learn how to use it.

Code: Learning Curve	Transcription 7 It takes me two to three weeks to understand a new tool and use it effectively. I believe I should learn a new concept so thoroughly that it is very easy to communicate it to my students.
Code: Learning Curve	Transcription 8 I still do not consider myself an expert. I am constantly learning–using the internet, exploring new tools, and attending training sessions to better understand and use different technologies.
Code: Learning Curve	Transcription 8 It varies–sometimes I am able to learn something new in a day, other times it takes a week. But I stay committed.
Code: Simplicity of Technology	Transcription 12 It depends on the complexity of the technology being introduced. If the technology is more complex, I would require additional training and practice to use it effectively. However, if it is simpler, I would be able to learn it more quickly.
Code: Simplicity of Technology	Transcription 12 The two apps, Seeing AI and Be My Eyes, serve different purposes. Seeing AI is easier to use and does not require much learning, allowing users to operate it independently. On the other hand, Be My Eyes often involves live calls, which may not always be convenient, especially when you are not in a position to take a call or do not have the time for it. While Be My Eyes is a good app, I personally prefer using and teaching Seeing AI because of its simplicity and ease of use.
Code: Simplicity of Technology	Transcription 14 It depends on the complexity of the tool. For example, it took me around a week to get the hang of online classes from A to Z, including setting meeting links, shifting between classes, preparing online study material, remaining in frame and communicating via PSL effectively on screen etc.
Code: Simplicity of Technology	Transcription 15 Depends on the type of technology. It was easy for me to learn Microsoft Word, but we needed a 3-month online training session to fully understand Microsoft Excel. Similarly, ERP was a bit harder to learn since it was an entirely new concept and we use the platform very infrequently for maintaining grades, so there is less practice and familiarity.
Code: Simplicity of Technology	Transcription 16 It depends on how complex a tool is. For example, we recently received training in Microsoft Office. Learning Word is relatively easy, but Excel takes more time to learn due to the different formulas and techniques involved.
Code: Simplicity of Technology	Transcription 2 For me, all AT is easy once I've gotten a grip of it myself. I've noticed that technology-based AT are easier for the younger generation to grasp but traditional AT like braille is difficult. I think it's hard to learn, manual, and learned over the years.
Code: Simplicity	Transcription 6 It depends on the complexity of the tool. If it is completely different from the regular tech and software we use, it might take more time for me to

of Technology	grasp it. But if you're patient and resilient, and have the will to make life easier for your students, you buckle down and learn how to use it.
Code: Technical Support Availiability	Transcription 1 Schools are not providing any training. There is a centralized institution that handles training.
Code: Technical Support Availiability	Transcription 10 Yes, we are provided training. When a teacher first joins, they receive comprehensive training during the initial three months, which includes Braille, orientation and mobility, as well as familiarization with the school curriculum.
Code: Technical Support Availiability	Transcription 10 Since my joining, no new technology has been introduced, but we are planning to integrate new tools, and research is currently underway. Once the tools are selected, we will be provided training before they are implemented. I believe that with proper training, I will be able to learn and use the new technology effectively.
Code: Technical Support Availiability	Transcription 10 While I do feel a bit hesitant when a new technology is introduced, proper training helps me become comfortable using it.
Code: Technical Support Availiability	Transcription 11 Yes, we are provided training. Some tools we learn through hands-on experience, while others are introduced during workshops and training sessions organized by the school. Even when a new technology or software is introduced, the school ensures that training sessions are arranged for the staff.
Code: Technical Support Availiability	Transcription 11 As for external factors, proper training should be provided, and it is important that the trainer is competent and well-versed in the subject.
Code: Technical Support Availiability	Transcription 12 Yes, if a new technology or software is introduced, we can learn it through self-learning, and training or discussion sessions are also arranged for teachers. The IT experts here guide us through the process. All the teachers here are familiar with technology and also try to explore things on their own.
Code: Technical Support Availiability	Transcription 13 Some mainstream schools I've worked at do provide training sessions, since they have a proper network and a system that they follow. They guide teachers with hands-on experiences when it comes to learning new technologies. However, most smaller schools don't have this training structure and you're pretty much on your own.
Code: Technical Support Availiability	Transcription 13 I learned about most tools and technologies I use today from my first job at a private autism care center, since they made sure to provide proper training sessions.
Code: Technical	Transcription 13 I think training would make it easier to use new technology, and it would be a bit difficult if you're left to your own devices. Self-learning requires

Support Availiability	a lot of time and practice, I have to watch so many tutorials to learn the new tool. So yes, training and support initially would make it easier to adopt a new technology.
Code: Technical Support Availiability	Transcription 14 The teachers who join this intuition usually know only the basics of sign language when they apply, but they are trained for a month in PSL before they can start teaching. We offer online and in-person courses for PSL.
Code: Technical Support Availiability	Transcription 14 Yes, teachers were trained on how to conduct online classes, how to stay in the frame while sharing slides online and remaining visible so students could see us sign during classes. Another example is the ERP system we use for grading. It was a new technology so everyone was hesitant at first, but the IT experts gave us demos on how to use it and remained available if we had any issues until we eventually got the hang of it.
Code: Technical Support Availiability	Transcription 15 Yes, we are provided with training. For instance, during the COVID-19 school closures, we were initially unsure about how to continue our work. The school then trained us in using platforms like Google Meet and Zoom, which allowed us to conduct online classes according to a set schedule throughout the pandemic. Although we come from a background in special education and are familiar with certain elements, many things are still new when we step into the practical field. To support us, the school organizes developmental days during summer and winter vacations. These sessions are focused on training us in the use of different tools, such as Microsoft Office and ERP, which we were recently trained in. Teachers now enter student results directly into the ERP system. So, training is regularly provided to teachers based on the needs of our students.
Code: Technical Support Availiability	Transcription 15 Mostly self-learning and training at the job. Month-long training at the start when teachers join, and workshops when some technology or tool needs to be integrated.
Code: Technical Support Availiability	Transcription 16 Yes, training is essential. When I first joined, I had very little idea about how to work with these students or how to use technology to support their communication needs, which are completely different from typical classrooms. English is not the primary mode of communication used here, so we often have to translate most of the content into Urdu to communicate it effectively to our students. Fortunately, our administration has provided us with proper training on how to use assistive technology to communicate with these students more effectively. After that, I started applying what I had learned in my classroom. I also had to prepare worksheets and exam papers, which required additional understanding of the students' needs. The school calls teachers in 15 to 20 days before the academic session begins for workshops, training sessions, and refresher courses.
Code: Technical Support Availiability	Transcription 17 Yes, the school does provide training. Recently, we were trained in using Microsoft Office along with ERP. We also received instructions on how to use the task sheet where we log all the tasks and activities conducted with our students. Initially, it was difficult to use these tools,

	but with time and practice, we became comfortable and can now use them with ease.
Code: Technical Support Availiability	Transcription 17 I have learned through self-learning, formal support, and peer support.
Code: Technical Support Availiability	Transcription 17 Practice and frequent use definitely make it easier to use a tool, and discussing it with peers also helps a lot. But training is a must. When a tool is just placed in front of you without any guidance, it becomes difficult to understand, just like how parents often struggle with social media because it is unfamiliar to them. Once we receive proper training, though, it becomes much easier to use and to teach with.
Code: Technical Support Availiability	Transcription 2 There is a government training institute for special education teachers that trains them to interact with students, latest AT introduced in their fields, and gives them revision courses on basics of special ed. In my opinion, the main thing is motivation, being passionate, prioritising learning technology for yourself and your students.
Code: Technical Support Availiability	Transcription 4 I believe that with proper guidance and training, any technological tool becomes easier to use. If a competent trainer provides clear instruction, using the technology should not be too difficult.
Code: Technical Support Availiability	Transcription 5 Teachers are sent to the provincial-level in-service training centre to receive training on how to use new technologies. Whenever a new tool is introduced in schools, teachers are first trained at the centre. However, the schools themselves do not provide any such training. Even teachers from other districts have to travel here (to Lahore) to attend. I believe there should be at least one training centre in every district to make it more convenient for teachers. It can be challenging–particularly for female teachers–to travel to a different district just for training.
Code: Technical Support Availiability	Transcription 5 At this level, I believe we are quite capable of using basic technologies. As a PhD scholar, I already had access to and familiarity with many tools. If there is something I am not familiar with, we have computer instructors available to guide and support us. Students also have the option to approach these instructors for assistance whenever needed.
Code: Technical Support Availiability	Transcription 6 One of the strengths of our department is that training sessions are provided whenever a new technology is introduced and needs to be implemented. The institute offers training courses that can last for several days, depending on how complex the new technology is. However, this training is only provided at the central level, not within individual schools.
Code: Technical Support Availiability	Transcription 9 Since NVDA is a free software, I was able to access and explore it on my own beforehand. But JAWS is a paid program, so I got the chance to learn it after joining this school. A computer expert here guided me with some aspects, and I picked up the rest through self-learning. There was not any formal training provided.

Code: Technical Support Availiability	Transcription 9 It is all about accessibility–the more accessible and user-friendly the interface is, the easier it becomes to use. And if proper training is available, that makes it even easier to get comfortable with the technology.
Code: Usage of Tech in Daily Life	Transcription 1 I regularly use technology in my daily life–things like my phone, laptop, social media, and other commonly used tools. I also make a point of using technology in ways that support my work. I watch videos to enhance my learning, read articles related to my field, and often consult AI for help. Along with that, I use platforms like LinkedIn and similar apps to stay connected and informed.
Code: Usage of Tech in Daily Life	Transcription 10 I personally use different software tools such as ChatGPT and DeepSeek. Additionally, I access research articles online using my phone and laptop.
Code: Usage of Tech in Daily Life	Transcription 11 I use different technologies in my daily life, including websites related to school, activities, and art, as I am passionate about art. I explore different activities to teach both my students and my own children. The internet has been a valuable resource for me in learning more about art.
Code: Usage of Tech in Daily Life	Transcription 12 I use my mobile phone, laptop, different software programs, and social media regularly. I am constantly exploring and learning through Google as well.
Code: Usage of Tech in Daily Life	Transcription 13 I use smartphone applications, social media, and laptop for work. Streaming services like Netflix and health apps like MyFitnessPal.
Code: Usage of Tech in Daily Life	Transcription 14 I use all social media apps, ChatGPT, smartphones, and laptops.
Code: Usage of Tech in Daily Life	Transcription 15 I use my smartphone the most, then laptop. I use all social media apps.
Code: Usage of Tech in Daily Life	Transcription 16 I mostly use a laptop, different apps, and spend a lot of time scrolling through social media on my phone. These are the tools I rely on in my daily life.
Code: Usage of Tech in	Transcription 17 Personally, I use instagram, whatsapp, facebook, and my laptop to develop teaching materials for my students.

Daily Life	
Code: Usage of Tech in Daily Life	Transcription 2 I use Jaws, a cane, Be-My-Eye software, braille, and NVDA software in my personal life. In addition to that, I use social media, smartphone and laptop. I like using accessibility and knowledge apps.
Code: Usage of Tech in Daily Life	Transcription 3 In my daily life, I use mobile phones, the TMS (Training Management System) app related to my work, social media platforms, AI tools, and similar technologies.
Code: Usage of Tech in Daily Life	Transcription 4 I use screen readers and other assistive tools and software to make my laptop and mobile phone accessible for me. These tools help me prepare lectures, write articles, and even work on my book, which I am currently writing. I am not much of a social media person, so I do not use it very often.
Code: Usage of Tech in Daily Life	Transcription 5 I use all the commonly used tools and applications in my daily routine, including my mobile phone, laptop, internet, social media platforms, and AI tools.
Code: Usage of Tech in Daily Life	Transcription 6 I use smartphones, laptops, and social media. These are a necessity at this point.
Code: Usage of Tech in Daily Life	Transcription 7 I use a smart phone and all smartphone-based apps for orientation & mobility, learning, reading/writing, and accessibility. I also use social media.
Code: Usage of Tech in Daily Life	Transcription 8 In my daily life, I use a smartphone, iPad, laptop, and social media, among other tools.
Code: Usage of Tech in Daily Life	Transcription 9 I personally use ChatGPT and DeepSeek. I have also installed the Be My Eye app to assist anyone who might need help. In addition to these, I regularly use Bing, Copilot, Gemini, and other AI tools.

Perceptions of Technology	
Code: Inclusivity & Accessibility	Transcription 1 Yes, it definitely does. In my field of intellectual disability, students benefit a lot from technology. They learn well through roleplay. We show them videos where teachers are roleplaying, and they pick up on those actions and behaviours. In a regular classroom setting, it can be

	challenging for a teacher to manage the class and demonstrate something at the same time. But with videos, it is much easier to show them exactly what to do and give clear instructions on how to act.
Code: Inclusivity & Accessibility	Transcription 10 Everything from Braille dictionaries, geometry tools, and braille textbooks for English, Math, and Quran is readily available. We also have access to well-equipped labs. In my opinion, no other school offers the same level of technological accessibility–this is one of the best institutes for visually impaired students. The canes used by students are even manufactured within the school itself. We have an embosser, and for students who cannot afford materials, the school provides books free of cost. Each student has a Perkins Brailler at their desk, and the library is stocked with a variety of storybooks and audiobooks.
Code: Inclusivity & Accessibility	Transcription 10 Accessibility remains a major issue in Pakistan. While technology is available here because it is a private institution, my experience in other institutions has been different. In some places, even basic tools like the Perkins are not truly accessible–often kept locked away in cupboards just for show. At present, the availability of technology across the country is quite limited. However, awareness is beginning to grow, and I hope the situation will improve in the coming years.
Code: Inclusivity & Accessibility	Transcription 11 These tools are quite accessible for both teachers and students, and they are also easy to use. For instance, if we talk about rhymes, the ones from our generation were very different from those available today. With the internet and other tools, it has become much easier for children to learn. For blind students especially, audio tools are incredibly effective in helping them learn rhymes and phonics.
Code: Inclusivity & Accessibility	Transcription 11 Yes, it does improve learning outcomes. Our blind students can also use mobile phones and even send text messages. Our former students are able to use phones with ease because they have learned to navigate technology.
Code: Inclusivity & Accessibility	Transcription 12 The technology we have here is fully accessible. It is up to the teacher to decide which tools are needed for the concept they are teaching. All tools at school can be used by both teachers and students. The administration is supportive.
Code: Inclusivity & Accessibility	Transcription 2 Yes, it definitely does. In my opinion, technology was created to help people like us. It increases student engagement, makes it easier for them to learn, and is overall a way for differently abled students to catch up with their ‘normal’ peers.
Code: Inclusivity & Accessibility	Transcription 5 Yes, to a large extent. Technology has a natural appeal–it draws everyone in, even infants–and it instantly makes learning more engaging. By incorporating technology, we can create a more interesting learning experience for our students. Of course, we are also aware of its side effects. As a psychology student, I understand that overreliance on technology can slow brain development. But in today’s world, it is nearly impossible to function without it.

	I believe technology should be used, but within healthy boundaries. For children with special needs especially, technology provides far more meaningful learning opportunities than simply relying on theoretical knowledge from textbooks.
Code: Inclusivity & Accessibility	Transcription 7 Absolutely. It really enhances learning outcomes, since technology makes educational text accessible for visually impaired students.
Code: Inclusivity & Accessibility	Transcription 8 The technologies are quite accessible, and whenever we face any difficulty, we make an effort to learn how to use them better so that the students can benefit more. We have one computer lab and a language lab in the institute. Since each classroom has fewer than 11 students, we have enough computers and other tools available for everyone to use comfortably during class.
Code: Inclusivity & Accessibility	Transcription 8 Yes, definitely. Whatever they cannot see, they can listen to, and they can explore with the help of computer skills.
Code: Perception of Usefulness	Transcription 1 Yes, it definitely does. In my field of intellectual disability, students benefit a lot from technology. They learn well through roleplay. We show them videos where teachers are roleplaying, and they pick up on those actions and behaviours. In a regular classroom setting, it can be challenging for a teacher to manage the class and demonstrate something at the same time. But with videos, it is much easier to show them exactly what to do and give clear instructions on how to act.
Code: Perception of Usefulness	Transcription 10 Yes, definitely. Technologies like audio tools make life easier for visually impaired students by allowing them to access information they cannot see. It is also important for us to make lessons engaging–if we speak for too long without any interaction, students tend to lose focus. Integrating technology into learning helps keep them attentive and makes learning more accessible. Students especially enjoy visiting labs and participating in hands-on activities.
Code: Perception of Usefulness	Transcription 11 These tools are quite accessible for both teachers and students, and they are also easy to use. For instance, if we talk about rhymes, the ones from our generation were very different from those available today. With the internet and other tools, it has become much easier for children to learn. For blind students especially, audio tools are incredibly effective in helping them learn rhymes and phonics.
Code: Perception of Usefulness	Transcription 11 Yes, it does improve learning outcomes. Our blind students can also use mobile phones and even send text messages. Our former students are able to use phones with ease because they have learned to navigate technology.
Code: Perception of Usefulness	Transcription 12 Yes, for example, when it comes to storytelling, technology can make it much more engaging. I even experiment by creating stories using ChatGPT and then adding voiceovers. So, by using technology, we can really enhance the learning experience.

Code: Perception of Usefulness	Transcription 13 Technology can offer access to vast learning resources, so of course it improves academic outcomes. For special needs children, it is very useful, since using Gemini in my speech therapy sessions gave me brilliant outcomes.
Code: Perception of Usefulness	Transcription 14 Definitely. Concepts are clearer when you show them visuals on screens, it is easier to engage them in classroom activities and study materials if they're digital in some form, and children relate more to videos and images than just PSL/words.
Code: Perception of Usefulness	Transcription 15 Definitely. Deaf students need visual aids to memorize better. If you see something, you're less likely to forget it. So yes, it definitely improves student outcomes.
Code: Perception of Usefulness	Transcription 16 Yes, to a great extent. If you just use textbooks to teach, students easily get bored. But if you use technology, students grow in confidence and become more excited to learn something new. This helps them focus more.
Code: Perception of Usefulness	Transcription 17 These are special children, and they respond much better to visual aids than to traditional, manual teaching methods. So I design my lesson plans with that in mind. Using technology in the classroom has proven to be quite beneficial for them.
Code: Perception of Usefulness	Transcription 17 Yes, to a large extent. I believe technology can really support our teaching and make it more effective. It can enhance the impact of our lessons and definitely helps improve students' learning outcomes.
Code: Perception of Usefulness	Transcription 17 I would like to share that, from what I have observed and implemented in my class, technology yields great results. We also report these outcomes to our institution and suggest that more technologies be introduced. The decision to create a smart room was a collective one made by our staff. I have high hopes for the future in terms of students' education and growth.
Code: Perception of Usefulness	Transcription 2 Yes, it definitely does. In my opinion, technology was created to help people like us. It increases student engagement, makes it easier for them to learn, and is overall a way for differently abled students to catch up with their 'normal' peers.
Code: Perception of Usefulness	Transcription 4 Yes, technology plays an important role in enhancing the learning of students, especially those with special needs. If schools provide students with the right technological tools, such as MP3 or MP4 players for visually impaired students, or access to computers, along with sufficient time and guidance from teachers, it can significantly support their development.
Code: Perception of Usefulness	Transcription 5 Yes, to a large extent. Technology has a natural appeal–it draws everyone in, even infants–and it instantly makes learning more engaging. By incorporating technology, we can create a more interesting learning experience for our students. Of course, we are also

	aware of its side effects. As a psychology student, I understand that overreliance on technology can slow brain development. But in today's world, it is nearly impossible to function without it. I believe technology should be used, but within healthy boundaries. For children with special needs especially, technology provides far more meaningful learning opportunities than simply relying on theoretical knowledge from textbooks.
Code: Perception of Usefulness	Transcription 6 Definitely. For example, a low vision student will find reading easy if I increase the font on the screen. This will increase student satisfaction and help them achieve their objective. So of course, learning outcomes will improve consequently.
Code: Perception of Usefulness	Transcription 7 Absolutely. It really enhances learning outcomes, since technology makes educational text accessible for visually impaired students.
Code: Perception of Usefulness	Transcription 8 Yes, definitely. Whatever they cannot see, they can listen to, and they can explore with the help of computer skills.
Code: Perception of Usefulness	Transcription 9 Yes, absolutely. If students have any questions, they can explore them through platforms like Google or AI tools. When they struggle to understand something, technology can help clarify concepts.
Code: Views on Student Engagement	Transcription 1 Yes, it definitely does. In my field of intellectual disability, students benefit a lot from technology. They learn well through roleplay. We show them videos where teachers are roleplaying, and they pick up on those actions and behaviours. In a regular classroom setting, it can be challenging for a teacher to manage the class and demonstrate something at the same time. But with videos, it is much easier to show them exactly what to do and give clear instructions on how to act.
Code: Views on Student Engagement	Transcription 10 Yes, definitely. Technologies like audio tools make life easier for visually impaired students by allowing them to access information they cannot see. It is also important for us to make lessons engaging–if we speak for too long without any interaction, students tend to lose focus. Integrating technology into learning helps keep them attentive and makes learning more accessible. Students especially enjoy visiting labs and participating in hands-on activities.
Code: Views on Student Engagement	Transcription 11 While we do teach them ourselves, we have noticed that students learn better and enjoy the process more when we incorporate internet-based and audio resources into our lessons.
Code: Views on Student Engagement	Transcription 12 Yes, for example, when it comes to storytelling, technology can make it much more engaging. I even experiment by creating stories using ChatGPT and then adding voiceovers. So, by using technology, we can really enhance the learning experience.

Code: Views on Student Engagement	Transcription 14 Definitely. Concepts are clearer when you show them visuals on screens, it is easier to engage them in classroom activities and study materials if they're digital in some form, and children relate more to videos and images than just PSL/words.
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Code: Views on Student Engagement	Transcription 16 Yes, to a great extent. If you just use textbooks to teach, students easily get bored. But if you use technology, students grow in confidence and become more excited to learn something new. This helps them focus more.
Code: Views on Student Engagement	Transcription 17 Developing students' interest in the lecture can be challenging, so sometimes I choose topics specifically to capture their attention
Code: Views on Student Engagement	Transcription 17 These are special children, and they respond much better to visual aids than to traditional, manual teaching methods. So I design my lesson plans with that in mind. Using technology in the classroom has proven to be quite beneficial for them.
Code: Views on Student Engagement	Transcription 2 Yes, it definitely does. In my opinion, technology was created to help people like us. It increases student engagement, makes it easier for them to learn, and is overall a way for differently abled students to catch up with their 'normal' peers.
Code: Views on Student Engagement	Transcription 5 Yes, to a large extent. Technology has a natural appeal–it draws everyone in, even infants–and it instantly makes learning more engaging. By incorporating technology, we can create a more interesting learning experience for our students. Of course, we are also aware of its side effects. As a psychology student, I understand that overreliance on technology can slow brain development. But in today's world, it is nearly impossible to function without it. I believe technology should be used, but within healthy boundaries. For children with special needs especially, technology provides far more meaningful learning opportunities than simply relying on theoretical knowledge from textbooks.
Code: Views on Student Engagement	Transcription 7 Students will not be engaged with a teacher who uses only manual tools, since tech is way more interactive.

Policy and Systemic Initiatives	
Code: Government Policies	Transcription 11 I do not believe there are any policies or issues that limit teachers' ability to use technology. Technology is being used in all schools, as

	far as I can tell. However, I cannot say for certain, as I do not have experience teaching at other schools.
Code: Government Policies	Transcription 14 I think the government likes to publicly highlight their actions and efforts for special children, but in reality when it comes to implementation, very little is being done.
Code: Government Policies	Transcription 15 I think even if policies exist in Pakistan, they are not followed properly so there is no implementation.
Code: Government Policies	Transcription 4 I believe that technology can reduce the challenges of disability by almost 70 to 80%. That is why I see assistive technology as especially valuable in schools. If the government makes an effort to provide these technologies at the school level–particularly for use in the teaching and learning process–it would be a great support for both students and teachers. It would help students develop their learning skills and allow teachers to improve their teaching strategies through the use of technology.
Code: Government Policies	Transcription 4 I do not believe there are major infrastructure issues in special education, but there is certainly room for improvement at the policy level. Specifically, there is a need to develop and strengthen policies related to the integration of technology in schools. Equally important is the effective implementation and consistent follow-up of these policies. As we know, Pakistan is an over-legislated country – there is no shortage of policies, but the real challenge lies in their implementation and oversight.
Code: Government Policies	Transcription 6 I think our policymakers don't consult special education teachers and experts while designing policies. They cannot assess the needs of teachers and students properly since they're laymen. It feels like they just consult Google and make policies, which leads to a significant gap.
Code: Government Policies	Transcription 7 Yes, I think policies are developed just for the sake of it. Policymakers often just copy foreign policies in terms of special education, which aren't compatible with our ground realities and resources, and this hampers implementation. In the local context, policymakers aren't aware of the problems facing the middle class and the special needs children, which is why policies aren't practical and inclusive. Even if a policy is developed, there is no mechanism to effectively implement it and monitor the progress.
Code: School Leadership Initiatives	Transcription 1 I have had a mixed experience with this. In some institutes, the administration is supportive, understands the value of technology, and encourages its use in teaching, while also providing resources to staff. In most centers and schools, there is a designated room with an LCD and other tools available. Sometimes, the school head encourages teachers to use the room, but I have also encountered situations where the head locks the room to prevent the technology from being damaged, even restricting students from using the computer labs. In my

	opinion, these resources are meant for the students, and they should be encouraged to make full use of them, even if there is a risk of damage.
Code: School Leadership Initiatives	Transcription 10 Yes, they are supportive. Even if a teacher is hesitant to use certain technologies, the administration takes it into consideration and tries to address it. It is the responsibility of every leader to support both students and teachers to ensure that learning is as smooth and effective as possible–and the administration here genuinely tries to fulfill that role.
Code: School Leadership Initiatives	Transcription 11 The administration is very supportive. They provide us with the necessary technologies and training, which enables us to effectively teach our students.
Code: School Leadership Initiatives	Transcription 12 Yes, the school administration is supportive and encourages us to use technology in the classroom.
Code: School Leadership Initiatives	Transcription 13 As a one-to-one aide to an individual student, I have been granted free reign to design my sessions as I see fit, so I would say that yes, the admin is supportive. In my previous institutes, they preferred to micromanage a bit and wouldn't allow a teacher to implement their own methods without submitting a proper plan/proposal to the admin. So I would say they weren't too supportive. It is a very parent and administrator-oriented environment, not a teacher and student-friendly one. Majority of the institutes in Pakistan are business hubs. They only care about making money, so they're not interested in applying new tech as it takes time, money, and training, so they'd rather stick to traditional methods. I also think most schools don't know the meaning of 'inclusivity' in Pakistan.
Code: School Leadership Initiatives	Transcription 14 Definitely, the admin is very supportive. The school's new plan is to create smart classrooms, which are equipped with LCDs and multimedias in each room. We don't have to rely on multimedia rooms any more. The school is willing to integrate new technology.
Code: School Leadership Initiatives	Transcription 15 They're very supportive. Since this is the era of technology, we have put requests in to place LCD screens in every class. We have also asked admin for a model resource room to hold interactive science and maths lessons and make it visually stimulating for students. These requests were approved and they will work on this very soon.
Code: School Leadership Initiatives	Transcription 16 In my experience, the administration is receptive to our input and provides support to the best of their ability, keeping the school's budget in mind.
Code: School Leadership Initiatives	Transcription 17 The school administration provides us with proper support. For example, In Sha Allah, they are planning to build smart rooms in the future. Work is already underway, and we hope to see the implementation soon. These smart rooms will be equipped with tools and technologies that both students and teachers can use during lessons.

Code: School Leadership Initiatives	Transcription 17 Speaking about this institute specifically, we have developmental days where refresher courses are arranged on tools we have already learned. It really helps because if you don't practice something regularly, it is easy to start forgetting it. Our department supports us by organizing these sessions, and I believe such training opportunities should be available in all special education schools.
Code: School Leadership Initiatives	Transcription 2 I would say they are very supportive. When I first came here, I didn't have a laptop. Most teachers relied on computer labs to gather resources for their class, but my principal issued a laptop for me to easily use my speech-to-text and screen-reading software and convey my lessons. Similarly, they do the best they can to provide technology to students as well.
Code: School Leadership Initiatives	Transcription 2 I think there are plenty of resources already available, if only people start using them to maximize their output. Similarly, admin support is also there as long as the school has resources. It is up to the teacher to make the best use of available resources.
Code: School Leadership Initiatives	Transcription 3 The school administration does their best to support us within the limits of the budget. They try to facilitate us as much as possible.
Code: School Leadership Initiatives	Transcription 4 In addition to the issues I mentioned earlier, the lack of consistent administrative support further adds to the challenges we face. When the administration actively supports the integration of technology into teaching practices for special education students, it encourages teachers to enhance their skills and adapt more confidently. Administrative backing is especially crucial from a financial perspective, as they are responsible for approving the budgets required to acquire essential teaching resources. However, more often than not, we find ourselves working in a restrictive environment, with limited flexibility and support.
Code: School Leadership Initiatives	Transcription 5 I think it really depends on how young and interested the administration is in integrating technology and recognizing its importance. When administrative staff have many years of experience, they can sometimes be resistant to change. Even if they want to support us, they may not fully understand the tools or the needs of the students. I have had mixed experiences with this. For instance, at one of the schools I worked at, the principal was nearing retirement and had difficulty understanding the technological needs of our students. But when a younger person took over, things changed quickly and new tools were integrated smoothly. This is actually a great question, because I truly believe that administrative staff also need to be educated and aware of how technology can enhance teaching. At my current school, the administration is very supportive in this regard–as you may have noticed.
Code: School Leadership Initiatives	Transcription 6 It depends on the honesty, dedication, and diligence of the admin – how loyal they are to their profession. Sometimes teachers want to implement new ideas but admin isn't receptive to these efforts, and at

	other times, admin does the best they can but teachers are unwilling to utilize resources.
Code: School Leadership Initiatives	Transcription 7 We are unfortunate in the sense that school heads/principals used to be teachers first, and they had no technology usage/interaction back in their time. So usually, they are either hesitant or entirely uninterested when it comes to technology integration. They don't often provide any additional support, and let teachers run things however they can manage on an individual basis. However, times are changing, and management positions are now filled with younger and more energetic individuals, who understand the need for technology and encourage it as much as they can.
Code: School Leadership Initiatives	Transcription 8 The administration always encourages us to integrate technology into our teaching. It becomes our responsibility to learn quickly so that we can equip every student with these tools–tools they can continue to use throughout their educational journey.
Code: School Leadership Initiatives	Transcription 9 We are now working towards teaching students how to use Artificial Intelligence. We have not started it yet, but we are planning to introduce a program after the upcoming final exams.
Code: School Leadership Initiatives	Transcription 9 The administration is very supportive and values our input. For instance, as we prepare to launch a program to integrate AI into our teaching, our head has asked us to provide written notes on how to implement it for the students, its potential benefits, and which websites and apps we can install on our computers. All teachers have contributed their thoughts on the matter, and work is currently underway. Another meeting will be held before we proceed with the implementation.

Recommendations	
Code: Recommendations	Transcription 1 Training should also be made available at the school level. Right now, teachers from all over the province have to travel to the in-service training institute in Lahore, and that creates a lot of problems. Not everyone can easily travel to another city, and adjusting to a new environment is not easy either. If the training lasts only a week, there is a limit to how much they can actually learn in that time.
Code: Recommendations	Transcription 1 Technology must be integrated into work with special children. If we introduce targeted technologies and arrange specialized courses for hearing-impaired individuals, we can significantly improve their chances of employment. Similarly, physically disabled students can also be trained through different courses to build skills that allow them to earn a decent income. The ultimate aim of special education is to support the rehabilitation and independence of students. This can only be achieved if we focus not just on academic education, but also on building their vocational skills.

Code: Recommendations	Transcription 10 If timely training and support are provided, we can integrate technology into our teaching much more easily. Otherwise, we have to learn everything on our own, which becomes more time-consuming and challenging.
Code: Recommendations	Transcription 10 I believe that integrating new technologies emerging in the market into our teaching can enhance the learning process, making it more efficient and accessible.
Code: Recommendations	Transcription 11 In an ideal situation, teachers would receive more comprehensive training. While we do have training sessions here, they could be more frequent and detailed. Students should be provided with all the necessary tools, such as tablets, computer labs, and other resources to enhance their learning. Teacher training remains the most crucial factor in ensuring effective teaching.
Code: Recommendations	Transcription 12 I would just like to say that this is the era of AI, and we should make the most of it. We should try to make our work, our lives, and our students' learning as easy and effective as possible. It is important for us to explore the world ourselves, and also help our students explore it. A visually impaired student may not be able to see, but we can make meaningful use of their other senses to enhance their learning.
Code: Recommendations	Transcription 13 I would say collaborative and hands-on workshops would really help. Where teachers can learn from each other and share feedback. I've not experienced these kinds of settings yet but they are very important.
Code: Recommendations	Transcription 14 For example, in summer vacations, we should be given interactive workshops and training to make our lectures more effective. Introduce us to the latest tools that can enhance our performance as instructors and help the children.
Code: Recommendations	Transcription 15 LEDs should be available in all classrooms for visual help to increase student engagement and enhance lectures.
Code: Recommendations	Transcription 16 One challenge I have observed is that many students, particularly those from lower-income backgrounds, struggle to interact effectively with their families. To address this, we conduct workshops on Pakistan Sign Language (PSL) to help both students and their families. We also have a YouTube channel where we upload sign language lectures, which we encourage parents to use. Unfortunately, some parents don't make the effort to learn, though those who do really benefit from these workshops and resources. Another issue is that some parents create their own signs to communicate with their children, rather than using PSL, which can create confusion. Additionally, many people are not fully aware of how to use hearing aids, such as cochlear implants, correctly.

Code: Recommendations	Transcription 2 In an ideal world, teachers are self motivated and are provided resources. Training and resources are also provided at the school level, rather than only at a central or provincial level, ideally.
Code: Recommendations	Transcription 2 I think we need more awareness at the parent level so children are provided with emotional and educational support at home too, in addition to schooling.
Code: Recommendations	Transcription 3 Even if we receive training in using technology, the biggest barrier is implementation. For instance, if I am trained in IT but the school I work at doesn't have the necessary IT resources, then that training goes to waste. It's important that the same tools and facilities we are trained on are also made available in our schools or centres so we can actually apply what we have learned.
Code: Recommendations	Transcription 4 I strongly believe that teacher training is one of the most important factors in improving special education. As you know, there is only one in-service teacher training college for special education, and that puts a lot of pressure on a single institution. I would suggest that if teachers were provided with regular, monthly training sessions within our own schools, conducted by experts from the field, it would not only enhance the quality of teaching but also boost our confidence in using technology effectively in the classroom.
Code: Recommendations	Transcription 4 Yes, I believe times are changing, and over the past two years, it has become clear that we are entering the era of Artificial Intelligence. I strongly feel that both teachers and students need to be trained in advanced tools to keep up with these developments. There should be a specialized department within the Special Education Department dedicated to technological training. Moreover, I believe the Special Education Department Punjab should not limit its efforts to the province alone. It should collaborate with other provinces to ensure that no region is left behind, and as a nation, we can stay competitive in today's rapidly evolving world.
Code: Recommendations	Transcription 5 Currently, things are not as accessible as they should be, like internet availability. I understand that we live in an underdeveloped country and we cannot expect all the resources to be available for us here. But I do think that the basic needs should be fulfilled, like Wifi should at least be available in all educational institutes, especially special education. Students face difficulties due to the lack of these resources. Computers are useless without the tools to access them. Internet facility is quite necessary and the system also needs to be improved to enhance learning.
Code: Recommendations	Transcription 7 First of all, like the developed world, we should have all apps and tools available to us. This will help learners with mobility,

	accessibility, and education. For blind children, we should have AI-based smart canes, for physical disabilities we should have robotic wheelchairs. These will facilitate teachers and students alike and improve the learning experience for everyone.
Code: Recommendations	Transcription 7 I think the government and responsible stakeholders should introduce technology which is low cost, easy to use, and within our financial means to implement for every student. Teachers should be properly trained regarding technology, so they can teach their students effectively. School infrastructure should be disability friendly for students as well. Government should play its role in the facilitation of these things.
Code: Recommendations	Transcription 8 I have a suggestion: there should be more competent trainers and instructors to facilitate these students. Additionally, the salary packages for these trainers should be competitive to ensure they remain motivated and committed to training these students. While I am personally motivated to be here, I have noticed that some IT experts leave due to the lower salary packages.
Code: Recommendations	Transcription 9 I would like to emphasize that while we often talk about social inclusion, it is equally important to focus on digital inclusion. Whether it is social media or AI, persons with disabilities, including those with visual impairments, should be fully included in the digital space. Unfortunately, many individuals with disabilities still lack access to digital tools, and even when they do have devices, they often do not know how to use them effectively.

Regional Differences in Tech Access	
Code: Regional Differences in Tech Access	Transcription 1 There is a huge gap in technology access and ease of use between schools in Central Punjab–like those in Lahore, Gujranwala, Faisalabad, and Rawalpindi divisions–and schools in South Punjab, such as Multan, DG Khan, and Bahawalpur. Some teachers in rural areas still do not even have access to basic technology. I remember one of my colleagues from DG Khan had to buy an Android phone only after moving to Lahore, and we helped him learn how to use it. So yes, teachers in different regions have very different levels of exposure to and familiarity with technology.
Code: Regional Differences in Tech Access	Transcription 10 This school is better than any other school or center I have come across. The technology here is not only advanced but also accessible, and proper training is provided to ensure it is used effectively.
Code: Regional Differences in Tech Access	Transcription 15 I previously worked in government schools before 2011. At that time, technology was non-existent in those institutions. As you know, technology has taken center stage after COVID, and if I compare this institution with public schools now, I'd say this is way ahead in terms of

	tech adoption and accessibility. Funding is easily available to private schools, and there is a check and balance/accountability by donors.
Code: Regional Differences in Tech Access	Transcription 17 There is a huge difference. Before joining my current institute, I worked at a government school, and while the government might have been providing resources on paper, they were not actually accessible there. For instance, there were computer labs, but no computers. We had to rely entirely on traditional teaching methods. In comparison, my current school is one of the best in terms of special education and the use of technology. Students here are facilitated in every possible way. We have psychologists, speech therapists, art instructors, and other specialists available. In the government school, there was no proper system in place.
Code: Regional Differences in Tech Access	Transcription 2 There is a huge difference in tech adoption in schools from different regions. For example, I have trained some teachers from remote areas who have come to Lahore for training, and they have never been around mobile phones or laptops at their homes. So you can imagine they don't have access to these technologies in their institutions either. From their accounts, I can tell you that they do everything manually.
Code: Regional Differences in Tech Access	Transcription 3 If I talk about the difference between schools in urban and rural areas, urban schools are much better. Teachers in urban areas are quick to learn and use new technologies. In rural areas, it is harder to adopt and implement technology because of issues like limited access and fewer resources.
Code: Regional Differences in Tech Access	Transcription 4 Previously, I taught at a school located in a less developed area. Compared to that, the school I currently work at is significantly better in many aspects, including infrastructure, accessibility of assistive tools, and the overall quality of teaching staff. In schools situated in backward areas, the lack of access to essential resources creates challenges for both teachers and students, hindering the teaching and learning process.
Code: Regional Differences in Tech Access	Transcription 5 My current school is significantly better than others when it comes to accessibility of technological tools. In many other schools, especially those located in backward areas or in South Punjab, such resources are not readily available. Both teachers and students there face far greater challenges in using technology than we do here. That is why I believe it is important to place more focus on these areas. I personally belong to South Punjab and have taught in schools there, so I have seen firsthand the contrast between schools in that region and those in cities like Lahore. There is a major gap in accessibility that needs to be addressed.
Code: Regional Differences in Tech Access	Transcription 6 There is a huge difference. We have visited many schools as part of training sessions and I can clearly say that government-run institutions lack a lot of resources, especially technological, compared to private and trust schools.
Code: Regional	Transcription 7 Students from rural areas have no interaction with gadgets, compared

Differences in Tech Access	to their urban counterparts. So yes, it takes some time to guide them about technology.

Teaching Experience	
Code: Over 10 Years	Transcription 11 I have had a positive experience in teaching and have been part of this institution for the past 14 years. I always had a desire to work with special children.
Code: Over 10 Years	Transcription 12 I have been teaching at this institute for visually impaired students for about 17 years.
Code: Over 10 Years	Transcription 14 I have been a special education teacher for almost 16 years.
Code: Over 10 Years	Transcription 15 In 2011, I joined my current institution for hearing-impaired children, where I have been for the past 14 years.
Code: Over 10 Years	Transcription 2 I have 12 years of teaching experience. I started my career by teaching slow learners and students with intellectual disabilities. Then, I moved on to visually impaired students.
Code: Over 10 Years	Transcription 6 I have been in this field since 2004.
Code: Over 10 Years	Transcription 7 I was appointed to the Special Education Department in July 2015, and I have been fortunate to work across all teaching cadres within the field.
Code: Over 10 Years	Transcription 8 I have been a teacher in Special Education since 2011.
Code: Under 10 Years	Transcription 10 I have a degree in Special Education and have been teaching here for almost three years.
Code: Under 10 Years	Transcription 13 I've been in this field for almost four and a half years now, in the private sector.
Code: Under 10 Years	Transcription 16 I have been working at this school for deaf children for the past six years.
Code: Under 10 Years	Transcription 17 I have been teaching at this school for children with hearing impairment for around three years now.

Code: Under 10 Years	Transcription 4 I started my career in 2016 as a special educator at the school level at Grade (Government Scale) 16.
Code: Under 10 Years	Transcription 5 I started working in 2016 and began my career teaching at a school for slow learners, where I worked for about a year and a half. After that, I taught at a school for students with hearing impairments for 10 months. In my current position–which I have held for the past six years–I work with students with different types of disabilities. Altogether, I now have over eight years of experience in this field.
Code: Under 10 Years	Transcription 9 I have been teaching here since November 2023, and it has been a very positive experience.

Tech Motivation	
Code: Tech Motivation	Transcription 1 Based on my own experience, if a technology is interesting and supports my teaching, I definitely make more of an effort to learn it. I don't really hesitate to learn new tools–even if they are not immediately useful to me, I still try to explore them. But I have noticed that, in general, people tend to hesitate when a technology might create problems for them. Take the facial attendance system, for example. Many teachers and students are wary of it. And honestly, I get it–biometric systems can be quite frustrating, especially when they mark us late even if we are just five or ten minutes behind.
Code: Tech Motivation	Transcription 10 Technology makes our lives significantly easier. For instance, without Duxbury, we would have to manually type everything, but now we can convert text into Braille with just a click, that in itself is a great motivation.
Code: Tech Motivation	Transcription 11 If you truly want to learn something, you can. For instance, I had no experience with braille before, but I managed to learn it. So I believe that with genuine passion, you can learn anything–whether it is technology or something else.
Code: Tech Motivation	Transcription 11 I do not feel hesitant; rather, I am motivated to integrate more technology into my teaching to enhance student learning.
Code: Tech Motivation	Transcription 12 The first factor is interest. If you are interested in using technology, you will pick things up more quickly. Secondly, the support and encouragement provided by the administration play a crucial role in how effectively you can learn and use technology. Additionally, if a technology proves to be effective and delivers positive outcomes, we are more likely to incorporate it into our teaching.
Code: Tech Motivation	Transcription 12 What motivates me is the process of learning new things and making my work easier. I do not feel hesitant when it comes to using technology. If I come across something new, I at least try to explore it.

Code: Tech Motivation	Transcription 13 Technology offers opportunities to develop new skills for teachers, and it enhances students' participation and engagement. These are good motivators. But technical issues while using technology and insufficient training do cause hesitation at times.
Code: Tech Motivation	Transcription 14 I love learning new things, so if I come across a new technology, I try my hardest to use it every single day in an attempt to quickly get good at it. I love learning, and it motivates me to think about how I can impart my knowledge to my students. So that just pushes me to absorb every latest thing in my field.
Code: Tech Motivation	Transcription 15 I don't hesitate about using technology because it is a necessity now. Our children need technology to thrive, so it makes me feel motivated. The admin is very supportive, so they offer training and resources so there is no need to hesitate.
Code: Tech Motivation	Transcription 16 I genuinely enjoy teaching speech, helping students learn how to talk, and I feel especially motivated to use any tools that support this process. I even create many of the models myself and am always exploring ways to integrate technology into my teaching practices.
Code: Tech Motivation	Transcription 17 I do not feel hesitant using technology in the classroom–I confidently teach whatever needs to be taught, whether it's theory or practical work. My motivation comes from the desire to teach these technologies to my students and then reinforce that learning. The aim is to prepare them to move confidently in society, to ensure they are familiar with the tools being used today, and that they know how to use technology in a positive way.
Code: Tech Motivation	Transcription 2 I am motivated about using technology because it is designed to help people like me, and I want to impart that knowledge to my students who face similar visual struggles. I won't say I'm hesitant about using it.
Code: Tech Motivation	Transcription 3 When a new technology is introduced, I feel very motivated to use it. This motivation helps me learn it more easily.
Code: Tech Motivation	Transcription 4 One of the main factors that motivates me is the healthy competition among teachers when it comes to integrating new technology in classrooms. For instance, if there are around 12 teachers in a school and 4 to 6 of them are actively and effectively using technology, it naturally creates a sense of competition. The desire to be among the 'good teachers' who are using modern methods is a strong motivator.
Code: Tech Motivation	Transcription 5 When it comes to motivation, accessibility to technology plays a key role. As times change, our systems must evolve too, ensuring that both resources and tools become more accessible for teachers and students alike. In my view, internet availability–currently limited in many places–is another major factor that encourages the use of technology in teaching. On the other hand, the absence of such essential facilities becomes a barrier to effective technology integration in classrooms.

Code: Tech Motivation	Transcription 6 I think it is about intention and motivation. Sincerity to your field is the biggest factor that can make technology or anything easy for you to use.
Code: Tech Motivation	Transcription 6 I think student response is the best motivator. Other than that, the dedication of the teacher will always motivate or demotivate them.
Code: Tech Motivation	Transcription 7 Teachers who have some knowledge about technology are motivated. As for me, I want to learn and adapt to new technology and want to teach my students everything I know. Reluctance stems from wanting to stick to the status quo – which is traditional teaching methods.
Code: Tech Motivation	Transcription 8 I genuinely like helping these students. What motivates me the most is knowing that if they learn computer skills, they will be able to compete with their sighted peers. However, there are times when I feel I should be more competent with technology myself.
Code: Tech Motivation	Transcription 9 If a technology is easily accessible and user-friendly, I do not hesitate to use it. My motivation to use technology comes from the fact that the world is advancing rapidly–technology is now inevitable, and we cannot avoid it. Visually impaired individuals should also be equipped with digital skills and be part of digital inclusion.

Technology Use	
Code: Challenges in Integration	Transcription 1 In my field, the student-teacher ratio plays a significant role. Many students face behavioral challenges and struggle to stay seated, making it difficult for one teacher to manage them effectively. International standards suggest a ratio of 1:3, but here, a single teacher is often responsible for 10, 20, or even 40 students in a class. It becomes a real challenge to address the needs of so many students, especially those with mental and behavioral issues. Even when using a projector to show something to the class, it is hard to manage the students effectively. Time constraints add to the difficulty since we have to fit everything into a 30-40 minute class and cannot provide individual attention to each student.
Code: Challenges in Integration	Transcription 10 We must adapt our teaching methods to the needs of our visually impaired students. At times, they grasp concepts easily, but there are occasions when extra effort is required to help them understand, especially with subjects like computers, where the lack of vision presents challenges.
Code: Challenges in Integration	Transcription 11 Sometimes, we face issues with internet connectivity and electricity, but other than that, I cannot think of any major challenges when using technology in the classroom.
Code: Challenges in Integration	Transcription 12 Sometimes, I face challenges in teaching technology to students. Some students grasp it quickly, while others take more time. Another issue is

	the internet connectivity–when the signal drops while we are teaching or working, it gets frustrating and affects the flow of the lesson.
Code: Challenges in Integration	Transcription 12 There is a lack of access to technology. Some students do not have any access to technology at home. So even if we teach them how to use a tool at school, they cannot really use it outside. Many students cannot afford a mobile phone or internet. Affordability and access are big issues. Also, many parents do nott know how to use braille or help their children at home.
Code: Challenges in Integration	Transcription 13 There are definitely barriers to accessibility when it comes to these tools I've mentioned. They're not commonly known or accessible. They're very expensive to use, charging monthly in dollars. I find that teachers are not well-trained when it comes to these technologies, and schools don't provide enough support to facilitate their learning either.
Code: Challenges in Integration	Transcription 13 A big challenge is connectivity issues in Pakistan. Other than that, technical glitches like frozen screens and audio problems also act as barriers. Moreover, since most of my sessions are online, making my autistic students respond properly over video calls is also a challenge at times.
Code: Challenges in Integration	Transcription 13 Permissions and licenses are required to use some digital tools such as e-books or online journals, which limits the teachers' ability to access them.
Code: Challenges in Integration	Transcription 14 I'd say the electricity outage in Pakistan is always a pressing issue, especially when laptops run out of battery. Technical issues with gadgets is another issue, because then we have to waste the class time to wait for the computer/multimedia to be fixed.
Code: Challenges in Integration	Transcription 15 It depends on the technology. Mostly we face technical issues like power outages, lack of internet, or system failure.
Code: Challenges in Integration	Transcription 15 Like I said, technical issues like electricity cuts and lack of internet. Or sometimes, two classes can overlap for computer labs or multimedia days, which means one teacher has to revert back to their classroom to accommodate the other class.
Code: Challenges in Integration	Transcription 16 Unforeseen factors, such as electricity issues, can create obstacles in both using and teaching with technology. We also face time constraints in our daily schedule, and having to work within those limitations can make it even more challenging to incorporate technology effectively.
Code: Challenges in Integration	Transcription 3 The first issue I would mention is the lack of resources, which makes it difficult to use technology. For example, some good schools in Lahore have LEDs to help students learn through visuals. But if you travel to smaller cities like DG Khan or Rahim Yar Khan, these tools often are not available. There are many reasons for this. In some areas of Punjab, even internet access is not available. I saw this myself during COVID-19, when we shifted to online learning–I could not even contact some

	students because they had no internet. The lack of training and basic resources in many places makes it hard to properly use technology in education.
Code: Challenges in Integration	Transcription 3 As I mentioned earlier, there are some technologies I was trained in but could not actually use because they were only available at the training institute, not in our schools. This is not just the case in my field–other areas of special education face the same problem. It is a major flaw in the system. Our schools often lack the resources and tools we really need, which becomes a big barrier.
Code: Challenges in Integration	Transcription 4 If I were to count the challenges on my fingertips, the first would be the lack of adequate resources for teachers. Secondly, many institutions do not have proper internet access. Third, there is a gap in teachers' training when it comes to using technology effectively. Fourth, the socio-economic background of most students makes it difficult to familiarize them with technological tools.
Code: Challenges in Integration	Transcription 5 Sometimes, due to external factors like power outages or short circuits, I choose not to use certain technologies, such as multimedia, to avoid wasting time.
Code: Challenges in Integration	Transcription 5 However, one major challenge is the limited availability of resources. We often have to make do with what is available, which can restrict the full potential of technology integration.
Code: Challenges in Integration	Transcription 6 The weak internet is the biggest hindrance. For example, if the school internet isn't working, and my mobile data runs out, my digital lecture gets disrupted. So I'd say infrastructure issues are the biggest challenges when using technology.
Code: Challenges in Integration	Transcription 7 Research analysis programs like SPSS and Nvivo aren't compatible with screen readers, so after a lot of tries, I had to give up using them because of lack of accessibility.
Code: Challenges in Integration	Transcription 7 Sometimes we get electricity outages so our gadgets are rendered useless until power comes back on. Secondly, we have students with very limited or close to no tech background, and they get scared when we use digital tools in class. It takes time to convince them to move on from conventional methods and adopt tech.
Code: Challenges in Integration	Transcription 9 Sometimes, we face electricity issues in this area, and power cuts can disrupt the lessons. As I mentioned earlier, some children struggle to grasp the material, so we often need to repeat it several times before they fully understand.
Code: Types of Platforms	Transcription 1 There are no specific applications or tools available for children with intellectual disabilities. They have to rely on the same tools used in general education, such as computers, projectors, among others. There isn't any tool or application to help develop individualized educational

	plans for these students in a time-saving way. Teachers have to work with the limited resources that are meant for regular students. Even applications that allow you to download flashcards for teaching are often paid, so they are not easily accessible. As a result, teachers have to design, print, and laminate flashcards themselves, and they also have to create their own worksheets and workbooks. While some apps can be downloaded, most of the good content is paid.
Code: Types of Platforms	Transcription 1 I try to make use of all the technologies available to me–computers, LCDs, projectors, as well as my personal phone and laptop. I believe learning should be an engaging experience. While intellectually challenged students may not be able to use computers effectively on their own, I still use these tools to show them videos and images, especially when other resources are not available.
Code: Types of Platforms	Transcription 10 We do not keep all tools in the classrooms; instead, they are placed in separate designated rooms. Each room–like the model room (with stuffed animals), the computer lab, the language lab, and the music room–has specific days when students visit. The computer lab is used more regularly, while the others are accessed as per schedule. Students attend their regular classes in the classrooms, but for practical learning, they go to these specialized rooms. Braille tools like the Perkins Brailler are available in the classrooms. If teachers need to play audio content, they can use their phones, and for multimedia use, we set up the equipment in the library whenever required.
Code: Types of Platforms	Transcription 10 Personally, I use Braille books, my phone, and the computer lab as part of my teaching. I usually conduct the computer classes myself, but I consult the school's computer expert if needed.
Code: Types of Platforms	Transcription 10 We even have software called Duxbury that translates text into braille.
Code: Types of Platforms	Transcription 11 I use computers, along with my personal tablet and mobile phone. Since our students are quite young, our primary use of the computer lab involves story sessions. We do not teach cane usage at this level–that begins from grade 4 onwards. At this early stage, students do not have much understanding of the cane, and there is a risk they might unknowingly hurt someone while using it. Instead, we focus on basic mobility training, such as wall guidance.
Code: Types of Platforms	Transcription 12 First of all, we cannot teach blind students without assistive devices because their learning does not happen through vision. They have to rely on their other senses. So, at the initial level, we use assistive technologies based on the subjects we teach. For example, for English or math, we have different kinds of tactile equipment. We may not have very advanced technology, but we make do with what is available here.
Code: Types of Platforms	Transcription 12 For teaching mathematics, I use Duxbury, Braille Blaster, and lately, we have also been utilizing ChatGPT. We create tactile sheets as needed, and for teaching fractions, we use a fraction kit. In Orientation and Mobility, the cane is essential. For self-betterment, we use original

	models, and we also have a model room for that purpose. Additionally, we have tools in the recreation and exercise rooms. For advanced students, some of them use apps like Seeing AI, Be My Eyes, and other similar software. In addition to the tools mentioned, I also use screen readers like JAWS to assist with teaching.
Code: Types of Platforms	Transcription 12 Yes, for example, when it comes to storytelling, technology can make it much more engaging. I even experiment by creating stories using ChatGPT and then adding voiceovers. So, by using technology, we can really enhance the learning experience.
Code: Types of Platforms	Transcription 13 I've worked primarily with autistic children. I use text-to-speech software, which allows children to read digital texts easily. I also use an app called Gemini in my speech therapy sessions.
Code: Types of Platforms	Transcription 13 I've been using Gemini for one and a half years now and it is extremely beneficial. I also use IXL, which gives me new and creative ideas for my lessons. They save my time and I don't have to make old-school notes for my sessions, which is why I recommend using technology for education, special and otherwise.
Code: Types of Platforms	Transcription 14 I use my tablet mostly. I have permission from the admin to use it in my classroom since children can easily see the pictures without having to zoom in (on my phone). This way I can utilize tech readily without going waiting for the designated computer lab days or waiting for the multimedia room to be free.
Code: Types of Platforms	Transcription 15 I mostly use a laptop, and mobile sometimes when I need to share a link/announcement with other teachers or parents on WhatsApp. We also have a Facebook and Instagram page where we share educational content and all academic/extra curricular announcements for teachers and students. We mostly work with visual aids so we always use a computer and flashcards.
Code: Types of Platforms	Transcription 16 Different teachers here are trained in different tools and skills, depending on their roles. We use different technological tools such as LEDs, and we have a computer lab upstairs where we also conduct art classes, according to a set timetable. For speech lessons, we use FM systems to improve the hearing ability of students who are hard of hearing. These systems help them pick up sounds more clearly, which gradually supports their speech development. We also have iPads, specifically provided for teachers to aid student learning. For example, when teaching rhymes, we play the video and use gestures to help students understand and engage. Hearing-impaired students require a lot of individual attention. They already find learning more challenging, and when we introduce abstract or imaginative content, it can sometimes confuse them even more.
Code: Types of Platforms	Transcription 16 I use my laptop frequently for classroom planning, filling out forms, and other administrative tasks. There is also a specific software that I use for setting timetables. When it comes to working with students, I mostly rely on multimedia. As I mentioned earlier, the school is also planning to set

	up a resource room, which will further support the integration of technology into our teaching environment.
Code: Types of Platforms	Transcription 17 We use a laptop to show visuals to students, and if we feel a topic is important for all of them to understand, like personal hygiene, we move the class to the conference room where multimedia has been set up. For both learning and enjoyment, we also take students to the library, where a media player is available for them to learn through stories, whether related to society, religion, or other topics. Visual aids like multimedia are an important part of our teaching approach. We have also created pages for students on Instagram and Facebook, where they can engage with and learn new concepts.
Code: Types of Platforms	Transcription 17 I personally use a laptop, which I need for teaching purposes–to make lesson plans, design worksheets, and conduct activities with students. I also use the laptop or multimedia as a visual aid for my students whenever needed.
Code: Types of Platforms	Transcription 2 ATs like white cane, braille, speech to text, screen reader are available in my classroom, and they are provided in most special institutions of punjab.
Code: Types of Platforms	Transcription 3 Different tools are used to address the specific challenges faced by these students. We mainly use hands-on teaching methods. At school, we often use TEACCH and PECS (which is especially helpful for children with autism), along with some other tools depending on the level of disability–whether it is mild, moderate, or severe.
Code: Types of Platforms	Transcription 3 I mostly use multimedia in my classroom, as it makes the learning experience more engaging and enjoyable for my intellectually challenged students. I also use my mobile phone or laptop occasionally, depending on the activity or lesson.
Code: Types of Platforms	Transcription 4 For instance, if a student with visual impairment needs a laptop or computer for their studies, the teacher can guide them to use assistive technologies such as screen readers, which can be downloaded from the internet. One useful website is blindhelp.net, which helps students access screen readers like JAWS or NVDA.
Code: Types of Platforms	Transcription 4 While teaching, I use a computer and often take assistance from artificial intelligence softwares. I have only recently started incorporating AI into my teaching, but I believe it offers many valuable applications.I also use Braille regularly, both for personal and professional purposes.
Code: Types of Platforms	Transcription 5 It depends on the type and level of disability. For example, with visually impaired students, we use assistive technologies that enhance their listening abilities, such as speakers. Since they cannot see, tools like slides and projectors are not useful, so we rely on audio-based methods instead. For hearing-impaired students, we focus on visual aids. However, projectors are not commonly used in schools due to limited resources. So, as teachers, we create realistic handmade models for students to identify, or we draw visuals and even arrange educational

	visits. I personally feel that projectors should at least be available to help provide visual support to students. Even when projectors are not available, computer labs are still accessible.
Code: Types of Platforms	Transcription 5 I personally use speakers, multimedia, computers, mobile phone, and laptop in my teaching. These tools help me enhance the quality of my lessons and make the learning experience more effective for my students.
Code: Types of Platforms	Transcription 6 The tools are used based on the students' needs and the institution's capacity to provide resources. For visually impaired students, for example, white canes are either provided by the schools or through donors. In addition to that, digital compasses are being used, and screen-reading software like JAWS is also available to students. These tools have become fairly common at the school level.
Code: Types of Platforms	Transcription 6 I use multimedia. Sometimes the wifi isn't available in the school, but most teachers bring a portable wifi device with them or use their mobile data to access the Internet. We utilize maximum digital technologies to facilitate our students. We teach braille and mobility & orientation from the start, and even have short courses during summer break – which are open to all participants, not just our students.
Code: Types of Platforms	Transcription 7 For students with visual impairment, we use braille technology. For that, we provide a braille frame and stylus, and we have a few Perkins braillers available as well for older students. However, that is expensive so we don't have Perkins braillers for all students. For hearing impaired students, we use visual aids like flashcards, multimedia, and videos to offer them interactive learning and a hands-on learning experience. I wouldn't say the digital tools are too advanced in Pakistan for now, just multimedia, audio and video, and braille.
Code: Types of Platforms	Transcription 7 I use smartphones in my class, and I, being visually impaired myself, prepare my lectures on my laptop and deliver them via multimedia. I give them soft copies of notes and class materials, and my students use screen readers to access them. We also encourage students to take exams however they're more comfortable, either on paper with braille or they can type it out on their laptops.
Code: Types of Platforms	Transcription 8 Students here use laptops, and there is also an embosser–a special printer used for printing in braille–which is available at the institute. Both students and teachers have access to multimedia tools as well. For low-vision students, there are also special glasses provided that help enhance their vision and make it easier for them to see.
Code: Types of Platforms	Transcription 8 In my teaching, I mostly use screen readers like JAWS (Job Access With Speech) and NVDA (Non-Visual Desktop Access).
Code: Types of Platforms	Transcription 9 Here, we use the Perkins Brailler, a tool that visually impaired students use for writing in braille. In addition to that, we have frames, white canes, and computers equipped with screen reader softwares like NVDA and JAWS. We also have IrisVision, which is an assistive device designed

	for students with retinal issues, such as degenerative disorders. It is especially helpful for those with macular degeneration, as it helps them see better.
Code: Types of Platforms	Transcription 9 We use the computer lab available here. All the computers are equipped with NVDA and JAWS. Braille is used for all subjects taught at this school.

Willingness to Adopt Tech	
Code: Willing to Adopt Tech	Transcription 1 If I feel confident using a particular technology, I am definitely more open to integrating it into my teaching. But if I am not comfortable with a tool, I tend to avoid teaching it. There are times when I simply don’t know how to use something, and that lack of familiarity can be discouraging. Of course, this experience varies from person to person.
Code: Willing to Adopt Tech	Transcription 10 Technology is a necessity in today’s world, so I believe everyone should be familiar with it. I would not call myself an expert, but I try to teach with confidence so my students can benefit as much as possible.
Code: Willing to Adopt Tech	Transcription 11 Whenever new technology is introduced, we assess whether it will benefit our students. If it seems valuable, we learn it and incorporate it into our syllabus.
Code: Willing to Adopt Tech	Transcription 12 We should use more technology in special education. I have taught many things to my students with the help of technology at the initial level. That is why I think all teachers should use it, and it should be available in every classroom. It helps make teaching easier and more interesting. There are so many tools we can use for this.
Code: Willing to Adopt Tech	Transcription 15 We are willing because it is a necessity now. We are also confident in our skills, and yes that increases willingness to use.
Code: Willing to Adopt Tech	Transcription 16 I actually consider myself a seeker of knowledge. I do not avoid using a technology just because it seems complicated or time-consuming.
Code: Willing to Adopt Tech	Transcription 2 Since students belong to Gen Z, they readily adapt technologies but teachers need training to brush up their technological skills. Especially older/more experienced teachers find it hard to adopt AT since they're not tech savvy.
Code: Willing to	Transcription 2 No, that has never been the case. In fact I teach braille courses for special education aspirants, parents, and teachers, which is the most difficult AT to learn. So no, I have never skipped any technology.

Adopt Tech	
Code: Willing to Adopt Tech	Transcription 2 Confidence does impact willingness to learn, it is a natural phenomenon.
Code: Willing to Adopt Tech	Transcription 3 Definitely. If I feel confident using a technology, I am naturally more willing to use it in my teaching.
Code: Willing to Adopt Tech	Transcription 4 As I mentioned earlier, I rely on technology because it significantly reduces the challenges of my disability. So, I have never avoided learning a technology just because it seemed too complicated.
Code: Willing to Adopt Tech	Transcription 4 On the other hand, a factor that sometimes creates hesitation is the lack of interest among certain teachers, especially those who have been in the profession for many years. They are often resistant to change or reluctant to adopt new tools. Even though I have also been working for a while, I still make an active effort to keep learning and using new technology.
Code: Willing to Adopt Tech	Transcription 5 Sometimes, due to external factors like power outages or short circuits, I choose not to use certain technologies, such as multimedia, to avoid wasting time. However, most of the time, I try to incorporate technology into my teaching, as it makes learning more effective and engaging for my students, compared to relying only on verbal instruction.
Code: Willing to Adopt Tech	Transcription 8 I might slow down my teaching pace, but I do not give up on a technological tool just because it takes time to learn.
Code: Willing to Adopt Tech	Transcription 9 So far, there has not been any technology that I have chosen not to use due to its difficulty.

E Interview Transcripts and Audio Recordings

Here is the Google drive folder that contains 17 interview transcripts, a PDF file with interview codes, and 16 audio recordings.