SOCIAL SCIENCE REVIEW ARCHIVES
ISSN Print: 3006-4694
ISSN Online: 3006-4708
https://policyjournalofms.com

Impact of Assistive Technology on Acquiring Learning Competence among Learners with Visual Impairment

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Abstract

Assistive technologies for teaching visually impaired students encompass a range of tools and strategies designed to accommodate varying levels of visual function. The study was carried out to evaluate the use of assistive technology for students with visual impairment. Objectives of the study were to explore the use of assistive technology for students with visual impairment, ascertain the awareness related to the use of assistive technology for students with visual impairment, and to pinpoint teaching strategies by using the assistive technology to improve the learning skills of students with visual impairment. The population of this study was consisted of all the teachers of students with visual impairment of government special education schools of the district Faisalabad. In sample size, there were 50 teachers of the government special education schools of the district Faisalabad. A structured questionnaire containing 20 questions was developed for the collection of data from the teachers of public special education schools of visual impaired students of district Faisalabad. The research tool was developed under the supervision of research supervisor and collaboration with faculty members of the campus. The questionnaire was distributed by researcher herself and all the requisite information was explained to the respondents. The entire questionnaires were collected back at the spot. The collected data was tabulated, analyzed, and interpreted in the form of mean and standard deviation. The study revealed that Braille, tactile maps and glasses were the mostly used assistive technology by the students with visual impairment in the classroom. It was inferred that a great number of the respondents were highly using the audio books, tactile maps, refreshable display and effective use of audition for the learning of students with visual impairment. The assistive technology was considered playing an important role in education, helps to resolve the educational problems, and it also helps to achieve the desired educational outcomes for the students with visual impairment.

Keywords: **Assistive Technology, learning competence, visual impairment.**

Introduction

Visual impairment describes a wide range of visual function loss. A few of the several elements of the visual system involve sharpness of vision, accommodation, or the ability of focusing, color vision, light adaption, and field of vision, or the region that can be viewed. As a result, there are numerous origins,

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manifestations, and intensities of impairment to vision. Acuity of less than 6/18 to 3/60 in vision is therefore regarded poor eyesight, as well as less than 3/60 is deemed without sight, after correction in both eyes. However, if a person has a discernible reduction of vision field, even those with better acuity may be diagnosed with a visual impairment. Importantly, most people who are blind or visually impaired adapt by developing heightened senses and skills, such as improved memory, spatial awareness, and auditory perception, allowing them to navigate and interact with the world around them effectively (Douglas & McLinden, 2004). The projected number of blind individuals worldwide, including those resulting from uncorrected refractive error, was 259 million. This figure is 61% higher than the one often reported by the World Health Organization. These numbers exceed the WHO projections depending on the best-corrected visual acuity by 14% and 75%, in that order. They comprise 217 million people with less severe visual impairment, which is characterized by less than 6/18 to 3/60 in the stronger eye's visual acuity and 42 million individuals who are blind, described as displaying less than 3/60 in the superior eye for visual acuity. Due to the ambiguity around the percentage of blindness, a sensitivity study suggested that the number of people worldwide who have irreversible refractive error-related visual impairment could range from 82 to 117 million (Abner & Lahm, 2002). While there are numerous tools available for assistive technology as well as apparatus on the market, many students with visual impairments, or the benefits of adopting specific technology have not yet been felt by those who are visually impaired or blind (Abner & Lahm, 2002). Children are not gaining the expertise with the tool that they need to engage successfully in the curriculum, according to a survey conducted in Illinois on how students with visual impairment use assistive technology at primary and secondary level. The study's findings are especially pertinent to students with visual impairment who were readers with an academic focus, such as those who read large print or braille, and who would have gained more from training in assistive technology (Akhtar et al., 2024). The term "assistive technology" describes networks and services that are connected to assistive devices. With the maintenance or improvement of cognitive, communicative, auditory, motor, self-care, and visual functioning, assistive goods promote an individual's health, wellbeing, inclusion, and participation (World Health Organization, 2014). Over the past century, we have concentrated on solving issues related to large populations, such as preventing the spread of infectious diseases, maintaining sanitation, building roads and bridges, and implementing public education. Education needs to be updated and improved constantly, our physical infrastructure needs to be maintained and repaired, and there are still disease processes that need to be understood and managed. Significant progress has been achieved in overcoming these enormous, population-based obstacles. In order to safeguard and advance our health, safety, and education, there is currently a fair amount of international legislation, as well as a respectable service infrastructure. Every nation frequently had a pretty distinct population that spoke a language and culture distinct from that of many other nations (Ran, 2022). In order to determine the assistive technologies that their kids were currently utilizing and to determine whether the teachers needed any additional training, educators working with students that are visually impaired in Kentucky conducted a survey. Just half of the teachers' students utilized computer-based technologies, despite the fact that they had access to and used them themselves. This was because the teachers lacked the support and training necessary to teach their students how to utilize these tools (Abner & Lahm, 2002).

The literature on technological assistance for students with disabilities was assessed in the study. The search of the literature turned up (N=57) publications, as well as the field studies on special education technologies revealed (N=17) manuscripts. The sorts of disabilities, learning objectives and tasks, available assistive device types, applicability and aptitude for coordinating assistive technologies to a particular handicap were the criteria used to evaluate each source. The findings indicated that the focus of this field's study is typically on faculty development and needs assessment. The technology

interventions were haphazard, imprecise, confusing, and general. The degree of comfort that pre-service teachers had with assistive technologies in an inclusive classroom did not increase (Sze, 2009). The most recent components of graduate-level courses pertaining to assistive technology is given, along with a review of The National Council for Accreditation of Teacher Education (NCATE) and the International Society for Technology in Education (ISTE) recommendations. Utilizing assistive technology in the classroom and its potential effects on educational technologists are covered by federal legislation. To better educate graduates of educational technology programs to improve the way children with impairments perform and create more accessible instructional materials, a model for a course on assistive technology and universal design is suggested. The study inspired educators working with exceptional education programs and instructional technology (Cavanaugh, 2002). The results of assistive technology tools are portrayed since emerging originate from the interplay between features within a particular kind of equipment, who uses it, and their surroundings. A type of device must be purchased at the outset, and there must be a period of introductory use. These elements, when combined, provide a range of short- and longer-term effects, as well as the potential for extended usage and its consequences. The structure may make it easier to create causal models tailored to a particular device. By highlighting metrics that must be created and identifying testable hypotheses about, say, how and for how long users use their devices; it may also help to design a study agenda for assistive technology outcomes research (Fuhrer et al., 2003).

For students who have some degree of visual function, giving written information in an enlarged format may be the most straightforward approach when employing assistive technology to educate children with visual impairments. Generally speaking, a font size of 18 to 24 points works well; however, going larger might not be the most effective. One can obtain enlarged text from multiple sources, such as publishers and suppliers, or alter materials using copy machines' magnification capability. Additionally, most digital publications allow users to quickly adapt the text size to their preferred size. For pupils who have visual impairments, using handheld magnifiers is also highly beneficial to their learning process (Tebo, 2009).The information is written in black text is often difficult to read for people with visual impairment, but color and movement can be transferred to traditional expressions, places, and objects. The most important points in these problems are; it is blindness in which students can see only a small part of the visual center and peripheral senses are absent. Vision in the periphery whereby the student can only view the external area of the material or surroundings, with the internal region affected or absent. Floaters cause poor vision, where part of the vision is covered by small particles that are distorted in color and depth. Visual distortion is the distortion of depth, color and pattern of images. This study frequently results while reading slowly and must have a look very closely at the data. Information written in black text can often be challenging to read due to the mixture of poor quality, and naturally color can also be difficult to read. In terms of mobility this can be done in terms of guidelines, facilities and equipment. For example, the 911 of problems such as photophobia, in which the students dislike all types of light and, in severe cases, reacts negatively to good lighting. These students often must wear sunglasses that filter out all but the smallest amount of light. Different colors, students will not have colored pencils. Although this means that students will have poor vision in normal light, they will see better in bright light than people with poor eyesight (Hayhoe & Sacks, 1997).

A totally blind student cannot sense the light. This will lead to differences in philosophy of teaching. For example, in these cases, students may need Braille training, tactile perception, audio equipment and equipment to record lectures and playback the file, although these strategies are important for students with visually impaired (Hayhoe, 2008).For students who are with visual impairment, the move

from secondary to tertiary education can be especially difficult because they frequently have difficulty comprehending and assimilating material. Although there is no way to completely eradicate these challenges, using assistive technology can help lessen them. The application of technologies like software for reading screens, video enlargers, and Braille technology is essential for helping students with visual impairment in higher education (Fuhrer et al., 2008). There are several assistive technologies in the market, many of which come highly recommended by institutions such as the National Institute of Blind people, among the foremost authorities on children with visual impairments. To learn more about how pupils with visual impairment use technology, a thorough survey was undertaken. In order to gather information about students' experiences with technology, the study used participant observation and focus groups led by researchers. Open-ended interview questions served as a guide, while data from teachers, administrative personnel, documents, recordings, and reports from the National Institute of Blind people were added to the mix (Bhatt & Kumari, 2015).

Literature Review

Visual impairment, defined as low vision (20/40 in the US and 20/60 by the WHO) or lack of vision (20/200 in the US for the superior vision and 20/400 by the WHO standard), is one of the most common disabilities: About ten years ago, at the time of the most recent accurate assessment, an estimated 40 million people worldwide were blind, and 110 million had low vision (Congdon & Lietman, 2023).High-tech innovative tools such as computer screens and readers have revolutionized education for people with visual deficiency and other disabilities. These assistive devices and tools enable students to participate in learning alongside their peers by providing accessibility and facilitating interaction with classroom materials. While assistive technology has significantly benefited students with severe physical disabilities, there remains untapped potential for those disabilities with learning. The According to National Assistive Technology Research Institute (NATRI) performed a survey at the University of Kentucky in 2005; assistive technology was primarily utilized by students with lower populations in special education categories, such as autism, deafness, or visual impairment, at the primary level. Furthermore, the survey found that assistive devices were more commonly used in special education classes than in general education classes at higher levels. It was also observed that teachers often relied on experts for information about the use of assistive devices and tools, indicating an absence of familiarity between students with these tools. This underscores the importance of providing instruction and assistance to both special needs and general classroom instructors to effectively guide and assist students in utilizing technology to enhance learning outcomes. By supplying educators with the information and abilities they need to use assistive technologies into their instruction, students with disabilities can receive the support they need to thrive academically (Hasselbring & Bausch, 2005). Utilizing assistive technologies products are designed to improve convenience for individuals with physical or mental disabilities. When selecting these products, compatibility with the computer's operating system and software programs is crucial. Various input devices enable users to control computers in alternative ways: a) alternate Keyboard: These keyboards may have modified functionality, alternative key configurations, or support one-handed operation; b) electronic Pointing Devices: For manually adjusting the screen's cursor, utilizing methods such as ultrasound, infrared rays, eye movement, or nerve/brain stimulation; c) sip-and-Puff System: Activated by inhalation or exhalation, allowing users to control computer functions; d) wands and Sticks: These devices allow users to push keys on a keyboard by being worn in the mouth and on the head, or fastened to the chin; e) Joystick: Controlled by hands, feet, jaw, etc., used to manipulate the cursor on the screen; f) Trackball: A movable ball atop a base, used to navigate the cursor across the screen; g) touchscreen: Enables users to interact directly with the computer screen, eliminating the need for a mouse or keyboard. Touchscreens can be integrated or attached to computer monitors; h) braille Embossing

Technology: Converts computer-generated text into embossed Braille output, aiding users with visual impairments; i) braille Translators: Convert text into Braille, which can then be printed on an embossing machine; j) big Screens: Function like computer monitors, enlarging portions of the screen to enhance visibility; and k) screen Magnifiers: Enable users to zoom in and out of specific areas of the screen, aiding in readability. These assistive technologies cater to diverse needs and preferences, empowering individuals with disabilities to access and utilize computer technology effectively (Smith, 2008).Keyboard filters are typing aids designed to streamline the typing process by reducing the number of keystrokes required. These tools include word prediction features and additional analysis tools. By predicting words or phrases as users' type, keyboard filters enable quick access to desired text and help prevent unintended errors. This technology enhances typing efficiency and accuracy, particularly for individuals with disabilities or conditions that may affect their typing speed or accuracy. With the assistance of keyboard filters, users can compose text more efficiently and effectively, improving their overall typing experience (Smith, 2008). A screen reader is a vital tool people with vision impaired computer users, as it converts the text, images, controls, and menus displayed on the screen into spoken words, allowing users to interact with the computer through audio cues instead of visual prompts. Essentially, it transforms the graphical user interface (GUI) into a voice interface, enabling users to navigate and access digital content effectively. Additionally, a beacon is a device that monitors the computer's audio output and alerts users through visual signals, typically a red light. This feature is particularly useful for individuals who may have difficulty hearing audio notifications from the computer. For example, a flashing light can indicate the arrival of a new email or the execution of a computer command, ensuring that users are promptly notified of important events or actions happening on their computer. This visual alert system enhances accessibility and enables users to stay informed and engaged with their digital environment (Smith, 2008).

In preschool education settings, children with impairments or those who are at risk can experience obstacles that assistive technology (AT) can help to solve and improve developmental skills. In order to properly assist the development of young children, early childhood education professionals are essential in integrating AT into the curriculum and must be knowledgeable and proficient in its application. This study investigates how well AT User Groups help teachers get ready to use AT in early childhood settings. Teachers can get more knowledge and skills, make better use of their time, collaborate more effectively, receive individualized training, and receive on-site support by joining User Groups. Furthermore, methods for integrating new instructors and dealing with any distractions are covered (Parette & Stoner, 2008).The 1990s saw tremendous progress in the application of assistive devices in special needs education. That being said, it is somewhat surprising that considering the high frequency of mild disabilities and the use of assistive technology comparatively few articles are found when adjectives like "assistive technology" and "mild disabilities" are used in searches, book chapters, and conference papers. The field has been hesitant to acknowledge the value of using cutting-edge integrating technology into services and programs for special education students with modest disabilities, despite the market's explosion of new goods and advancements. The fact that the field is still in its infancy could be one reason for this lack of attention. Both historical and policy arguments lend weight to this viewpoint (Edyburn, 2000). Explaining blindness and visual impairments, providing examples, Summaries and condensed versions of study results on assessments related to assistive tools, discussing the implications of research findings for the utilization of assistive technology with learners who are with vision loss or blind, and discussing the implications of research findings for early academic understanding, reading, writing, math, and general science. According to the research summarized, using assistive devices with learners who are blind or with vision deficiency can enhance many

learners' outcomes related to learning and academics by engaging other senses and abilities (like oral language) and/or improving already-existing sight abilities. Furthermore, studies indicate that the breadth and caliber of assessments play a crucial role in determining the results of assistive technology deployment over the long run (Mulloy & Gevarter, 2014).Assistive technology has become a vital tool for practical educators working with visually impaired pupils, helping them with assessment and content learning. Since there hasn't been much research done in this field, the goal of the study presented here was to find out how much knowledge and expertise teachers self-reported having in assistive technology. The participants rated their level of assistive technology skills using an online survey. Descriptive statistics and Pearson r correlation coefficients were employed by the researchers. An online survey was completed by 840 teachers of visually impaired pupils in the US, the Virgin Islands, and Palau to determine their perceived proficiency with assistive technology (Zhou & Ajuwon, 2012). The study objectives of higher education students studying blindness who participated in three university programs' assistive devices and tools courses. Pre- and posttests given throughout the course were used to assess the students' perceptions of their learning. In 2011, an electronic a survey was transmitted to the attendees as a confirmation. The demographics of the participants, their perceived skill level, their training since finishing the course, how frequently they used the devices with students and their opinions on the significance of particular gadgets were all acquired through the questionnaire. Likert scales were used to code the variables, and Spearman's correlation was used to code the correlations for data that are not parametric. Prior to the posttest results (n = 97) demonstrated that attendees improved their usage of the devices that were introduced in class, with a higher increase in devices created especially for people with vision deficiency (Hannan & Herrera, 2012).Even though there is a huge range of assistive technology tools and equipment on the market, many learners who are visually impaired, or those who have blindness or have restricted visual deficiency, not yet benefited from employing this particular technique. A study done in Illinois on how visually impaired primary and secondary students use assistive technology found that kids aren't getting the practice with the device they need to be effective in the classroom. The study's findings were especially pertinent to visually challenged students who read academically, such as those who read braille or large print, and who would have profited more from instruction in assistive technology (Akhtar et al., 2024). According to the results of a recent analysis of a federally representative survey on the use of assistive devices and tools, Illinois's status with regard to students with vision deficiency is similar to that of the rest of the country (Kelly, 2009). Just over half of academically focused children with visual impairment in the United States were using assistive devices and tools at least once throughout every one of the three time periods examined, according to the Longitudinal Study of Special Education. This points to a national problem in which a large number of visually impaired students, especially those who are academically oriented, lack access to or use assistive technology tools and resources. To guarantee that students with visual impairments have equal opportunities to participate fully in and achieve in educational environments, it is vital that this gap be addressed (Kelly, 2011).

The literature on assistive technology for students with impairments was examined in research. N = 57 publications were found in the literature search, and 17 manuscripts related to the field studies of special education technology were found. The sorts of disabilities, learning objectives and tasks, available assistive device types, application, and skill in matching assistive technology to a particular handicap were the criteria used to evaluate each source. The findings indicate that 1) this field's research tends to focus only on faculty development and needs assessments; 2) technological interventions looked dispersed, ambiguous, non-specific, and incomprehensible; and 3) pre-service teachers' comfort level with assistive technology in an inclusive classroom is still low (Sze, 2009). \The teachers claim that different assistive technology applications and specificities apply to blind and low-vision kids, for

whom particular computer programs are crucial. Information technology improves writing and reading comprehension as well as equal access to the outside world, which raises quality of life and speeds up education. The absence of course planning is the primary deterrent to information technology use. Advisers to assist teachers, a sufficient number of computers for every student, and pedagogical support are the primary prerequisites for the use of information technology in schools. Assistive technology may be able to help meet the educational needs of students with impairments, who often confront numerous obstacles in their educational pursuits (Presley & D'Andrea, 2008). Assistive technology may be able to help meet the educational needs of students with impairments, who often confront numerous obstacles in their educational pursuits. This study's objective was to gather data regarding instructors' knowledge and proficiency with assistive technology. One hundred and twenty-seven individuals provided information on their self-reporting through a questionnaire. In order to add more depth and breadth to the study of the survey data, three participants were interviewed as well. The findings indicated that teachers' knowledge and proficiency with assistive technology is insufficient. Therefore, pre-service and in-service training for teachers is necessary to improve their overall understanding of utilizing assistive technology and universal design for learning for students with disabilities (Alkahtani, 2013).

Numerous pupils with visual impairments, that is, those who are blind or have low vision, have not yet benefited from using the wide array of assistive technology devices and tools that are on the market. In elementary and secondary education, visually impaired students are not utilizing assistive technology in the ways that would allow them to properly participate in the curriculum, according to an Illinois survey. The study's findings are especially pertinent to visually impaired students who were readers with an academic focus, such as those who read large print or braille, and who would have gained more from training in assistive technology. Standard descriptive statistics were calculated using SPSS frequencies. Thirty universities in total responded to the survey, resulting in a 79% response rate (Akhtar et al., 2024). Using SPSS frequencies, standard descriptive statistics were computed. A total of thirty universities completed the poll, yielding a 79% response rate, that is, 82% of US programs and 50% of Canadian schools contacted. The participants were asked to explain how their individual programs for educating teachers of students with visual impairments addressed assistive technologies. Three programs offered “generic or multidisciplinary assistive technology courses,” while fifteen offered a “specific assistive technology course for [teachers of] individuals with visual impairments” out of the eighteen that offered such courses. The remaining twelve universities either included assistive technology as a component of a course (6 programs) or as a part of the entire curriculum (6 programs). The twelve universities that don't currently provide a course on assistive technology (Smith & Kelley, 2007). Ocular diseases included congenital cataracts, aniridia, retinochoroiditis, retinopathy of prematurity, and corneal opacity. For close visual acuity, the range was 0.8 to 6 M, and for far vision, it was 20/200 to 20/800. Using round lenses, telescopes, and supporting glasses for magnification was advised. Following the intervention, three out of the five individuals with low vision were able to decrease the font size on the computer screen, and the majority of participants (83.3%) decreased the amount of time they spent reading during the second observation session. During the second observation session, every low vision person could read content written in smaller font sizes than what was printed, and they could read for shorter amounts of time. For pupils who are blind or visually impaired, high-tech assistive technology (AT) is essential to their daily life and educational experiences (Presley & D'Andrea, 2008, 2014). The lives and educational experiences of students with visual impairments, those who are blind or have limited vision, are greatly impacted by high-tech assistive technology (AT). About how these pupils really employ AT in their educational programs, however, not much is known. For print access, students mostly utilized commercially purchased AT. There were

some differences in how primary and secondary pupils used the resources. The utilization of technology by students and the instruction provided was closely matched. Teachers should take into account AT for a variety of student needs, encourage device use at home, evaluate their lessons, and seek out professional development in this field (Tuttle & Carter, 2022).

Statement of the Problem

Teachers utilize assistive technology to help students who are with poor vision. According to experts, any level of vision loss, from complete blindness to partial blindness, is referred to as "visual impairment". There are those who are totally blind, but many suffer from legal blindness. Students with visual impairment have various challenges, including those related to orientation, transportation, academics, Braille, audio, and soft copy reading materials, taking exams in various formats, and using assistive technology. When blind or low vision students have access to assistive technology, they can take charge of their education by taking notes on their own and using these AI-powered tools to voice-search for the information they need for learning. Keeping in view the magnitude of the use of assistive technology, researcher aimed to explore the use of assistive technology for students with visual impairment.

Objective of the Study

Following were the objectives of the study:

1. To explore the various assistive technologies used for students with visual impairment.
2. To assess the level of use of assistive devices for teaching students with visual impairment.
3. To ascertain the impact of assistive technology on the educational performance of students with visual impairment.

Research Questions

The research questions were as follows:

1. Which assistive technology are available for utilize with learners who are with visual impairment?
2. How much learners with visual deficiency being taught using assistive devices?
3. How much might assistive technology impact on academic performance of learners with visual impairment?

Research Methodology

The methodology deals with appropriate procedure for the research in investigating and collecting the pertinent data and information to establish a trustworthy conclusion (Tashakkori & Creswell, 2007). Following methodology was adopted for the study.

Nature of the Research

The approach used in the study was described. Research that is descriptive explains and characterizes phenomena as they occur. It is focused on interactions and situations that already exist, as well as ongoing activities, decisions made, effects that are visible, and emerging trends.

Population of the Study

The study sample is chosen from the study population (Barker, 2008). The study's population comprised all of the teachers of Govt. Special Education Schools of district Faisalabad.

Sample of the Study

A sample is a small number of people chosen from the target population, or a subgroup. On the other hand, the entire participant pools whose characteristics the research team is interested in is the target population (Martínez-Mesa et al., 2014). Only a portion of a "population's information is gathered to create the study sample. Nineteen male and thirty-one female teachers made up the sample of 50 chosen for this study.

Table 1

Gender wise frequency distribution of the respondents

Gender	*f*	%
Male	19	38
Female	31	62
Total	50	100

Note: f=Frequency, %=Percentage

Table 1 represented the gender wise frequency distribution of the respondent. 38% respondents were male whereby 62% were female who participated in the study. It showed that more than half of the respondents were female who took part in the study.

Sampling Technique

Sampling is the process of choosing specific individuals or a subset of the population in order to estimate the characteristics of the entire population and draw statistical inferences from them (Fleetwood, 2020). The study's samples were chosen using a simple random sampling technique. To create a basic random sample, elementary units are chosen with the goal of ensuring that every unit in the population has an equal chance of being chosen. Sampling bias does not exist in a basic random sample.

Tool of Research

Tools for research are basically vehicles that make study and related activities easier overall and allow researchers to gather data. Creating the questionnaire was the initial stage in gathering the data. Through surveys, all relevant data and respondent opinions were gathered for this investigation (Fink, 2003). There were twenty items on the questionnaire. The questionnaire underwent numerous iterations and improvements with input from the research supervisor.

Data Collection

The systematic process of gathering measurements or observations is known as data collection. Whether you are a researcher in academia, business, or government, gathering data allows you to learn about your study subject directly from the source and generate ideas (Morgan & Harmon, 2001). In order to gather data, researchers individually visited the government-run special education schools in the Faisalabad district and spoke with the pupils. For the goal of gathering data, a total of fifty sets of questionnaires were created and given to special education teachers. Nearly all of the respondents were eager to share data and quite cooperative. The questionnaire was to be completed by the special

education teachers, who were to rate their opinions based on the options provided against each. There had been no problems for the researcher while gathering the data.

Data Analysis

Data analysis is the process of sanitizing, transforming, and modeling data to obtain pertinent information for business decision-making (Gallagher, 2009). The goal of data analysis is to extract useful information from data and make decisions based on that knowledge. The gathered data was tabulated and analyzed in terms of percentage, mean, and standard deviation. Just below the tables, you will also find the appropriate interpretation of the data

Results and Discussion

The study was carried out to determine the use of assistive technology for students with visual impairment. The results are as under:

Table 2

Assistive technology used for the learners with visual impairment in the classroom setting

Sr. No.	Type of AT	AT Usage in class			
		Frequency		Percentage	
		Yes	No	Yes	No
1	White cane	33	17	66	34
2	Glasses	38	12	76	24
3	Braille	43	07	86	14
4	Slate and stylus	34	16	68	32
5	CCTV Cameras	22	28	44	56
6	Screen reading software	25	25	50	50
7	Braille embosser	34	16	68	32
8	Tactile maps	40	10	80	20
9	Math slate	36	14	72	28
10	Abacus	34	16	68	32

Note: AT-Assistive Technology, CCTV-Close Circuit Television.

Table 2 represented the assistive technology used by the students with visual impairment in the classroom setting. Mostly used assistive technology by the students with visual impairment was Braille (86%), tactile maps (80%), and glasses (76%). On the other hand least used assistive technology were CCTV cameras (44%), screen reading software (50%) and white cane (66%). It revealed that Braille, tactile maps and glasses were the mostly used assistive technology by the students with visual impairment in the classroom. Whereby CCTV cameras and screening reading softwares were given less consideration.

Table 3

Level of use of assistive technology devices for teaching learners with visual impairment

Sr. No.	Statements	Min	Max	M	S.D
1	Use Braille devices to produce writing content for students with visual impairment.	2	5	4.40	.756
2	Use CCTV cameras to enhance screen visibility for students with visual impairment.	1	5	3.78	1.112
3	Use screen reading software to teach students with low vision.	1	5	3.82	.983
4	Allow use of white canes to students with visual impairment for independence movement.	1	5	3.82	1.155
5	Use audiobooks to improve learning and listening skills of students with visual impairment.	1	5	4.12	.895
6	Refreshable Braille display is used as an economic means of learning for Blind.	1	5	4.00	1.088
7	Math skills of students with visual impairment are improved using talking scientific calculator.	1	5	3.76	1.098
8	Tactile maps are used to improve the orientation skills of students with visual impairment.	1	5	4.02	1.097
9	Initial reading writing skills of blind are developed using slate and stylus.	1	5	3.82	1.004
10	Effectively use audition sense to support learning of students with visual impairment.	1	5	4.08	1.027

Note: Min-Minimum, Max-Maximum, M=Mean, S.D-Standard Deviation

Table 3 represented the level of use of assistive technology devices for teaching learners with visual impairment in the classroom setting. Majority of the respondent (M=4.40, S.D=0.756) opined that they use Braille devices to produce writing content for the learners with visual impairment. A large number of the respondents (M=4.12, S.D=0.895) were using the audiobooks to improve learning and listening skill of the learners with visual impairment, most of the respondents were using tactile map (M=4.02, S.D=1.097), effectively using audition sense to support learning (M=4.08, S.D=1.027), and Refreshable display (M=4.0, S.D=1.088). It was inferred that a great number of the respondents were highly using the audio books, tactile maps, refreshable display and effective use of audition for the learning of students with visual impairment.

Table 4

Impact of assistive technology on the educational performance of students with visual impairment

Sr. No.	Statements	Min	Max	M	S.D
1	Assistive Technology plays an important role in education.	1	5	4.28	.927
2	Assistive technology ameliorates the student learning.	1	5	3.72	1.262
3	Gamification learning brings charm to the educational activities.	1	5	3.72	1.144
4	Use of assistive technology helps to achieve the desired outcomes.	1	5	4.02	1.000
5	Use of low vision devices enhances the reading capacity of students with visual impairment.	1	5	3.60	1.262
6	Students feel more comfortable in mobility using white cane in classroom.	1	5	3.78	1.166
7	Assistive technology develops confidence among the students with visual impairment.	1	5	3.68	1.285
8	CCTV cameras provide more comfortable reading for students with visual impairment.	1	5	3.78	1.200
9	Assistive technology helps to resolve educational problems of students with visual impairment.	2	5	4.08	.944
10	Assistive technology use provokes students with visual impairment to willingly participate in educational activities.	1	5	3.70	1.233

Note: Min-Minimum, Max-Maximum, M=Mean, S.D-Standard Deviation

Table 4 depicted the impact of assistive technology on the educational performance of students with visual impairment in the classroom setting. Majority of the study subjects (M=4.28, S.D=0.927) replied that assistive technology plays an important role in education. A great number of the participants (M=4.08, S.D=0.944) opined that assistive technology helps to resolve educational problem of learners with visual impairment, most of the respondents (M=4.02, S.D=1.000) replied that use of assistive technology helps to achieve the desired educational outcomes. It indicated that assistive technology was considered playing an important role in education, helps to resolve the educational problems, and it also helps to achieve the desired educational outcomes for the students with visual impairment.

Findings of the Study

Assistive technology was effectively used by the students with visual impairment in the classroom setting. Mostly used assistive technology by the students with visual impairment was Braille (86%), tactile maps (80%), and glasses (76%). On the other hand least used assistive technology were CCTV cameras (44%), screen reading software (50%) and white cane (66%). The level of use of assistive technology devices for teaching learners with visual impairment in the classroom setting was determined. Majority of the respondent (M=4.40, S.D=0.756) opined that they use Braille devices to produce writing content for the learners with visual impairment. A large number of the respondents (M=4.12, S.D=0.895) were using the audiobooks to improve learning and listening skill of the learners with visual impairment, most of the respondents were using tactile map (M=4.02, S.D=1.097), effectively using audition sense to support learning (M=4.08, S.D=1.027), and Refreshable display (M=4.0, S.D=1.088). The impact of assistive technology on the educational performance of students with visual impairment in the classroom setting was assessed. Majority of the study subjects (M=4.28, S.D=0.927) replied that assistive technology plays an important role in education. A great number of the participants (M=4.08, S.D=0.944) opined that assistive technology helps to resolve educational problem of learners with visual impairment, most of the respondents (M=4.02, S.D=1.000) replied that use of assistive technology helps to achieve the desired educational outcomes. It indicated that assistive technology was considered playing an important role in education, helps to resolve the educational problems, and it also helps to achieve the desired educational outcomes for the students with visual impairment.

Conclusions

In conclusion, the study highlights the effective use of assistive technology by students with visual impairments in the classroom setting. Among the various tools, Braille, tactile maps, and glasses were most commonly used, while technologies like CCTV cameras, screen reading software, and white canes were less frequently utilized. The findings indicate that assistive technologies, particularly Braille devices, audiobooks, and tactile maps, are integral in supporting the learning and educational development of students with visual impairments. Moreover, the positive impact of these technologies on educational outcomes is evident, as a majority of respondents affirmed their importance in resolving educational challenges and achieving desired results. Overall, the study underscores the significant role assistive technology plays in enhancing the learning experience for students with visual impairments, improving both their educational performance and access to curriculum content.

Study Recommendations

Following recommendations were made at the end of the study:

1. CCTV cameras, screen reading softwares, Braille embosser, and Refreshable Braille display are required to be provided for the effective instructions of students with visual impairment.
2. School administration should be provided the assistive technologies for the better learning of students with visual impairment.
3. Government should provide free of cost assistive technologies for students with visual impairment.
4. Teacher must use gamification learning for student's charm education.
5. Teacher must use tactile maps to improve orientation skills of students with visual impairment.
6. Teacher must use assistive technology ameliorates for students better learning.

Limitations and Delimitations

The study was confined to the district Faisalabad due to financial constraints. Only few numbers of special education teachers were included in the study due their shortage in near vicinity. The study's boundaries are listed below:

1. Accessing assistive technology for education presents numerous obstacles for visually impaired students, particularly in low- and middle-income nations.
2. The study's primary obstacles are the lack of assistive technology and its restricted availability in blind schools.
3. School administrators should be aware that it is their responsibility to guarantee that students have enough access to assistive technology, whether it be academic or not, visual or not.
4. Rather than concentrating on students attending school, future research should examine all community youngsters of school age.

Ethical Considerations

The data of the study was collected from the special education teachers who were currently teaching the learners with visual impairment. The research ethical protocols were observed by sharing necessary information with the respondents regarding the research and keeping in view the safety and security of the study participants. Impartial view point of the participant was incorporated in the study without any biasness. The recorded data was kept confidential as well.

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