

An Investigation of Educational Technologies for Children with Down Syndrome

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Abstract

Educational technology provides a personalized and motivational learning environment for students with Down syndrome (DS). It supports and facilitates the teaching and learning process along with inclusive acceptance among society . Several prior studies have examined the use of educational technology in the form of applications, software, and tools as support for teaching DS students. However, the majority of these studies were carried out in various educational and social contexts, which is not the same as what exists in the context of Bangladesh, Afghanistan, or other underdeveloped countries where the use of educational technology at the school level has not been well-placed in practice. This research aimed to determine the teaching strategies used in a developing region with a sample size of 4 schools, 10 educators, and 4 principals in Chittagong-Bangladesh, to examine the use of technology and its impacts on the teaching and learning processes of DS students. A thematic analysis was accomplished to find out the tools, applications, and teaching strategies that can support and accelerate learning in DS children. It was found that computer-based learning through the use of interactive games, exercises, and self-paced learning supports learners with DS since it provides them with more personalized learning and includes visual, auditory, kinesthetic, and tactile modalities. Not only it improves the learning process but the teaching process as well. This research can act as guidance for educators and families of DS children. The learning methods and types of educational technologies discussed in this paper can help special educators get the support of those teaching strategies while at the same time helping DS students learn more effectively

Keywords: Down Syndrom, educational technology, special education, special educator, children with diverse abilities .

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Chapter 1- Introduction

1.1 Background of the Topic

Technology has already started to transform education, influencing how students learn the skills they need to get ready for college and a profession as well as how teachers use digital technological instructional tactics to educate (Delgado et al., 2015). Educational technology can create an assistive learning environment in which students with learning difficulties can learn better. To solve the curriculum challenges of teaching and learning for people with diverse abilities, information, and communication technology (ICT)-assisted learning is becoming more and more important (Wood, 2004). ICT can alter and equalize efforts to integrate and include children with special educational needs in regular classrooms and society. Inscribed in the Universal Declaration on Human Rights, education is a basic right for everyone (Hey, 2018), but not everyone is getting an equal chance to get an equal education, especially those with diverse abilities including learning or physical disabilities. Down syndrome is also known as an intellectual disability in which a child is born with an extra copy of chromosome 21 (U.S. National Institute of Health). Down syndrome kids have unique educational demands. Such people in particular age slowly, and their deficiencies are dictated by biological traits. They learn either more slowly or more quickly, and their learning outcomes depend on the educational practices that interfere with their cognitive development (Leghari, 2021). Down syndrome is one of the learning difficulties, in which children exhibit distinct deficits in learning to use spoken language in comparison to their non-verbal understanding comprehension. The children struggle with two different sorts of expressive difficulty: a delay in acquiring sentence structures and syntax, as well as specific challenges with producing clear speech. Language delay also contributes to cognitive delay. Computer-assisted learning has been highlighted as offering particular benefits for children

with Down syndrome (Wood, 2004). This research is an evaluative study of the possible impacts that educational technology and digital curriculums can have on the learning process of children with Down syndrome and can be used as an additional tool for teachers and in many cases families as well.

1.2 Statement of the Problem

Learning new things typically takes longer for people with Down syndrome. For certain learners, learning new abilities may need breaking them down into smaller steps than for other learners, and retention of learned skills may require greater repetition (Wood, 2004). For children with Down syndrome to function independently in class, their activities may need to be more structured (Better Health, n.d). According to the United Nations, Down syndrome is estimated to affect between 1 in 1,000 and 1 in 1,100 live births worldwide. Between 3,000 to 5,000 children are born with this chromosomal disorder every year. Traditional educational approaches, which emphasize textbooks and fundamental practical lessons, have some limitations in how well they may help students develop their knowledge and intellectual abilities. Additionally, they are limited in their ability to accommodate students with various cognitive abilities and learning preferences (Chen 2006 as cited by Ramli and Zaman, 2009).

To support and facilitate learning in DS students, researchers suggested using educational technology, that integrates their multiple intelligence in a more personalized way. This is because many people are not aware of the potential benefits of educational technology in the learning process of DS children. The majority of the regular schools implement the same teaching methods for all students regardless of their special educational needs. This is why most of them face a lot of difficulties in regular schools that result in their drop-out and isolation from society. On the

other hand, special educational centers are not aware of the simple but valuable use of educational technology in DS education.

Furthermore, there are few schools in Afghanistan and Bangladesh that support children with diverse abilities, and even fewer for children with Down syndrome. Also, there is a lack of research done on this area or any initiatives for helping them not to be isolated from society and education. Therefore, it is required to do a study in this area and offers help to the Down syndrome community.

1.3 Objectives of the Study

The overall objective of this research is to find out the ways that educational technology can help in facilitating the learning difficulties of children with Down Syndrome and offering them to schools, teachers, and families. Based on the ongoing status of education for children with Down syndrome in Afghanistan and other developing countries, this study can be a startup point to educate DS people for their right and role in the society. Following are the bullet objectives for this study.

- To determine the possible use of educational technology as a teaching and learning tool for children with Down syndrome.
- To find out what is teachers' attitudes and experiences in teaching DS students using educational technology and general.
- To find out the existing initiative that schools implement for children with Down syndrome in Afghanistan/Bangladesh (Special Educational centers).
- To determine which technologies, digital curriculums, software, and other factor included in educational technology can help students with Down syndrome to learn.

1.4 Research Questions

Since this study is designed particularly for Afghanistan, Bangladesh, and other developing countries the following questions had been focused on.

- 1- How are Down syndrome cases dealt with at schools in Afghanistan/Bangladesh?
- 2- What is the existing initiative that schools implement for children with Down syndrome in Afghanistan/Bangladesh?
- 3- How can Ed-tech take place in facilitating the learning process for children with Down syndrome?
- 4- Is there any digital curriculum specifically designed for children with Down Syndrome in Afghanistan and Bangladesh and are they being implemented successfully?

1.5 Significance of the Study

Contrary to what is stated in the Universal Declaration of Human Rights, not everyone has access to equal educational opportunities in today's society especially in underdeveloped nations with low levels of economic development and education like Afghanistan. Therefore, it is important to draw attention to people who have specific needs and abilities as others. Not to disregard their right to education merely because of their limited abilities. This study sought out the ways that educational technology; digital curriculums, ICT devices, and applications can help in facilitating the learning difficulties of children with Down Syndrome and offering them to schools, teachers, and families.

According to several studies, there are numerous advantages of ICT learning for children with Down syndrome. The findings of this study will be a valuable source of information for special education practitioners, as they can learn from the experiences and teaching strategies used in the schools where the data was gathered, and the literature shows. This study demonstrates how

new, straightforward, but valuable technological approaches can be used to improve circumstances for students with diverse abilities in the classroom and increase attention and accuracy in this area.

As has frequently been highlighted, countries with fewer resources, like Afghanistan, haven't carried out an adequate study in this area, in addition to the lack of services and knowledge on the education of DS students. Thus, this research can serve as a foundation for future research on the education of individuals with DS, particularly the use of educational technology in their teaching and learning practices. This research is done by collecting information in Bangladesh, where the existence of special educational centers is far more than in Afghanistan, it can have a noteworthy role in modeling such proceedings in Afghanistan.

Chapter 2- Technologies Used to Teach Children with Down Syndrome: A Literature Review

2.1 Introduction

According to definitions, DS is a general disorder brought on by chromosomal abnormalities. Children with Down syndrome typically progress and learn more slowly than most other kids. Yet not every area of development is equally impacted. Children with Down syndrome exhibit a particular pattern of cognitive and behavioral traits that are different from those of children who are usually developing and those who have intellectual disabilities from other sources. Children with Down syndrome frequently struggle with expressive language (Down Syndrome Education International, 2022). When it comes to their schooling, children with DS have several physical and cognitive traits that require careful consideration (Alfaraj & Kuyini, 2014). This literature review aims to provide an overview of the technologies used in teaching children with Down syndrome, identify the existing research gap, and discuss the implications for future studies. By examining the current state of the field, this review seeks to contribute to the advancement of effective and inclusive educational practices for children with Down syndrome.

2.2 Methods

To conduct this literature review, an extensive search was performed on electronic databases, including PubMed, PsycINFO, ERIC, and Google Scholar. The search terms used were "Down syndrome," "children," "educational technology," "assistive technology," "teaching aids," and "learning tools." Only studies published in English between 2000 and 2023 were included to ensure the most recent information.

Educational Technology for Children with DS

Students with diverse abilities can become more independent through educational technology, which relieves them of the need for ongoing teacher participation. As a result, students can select the learning pace that works best for them, resulting in more individualized instruction. When a student does not impede the learning of the entire class, it allows for a decrease in anxiety, which is important for education as well. Technology integration in special education enables communication simplification and learning improvement for students with disabilities (Dikusar, 2018).

2.3 Technologies Used to Teach Children with Down Syndrome

Educational Apps and Software

Research has been done on the effectiveness of educational technology in the learning process of people with learning difficulties showing that it increases engagement, safer learning environment, and the effectiveness of education. Wood (2004) outlines some advantages of ICT-based education for children with Down syndrome. Visual learning style is the first advantage; children with Down syndrome learn well visually and struggle to learn just by listening. Both visual and aural stimulation can be obtained via computer software and other ICT components. Another advantage is the non-verbal mode of response; the speech and language impairments that Down syndrome children have, are defined by speech production abilities that lag behind understanding and children who frequently have trouble verbally responding to questions. They find it simpler to communicate their comprehension by touching the screen, clicking the mouse, or pressing a key. Opportunities for practice and immediate rewards; opportunities for practice and quick rewards: Compared to their peers who are usually developing, children with Down syndrome may require more practice opportunities. The computer may provide infinite opportunities to try

the same activity by repeatedly simulating the exact experience and rewarding the user with animations, music, and sound effects. Errorless learning, self-paced learning, improving motivation, a clutter-free working environment, and less fear of failure are other advantages mentioned by Wood (2004). Organizations like AbilityNet, Inclusive Technology, Semerc, and The ACE Center Advisory Trust also provide a range of training, counseling, testing, and support services. Computer-assisted teaching, and especially multimedia material, could be a very helpful tool since it can help ease many of the challenges already mentioned. First and foremost, multimedia content enables the blending of aural and visual information into a single packaged format, which may be used to speed up access to it. Considering this, it is acceptable that the information is given predominantly through visual means (Tudela & Ariza, 2006). It could be inferred from the differences between the two groups (computer-assisted and paper and pencil-based) that the computer, especially multimedia teaching applications, optimizes learning these ideas for individuals with Down syndrome (DS). These findings also lend credence to the idea that the methods used to teach people with DS may potentially have an impact on their ability to learn mathematical ideas, rather than only being a direct cause of specific features associated with persons with DS (Tudela & Ariza, 2006).

Regarding the effectiveness of technology in learning, some teachers concentrated on how technology-assisted learning may improve students' ability to learn using programs that included voice and pictures, while others thought that various technologies made it easier for teachers to convey lesson topics (Alfaraj & Kuyini, 2014). The identification, curriculum, and location difficulties are the three fundamental challenges in teaching and learning for students with exceptional needs. To solve these three problems, the use of information and communication

technology (ICT)-assisted learning is becoming more and more important (Ralph, 2006, as cited in Starcic and Bagon, 2014).

A pilot study of the use of emerging computer technologies (HATLE) was conducted by Felix et al. (2017) to demonstrate how it can increase the impact of reading and writing interventions for DS students. Authors note that children with Down syndrome may benefit from computer-assisted learning when it comes to their academics. HATLE is a supplementary learning application that makes use of mobile computing, multimedia design, and computer speech recognition and aims to improve Spanish reading and writing skills in children with Down syndrome. They found that the HATLE group, on average, achieved considerably more progress on Single-Word Reading and Handwriting-Form tests than the control group. Letter Identification demonstrated improvement with the HATLE group. The outcomes for handwriting legibility and spelling were positively affected by the intervention, however, the effect was insignificant. As a result, the computer-assisted intervention helped children who had learning difficulties. The HATLE group experienced reading aloud while using touchscreen voice recognition input and visual-speech output, which led to improvements in the Single-Word Reading testing. Moreover, The authors argue that the development and implementation of new technologies like mobile computing, touchscreen layout, speech recognition, and multichannel inputs are more explicit, user-friendly, and affordable than other types of assistive technologies. Specially created educational applications like HATLE, which has a more individualized and responsive user interface provide a new path of learning for children with DS.

Additionally, Leghari (2021) researched employing interactive technology to implement a human-computer interaction method that will help intellectually challenged Down syndrome students who struggle with reading and writing in Pakistan. Based on their findings Interactive

technology and intelligent solutions offer ongoing assistance with touch-to-speak technology to let people express themselves, control communication, and reduce irritation. During a live workshop session, 10 students with Down syndrome of all genders and ages used interactive technology like a desktop computer, laptop, smartphone, and tablet. They had trouble reading and writing before technology was accessible and couldn't understand the tasks. They discovered that using various technologies was useful, and they soon became interested in using computers, laptops, and smart devices. Tablets and laptops were deemed to be user-friendly and convenient devices. They found that people with Down syndrome often struggle with reading and writing. Text-to-speech software and Microsoft Windows-based applications were specifically created to assist with this. They were able to improve their cognitive and mental abilities by reusing smart interactive solutions, such as a table and a smartphone. Through interactive technology, DS children are more likely to send questions and comments for the teacher to discuss. For students with intellectual disabilities, technology-based curricula that can be educated with audit books, portable keyboards, tape recorders, calculators, magnifiers, and computers are highly supported. These resources offer a useful method for completing exercises.

In a different study by Karagianni and Drigas (2022) the integration of digital games in the educational setting for DS, it is shown that beyond their role as pleasure, digital games may frequently be employed as crucial intervention tools for special education needs (SEN) kids, giving them equal educational possibilities. Digital games help make up for many of the cognitive difficulties that DS children have when learning. When they give the right amount of challenge and pace, tailoring mastery to the dynamics and requirements of this particular group so that they do not repeatedly fail and become frustrated, which lowers their motivation to succeed and their confidence. “PRADIA: Mystery in the City” and “Magic Stone” are two games studied in this

research and found useful for learning-disabled children. Furthermore, children with Down syndrome must have phonological awareness and letter knowledge to learn to read alphabetically. For this reason, "Centro Diferencas" created a game with 7 mini-games in conjunction with the New University of Lisbon to give them effective individualized learning and enhance their speech and reading abilities.

In a similar study on the effectiveness of educational technology on Down syndrome students' reading skills, Haro et al. (2012) presented the successful outcomes achieved when the DSRW methodology was used with an interactive technology with sensory interfaces while tested on children with Down syndrome in the Down Institute of Colima facilities. DSRW is a book that outlines a technique created in 1970. It was released in 1991 and teaches young kids to read before they turn five using a perceptual-discriminative method. The objective and main goals of this approach are for the learner to comprehend what he reads fluently, to stay motivated, and to maintain his interest in reading (Tronosoco, 2000, as cited in Haro et al., 2012). They used DSRW methodology with software, a tabletop, and a tangible interface. The tabletop comprises a table with a clear surface, nearly transparent, where the cards of the instructional content will be projected, and at the same time, it allows the Reading of the augmented actual tags by a web camera. The tangible interfaces will be physical things indicative of the images or phrases that are provided to the students. These things have underside augmented actual tags which are read by a web camera positioned under the table. The camera provides the reading to the software particularly built for our prototype. The model analyzes it, determines whether the toy's tag matches the word card or image card that is on the table, and then provides feedback to the user based on its findings. Results of this prototype on 3 Down syndrome students show that during the sessions, the kids demonstrated interest and curiosity when engaging with the prototype. The

opinions of the teachers were very positive, mentioning fascinated, and said that maybe the learners would learn faster with the interaction that the system allows them to have and that having this kind of technology would make them feel more integrated into society because then they would also know how to use technology. Finally, the general reaction of the first teacher was “The first teacher's overall response was exceedingly positive and liked to apply the strategy in both special education and normal classes when it is available.

Multimedia and Visual Aids

Multimedia tools including videos, animations, and visual aids have the potential to improve learning for kids with Down syndrome. Bennett et al (2013) examined the impact of a computerized visuospatial memory training intervention on the memory and behavioral abilities of children with Down syndrome in a four-month program. They applied a growing evidence program called Cognitive Working Memory Training (CWMT). In this program, individuals train intensely over many weeks on computerized adaptive Working Memory (WM) tasks that are incorporated inside a game-style environment. Working memory (WM), the multicomponent cognitive system responsible for the temporary storage of information throughout complicated mental operations, plays a critical role in learning (e.g., Gathercole & Alloway, 2008). Deficits in WM are observed in many cognitive and genetic neurodevelopmental disorders, including Down syndrome. The WM training program, JCWMT, comprises seven different computerized visuospatial memory training activities. Every task includes the temporary storage (and sometimes manipulation) of visual-spatial sequences, e.g., bumper cars that move within the screen and light up one at a time that has to be eventually remembered in serial order by the user who clicks with the mouse on the computer on the cars on screen. There were various motivational components in the application, which included regular positive vocal feedback, a collection of stars after every

perfect attempt, and after every finished session the child received a reward for their digital fish tank, e.g., a fish, a boat, or some seaweed. Each participant accomplished 25 training sessions, comprising 75 tasks. The Cognitive Index of Improvement (CII) which is generated by the program automatically represents a measurement of general progress on the learned tasks. The CII reported an improvement of on average 14 points. As a result of post-tests children in the intervention group exhibited significant improvements pre- to post-training. There was likewise a meaningful increase in spoken Short Term Memory (STM) scores for this group following preparation. The primary findings were that students could complete computerized memory training at school and that it proved helpful in improving their performance on both trained and untrained visuospatial STM tasks.

Virtual Reality and Augmented Reality

Augmented reality (AR), a relatively new technology, provides the proper tools for creating integrated learning environments that permit manipulating real-world objects and visualizing content, enhancing learning (Ramli & Zaman, 2009). The traditional teaching strategies that heavily depend on textbooks have limitations in accommodating students with different cognitive capacities and learning preferences. Ramli and Zaman (2009) point out that, because Down syndrome students are visual learners and that AR technology offers a learning environment that fits their learning styles, AR has had a significant impact on Down syndrome students. This is because traditional textbooks are not interactive and have constraints like static text, 2D images, basic drawings, and black and white color (cheap volumes). By offering creative presentation and interaction possibilities, tangible experience, and active exploration, interactive AR can get around some of these drawbacks. This prompted numerous studies on AR books to be conducted by

scholars and teachers. Dunser (2008), reports that AR books can help students who struggle with conventional textbooks.

Books with augmented reality (AR) can help pupils manipulate and visualize objects in real time. One of the biggest issues for people with Down syndrome is speech and language (Jenkins, 1993, as cited in Ramli & Zaman, 2009). The research by Ramli and Zaman which was conducted through class observations and interviews at 3 Down Syndrome foundation centers demonstrates that Numerous Malaysian students with learning difficulties are still unable to read (Yahya, 2003). Also, our society assumes that people with Down syndrome cannot learn to read. Yet, according to Prof. Madya Dr. Zainiyah, president of the Down Syndrome Foundation, students with Down syndrome can learn to read just like other students. Although the learning difficulties experienced by students with Down syndrome and dyslexia are distinct, they can nevertheless be fixed (Doman, 2005). As per this research, reading ability is the most struggling skill for a student with DS. Thus, the development of augmented reality basic reading courseware that integrates characteristics and parts of the Whole Language Philosophy and the phonics approach is required to aid kids with Down syndrome in learning to read. The research has selected common sight words from the real world to serve as the 3D environment. Augmented reality is one method for bringing experience and location-based learning to students by enhancing existing environments as opposed to inventing new ones.

Augmented reality can take learning outside of the classroom and into the places where students live by fusing technologies, they are already familiar with in places they see as their own. In another study by Alfaraj and Kuyini (2014) in Saudi Arabia it is discussed that because of the constraints of conventional teaching methods, students with Down Syndrome (DS) and other disabilities have long been at a disadvantage in terms of access to the school curriculum. To

promote the learning of kids with DS, teachers typically employ a variety of instructional techniques and strategies including task analysis, repetition, and pacing. While some children successfully used these strategies, others did not perform well in school, and teachers were encouraged to come up with more inventive ways to help students, including using technology. Computers are the most widely used device, as a learning technology besides other devices that are used in schools including iPads, projectors, and to a lesser extent, television sets since only one teacher mentioned the use of television as a teaching aid. These findings corroborate views in the existing literature which point to the use of different computer-assisted technologies as aids to support the learning of children with DS (Wood, 2004).

Assistive Technology

Various studies have been done on the effectiveness of Assistive Technology (AT) in the learning process of children with Down syndrome. Assistive Technology is acting as a facilitator in the life of Down Syndrome. With the aid of assistive technology, people with Down syndrome can participate in daily activities and become more autonomous and social (Alammary et al., 2017). For instance, Alammary and his colleagues conducted research to understand more about how AT is now being adapted for the learning process of DS children in inclusive schools and centers for rehabilitation. This will be addressed from the following angles: difficulties faced by DS students due to their unique characteristics or disabilities, and how much these challenges are affecting their teaching and learning processes; types of AT used by inclusion schools and rehabilitation facilities for the teaching and learning processes. AT is described as the equipment, devices, services, systems, and processes to help disabled people with special educational requirements better function in everyday life, improve their quality of life, and ensure their full, active, and simple involvement in society (Lancioni et al., 2013, as cited by Alammary et al.,

2017). By creating a theoretical model based on the relevant research, the effect of AT on DS pupils was investigated and evaluated. The basic premise of the concept is that implementing AT in the instruction of DS students can improve their performance, social engagement, and independence. Since AT can support a variety of DS features and disabilities, the study model has determined how each type of AT affects the effects listed above. In general, it can be stated that the inclusion of AT in DS students' instruction and learning can help them become more autonomous and sociable beings. The results of the study show that through improving DS's communication, performance, social interactions, and independence. AT is helping to enhance their learning and give them the ability to participate fully in society. Direct and indirect training can be applied by AT to develop capabilities and skills. Through the participation of specialists, developers, special educators, teachers, and volunteers in various workshops and courses, direct training can be carried out. Indirect training can be accomplished by speaking with landlords and parents of disabled children. Implementing specialized e-learning networks for teachers in inclusion schools to exchange lessons, courses, and information among themselves or network is another indirect method of expanding the knowledge and experiences of AT for assisting Down syndrome.

2.4 Gap in the Research Literature

Although significant advancements have been made in exploring the use of technology in teaching children with DS, there is a noticeable gap in the literature regarding the long-term effectiveness and impact of these technologies on learning outcomes, social interaction, and independent living skills. Furthermore, limited research has focused on the perspectives of educators, parents, and children themselves regarding the usability, acceptability, and practicality of these technologies in real-world settings. Furthermore, there are few research available in the

context of developing countries on the usage of technology in DS education while even educational technology does not have a clear and constant stand at the school level.

2.5 Conclusion

This literature review provides an overview of the technologies used to teach children with Down syndrome, highlighting their potential benefits in facilitating learning and addressing specific educational needs. While the use of technology holds promise, there is a need for further research to evaluate the long-term effectiveness and impact of these technologies on educational outcomes, social integration, and independent living skills. Additionally, future studies should consider the perspectives of key stakeholders to ensure that the selected technologies are practical, user-friendly, and tailored to meet the diverse needs of DS students. By addressing these research gaps, educators and researchers can make informed decisions and design effective interventions that maximize the educational opportunities for children with Down syndrome, ultimately promoting their overall development and inclusion in society.

Chapter 3- Methodology and Material

To investigate the role of educational technology in the teaching and learning process of children with Down syndrome, in addition to finding the existing teaching strategies being implemented in the targeted research locations, a semi-structured interview was conducted with special schools. The people who participated in the interview are teachers and school principals with 15 to 2 years of experience in the field of special education. To conclude, insightful results and findings were obtained through a thematic analysis done through MAXQDA qualitative data analysis software. The four research questions were considered to be included in the interview questions. This chapter includes details on the design of the research, research participants, limitations, and research locations. In addition to the data collection and analysis process.

3.1 Research Design

In this study, a pragmatic paradigm was considered to answer the research questions, because pragmatism frequently bases the research methods on the research question itself. According to Kaushik & Walsh (2019), reality is constantly understood and bargained against an ever-evolving background of uncertain circumstances. Pragmatists frequently blend constructivism and positivism tenets in a single research effort since they are more concerned with finding the best way to address the research topic. The research purpose was to find the teaching methods available in both special and mainstream schools for children with Down Syndrome and how educational technology can support their teaching and learning process. For this schools and special educational centers were visited to find teaching methods under different circumstances in both traditional and ICT-based teaching methods. A key tenet of pragmatic epistemology is the idea that knowledge is always dependent on experience. Social interactions have an impact on how we perceive the world. Since each person's experiences are unique, so are how they shape their

knowledge. However, a large portion of this information is socially shared because it is derived from socially shared experiences (Morgan, 2014 as cited in Kaushik & Walsh, 2019).

Thus, inductive thematic analysis of the data; experience of teachers, and principles in the field of special education supported to draw conclusions and identify patterns, themes, and meanings within the collected data. Having known the idea of school principals who had been working in the field of special education for more than a decade and mainstream schools who have been pioneers with more technology-based approaches, their common and special experiences added significant value to the findings of this study.

3.2 Research Participants:

Participants in this study are 10 female special educators, and 3 school principals from 4 schools in Chittagong; 4 teachers had been interviewed through the pre-designed semi-structured interview questions and 4 school principals provided their general experience and information in their work history. Additionally, 2 focus group discussion was conducted with other 6 special educators. The participants were selected as a purposive sampling because there are not a lot of schools around the city where I could interview people and observe classrooms for Down Syndrome children in Chittagong in addition to my absence in Afghanistan and the lack of special educational centers there. The teachers were those who have been trained specifically to teach students with Down syndrome and other disabilities like Autism, Global developmental delay, and other neurodevelopmental disabilities by experts from India and Bangladesh.

3.3 Research location

The three research locations are special education centers where children with different kinds of diverse needs are being trained there. Just one of the schools is a therapy center only for

Down Syndrome. Although, some of them are named for Austims, they provide education for many DS students too.

- (a) Frobel Academy is an English medium secondary school that integrates students with diverse abilities into mainstream classes. It also provides parents with the opportunity to learn through workshops and conferences, allowing them to improve their child's learning at home. It has an Enrichment Center as well as a Wiggle Room for children with learning impairments and special needs. Trained special educators provide support to all students as needed in a professional technology-integrated setting.
- (b) The Chittagong Chapter of the Down Syndrome Society has been doing phenomenal work in raising awareness and fighting the stigma surrounding Down Syndrome in Bangladesh since 2019. This is a therapy center for making children with DS ready to attend school and normally get a role in their social lives. This center works as a chapter for the Down syndrome society of Bangladesh but has its independent programs as well. Most of the children who come to this center receive one-to-one and sometimes group therapies for being ready to attend regular schools.
- (c) The Foundation for Autism Research and Education is a non-profit organization that was founded on October 2, 2007. The organization is run by a group of committed parents of autistic people as well as a few prominent philanthropists. FARE supports the potential of people with diverse needs. This school is providing pre-vocational classes for children with disabilities aged 6-15, counseling and guidance to parents, and parent-child training. The pre-vocational training in this center is held in techno hub computer labs where the children with diverse abilities like autism and Down syndrome are taught by special education experts using curriculum/software.

(d) Seher Autism Center is a non-profit, non-governmental, and humanitarian organization for children with all special needs. Unlike its name, the center provides education for different disabilities besides autism. Their mission is to assist the numerous parents of children who have been identified as having disabilities in creating a better life for their kids. By giving them quick access to a network of other parents, specialists, resources, and treatment alternatives, they give them more power. They integrate children with learning disabilities into the community through methods of intervention and therapies together which are used in the classes inspired by worldwide known behavioral, cognitive, and developmental approaches such as Applied behavior analysis (ABA) and Teaching and Education of Autistic and Related Communication Handicapped Children (TEACCH).

3.4 Data Collection

The data collection process took place between June 7, 2023, and July 10, 2023, and incorporated qualitative interviews with 4 female special educators aged 25-35, and 3 school principals. In addition to 2 focus group discussions with 6 special educators in two of the schools. Also, observation of both technology-integrated and traditional classrooms for special children was done to better conceptualize the collected data of the interviews. To identify and find special education schools a web search, and consultation with AUW professors and some of the school principals was done. Although it was tried to find at least two schools in Afghanistan; unfortunately, due to the lack of such centers for special education and the current disparate educational situation in Afghanistan it did not happen. However, since the purpose of this research was to find and do an analysis on the teaching methodologies that special educators use whether in special education centers or regular schools, and the possible effectiveness of educational technology integration in the teaching and learning of DS children in the context of developing

countries, the location did not matter a lot in collecting the required data. In selecting the teachers, the ICT experience of the teacher and experience of working with Down Syndrome students was prioritized. The interview questions, in the semi-structured form, focused on what teaching strategies teachers use for teaching children with Down Syndrome and if they use technology, what are the resources with their effects in their learning. For this, the main target group was teachers who had at least one year experience of teaching in special education.

Ethical reviews, consent forms, and information sheets along with a formal interview letter from the Ethical Review Committee of the Asian University for Women were carried out during the data collection. Additionally, oral and written consents were taken from respondents before the in-depth interview and voice records.

3.5 Data Analysis

This study consists of transcripts of interviews from audio recordings, notes of focus groups discussion, and observations which were all in qualitative format. For analyzing the research data, a thematic analysis was conducted using the help of the MAXQDA qualitative data analysis program. Researchers agree that thematic analysis is an adaptable and effective approach in producing reliable qualitative research findings by identifying, analyzing, and summarizing patterns (themes) within data (Saunders et al., 2023). The Analysis process is conducted in three stages suggested by Saunders et al. (2023); reading, coding, and theming. In the very initial step, the interview transcripts were read carefully, and a complete comprehension of the data was accomplished for a better stage of coding and theming. In the second phase, the data were coded and categorized through MAXQDA software to contextualize and connect different experiences of participants into meaningful groups and themes. Finally, meaningful themes were identified

from the coded transcripts to make deep meanings and analysis of the data regarding experts' experience in teaching children with DS and the use of technology.

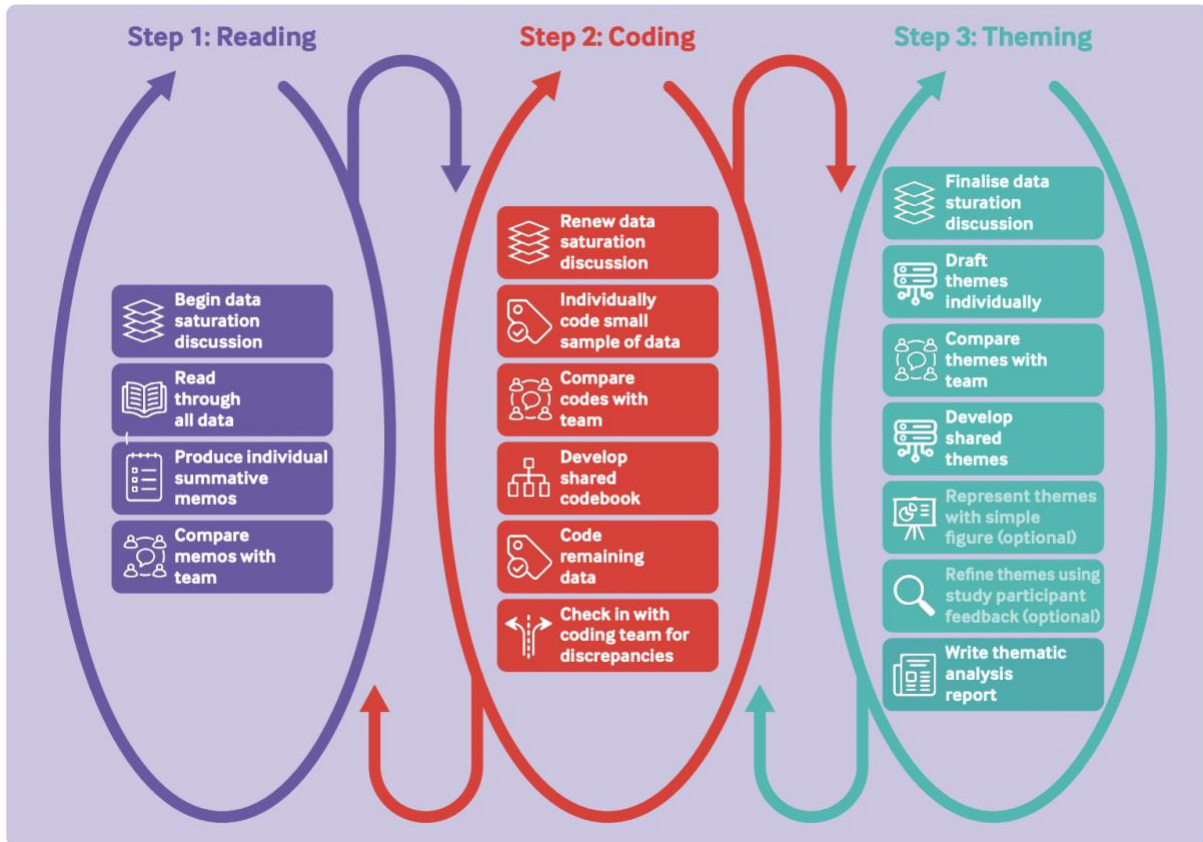


Figure 3.1 Thematic Analysis Process (Saunders et al., 2023)

3.6 Limitations:

Special education and children with diverse abilities are neglected parts of the majority of developing societies and even families. Researching this topic, especially the role of educational technology in special education schools or the regular school with inclusive systems is not easy and needs more time. Bangladesh and Afghanistan as lower-income countries have limited enterprise in the field of special education. Most of the educational centers for children with DS are in big cities and few of them are occupied with enough facilities and use educational

technology. As per the data collected in this study most of the children with DS are enrolled in special schools, and some are both in regular and special schools where there are not enough facilities for them to receive a special education through educational technology.

Since the fieldwork and interviews were conducted in Bangladesh where the researcher did not have any network with people and areas, it caused sort of problems in the data collection phase. Some schools of special education which are run by the Bangladesh military and Navy were challenging to access due to a foreigner identity. Meanwhile, reaching out to the schools where they work with special children and do not have mostly any visitors for research and study purposes through emails, calls, and direct visits was much thought-provoking. These limitations have somehow affected the findings and the quality of the collected information.

3.7 Conclusion:

This chapter focused on the design and rationale of the study as well as the standards for conducting reliable and legitimate research, additionally, methods of analyzing and interpreting the data. For a better understanding of the research questions and methods of teaching special children, 4 schools had been selected purposely. The data is collected through semi-structured in-depth interviews with special educators in regular and special educational centers. Through a pragmatic paradigm, the knowledge and experience of specialists in the field of special education for children with Down Syndrome, Autism, and other neurodevelopmental disabilities were considered. As Kaushik & Walsh (2019) cite; this paradigm gives the researcher the ability to select the best research methods from a wide variety of qualitative and/or quantitative methodologies and this pluralism has various benefits for social research.

Thematic analysis, which is the most appropriate method for understanding details and common experiences of people, was conducted through MAXQDA, qualitative data analysis

software for more reliability and validity. Ethical considerations are considered as an important part of the data collection and interviews and all participants signed and read the information sheet and voluntary consent form before interviews. Despite all the constraints related to time, resources, network, and accessibility of schools, a final effort has been made to obtain valid and valuable findings.

Chapter 4- Results and Findings

Experience of Teachers and Principals in Educating and Training Students with Down Syndrome

Over the past 20 years, there has been a notable improvement in increasing access to educational opportunities, yet evidence suggests that many children with disabilities are still falling behind. Without providing children with disabilities and other marginalized groups with high-quality education, the world will not be able to accomplish Sustainable Development Goal 4, which calls for high-quality education for everyone (Hassfurter, 2021). Whereas, in developing countries like Afghanistan and Bangladesh the ignorance of children with disabilities is much higher than other countries. This chapter will represent the analysis of interviews based on the themes identified in the thematic analysis to answer each research question in chronological order.

4.1 Specialists' Experience in DS Education

The level of awareness and society's perception about Down syndrome appeared to be at a moderate level in Chittagong city of Bangladesh compared to Afghanistan. There are approximately 10 special educational centers all around the city where children with diverse abilities like Down syndrome, autism spectrum, and other diverse abilities are being taught and supported for their education. World Down syndrome day is celebrated on March, 21 of each year through Public Outreach Campaigns by special educational centers and Down syndrome activists. Despite a moderate level of social awareness still, parents and families are not doing the appropriate early interventions for their children with Down syndrome. A principal at one of the special educational and therapy centers stated that,

“Most parents who have children with DS do not tend to bring their children, unlike other children with Autism because DS children are so loving and caring. They only worry after

the age of 7 and 9 when they did not learn anything or cannot do something. While autistic children shout, they have anger management problems which is why, their parents take them to us earlier since they are alert. Parents assume that if they give their DS child time, they will learn things like how to talk, how to sit, how to walk, and learn, but they do not know that giving time to a DS child means wasting time. As early as the children are taken care of as better it is “(SP1, Jun 15, 2023, p.74).

According to the information collected from people with more than a decade of experience in special education, families have the most important role in the future of their children. Most families in developing countries deny accepting that their children need special therapies or education. Based on research on The Impact of families’ early interventions among Down syndrome Children by Navi et al. (2013), it was declared that children who have Down syndrome or other developmental abnormalities are potential candidates and eligible for early intervention services. Early intervention has several different definitions. Early intervention is described by Bowe (2004 as cited in Navi et al., 2013) as a service or a special program for kids from birth up to the age of three who have developmental issues or are at risk. According to Watts (1983, as cited in Navi et al., (2013), early intervention is the provision of therapy or early treatment before the age of four and typically starts as early as the first 36 months of age. They found that families’ income also has an impact on how they perform early intervention for their children in different sectors of stimulation, occupational therapy, physiotherapy, speech therapy, and other treatments. 61.9 % of families believed that Early intervention is essential for helping them to support their children's development and education (Navi et al., 2013). Thus, families need to take care of their children’s growth and education in a world where a person cannot live and survive without a basic education.

4.2 Down Syndrome Schooling Status (Mainstream VS Special Education Schools for Down Syndrome)

To respond to the first research question; *how are Down syndrome cases dealt with at schools in Afghanistan/Bangladesh?* both inclusive and special educational environments for DS children had been visited and interviewed. It was attempted to make a comparison of both by asking about the perception of teachers and experts at inclusive education versus isolated education for children with diverse abilities, and their experience in real cases of Down syndrome children.

According to UNICEF, inclusive education means every child in the same classrooms, in the same school. It entails genuine opportunities for learning for formerly marginalized populations, including minority language speakers as well as children with disabilities. One of the visited schools was an inclusive school that integrated disabled children into mainstream classrooms. The head teacher of the department of special education shared their experience in inclusive education for DS students as follows:

“We teach our special students in mainstream classes. They participate in extracurricular activities like yoga, dance, and arts and they learn social skills in the class. However, their main training is being done in one-to-one sessions with special educators at a different level for example, the child is taking the mainstream class as per their age and yearly grade upgradation, but they follow a lower grade curriculum in their specialized time with experts. This is very important for their social development to be with other children. If they are isolated, and in a place where they are always kept specially and their difference is always mentioned to them, it affects their social interaction and life skills. Down syndrome students in regular classes participate in group activities, to learn how to interact with others, wait for their turns, claim for their rights, and make friends. Also, in this way,

the level of awareness among other students rises. They learn to respect everyone in society and to believe that people who are different are not less than others, but they think, act, and learn differently. This is a starting point for society to accept differences, and not be the reason for them to lag in other social activities” (SPE1, Jun 11, 2023, p.62).

On the other hand, special education schools where Down syndrome children and other neurodevelopmental disorder students get education and therapies are another important social initiative. It provides students the chance to receive a quality education that is tailored to their specific needs. Another three places visited for data collection were special education schools and therapy centers which teach school subjects and other social life skills. The principals in these schools believe that children in regular schools are not being treated well, teachers in regular schools do not provide them with specialized teaching, and they burden them with too many loads of homework and tasks like normal children which is very demotivating for them. Also, being bullied by other students is another problem they face. They state from their experience that the problem is with society and parents, we should teach our children that all people are not the same. Some people are different, they are not disabled or less, they are differently abled. They see details, they feel everything, but they are not less and worthy of bullying. If we teach our children, there is no need for special children to be isolated from society or bullied. They can go to regular schools and have inclusive education in case society is aware; including teachers, parents, and other children at schools. Still, few schools have inclusive education considering specialized curriculums for them or giving them different tasks or assignments (SP2, 21/06/2023).

In a group focus discussion, one of the experts said a case about a student with Down syndrome who received inclusive education besides early intervention from the family side and now her level of education is quite good. Not only can she stay independent in her life but she

helps her teachers to deal with other students of her kind and many other examples of students who received early-age therapies and care from their families and now go to mainstream schools without facing serious problems. The regular children in mainstream school have recognized their peers with diverse abilities and respected their exceptional talents like their very unique paintings on the walls of school art class challenges (FGD, Researcher's note, 21/06/2023). Also, a therapy center expert reported the status of students in this center for the last 5 years,

“Most of our kids are now enrolled in regular schools, mostly in private and English medium schools and in some cases in public schools. Sometimes their parents take them to shadow teachers too but we aim to see our kids in mainstream schooling. We can open up a school for these children and teach them in an isolated environment but this is not the case which can change the society. We want regular schools to have this setup for every child because they should deal with typical students, they can socialize with them. We want regular schools to have special teachers, and to have this setup and mindset to accept students with DS and other special needs in inclusive education. We give them speech therapies, functional therapies, and basics of the classroom, concentrations, the ability to follow instructions and know social interaction skills so they are ready for school. If the students have those basic skills of attending a regular class, they will be accepted in the regular school, because the teachers can instruct them” (SP1, Jun 15, 2023, p.74).

It can be concluded that it is good to allocate special attention to DS children in isolated educational centers, but they should be accepted in society and this can happen not only by increasing social awareness but also by educating them among their biotypes.

4.3 Common Strategies in Technology-based Classes and Traditional Classes

The second research question was to find *what is the existing initiative that schools implement for children with Down syndrome in Afghanistan/Bangladesh*. As a result of data analysis, it was found that children with diverse abilities require specific and precise methods, strategies, and practices. Regardless of whether they are in technology-integrated classes or a traditional learning setting. A particular part of the interview questions consists of the teaching method for children with Down syndrome in those schools. As found during this study there are many common methods and strategies that experts and special educators use for teaching special students which are described as follows. Before any kind of curriculum or syllabus, one of the common teaching strategies in both types of schools is having an Individualized Education Plan (IEP). An IEP is a written plan for an individual with a disability that is created, evaluated, and changed in a meeting with an IEP team. The decisions taken by the IEP team; parents and experts are documented in the IEP which represents a commitment to providing the services required to meet each student's unique learning needs (APE Center, 2006). Schools of special education and regular schools develop IEPs for students after doing a sort of assessment using standardized methods like ABLLS (assessment of basic language and learning skills). After that, they plan for therapies and academic programs addressing each of those individuals' needs separately. (See appendix; SP2, SEP1, SEP4) for more information.

Additionally, the type of syllabus and curriculums being considered for DS children is different and more focused on basic functional life skills. For example, they use ADL (Activities of Daily Life) in group work where they are being trained to cope with the social life challenges that may not be a challenge for regular students, but it is for them i.e., how to make a sandwich for themselves, how to take care of themselves, how to iron clothes, toilet habits, hygiene habits, eating

habits, clothing, washing clothes, etc. Also, Yoga classes, music and arts, and physical education if they are good at any skill, help them to improve in that area like drawing, coloring, etc.

Regarding their syllabus, they are not following the subjects and books of regular students because they mostly cannot grasp those things due to their working memory shortage and different learning styles. One of the experts declares:

“We instruct DS students in functional math, functional English, fundamental awareness, and a mixture of social studies and science. The reason to use functional math is that we don't see any application of very advanced math concepts like the Venn diagram in the lives of our pupils with Ds. Instead, they are being trained on the money concept, the time concept, and the things necessary for their lives. Normal students learn these concepts during their normal school day; they don't need a separate time for it, while students with disabilities do. Thus, how to read time, measurement concepts, comparison, and money concepts are being taught in the special math curriculum to special children. Same to this, in functional English we focus on functional aspects of language like doing a conversation during a phone call, taking an appointment in the hospital, or booking a ticket for a plane. Those things are covered in functional English instead of focusing on the grammar, tenses, and the things that are difficult to grasp for special students.” (SPE3, Jun 11, 2023, p.70)

Whether in an inclusive or special setting, DS students need to be taught differently; as per the teachers, they can learn basic things at their elementary levels compared to normal children. So, the point of specialized, one-on-one education is also tailoring learning material and class load based on their needs.

4.4 Technology-based Classes

How can Ed-tech take place in facilitating the learning process for children with Down syndrome? It was the third research question. To investigate the response a big part of the research questions had been focused on the use of educational technologies used in teaching DS students. Schools with technology-integrated learning environments believe that technology as a helpful resource, and certainly not the only resource, is a basic important principle in teaching people with learning disabilities, whether it is Down syndrome or other special needs. They use special IT laboratories or private and smaller environments such as special rooms with small cabins for their teaching. The environment that they have considered is not equipped with many technologies, but only equipped with electronic devices such as laptop computers, tablets, internet, and other necessary items for a classroom. But they consider these limited tools with proper use as a good learning factor with more attraction for Down Syndrome children who are more visual thinkers and learners than others. Some of the simple things like comping with family are shown to them through YouTube videos instead of abstract things in textbooks.

4.5 Teaching Strategies with Educational Technology for DS Children in Schools.

Visual Auditory kinesthetic tactile (VAKT) is a learning style taken into consideration for children with Down Syndrome in technology-based personalized classes in these schools. VAKT was created by Orton-Gillingham and Fernald. A learning technique called the VAKT method makes use of the visual, aural, tactile, and kinesthetic senses. The foundation of the VAKT approach is the idea that children will learn more effectively if the instructional material incorporates a variety of sensory modalities, including vision, hearing, touch, and movement (Prasetyaningrum & Faradila, 2019).

The use of VAKT combined with educational technology in one of the schools is as follows. The VAKT approach is being used as the main strategy for teaching children with Down syndrome. In this strategy, educators consider each of the sensory modalities as a separate part of the teaching plan. For visualization, they use live worksheets and other laptop resources. According to its official website, [live worksheets](#) are interactive worksheets that let teachers turn traditional printable exercises (doc, pdf, jpg, etc.) into engaging online activities with self-correction. Additionally, these interactive worksheets fully utilize the current technologies used in education. They may have sounds, pictures, drag-and-drop activities, join-with-arrows exercises, multiple choice activities, and even speaking activities that need the use of a microphone by the students.

Since the majority of printed sheets and traditional textbooks are in black and white, teachers believe that employing these interactive activities through laptop resources allows them to exhibit colorful graphics of the learning material to students. A red apple will therefore be simple for normal pupils to imagine if they are given a black-and-white worksheet for seeing a piece of fruit, but a child with DS will not be able to do so. So, it will be beneficial for them to see a vibrant image on a laptop. Additionally, if it is a video, such as one on YouTube, it will be more beneficial for them since they can see how it appears. For instance, if someone were to envision biting into an apple, they may see what it would feel like. They are absorbing this visual information, then.

Videos from YouTube are used to provide audio input too. For instance, when kids are learning about places to vacation, they see it in the film, and it informs them of the locations they can go to. For them, thinking is a significant difficulty. For them. As a result, when you explain to the audience that beach surfing is similar to when you Skitt, normal schoolchildren will be able to understand and think of it. But for them, it is very abstract. Abstract information is really difficult

for special students to understand. YouTube is a fantastic resource for us to use to show them videos that they can both hear and see. Therefore, that is the thing that greatly helps their learning.

In terms of their kinesthetic tactile approach, they mostly use games and websites like lifeworksheet.com, Nearpad.com, and Kahoot. The levels of the quiz game KAHOOT can be set by teachers according to the ability of their students. It is not boring for kids to learn in lifework worksheets. In lifework sheets, learning is not monotonous for them. They are more than just writers and writers' crew. Additionally, they are selecting and typing on laptops. As a result, these are providing them with tactile and kinesthetic approaches. Other physical resources, such as objects that they touch, feel, and do with, are also used by kinesthetic and tactile learners in addition to computers. See (Appendix; SPE3) for more information.

4.6 Technologies, Applications, and Digital Curriculum Applied in Schools

However, in the fourth research question, it was planned to find if there are any digital curricula specifically designed for children with Down Syndrome in Afghanistan and Bangladesh, and if they are being implemented successfully, the result suggests that there are several online games, quizzes, applications, and digital curricula to support special education not specifically DS which have been so far implemented successfully and effectively in a number of schools. The following technologies are those that special educators use in the visited schools. For instance, Ms. Word and PowerPoint, lifeworksheet.com, Kahoot (Game, quiz, competition), Digipuzzle.net, Nearpad.com, Jolly Phonic, Bubble Shooter, Free Online Jigsaw Puzzle, Ballon Bang, and AVAZ. Educators use these digital curricula, which contain educational games, practices, and quizzes for teaching DS students. As reported by teachers, for the times that DS students do not like to write, they just use these games for their enjoyment because otherwise, they feel bored. As an example, on Digipuzzle.net, there are lots of games like clocks, Monster games, and matching games.

Students can play these games and learn. For example, in the monster game, they learn the time concept in math by feeding the monster, which is a mix of joy and learning.

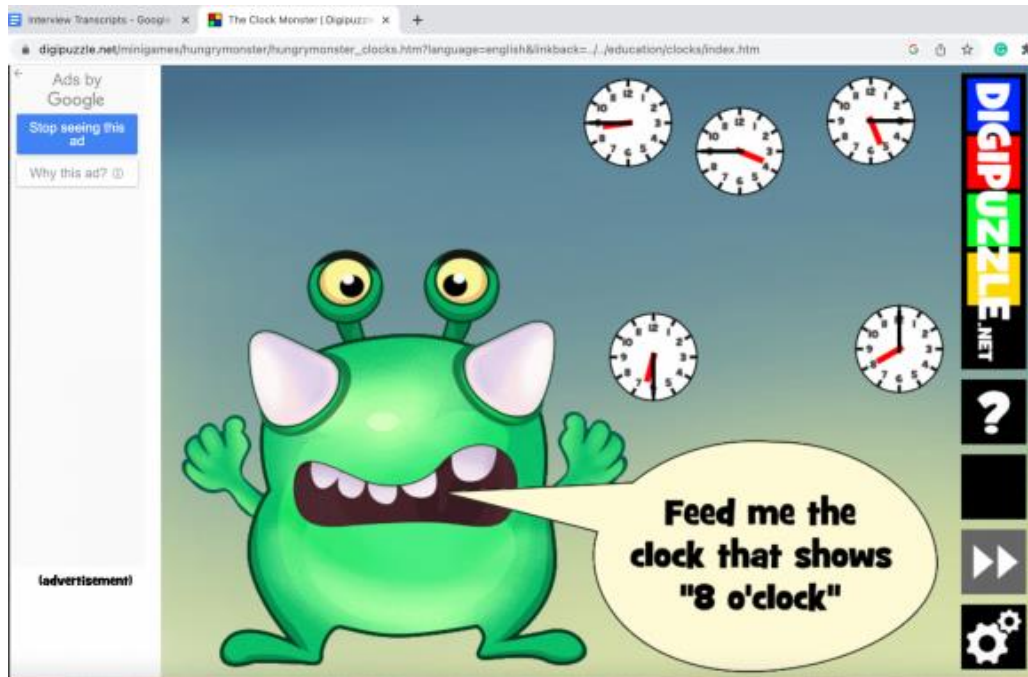


Figure 4.1 Jigsaw Puzzle monster game used by teachers

Then the feedback will be given by both the teacher and the system itself. These exercises are completely planned based on individual needs because some of them enjoy this, but some do not, while students with DS enjoy this “reported the teacher”. There are a lot of games on this site that help students with learning disabilities (SPE2, Jun 11, 2023).

As teachers reported, students are first taught the basic concepts of functional math, English, or other subjects in their one-to-one classes with special educators. After receiving the necessary learning level, these types of games and interactive exercises are used for their practice and a better understanding of the concept. Children with DS get bored with writing tasks and repeated things; thus, the traditional way does not work for them. In math, most of the exercises are based on the games like clock concepts, money concepts, fractions, and elementary arithmetic (SPE2, Jun 11, 2023).

Nearpod website is another source being used by special educators in technology-integrated classrooms. According to its official website, Nearpod is a teaching aid for educators that provides real-time insights into students' comprehension through interactive programs, interactive videos, gamification, and activities – all on one platform. According to teachers' experience, this website enables them to create practice worksheets related to their syllabus and students' level of interest. Not only can they use the pre-designed presentations for several subjects and grades there, but they can also make their own lessons in their free accounts and use them as part of their IEPs for each student. The math teacher reported that they design the sheets on the Nearpod website, which is used for students' assessment since there are lots of questions in its library but they are not according to teachers' and students' demands. Thus, in this case, they make some quizzes on the game format and in the meantime print that sheet and get their marks in the printed copies which are used as students' evaluation documents (SPE2, Jun 11, 2023).

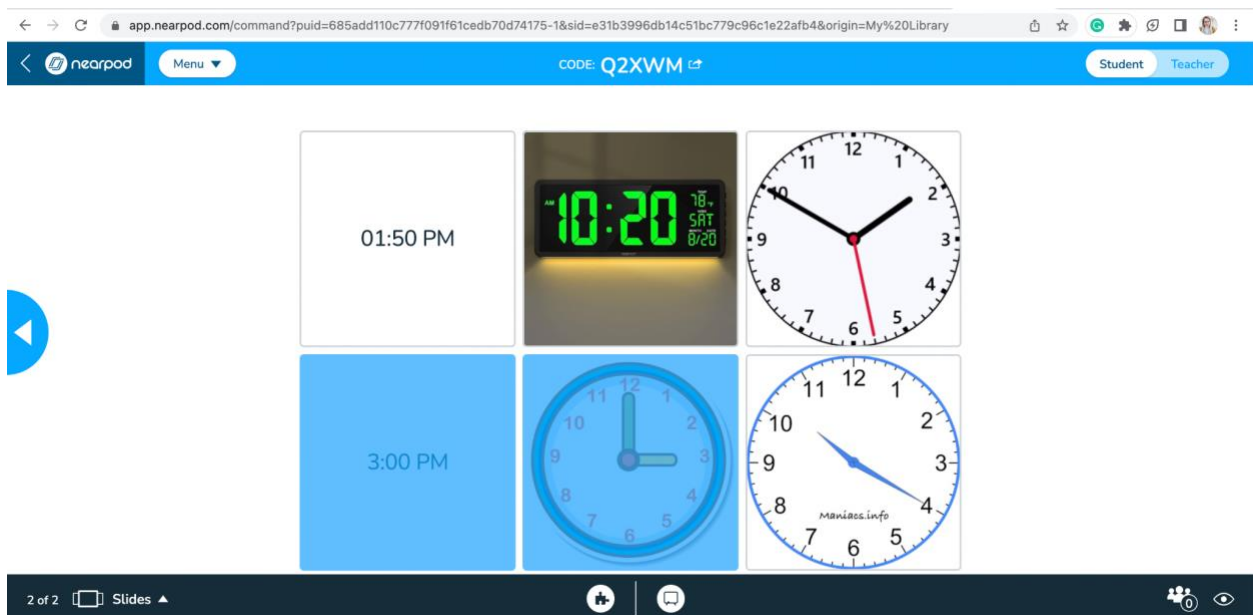


Figure 4.2 Nearpod matching game developed by the user.

In addition to the mentioned website as a digital curriculum and instructions used for teaching children with Down Syndrome, there are many other quizzes and games with the same purpose of creating an interactive learning environment. To keep students who have a lack of focus, lack of working memory, or need more practice than a normal student. 50 minutes are allocated to each subject for a student daily. Most of the teachers use the same. While some of them are using different sources based on their subject and level of students which are mostly free to access through the internet. Lessons are planned on weekly and biweekly bases. The type of curriculum and syllabus is up to the teachers which includes the VAKT approach in it.

4.7 Teachers', Students', and Parents' Attitudes toward Using Educational Technology

Teachers, who are the base of the educational system, were asked to share their experiences and attitude in using educational technology and digital curricula for special students. As a result, it was found that teachers who use these technologies are found to be more successful than others. They work systematically and most importantly their teaching style is the favorite of students and more responsive. When a teacher gets the result of her work, she gets motivated and more focused.

One of the principles stated that they are very much benefited by the technology because even educators and other experts in special education are getting training online from experts in different parts of the world. A teacher stated "Despite facing lots of difficulties in this process, we are practicing and learning every day. We should search a lot of things while dealing with special children, the things with which they feel comfortable, and how to manage the extra use of technology resources in the teaching plans" (SPE1, Jun 11, 2023, p.63). Teachers believed that using technology eases their teaching process because students love using technology, computers, phones, and tablets so they learn, practice, and work enthusiastically. Students learn more

effectively and with greater focus when they are willing to participate in the lessons, it is a success for the teacher as well.

Meanwhile, children like using computers and tablets instead of textbooks and writing assignments or practice sheets. Teachers reported as an example: “If they are asked to write something on paper, they don't like it too much but when we ask them to type the answers on computer worksheets, they do it independently. If they like some activities, we ask them to type that and search for them to inspire them. They sometimes do use the software at home also. Their skills to use the laptops and operate them comes from their families” (SPE1, Jun 11, 2023, p.65).

Parents are also supportive and cooperative in using technology-integrated teaching methods for their children. They do see the impact on students. For example, a DS student who comes in grade 7 is able to independently read the sentences and comprehends them to a certain level. So, parents see the improvement in this method of teaching that is why they are really happy to see improvement in their child's education. There had never been any limitations towards the use of technology for children from parents.

4.8 Learning Outcomes in both Traditional and Technology-based Classes for DS

Based on the National Health Services, learning domains including reading, writing, spelling, mathematics, etc. are affected by a learning difficulty, which is a special education need. The learning outcomes of the mentioned teaching strategies, technologies, and pieces of training in both traditional schools, technology-based schools, and therapy centers were analyzed during the data collection process and in-depth interviews. A common experience of experts in the field of special education is that these students need practicing and more practice over their whole learning process. Specifically, children with Down syndrome have a working memory shortage which makes their learning and remembering process difficult. Some of the DS students learn well

through this software and other classes they take, while others cannot learn easily and it should be practiced with them regularly.

Despite challenges in their learning process, students who participate in both inclusive and special educational centers have considerable learning progress. Those at higher levels can read and write independently. Use mobile devices, computers, and other devices. As reported by one of the teachers the levels of DS students get better but quite slowly than other students. A special educator shares her experience of working with a DS child in three years as this,

“She remembers things sometimes, but she mostly forgets, it should be repeated continuously to her because they forget most of the things that I teach them during their previous grades like simple additions and subtractions. However, they remember basic knowledge, like digits reading, and writing which are the bases of living independently. When working with them through the software, interactive games, and quizzes they can learn and remember 80 % of the things but we always need to repeat them. Similarly, when we do money functions, they sometimes get confused about whether to do a subtraction or addition so then we help them. In the practice worksheets, she learns well and can-do things independently with my instruction. In their daily lives, they can read the prices when they go shopping or to the cafeteria at school and pay the money, but they cannot calculate how much they need to get back their change. But they can do it with a calculator. They put the number calculator and subtract the price.” (SPE2, Jun 11, 2023, p.68)

Although it is a fact that DS children learn and grow slowly, there are a lot of success stories for those of them who went to college, work and have their businesses. like what the teacher stated, they need to be educated to live dependently like any other individual.

Through training in schools, students become more independent in their social lives. The reason behind this is when they are in mainstream classes, or with other students in a class, they

learn most of the necessary social life skills. In contrast, when they are isolated in their home environments, even if they are being treated very well with every facility they need, it affects their abilities to live independently in society. Thus, as much as the focus on educational centers is concentrated, they are focused on activities of daily living (ADL). Doing therapies, group activities and generally being in a separate environment rather than home, strengthen their social life skills. Additionally, while using these ICT-based sessions and practices students learn sitting correctly in the classroom, they practice eye contact and gesture activities. They learn when their to-do lists start and when it ends which is teaching them social life skills. This is how they learn activities related to their real-world settings as well.

Chapter Conclusion

The overall findings of this study show that a formal education whether in an inclusive or special education format supports students with learning disabilities to receive basic education and social life skills. However, there are some differences in the quality of education in technology-integrated settings versus traditional ones. Students with Down syndrome and other neurodevelopmental disorders like autism need very special teaching plans and strategies. This is why any educational center for these students has an Individualized Education Plan (IEP) and specific one-to-one sessions. Unlike regular students, students with DS should have early intervention and support from their families, and society. As much as formal education is important in their lives, society's awareness, parents' awareness, and acceptance are important too. Also, a set of digital curricula is designed to foster the teaching and learning process of teachers and students with DS, which have been used in some of the schools and found to be supportive to keep students motivated and focused on the learning process.

Chapter 5- Discussion

This study aimed to research the potential application of educational technology as a teaching and learning tool for Down syndrome kids and determine the views and experiences of teachers towards the use of educational technology in educating DS students. Besides this, identify the educational tools, digital curricula, software, and other teaching strategies that can benefit children with Down syndrome in schools and educational centers. Since this research had been done in Bangladesh and was about the educational status of children with Down syndrome, it also tended to learn about the current program that Bangladesh's Special Education Centers are implementing for students with Down syndrome or other diverse abilities. This chapter will discuss on the findings of the research in relation to the research objectives and how the findings contribute to the gaps in the literature review.

5.1 The Research Findings' Contribution to the Literature Gaps

As was identified in the research literature gaps, the long-term effectiveness and impact of technologies on learning outcomes, social interaction, and independent living skills of DS children have not been discussed a lot. Therefore, this study was conducted to investigate these gaps and provide insightful information on the use and impacts of educational technologies in practice by collecting and analyzing primary data. The findings of this study indicate that special education requires inclusive attention from schools, educators, parents, and society. In most developing countries like Bangladesh and Afghanistan, there are few educational centers to support students with DS, who constitute a remarkable part of society.

The analysis of data implies that special education schools and inclusive schools mostly focus on personalized education and one-on-one sessions with DS students through the use of

technology. Experts believe that each DS student has different learning needs and strengths. So, the learning material, syllabus, and methodology should be tailored based on each individual under the name of IEPs. According to Rickabaugh (2016), personalized learning transforms teaching and learning methods to give students the chance to reach learning standards and aims through setting objectives and reflection, which enables children to acquire the executive functioning abilities required for independent learning. Most of the children in the visited schools were between the ages of 5 and 16, with elementary levels. As per the experience of teachers, some are able to do the exercises independently, read and write independently, or go to regular schools. Regardless of the type of teaching approach in schools of special education, whether technology-integrated or traditional, developing IEPs in the form of personalized learning is the most practical teaching strategy for DS students. According to the teachers, the results of using these technologies have a significant impact on the long-term learning of students. One of the teachers stated that during the several times that she had taught DS students through technology, they had noticed a great improvement in the student's reading, writing, and independent life skills like going to the shop and buying something using calculator.

Use of Applications and Software

The focus of this research is on the use of educational technology to facilitate the learning process of children with Down syndrome. The findings indicate that educational technology in different formats of tools, resources, and strategies is being effectively used for teaching DS students. Special educators use online digital curriculums, interactive exercises, games, and quizzes through the digital tools of computers and tablets. Educational apps and software have been found to be useful in the education of DS students in many studies. Wood (2004) has mentioned that ICT-based education for DS children is useful due to some of their characteristics.

Firstly, they are visual learners and will be better supported through educational websites, games, or videos. Also, teachers with 1 to 3 years of experience in teaching children with DS believe that the use of games, interactive exercises, and quizzes on computers or tablets supports the visual modality of children. They used the VAKT approach in their curriculum design. Specifically supporting their visual learning characteristics through digital curriculums.

Additionally, literature has shown that computer-based learning approaches provide errorless and self-paced learning, improve motivation, and create a less fearful environment for DS students. The present study confirmed the effectiveness of specialized education through the use of a computer-based approach. Special educators believed that in this approach, students feel safe and are more motivated to learn since the learning style is tailored based on each individual's needs and even their mode of operation. So in this way, DS students have an opportunity to learn more effectively. Karagianni and Drigas (2022) suggested that the integration of digital games in educational settings for DS gives them pleasure and supports many of their cognitive difficulties when learning. The results lead to a similar conclusion where apps and games have been used in speech and language therapy in special education centers as well as basic learning.

Virtual Reality and Augmented Reality

What was implied in the literature regarding augmented reality and virtual reality suggested that augmented reality (AR), a relatively new technology, offers the right tools for building integrated learning environments that allow users to manipulate real-world objects and visualize content to improve learning (Ramli & Zaman, 2009). In line with previous studies, findings indicate that augmented reality in its simplest form like YouTube videos, and interactive worksheets in practicing math and English enhances learning effectiveness. Teachers believe that employing these interactive activities through laptop resources allows them to exhibit colorful

graphics of the learning material to students. Showing things in AR format improves the imagination of DS children and helps them better realize and learn things. Like an apple, comping, surfing, etc. are traditional teaching strategies that heavily depend on textbooks. While also not interactive and having constraints like static text, 2D images, basic drawings, and black and white color, DS students have limitations. On the other hand, AR can get around some of these drawbacks by offering creative presentation and interaction possibilities, tangible experiences, and active exploration. However, due to the research sites and location, assistive technologies are not used in the visited schools. One of the schools mentioned it as their future plan, but until now, there has been no assistive technology implemented for those DS students with physical disabilities or movement impairments.

According to the literature, there are a number of software and quiz games specifically designed for educating DS children; however, they are not specifically in the format of an exact curriculum as regular schooling. Some games and programs like "HATTLE", "PRADIA: Mystery in the City," and "Magic Stone," which were studied by Felix et al. (2017) and Karagianni and Drigas (2022), are experienced as being useful in the teaching and learning process of DS children. The HATTLE application was practiced in reading aloud while using touchscreen voice recognition input and visual-speech output, which led to improvements in the Single-Word Reading testing of DS students and provided an individualized and responsive learning interface. The two later games were used to enhance their speech and reading abilities. However, when comparing our results to those of older studies, it must be pointed out that there are some sort of computer-based programs or mobile applications that are designed to foster and facilitate learning in children with learning difficulties. These sorts of digital curriculums, indicated in the results chapter, have been found to be effective in the learning process of any type of diverse child, like those with DS, Autism, Global

Developmental Delay, and other neurodevelopmental disabilities. The majority of technology-integrated special education centers in Chittagong use these digital curricula to support and ease the teaching and learning of all children, not just DS.

5.2 Perspectives of Educators, Parents, and Children Regarding Technology

Another gap in the literature was limited research focusing on the perspectives of educators, parents, and children themselves regarding the usability, acceptability, and practicality of educational technologies in real-world settings. Thus, it was embedded in the research questions to ask teachers' perspectives about using technology in teaching and how they feel about their students' and parents' attitudes towards it. The findings imply that teachers are more organized and confident when using technology. They believed It was technology that made them closer to other experts in the world. They found that accessing technology at first enabled them to enhance their knowledge and expertise in the field of special education. On the other hand, findings show teachers are satisfied with using technology because it can keep students engaged and motivated. Also, they can achieve better learning outcomes for students. This is why their attitude is positive about using educational technology, not only because their teaching will be facilitated with technology but also because they can have a more personalized setting and greater learning outcomes.

Although parents and students are not directly interviewed during data collection, it can be concluded from teachers' and school administrators' perspectives that students are very enthusiastic about using technology in their learning. The gamification and interactive modality of the digital curriculum that was used attracted students to learning. Students with DS can focus better, learn better, and remember learning staff by making use of the VAKT approach, which

involves their major learning strengths. Visual, auditory, tactile, and kinesthetic combinations in learning make them active and better learners. Similarly, parents' attitudes could be acknowledged from the teacher's point of view. The findings of the study indicate that as long as children can learn effectively and enthusiastically, their parents are delighted. When it was asked if any of the DS students' parents complained about the overuse of technology or the excess use of digital tools by students, teachers replied that they use digital tools and curriculum completely under the supervision of experts. Students are not allowed to use mobile phones or any of the educational quizzes at home. So, there have been no negative attitudes toward the use of educational technology in DS teaching and learning.

Chapter 6- Conclusion

In this study, it has been attempted to identify what teaching techniques and strategies special education centers and other inclusive learning environments use to instruct children with Down syndrome. It has also been sought to learn how educational technology supports both the teaching and learning processes of kids with DS. This chapter will conclude the study by summarizing the major findings in relation to the objectives and research questions and analyzing their importance and contribution. Additionally, it will discuss the study's limitations and suggest areas for additional investigation.

6.1 Overall Research Conclusion and Contribution

Even though there are few special educational centers in Bangladesh, those schools that practice teaching strategies using educational technology, such as digital curriculums, games, and computer resources, reported more engaging and effective literacy settings. What is important when teaching students with DS is to consider their learning needs and habits. Create precise and individualized plans for each individual and plan their teaching accordingly. Special educational centers not only provide education for DS students in a personalized setting but also engage them in group and social activities to enhance their social life skills. Additionally, those inclusive educational settings engage DS students in mainstream classes for extracurricular activities and also provide them with some speech and functional therapies as well. There are some software, games, interactive worksheets, and quiz exercises that teachers use to plan their syllabus for teaching children with DS that consider their diverse educational needs through the VAKT approach. Educational technology can support teachers in making their teaching style more personalized and attractive for their students. Through the use of educational technology, teachers

can overcome a lack of focus and sometimes a lack of interest in children with DS because they have reported a good relationship between students' motivation and technology-based classes.

The research investigated teaching strategies, tools, and techniques used for teaching DS students. In addition, digital curricula, interactive exercises, applications, and teaching strategies were identified based on the real experience of experts in special education. Schools, educators, parents, and students can use the findings to get an idea of educational technologies' potential support in teaching DS students and other students with special needs. This contribution extends awareness in the field of special education in Afghanistan and other countries where special education has received less attention.

6.2 Limitations of the Study

As a researcher, in this section, I would like to honestly refer to the limitations that I faced in conducting this study. This research has been conducted in a different context with different cultures, languages, and norms. Of course, there had been limitations in access to research information, language barriers, and cultural difficulties as a foreigner, in addition to time constraints.

Research Design Limitations

First of all, choosing to investigate the impact of technology on special education in developing countries is a challenging issue with little background. In practice, the issue of teaching students with Down syndrome has received less attention, and less research has been carried out in these fields. This is to mention that, in the beginning, one of the goals of this study was to investigate the educational situation of students with Down syndrome in Afghanistan remotely. However, it could not happen due to not finding any special educators or schools there to interview.

In addition to that, according to the current conditions, it was not possible for me to go there in person since Afghanistan is still in a severe educational and social crisis. Hence, I could not perfectly conduct the study as planned. But it should be mentioned that based on my personal experience and even before deciding to choose this topic as my thesis topic, I had researched this issue in Afghanistan. Indeed, the lack or even the absence of special educational centers and specialists in this field has made me do research in Bangladesh so that it can be used as an example to implement in Afghanistan, or another country based on the help and facilities of educational technology.

Limited Access to Information

In addition to the lack of information from Afghanistan due to the reasons mentioned, there have been limitations in collecting data from the available schools located in Chittagong in support of children with DS. There is only one trophy center in this city where there is no formal schooling and no use of education technology. On the other hand, other schools of special education are not only focused on one category of students with diverse abilities but they are mixed with other children with Autism, cerebral palsy, global developmental disabilities, etc. So, the results cannot be specifically allocated to the education of children with DS. Furthermore, schools providing quality education using technology are private and expensive, which are not accessible to everyone with a lower economic level, so they do not represent the whole. Another limitation is the age group is big, It includes children, teenagers, and young adults at the age of 16.

Limited time

Another constraint in this study is the time shortage. I had to finish this study before I began my next educational journey, which would have been started at a short distance with my current

MA degree. I believe allocating more time to data collection and visiting more schools of special education and teachers would have greatly improved the quality of the findings of this study.

6.3 Recommendations and Suggestions for Future Research

Whatever has been mentioned in the limitations of the study is a recommendation for future research. Firstly, in-depth data collection should be done to find more schools, experts, and educators who have experience using educational technology in teaching DS students, which will extensively impact findings and suggest more accurate information for readers. Secondly, discovering more diverse sources of information regarding the research focus. If people from different parts of the world, including developing countries and first-world countries, are interviewed, it could make a great contribution to this field. So, it can be a guideline for fulfilling the very basic and most important rights and needs of people with DS, including and aligning them with the society. Take them out of isolation and increase their level of social awareness.

Furthermore, based on what has been explained during the study, it can be suggested that a comparative study between traditional special education schools and technology-integrated ones based on the case studies and observation of one to two months can provide a deeper understanding of the effectiveness of ICT-based learning. Also, parents can be included in reporting on the learning outcomes of their children with DS. In Addition, a comparative study of different technologies in DS education could be worth investigating as well. In addition, the research informants can be divided into three groups of children, teenagers, and young adults. This way the study focus and contribution to the teachers and school would be more meticulous.

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Glossary

Down Syndrome: Often referred to as trisomy 21, is an inherited disorder imposed by the existence of a third copy of chromosome 21 in whole or in part. It is typically accompanied by physical characteristics, mild to moderate intellectual disability, and developmental delays.

Intellectual disability: This is a widespread neurodevelopmental disorder that is markedly deficient in cognitive and adaptive abilities. It is recognized as having an IQ below 70 and two or more adaptive behavioral deficiencies that have an impact on daily, general life.

Children with diverse abilities: They are kids who struggle with learning or other aspects of their lives because of an impairment or a combination of difficulties. Children with special needs include those who: Have mental retardation, which slows their growth compared to normal kids' growth. Speech & Language Impairment, such as difficulty comprehending or expressing oneself. Physical impairment, such as cerebral palsy, eyesight issues, or other problems. Learning Disabilities, which cause their senses' signals to be distorted. Emotional disorders, including antisocial behavior or other behavioral issues.

Special educator: A person skilled in communicating with individuals who have special needs in a way that takes into account their unique needs and distinction.

Appendix

Interview #1, Special Educator 1 (SPE1)

Date: Jun 11, 2023

Gender: Female

Age: 27

Nationality: Bangladesh

Years of teaching experience with children DS: 2-years

General questions:

1- What subjects do you teach?

English, Math's, and Easy Bangla in general and just English for the 2nd grade Ds student

2- Which grades do you teach?

Pre-schools for 2nd grade and 4th grade for 7th-grade students

3- What types of curriculums do you use? National curriculum or any specially designed one?

We teach specially designed curriculums through life worksheets and other software and other activities like cutting and pasting, and kinesthetic approaches like practicing prepositions with objects. The worksheets are on both computers and colorful printed papers because preschool students can learn better with colored pictures.

4- Do your students learn how to read and write easily?

She is at the beginning of her stage, she can read small words like CVC words (consonant+vowel+consonet) like cat, dog, cup and etc.

5- What is different in your teaching method compared to other normal methodologies?

“We teach our special students in mainstream classes. “They participate in extracurricular activities like yoga, dance, and arts and they learn social skills in the class. However, their main training is being done in one-to-one sessions with special educators at a different level for example, the child is taking the mainstream class as per their age and yearly grade upgradation but they follow a lower grade curriculum in their specialized time with experts. This is very important for their social development to be with other children. If they are isolated, and in a place where they are always kept specially and their difference is always mentioned to them, it affects their social interaction and life skills. Down syndrome students in regular classes participate in group activities, to learn how to interact with others, wait for their turns, claim for their rights, and make friends. Also, in this way the level of awareness among other students rises. They learn to respect

everyone in society and to believe that people who are different are not less than others but they think, act, and learn differently. This is a starting point for society to accept differences, and not be the reason for them to lag in other social activities.

Focused Questions:

6- Do you use any ICT tools? Like computers, multimedia, games, smart boards, assistive technology, or special digital curriculum?

Yes, we use Laptops, life worksheets, visual perception worksheets, games, and online quizzes and there are a lot of worksheets. The practice sheets are designed, and we select which are the best for students. Worksheets are selected as weekly plans before the class with teachers. These worksheets are all practiced in their teaching time, and there is no homework given to them; any worksheets, or quizzes. We do activity-based learning than writing-based. We do not give them lots of pressure on writing. In terms of writing, they type on computers. There are no any special tasks given to parents at home.

7- If yes, Which kinds of technology do you use to facilitate the teaching process for your students?

Using projectors (PC screens) in the classroom

Searching the internet to find information/ YouTube

Using specially developed software, apps, or games

8- How do you find using educational technology useful in the teaching process? Does it ease your process or make it more difficult?

The worksheets actually help students, we select the worksheets which are appropriate for them not highly standardized, and not low standard. In teaching, although we face lots of difficulties, we are practicing and learn every day. We should search a lot of things while dealing with them, the things with which they feel comfortable. We do not use the traditional approach just reading books.

9- Do students like to use digital tools like smartphones, tablets, computers or etc for learning? And how do you think it is helpful for their learning?

Yes, the love a lot. They sometimes do not like to write on paper but when we tell them to type something including their practice sheets, they do it enthusiastically. However, using smartphones is prohibited for them. They just use teachers' computers while their study time.

10- What is the long-term effectiveness and impact of these technologies on students independent living skills? How?

Yes, students become independent the reason behind this is when they are in mainstream classes with other regular students, they learn how to live independently. Because when we isolate them in separate classrooms and provide them with every facility they need, what will happen when there are no facilities for them, and they need to live independently? We teach them life skills, like tying their button, ironing, etc.

11- What is parents' attitude towards using ICT? Why?

Our parents are very much supportive and cooperative and they do see the impact in our school like they see students who come in grade 7 he is able to independently read the sentences and also understand those sentences and comprehend them to a certain level. So, that is a very big achievement for a school. The parents see the improvement in this method of teaching and our school that is why parents are really happy to see this development of their children.

12- Do you think technology would improve your ability to teach? How?

Yes definitely, because technology helps us to be lifelong learners, even though we ourselves are learning different strategies through technology from across the world. Despite facing lots of difficulties in this process, we are practicing and learning every day. We should search a lot of things while dealing with special children, the things with which they feel comfortable, and how to manage the extra use of technology resources in the teaching plans. Whenever we face any difficulty, we can learn it from internet resources. We feel that special education needs constant learning because there are different aspects of a child's life, like a child's behavior, child's academic life, child's social interaction so there are plenty of things that we need to deal with as educators. So, to solve these things we should learn. Actually, we are not also with a background in special education, we are having training through Zoom sessions and other online platforms. We are being trained by trainers across the world mostly from India. So, without any technology, we are not able to have that connection. We are having a Zoom session and AVI. Recently we have had a specialist who has 20 years of experience in this field and observes our classes and gives us feedback that was are our progress and what can we do for the betterment. Most of the trainers are from India, and online based, they do come to Bangladesh as well for observing our classes but mainly the trainings are online.

13- Does ICT positively impact on learning quality of students? How?

Yes, As mentioned before, they are more interested in learning with technology, and also there are a lot of resources available on the internet like those worksheets we mentioned before. The VAKT approach can be done through this ICT-based learning and also the games and quizzes that we use they all make the learning process easy and more visual for them. We also have (IEP) Individual Education Plan which is a biweekly plan for teachers to make it for every individual student with special needs including DS. We can see the progress of our students one of them can now read and write independently, they can read the clocks, and many other functions which they learn in functional math classes.

14- What are the perspectives of educators, parents, and children themselves regarding the usability, acceptability, and practicality of these technologies in real-world settings?

Children like it, for example, if they are asked to write something on paper, they don't like it too much but when we ask them to type the answers on computer worksheets, they do it independently. If they like some activities and we ask them to type that and search for them to inspire them. They sometimes do use the software at home also. Their skills to use the laptops and operate them comes from their families.

Interview #2, Special Educator 2 (SPE2)

Date: Jun 11, 2023

Gender: Female

Age: 31

Nationality: Bangladesh

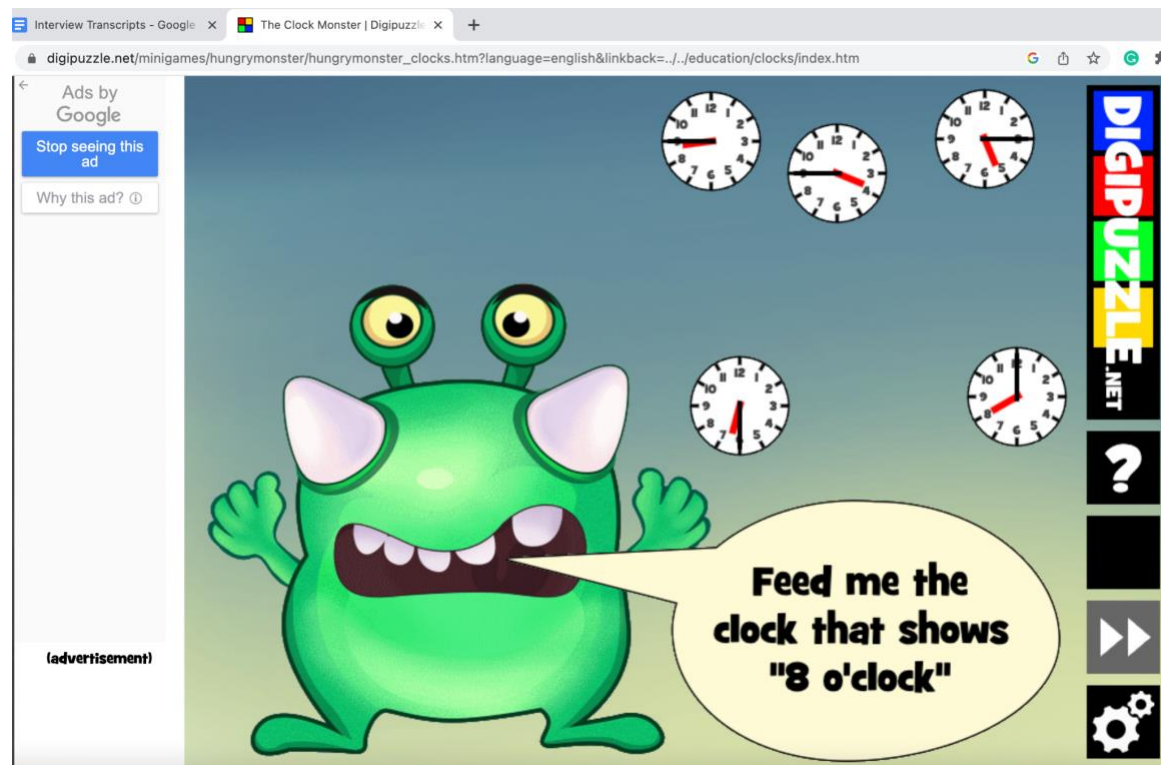
Years of teaching experience with children DS: 4-years

These are the websites and games that we use:

Lifeworksheet.com, KAHOOT (Game, quiz, competition), Jollyphonics, Nearpad.com, Free online jigsaw puzzles

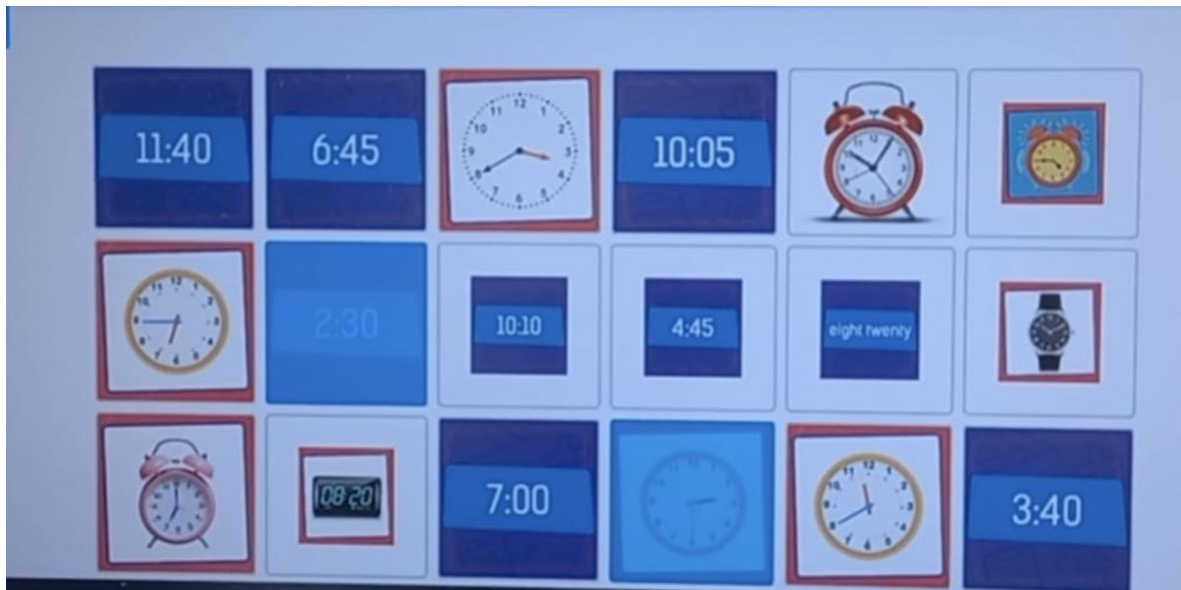
Digipuzzle.net (Educational games and puzzles)

Educator: We use this site which is education games and quizzes for the times that students don't like to write we just use these games for their enjoyment because otherwise, they feel bored. There are lots of games on this site like clocks, monster games, and matching. So, they play these games and learn also. For example, in the monster game, they learn the time through this and they choose which time can feed the monster.



Then the feedback will be given by the teacher. But again, this is something completely planned based on individual needs because some of them enjoy this but some do not, while our students with DS enjoy this. There are a lot of games on this site. First, I teach them the basics of knowing time with a clock and while they learn it then for the purpose of practicing, we work on these

games because they don't like writing every day, the traditional way does not work for them. This is only one topic for the clock, while there are a lot of other topics like fractions, money and etc. If I don't find a worksheet related to my syllabus or topic, sometimes, we design the sheets ourselves on Nearpod website, which is used for their assessment because there are lots of questions in the library but they are not according to my demand so, in these cases we make some quizzes on the game format and in the meantime, we print that sheet and get their marks in the printed copies which are with us like the following picture. (Matching game made by teacher).



In addition, there are some jigsaw puzzles we give them for a brain break, life games, and their general intellectual abilities. We work 50 minutes per class with one child 3 classes a week. Most of the teachers are using these websites while some of the resources vary too. Some of them are using different sources since there are a lot of websites on the internet that teachers can use. Most of them are free to access.

Question:

It is up to your which website and quizzes you want to use. Or it is pre-selected by the management of the school?

Answer:

Yes, we can choose our learning materials by ourselves, and we share them with each other in case it is practical and great, we have 2 weeks of lesson plans.

Question: Do they have midterm and final exams?

Answer:

Yes, they do, we design their tests based on their level and for each student separately.

Question: Do they promote to another grade?

Answers: Yes, they upgrade in their mainstream classes but their one-to-one classes do not have any specific level that they can promote from one level to another. We just upgrade their learning material and syllabus based on their progress. Suppose if they learn 2 digits in math, we upgrade their syllabus to 3 digits in the next term.

Question: In math, is the Ds student able to do equations like summation, subtraction, and ...?

Answer: They do sometimes but they mostly forget, she should learn continuously because she forgets most of the things that I teach like simple additions and subtractions. So, we work on money concepts with them. They remember basic knowledge, like digits reading, and writing. When working with them through this software, they can learn and remember 80 % of the things but we always need to remind them, because they enjoy it and put their attention to it which makes them remember and focus better. But when we do money functions, they sometimes get confused about whether to do a subtraction or addition so then we help them. In the practice worksheets, she learns well and can-do things independently with my instruction. In their daily lives, they can read the prices when they go shopping or to the cafeteria at school and pay the money, but they cannot calculate how much they need to get back their change. But they can do it with a calculator. They put the number calculator and subtract the price.

Interview #3, Special Educator 3, (SPE3)

Date: Jun 11, 2023

Gender: Female

Age: 27

Nationality: Bangladesh

Years of teaching experience with children DS: 5 years

General information about the special education department.

There are 2 students with Ds in our school who are in 2nd and 7th grade. The one in 2nd grade is in a mainstream class with other students in 2nd grade but her level is pre-school (KG) so in their time with special educators she learns the KG curriculum. Also, the one in 7th grade is also with other students in 7th-grade class with other students while taking part in Yoga, physical activity, and other classes for her social interaction training but teachers teach her in the 4th-grade specialized curriculum. VAKT (Visual Auditory Kinesthetic Tactile) is the teaching approach that we use here. This is because it considers four different senses of DS students.

For visualization, we use life worksheets and laptop resources so that we can show them colorful pictures of those because most of the printed sheets are in black and white right? So, if normal students are given a black-and-white worksheet for seeing an apple, a red apple will be easy for them to visualize but a child with special needs will not be able to visualize a red apple. So, seeing a colorful picture on a laptop is going to help them. Also, if it is a video like YouTube videos will be more helpful for them, they can see what it looks like. For example, if somebody is biting an apple, they can see what would be the texture of that apple and visualize it. So, this is the visual input that they are giving.

For auditory input that they are giving is again through videos from YouTube. For example, they are learning about places to visit on holiday they see it in the video and it gives them information on which places they can visit. Because for them thinking is a significant difficulty. So, when you auditory gives them information like beach surfing is like when you Skit and everything. Normal students will be able to grasp and also think as you see. But for them it is very much abstract, abstract information is really difficult to understand. So, YouTube is a great resource for us to show them videos that they see visually as well and auditory as well. So that is the thing that helps them a lot.

Then about their kinesthetic tactile approach, we mostly use websites like lifeworkshee.com, KAHOOT, and some games. KAHOOT is a quiz game. That has different levels and teachers can set the levels based on the ability of students. In lifework sheets, learning is not monotonous for them. They are not only writing and writing staff. They are also choosing answers, they are typing answers on laptops. So, these are giving them kinesthetic and tactile approaches for them. In their kinesthetic and tactile it is not only computers that they use, there are other physical resources like things that they touch, feel, and do them. For example, if a student is learning prepositions, rather than doing it pen and paper, we give them certain objects like keeping this remote on the table. They put it on the table or others, they are learning it by doing.

Question:

Students with Ds are not able to remember things well, even the letter and numbers at the very beginning of their learning. Even if they learn letters they cannot match the words with the same sound for a letter like A, Apple, and then Ant and What is your approach here, how do you make them remember the letter with their sounds, do you use any app or software for that or do you have other methods?

Answer: we use phonics for our students so that they can associate the sound with the letters for example for the letter A, make the A sound. whenever they hear A sound, they can match other words too. The app we use for that is the Jolly Phonics program, here students learn the sound rather than the letters. And then they can learn the writing of it also. Also, for that we create phonological awareness means being able to distinguish the sound. If you say that, cat, pat, and can which word be not right with this phonics, they are able to distinguish the sound.

Question:

Which subjects are being taught to Ds students?

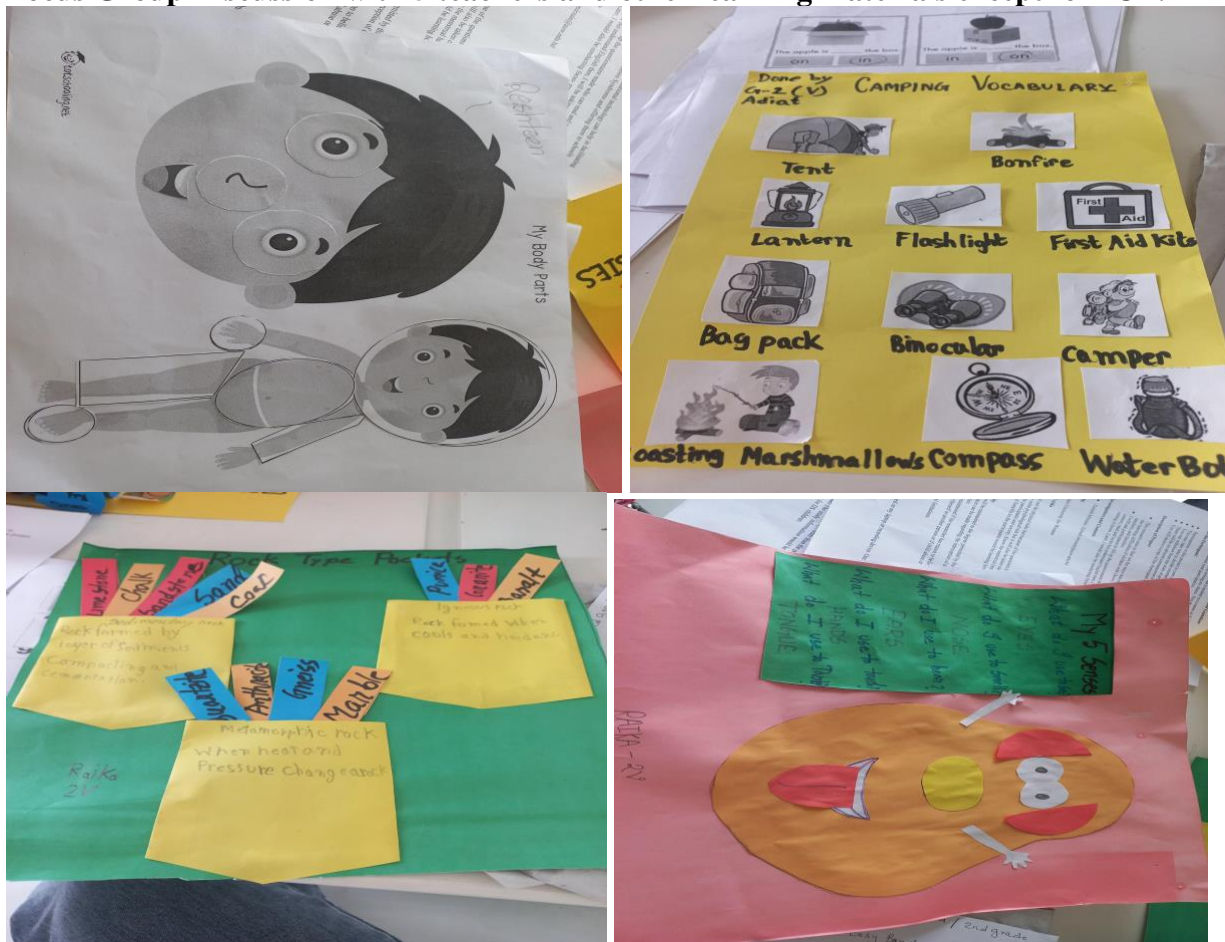
Answer: We instruct DS students in functional math, functional English, fundamental awareness, and a mixture of social studies and science. The reason to use functional math is that we don't see any application of very advanced math concepts like the Venn diagram in the lives of our pupils with Ds. Instead, they are being trained on the money concept, the time concept, and the things necessary for their lives. Normal students learn these concepts during their normal school day; they don't need a separate time for it, while students with disabilities do. Thus, how to read time, measurement concepts, comparison, and money concepts are being taught in the special math curriculum to special children. Same to this, in functional English we focus on functional aspects

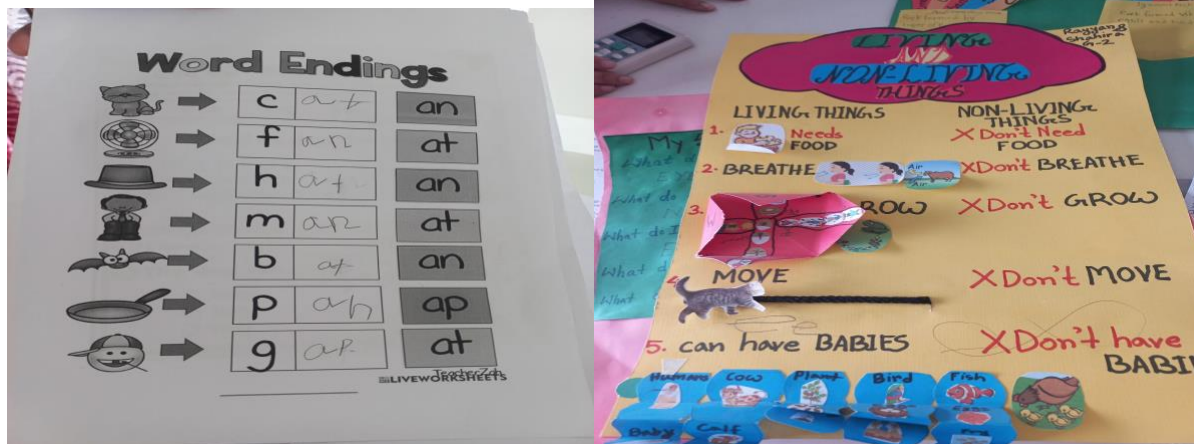
of language like doing a conversation during a phone call, taking an appointment in the hospital, or booking a ticket for a plane. Those things are covered in functional English instead of focusing on the grammar, tenses, and the things that are difficult to grasp for special students.

Question: Do you teach Bangla to them in the same method?

Answer: Not too much, our main focus is English because for these students' bilingualism is very difficult and since more online resources are available in English, we more focus on that. But we teach a simple Bangla to the students in 7th grade too, because of the interests of parents. But if we make pressure on them to learn 2 languages together that is why we stick to English.

Focus Group Discussion with 5 teachers and other learning materials except for ICT.





According to a group discussion with teachers of Frobel Academy, they do not only rely on computer-based learning, but they also use other extracurricular activities and learning material which helps their teaching process for special students (Global developmental delay, Down syndrome, Autism). For example, the pictures above are some activities that help students to learn parts of the human body to touch it and learn it better. Some of the pictures show CVC words learning activities which is a printed copy of the life worksheets, also other learning materials which are for functional math and science. With papers and colorful shapes, they show their modes of the day, like sad, happy, and scared, and then explain why. If they are sad and they are not in the mode of writing, they do other activities for learning like cutting and pasting which they like a lot. Some of the above activities are functional English that what tools they need when they go camping. Also, when they learn their 5 senses, they do their crafts and like it a lot.

Interview #4, School Principal 1 (SP1)

Date: Jun 15, 2023

Gender: Female

Age: 31

Nationality: Bangladesh

Years of teaching experience with children DS: 15-years

What are your main objectives and achievement so far from 2019

Most of our kids are now enrolled in regular schools, mostly in private and English medium schools and in some cases in public schools. Sometimes their parents take them to shadow teachers also but Our aim is to see our kids in mainstream schooling. I can open up a school for these children and teach them in an isolated environment but this is not the case which can change society. I want regular schools to have this setup for every child because they should deal with typical students, they can socialize with them. We want regular schools to have special teachers, and to have this setup and mindset to accept students with DS and other special needs in inclusive education. We give them speech therapies, functional therapies, and basics of the classroom, concentrations, the ability to follow instructions, know social interaction skills so they are ready for school. If the students have those basic skills of attending a regular class, so they will be accepted in the regular school, because the teachers can instruct them.

Question: Is there any age limit for you to accept children?

Answer: Not specifically, but we cannot accept very adults and if we do their therapies might be different from kids. For instance, we have a 29 girl and a 16-year boy, to whom we have ADL Activities of daily living like how to make a sandwich for themselves, how to take care of their selves, how to iron clothes, toilet habits, hygiene habits, eating habits, clothing, washing clothes and etc. also Yoga classes, physical education if they are good in any skill, we help them to improve in that area like drawing, coloring and

Question: Is there any training on school subjects for school-age children between 7 to 11?

Answer: Yes, our educators do plan for each individual. They teach them basic English, basic math, and basic life skills and they are being trained by special education experts from India. However, when we feel they are ready we recommend parents to enroll them in the regular schools.

Question: Do they go to public schools or private?

Most of them go to private schools and very few of them go to public schools because there are not enough facilities in public schools.

Question: Are there special educators in private schools?

I do not say it confidently but as far as I know, the regular teachers give them less pressure work than other students. In addition, they use more visual materials and worksheets which is easier for students to grasp.

Question: What are the group activities:

We teach them some social skills, like sharing things with others, waiting for their turn, and how to protect themselves when someone bullies them. How does a group activity happen and such other things?

Question: How about the number of people who refer to you, is it a lot or few?

This is funny that most parents who have children with Ds they do not like to bring their children, unlike other children with Autism. Because Ds children are so loving and caring. They only worry after the age of 7 and 9 that they did not learn anything or cannot do something. While autistic children shout, they have anger management problems so that is why their parents take them to us earlier since they are alert. Parents assume that if they give their Ds child time, they will learn things like how to talk how to sit how to walk, and learn, but they do not know that giving a special child time means wasting time. As early the children are taken care of better it is.

Interview #5, Special Educator (SPE4)

Date: 21/06/2023

Gender: Female

Age: 25

Nationality: Bangladeshi

Years of teaching experience with children DS: 1 year

General questions:

1- What subjects do you teach? Computer, ICT

2- Which grades do you teach? We do not have specific grades like normal schools, but we have 3 sections of: Elementary, Junior, Senior. And I am teaching junior and senior sections

3- What types of curriculums do you use? National curriculum or any specially designed one?

Since there is a special education school, we do not use the national curriculum or any English curriculum but we have a special curriculum called DASK which is designed for children with special needs.

4- Do your students learn how to read and write easily?

We do practice with them, each child with special education needs a special method of teaching. If one method works for one it does not work for another one. Some of our students learn well through this software and other classes they take while others cannot learn easily and it should be practiced with them regularly.

5- What is different in your teaching method compared to other normal methodologies?

Special education like its name is different from normal teaching methods, they need more attention, more practice, one-to-one sessions, and personalized education. If we put them in mainstream classes, they will not be able to grasp as normal students which is why we work with them one to one. We have an IT lab for our students which hosts around 4 teachers and 4 students one in one session. Each student has an IEP (individualized education plan), and we design a to-do list for each student for example they have 4 activities to do in a day. When they finish one they for another one and these IEPs are either 6 months or 9 months for each student. Few of the students go to regular schools too.

Focused Questions:

6- Do you use any ICT tools? Like computers, multimedia, games, smart boards, assistive technology, or special digital curriculum?

Yes, we use computers, and tablets more. And we use skill-based software and games for their leisure activities, social interaction, and speech therapies. Also, the DASK curriculum for them.

The websites and games that we use are as follows:

Ms. word and PowerPoint, bubble shooter, jigsaw puzzle, Ballon Bang and AVAZ

7- If yes, Which kinds of technology do you use to facilitate the teaching process for your students?

Using projectors (PC screens) in the classroom

Searching the internet to find information/ YouTube

Using specially developed software, apps, or games

8- How do you find using educational technology useful in the teaching process? Does it ease your process or make it more difficult?

Since I am an ICT teacher and I do the one-to-one computer-based classes with students because of their speech development, focus and attention focus, and other motor developments, it definitely eases my teaching process because they love using technology, computers, phones, and tablets so they do it happily. When they are willing to participate in the sessions, they learn better and focus better which is an achievement for the teacher.

9- Do students like to use digital tools like smartphones, tablets, computers or etc. for learning? And how do you think it is helpful for their learning?

Yes, they love it and use the digital tools excitingly. As mentioned earlier they practice attention and focus with it, typing and learning words and speech practice with it. So, it is helpful for their learning.

11- What is parents' attitude towards using ICT? Why?

Parents are happy and willing to use technology for their children's learning. We have never faced any limitations towards the use of technology for children from their parents.

12- Do you think technology would improve your ability to teach? How?

Yes, since most of the children with special needs like Ds and Autism learn by visual things and have problems with their focus and attention. Using ICT-based lessons enables teachers to prepare better learning materials and keep students engaged and focused.

14- What are the perspectives of educators, parents, and children themselves regarding the usability, acceptability, and practicality of these technologies in real-world settings?

While using these ICT-based sessions and practices students learn sitting correctly in the classroom, they practice eye contact and gesture activities. They learn when their to-do lists start and when it ends which is teaching them social life skills. This is how they learn activities related to their real-world settings as well.

Interview #6, School Principal 2 (SP2)

Date: 21/06/2023

Gender: Female

Age: 25

Nationality: Bangladeshi

Years of teaching experience with children DS: 10 years

How do you enroll your students

Prior to the enrollment, not only for DS but for all children with special needs we do a pre assessment through the methods of ABLLS (assessment of basic language and learning skills) we then make an individual education plan for each student.

How to you teach them?

We have both schooling and therapy center, wehre we offer the children at one to one level as well as in groups. the main aim of our intevention is deleeping communication and play. An integral part of our program is involvement of parents. Before the admission of the child into our programs, the parents are trained in our methods of teaching and management used by us. We work as team with the program head, teachers, parents, and any volunteer working with the child at home. After making IEPs we conduct one to one session with students with therapies that they need. After we make sure they are ready, we put them in academic classes for learning English, Math's, social interactions, group works and other live skills like cooking, camping, and other things.

Do you use any educational technology in their teaching process?

No, before we had computer classes for them, but after COVID 19 and lack of budget we cannot have ICT based trainings for them. We only have few classes for their activities.

Are the children enrolled in regular schools too?

Yes, they are, some of them are in regular school but they are not being treated well, teachers in regular schools do not provide them specialized teaching, they burden them with too many loads of HomeWorks and tasks like normal children which is very de motivating for them. Also, being

bullied by other students is another problem they face. The problem is with society and parents, we should teach our children that all the people are not the same. Some people are different, they are not disabled or less they are differently abled, they see details, they feel everything but they are not less and worthy of bullying. If we teach our children so there is no need for special children to be isolated from society or bullied. They can go to regular schools and have inclusive education in case the society is aware; including teachers, parents and other children at schools.

What is different in teaching special children with regular students?

Everything is different, the special children need specialized curriculums, IEPs, and repetition in learning. They have memory shortage; they should repeat things to remember and very basic things should be told to them like the use of a painting brush vs a pen. They need therapies beside education and some one patient to work with them passionately and empathetically. In most of developing societies there are not enough experts in mainstream school and a low rate of social awareness, there at least should be somewhere.