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ENHANCING AUTISM EDUCATION: EXPLORING INTERACTIVE VIDEOS AND AI INTEGRATION FOR EFFECTIVE TEACHING

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College of Information Technology

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Cover: First Screen of the Implemented Interactive Video

(Photo: By Fatima Ahmed Ali Murad Alraeesi)

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Declaration of Original Work

I, Fatima Ahmed Ali Murad Alraeesi, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this thesis entitled "*Enhancing Autism Education: Exploring Interactive Videos and AI Integration for Effective Teaching*", hereby, solemnly declare that this is the original research work done by me under the supervision of Dr. Jose Berengueres, in the College of Information Technology at UAEU. This work has not previously formed the basis for the award of any academic degree, diploma or a similar title at this or any other university. Any materials borrowed from other sources (whether published or unpublished) and relied upon or included in my thesis have been properly cited and acknowledged in accordance with appropriate academic conventions. I further declare that there is no potential conflict of interest with respect to the research, data collection, authorship, presentation and/or publication of this thesis.

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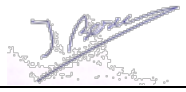
   Signature  Date 5/December/2023

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Abstract

This research focuses on enhancing autism education by integrating interactive videos and AI solutions to improve teacher training. As the number of autistic students rises, it becomes crucial for special education teachers to employ effective teaching strategies tailored to individual needs. The most effective teaching methods for autistic students involve understanding the condition and incorporating customized instruction strategies, such as adapting assignments to suit the student's needs, assisting those with difficulty speaking, and employing visual aids for better organization. The proposed solution involves utilizing interactive video technology to train teachers, bridging the gap between research and practical implementation of educational interventions. Additionally, an AI Chatbot is integrated to provide real-time guidance and personalized assistance, fostering a more responsive and adaptive educational environment. Traditional teacher training methods can be both expensive and time-consuming. In contrast, interactive videos provide a proactive and flexible way to access training content, empowering teachers to engage with the material dynamically and take control of their learning experiences. The main objective of this thesis is to improve teacher training in teaching autistic children through the innovative use of interactive videos and AI solutions. Three research questions guide this study: (RQ1) What is the impact of creating interactive videos to assist individuals in understanding autistic behaviors? (RQ2) What are the benefits of using interactive videos for effectively managing and supporting autistic students? (RQ3) How does integrating an AI Chatbot contribute to improving support systems and understanding in the education of autistic students? The research methodology employs the Lean UX product cycle, utilizing Canva for interactive video model development, Mindstamp for enhanced iteration, and Microsoft Forms for survey implementation. The study explores the integration of an AI Chatbot within the interactive learning environment, specifically tailored to support shadow teachers, and is executed in Google Colaboratory. Results indicate that using interactive videos in teacher training positively impacts the education and support provided to autistic children. The comparison of training methods, including current teaching practices, interactive videos, and AI teacher (Chatbot), reveals the effectiveness of the proposed innovative approaches. The questionnaire results affirm the utility and positive

impact of interactive videos and AI Chatbots on training individuals. This research contributes to the advancement of autism education by showcasing the potential of interactive videos and AI solutions in teacher training. Training using interactive videos provides a better understanding of how to teach autistic children efficiently.

Keywords: Interactive Videos, Teacher's Training, Autism Spectrum Disorder (ASD), AI-Driven Chatbot, Special Education.

Title and Abstract (in Arabic)

تعزيز تعليم التوحد: استكشاف مقاطع الفيديو التفاعلية وتكامل الذكاء الاصطناعي للتدريس الفعال

الملخص

يركز هذا البحث على تعزيز تعليم التوحد من خلال دمج مقاطع الفيديو التفاعلية وحلول الذكاء الاصطناعي لتحسين تدريب المعلمين. مع ارتفاع عدد الطلاب المصابين بالتوحد، يصبح من الضروري لمدرسي التعليم الخاص أن يستخدموا استراتيجيات تعليمية فعالة مصممة خصيصًا لتلبية الاحتياجات الفردية. تتضمن طرق التدريس الأكثر فعالية للطلاب المصابين بالتوحد فهم الحالة ودمج استراتيجيات التدريس المخصصة، مثل تكييف الواجبات لتناسب احتياجات الطالب، ومساعدة أولئك الذين يعانون من صعوبة في التحدث، واستخدام الوسائل البصرية لتحسين التنظيم. يتضمن الحل المقترح استخدام تكنولوجيا الفيديو التفاعلية لتدريب المعلمين، وسد الفجوة بين البحث والتنفيذ العملي للتدخلات التعليمية. بالإضافة إلى ذلك، تم دمج Chatbot المدعم بالذكاء الاصطناعي لتوفير التوجيه في الوقت الفعلي والمساعدة الشخصية، مما يعزز بيئة تعليمية أكثر استجابة وتكيفًا. يمكن أن تكون أساليب تدريب المعلمين التقليدية باهظة الثمن وتستغرق وقتًا طويلاً. في المقابل، توفر مقاطع الفيديو التفاعلية طريقة استباقية ومرنة للوصول إلى محتوى التدريب، مما يمكّن المعلمين من التفاعل مع المادة بشكل ديناميكي والتحكم في تجارب التعلم الخاصة بهم. الهدف الرئيسي من هذه الأطروحة هو تحسين تدريب المعلمين على تعليم الأطفال المصابين بالتوحد من خلال الاستخدام المبتكر لمقاطع الفيديو التفاعلية وحلول الذكاء الاصطناعي. هناك ثلاثة أسئلة بحثية توجه هذه الدراسة: (س1) ما هو تأثير إنشاء مقاطع فيديو تفاعلية لمساعدة الأفراد في فهم سلوكيات التوحد؟ (س2) ما هي فوائد استخدام مقاطع الفيديو التفاعلية لإدارة ودعم الطلاب المصابين بالتوحد بشكل فعال؟ (س3) كيف يساهم دمج Chatbot بالذكاء الاصطناعي في تحسين أنظمة الدعم والفهم في تعليم الطلاب المصابين بالتوحد؟ تستخدم منهجية البحث دورة منتج Lean UX، باستخدام Canva لتصميم نماذج الفيديو التفاعلية، وMindstamp للتكرار المحسن، وMicrosoft Forms لتنفيذ الاستطلاع. تستكشف الدراسة تكامل Chatbot AI في بيئة التعلم التفاعلية، المصممة خصيصًا لدعم معلمي الظل، ويتم تنفيذها في Google Colaboratory. تشير النتائج إلى أن استخدام مقاطع الفيديو التفاعلية في تدريب المعلمين يؤثر بشكل إيجابي على التعليم والدعم المقدم للأطفال المصابين بالتوحد. وتكشف مقارنة طرق التدريب، بما في ذلك ممارسات التدريس الحالية ومقاطع الفيديو التفاعلية ومعلم الذكاء الاصطناعي (Chatbot)، عن فعالية الأساليب المبتكرة المقترحة. تؤكد نتائج الاستبيان فائدة وتأثير مقاطع الفيديو التفاعلية وروبوتات الدردشة المدعمة بالذكاء الاصطناعي في تدريب الأفراد. يساهم هذا البحث في تطوير تعليم التوحد من خلال عرض إمكانات مقاطع الفيديو التفاعلية وحلول الذكاء الاصطناعي في تدريب المعلمين. يوفر التدريب باستخدام مقاطع الفيديو التفاعلية فهمًا أفضل لكيفية تعليم الأطفال المصابين بالتوحد بكفاءة.

مفاهيم البحث الرئيسية: مقاطع الفيديو التفاعلية، تدريب المعلمين، اضطراب طيف التوحد، Chatbot المبني على الذكاء الاصطناعي، التعليم الخاص.

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I extend my heartfelt thanks to Dr. Jose for his unwavering support and guidance during this research. His mentorship and expertise have been invaluable in shaping the direction and enhancing the quality of this study. I'm deeply appreciative of the participants for their valuable contributions, which have been instrumental in the successful completion of this research. I would like to thank my committee for their guidance and support.

Dedication

To my beloved parents and family

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List of Abbreviations

ASD	Autism Spectrum Disorders
EBP	Evidence-Based Practice
SCHS	Sharjah City for Humanitarian Services

Chapter 1: Introduction

1.1 Overview

Autism spectrum disorder is a group of conditions that affect individuals with a specific set of cognitive and sensory impairments. The primary characteristics of autism spectrum disorder are repetitive and unusual sensory and social communication behaviors. Although it is regarded as a specific condition that can range from mild to severe, most individuals with this condition require lifelong support. Direct providers, families, and teachers make a huge difference in the lives of individuals with autism; clinicians also play a vital role by providing information and support to families and individuals with the condition. Due to the condition's prevalence, autism spectrum disorder presents a significant economic burden, mainly due to the provision of support to adults who cannot work independently, resulting in high costs of health care and education and loss of income for caregivers (Lord et al., 2018). Autistic, or Autistic Spectrum Disorder (ASD), is a neurodevelopmental condition characterized by impairments in social interaction, communication, and behavior. Although signs and extent may vary greatly, it is often identified in early infancy and is viewed as a lifelong illness (Brinkman et al., 2018). ASD affects 1 in 54 children in the United States, reaching 31.4 per 1,000 children in states like New Jersey. The prevalence of autism has steadily increased over the past three decades, and boys are 4.3 times more likely to be autistic by age 8. Autism is associated with higher healthcare consumption than typically developing children, even though its etiology is not fully understood (Bevan et al., 2023). Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental disorder characterized by difficulties with social communication skills and restricted, repetitive behavior patterns. According to recent studies, the prevalence of ASD has grown from 0.05% in 1966 to 0.9% to 1.5% today. This translates into a significant number of students in schools requiring specialized educational accommodations due to their social and communication difficulties (Larraceleta et al., 2022).

Swiss physician Eugen Bleuler used the word "autism" in 1911 to describe a manifestation of schizophrenia. But it wasn't until the 1940s that autism was properly identified as a medical disorder. American psychotherapist Leo Kanner first defined a

subset of infants with developmental delays in interactions with others, language, and repetitive habits in a 1943 study titled "early infantile autism." In around the same time frame, Austrian doctor Hans Asperger identified a disorder that would later be called Asperger's Syndrome. Researchers kept at it over the next several decades, and by the 1980s they had developed diagnostic criteria for autism. Ever then, there has been a dramatic rise in the quantity of children being diagnosed with autism, prompting a flurry of new studies into the disorder's origins, manifestations, and potential treatments (Jeste & Geschwind, 2014). It is unclear what causes autism, although studies point to a potential interaction between hereditary and environmental factors. An increased risk of autism has been linked to a family history of the illness, and many genes have been investigated as possible contributors to the disorder. However, the underlying genetic origin of the disease remains unknown. Prenatal exposure to pollutants like mercury and lead, and problems during pregnancy or delivery, are two examples of environmental variables that have been linked to autism. The autism spectrum disease is likely the consequence of a complex combination of genetic and environmental variables, but it is vital to remember that the great majority of cases cannot be traced to a single cause (Baio et al., 2018). The symptoms of autism can vary widely, but they typically include difficulties with social interaction, communication, and behavior. Children with autism may have difficulty making eye contact, understanding social cues, and developing friendships. They may also have delayed speech and language development and may struggle to initiate or maintain conversations. In addition to social and communication difficulties, children with autism may engage in repetitive behaviors or have specific interests that they focus on intensely. They may have difficulty adapting to changes in routine or environment and may become upset or distressed if their routines are disrupted. Autism is difficult to diagnose since there is no gold standard test or set of diagnostic criteria. Instead, a number of different pieces of information, such as the child's behavior and developmental history, as well as consultations with parents and caregivers, go into making a diagnosis. The American Psychiatric Association's Diagnostic and Statistics Manual of Mental Disorders, Fifth Edition (DSM-5) details the criteria used to diagnose autism in the United States. Restrictive or repetitive behaviors

and difficulties with social communication are two of the DSM-5's criteria for a diagnosis of autism spectrum disorder (Tager-Flusberg, 2016).

1.1.1 Treatment

There is no cure for autism, but there are a range of treatments and therapies that can help children with the disorder to develop their communication and social skills and manage their symptoms. Early intervention is key, and children who are diagnosed with autism at a young age can benefit from Early Intensive Behavioral Intervention (EIBI), which involves structured, individualized programs designed to address specific deficits in communication and social interaction (Dawson & Burner, 2017). some of the most common treatments for autism includes Applied Behavior Analysis (ABA), Speech Therapy, Occupational Therapy, Medication, and Special Education.

1.1.2 Ways Teacher Used for Teaching Autistic Children

Teaching autistic children might be difficult since they don't always learn or communicate like typically developing youngsters. However, there are several tools and approaches available to educators who work with autistic students. Educators of autistic children may benefit from a few strategies, such as differentiated instruction, visual aids, incentives that are beneficial, and social storytelling. Physically or cognitively challenged kids have a special need that is met by special education programs (Kriete et al., 2018). A great special education lesson is one where all kids with disabilities get high-caliber teaching. Special education courses are necessary for kids who are seriously impaired, despite the current trend in education favoring distance education and the integration of individuals with special needs into regular classrooms. The goal of a special education classroom is to provide each student with the one-on-one support they need to succeed. However, there may be a large variety of students' skill levels and abilities even within special education classroom settings (Maljaars et al., 2019). Teaching autistic children requires patience, flexibility, and creativity. Teachers must be willing to adapt their teaching strategies to meet the unique needs of each child. By using individualized instruction, visual aids, positive reinforcement, social stories, and other effective teaching strategies, teachers can help autistic children succeed in the classroom and beyond (Moore et al., 2017).

1.1.3 Current Methods Used in Teacher Training on How to Teach Children with Autism

Children with autism may suffer significant harm if their classroom environment is poor. It can cause them difficulty engaging in learning activities and coping with daily life. Furthermore, these issues may have a lasting effect. The goal now is not to separate people of determination in an organization but to integrate them with the rest of society as individuals of value. Teachers must learn as much as possible about autism and the best teaching methods and modifications for these students, not many teachers have encountered a student with autism before. For general education teachers on a time crunch, many of whom may not have encountered a student with autism before. A study reported that the most common type of training received by teachers of students with Autism Spectrum Disorders (ASD) was attending a full or half-day workshop; less than 15% reported having received training from a university or college teacher preparation program (Morrier et al., 2010). Teaching autistic children can be challenging, and it requires specialized skills and knowledge. Teachers who work with autistic children need to be trained in the latest research, best practices, and effective teaching strategies. the current methods used in teacher training for teaching autistic children, including specialized training programs, professional development workshops, Picture Exchange Communication System (PECS), Structured Teaching, Sensory Integration Therapy, Provide different levels of books and materials, and ongoing support and coaching (Chung & Lee, 2019). Ongoing support and coaching are essential for teachers who work with autistic children. Teachers need ongoing support and guidance to implement effective teaching strategies and interventions. This support can come from a variety of sources, including special education supervisors, school psychologists, and behavior specialists. For example, the Statewide Autism Resources and Training (START) Project in Pennsylvania provides ongoing support and coaching to teachers who work with autistic children. The program includes training, coaching, and consultation to help teachers develop and implement effective interventions and teaching strategies. In addition to these methods, there are several other ways in which teachers can receive training and support for teaching autistic children. These include:

- Peer-to-peer mentoring programs were experienced teachers' mentor new teachers.
- Conferences and symposia, where teachers can learn about the latest research and best practices in the field of autism education.
- Online courses and webinars, which provide teachers with convenient access to training and professional development opportunities.

Teaching autistic children is a challenging but rewarding task. To effectively teach autistic children, teachers need specialized training and ongoing support. Specialized training programs, professional development workshops, and ongoing support and coaching are some of the most effective methods for preparing teachers to work with autistic children. By providing teachers with the knowledge and skills they need, we can ensure that autistic children receive the best possible education and support (Wang et al., 2018).

An investigation of the training providers in one Southern state in Georgia who work with students with Autism Spectrum Disorders (ASD) done by researchers. The most common methods of training reported were attending workshops (e.g., full- and half-day workshops; 20.54%), hands-on training with students with autism (18.92%), and self-learning (18.38%). There was the least likelihood of teachers being trained by parents of students with autism spectrum disorders (2.16%) or software developers (1.08%). The percentage of teachers who reported training through university teacher preparation programs was less than 15.0%. Most teachers were self-taught and taught through interpersonal interactions (Morrier et al., 2010). Most skills-based strategies were taught through full-day workshops or self-teaching. Teacher preparation programs and full-day workshops were the primary training sources for teachers who reported using cognitive techniques. Participants learn physiological, biological, and neurological strategies through hands-on, full-day workshops. The use of other strategies has been learned through peer educators or therapists or has been self-taught (Morrier et al., 2010).

1.1.4 Advantages of Interactive Videos for Training Purpose

New teaching and learning environments have been created due to the development of information technologies, such as virtual workspaces and digital libraries. The use of e-learning has become a promising alternative to traditional classroom learning in recent years. Video is a rich and powerful medium for learning. Multimedia and communication technologies have enabled robust educational systems with interactive video features. Interactive video technology allows students to interact with instructional videos. As a result, learner engagement may be enhanced, resulting in more effective learning (Zhang et al., 2006). Both teachers and students share short videos on their mobile phones due to the increasing use of mobile phones. Video-based learning refers to video resources' methodological assistance to develop competencies and skills related to specific knowledge. As learners watch long and short videos, their engagement level and viewing strategies may be affected by the length of the videos. An interactive video is a type of media that involves various interactive elements, such as asking questions, answering surveys, and exploring. It also lets students interact with the content of the presentation (Afify, 2020).

A video clip can be transformed into an interactive one with unlimited actions to engage the audience (Shahrokni, 2018). The concept of the interactive video involves breaking down the content into small pieces for learning. This means that a short video can provide explanations instead of creating a whole video containing all the information. In addition, it enables the creation of learning units suitable for the student's limited memory (Slemmons et al., 2018). A study by Jill et al. (2019) revealed that interactive videos improved students' performance and motivation. Besides, these types of videos can help students perform well in their studies by providing them with the necessary support during various scheduled lectures (Rismark & Sølvberg, 2019). We can define interactive video as an online visual experience that permits the user to click or touch the image to trigger an action. That action can be loading a pop-up screen, opening a web page, or, more interestingly for visual storytellers, causing the video to jump to a predefined spot, or to immediately and seamlessly start playing a new video.

Videos have the potential to reach a wide audience, which is one of their main advantages. As a result, video is a fantastic tool for education. On the other hand, video consumption has the potential to be a quite passive experience. When participants are more actively involved in their training, they may learn more effectively. Viewers are more likely to respond positively, trainees are more likely to participate, and the setting is more engaging for improved learning when there is more interaction. Corporate training has been hampered by the proliferation of cellphones and the rise of highly participatory social media (Chen & Lin, 2018). The audience is no longer willing to just watch the entertainment; they demand a more active role. It's clear that they want to step up their efforts. Interactive video viewers nowadays want the freedom to watch their content whenever and whenever they choose, on whatever device they happen to have handy. They would also want input into the content creation process and the ability to pick just the information they need. To solve this problem, we may use interactive videos. Training films that allow viewers to do things like launch a website or choose choices from a pop-up menu are examples of interactive videos. Because of the dynamic nature of these films, the makers may have more say over the final product. For instance, users could be able to set the movie to automatically start at a certain time or advance to a certain frame. Viewers may learn more about their options with the aid of interactive movies. Characters in interactive training videos may take cues from the spectator and act upon them. Since viewers of these movies typically get to choose where they want to go next, the experience might seem less linear. Students might potentially learn more by watching videos from the point of view of a certain character. With a greater level of engagement, the experience may be more immersive and pique the attention of the audience (Jonassen & Land, 2017). Videos that can be interacted with are very useful for teaching and instruction. They provide students with a stimulating environment in which to take an active role in their education. The advantages of interactive movies for training purposes include higher engagement, better retention, and enhanced learning outcomes. Interactive videos offer a wide range of benefits for training purposes. They increase learner engagement, improve retention rates, enhance learning outcomes, provide flexibility, are cost-effective, offer real-time feedback, and can be customized to

meet the specific needs of learners. As the demand for online learning and training continues (DeFranco & Hockenberry, 2018).

- Increased Engagement

One of the primary advantages of interactive videos is their ability to increase learner engagement. Interactive videos offer a dynamic and engaging learning experience that captures the learner's attention and keeps them engaged throughout the training. Interactive videos incorporate a range of features, such as quizzes, branching scenarios, and interactive elements, that encourage learners to actively participate in the learning process. This level of engagement leads to increased motivation and interest in the subject matter, which can improve learning outcomes (DeFranco & Hockenberry, 2018).

- Improved Retention

Interactive videos also improve retention rates by providing learners with an immersive and memorable learning experience. The interactivity of the videos creates a sense of personalization, as learners are able to control the pace and direction of the learning experience. This personalized experience allows learners to connect with the content and retain it more effectively. Additionally, interactive videos can incorporate repetition and reinforcement strategies, such as quizzes and review questions, which help to reinforce key concepts and improve retention rates (DeFranco & Hockenberry, 2018).

- Enhanced Learning Outcomes

Interactive videos have been shown to enhance learning outcomes. Research has demonstrated that learners who engage with interactive videos perform better on assessments than those who engage with traditional video or text-based learning materials. The interactive elements of the videos, such as branching scenarios and simulations, provide learners with opportunities to apply their knowledge and skills in a realistic setting. This application of knowledge and skills leads to a deeper understanding of the content, which can improve learning outcomes (DeFranco & Hockenberry, 2018).

- Flexibility

Interactive videos also offer a high degree of flexibility in terms of access and delivery. Learners can access the videos from any device with an internet connection, making them accessible to learners from anywhere in the world. Additionally, interactive videos can be delivered asynchronously, which allows learners to complete the training at their own pace and on their own schedule. This flexibility makes interactive videos an ideal tool for remote or distance learning (DeFranco & Hockenberry, 2018).

- Cost-Effective

Interactive videos can also be a cost-effective training tool. While the initial development costs of interactive videos may be higher than traditional training materials, the long-term benefits can outweigh the costs. Interactive videos can be used repeatedly, making them a cost-effective solution for training large numbers of learners. Additionally, interactive videos can be used to train learners in a wide range of topics, which can reduce the need for multiple training programs (DeFranco & Hockenberry, 2018).

- Real-Time Feedback

Another advantage of interactive videos is the ability to provide real-time feedback to learners. Interactive videos can incorporate quizzes and assessments that provide immediate feedback to learners. This feedback allows learners to identify areas where they need to improve and adjust their learning strategies. Real-time feedback can also help learners stay motivated and engaged, as they can see their progress and accomplishments in real-time (DeFranco & Hockenberry, 2018).

- Customization

Interactive videos can be customized to meet the specific needs of learners. For example, interactive videos can be designed to address the unique learning styles of individual learners. Learners can control the pace and direction of the learning experience, which allows them to focus on areas where they need additional support or skip over content that they have already mastered. Additionally, interactive videos can

be customized to address specific learning objectives or job requirements, which makes them an ideal tool for job-specific training (DeFranco & Hockenberry, 2018).

- Make Your Learning Accessible

Learning can be broken down into manageable portions, and interactive films are a great medium through which to do so. Today's students have specific demands, and microlearning meets them. The program's goal is to provide instruction through entertaining and informative films that may be seen on many gadgets. This kind of instruction also permits retakes. Repeating a course in a typical classroom setting might be prohibitive due to the time and money involved in doing so. Safe failure is facilitated in e-learning using interactive video, which provides students many chances to complete lectures and tests. It's not simply economical to provide this accessibility; it also improves learning outcomes and retention of information (DeFranco & Hockenberry, 2018).

- Realistic Simulations

Interactive videos can provide learners with realistic simulations of real-life scenarios, allowing them to practice and apply their knowledge in a safe and controlled environment. This can be particularly useful for training in high-risk or complex environments (DeFranco & Hockenberry, 2018).

There have been many advances in technologies such as Artificial Intelligence (AI), Big Data, and the Internet of Things (IoT). There is a wide range of applications for these technologies. One such application is “Chatbot”. Chatbots are conversational artificial intelligence systems that mimic a human during a conversation. Artificial intelligence and Natural Language Processing (NLP) are combined in this technology. Chatbots have been a part of technological advancement because they eliminate the need for human tasks and automate monotonous tasks. Chatbots are used in different fields like education, healthcare, and business (Meshram et al., 2021). In Children with Special Needs (CSN), shadow teaching improves academic performance, psychosocial skills, and independence abilities (Maryola & Edilberto, 2009). AI Chatbots can be used to train shadow teachers.

This thesis focuses on enhancing the teaching methods for teachers working with autistic children through interactive videos to elevate the quality of education. Additionally, the research targets explicitly shadow teachers to assess the effectiveness of interactive videos in training and learning in special education. Moreover, the study explores the integration of AI Chatbots to augment the training process further, aiming to provide real-time support and personalized guidance for shadow teachers, thereby enriching the educational experience for students with autism. Each autistic child needs a distinctive and customized learning experience that accommodates their strengths, challenges, and learning preferences.

1.2 Statement of the Problem

The number of autistic students is increasing exponentially. There is a wide range of symptoms and characteristics associated with autism. To meet their learning needs, they need a skilled and knowledgeable teacher. In the absence of appropriate guidance, children with autism may suffer from a life-long predicament; however, with proper guidance, children with autism can continue to live without experiencing too many difficulties. Providing competent autism teachers is a challenge for schools. An autism educator must be skilled, knowledgeable, and favorable toward autistic children (Lin & Daun, 2017). Teachers cannot handle the increasing number of autistic students, so the question remains whether they can manage this growing number. For special education teachers to be qualified, they must know how to select appropriate teaching strategies for each student.

Therefore, in this research, the proposed solution is to train teachers in innovative and effective ways to educate autistic children using interactive video technology, which will positively impact teaching children with autism. By using interactive videos, teachers can gain the necessary skills and knowledge to support students with ASD in the classroom, reducing the gap between research and implementation of educational interventions. Additionally, incorporating an AI Chatbot solution further enhances teacher training by providing real-time guidance and personalized assistance, fostering a more responsive and adaptive educational environment for autistic children.

1.3 Research Objectives

The main objective of this thesis is to improve teachers' training in teaching autistic children using interactive videos. The study aims to evaluate the effectiveness of interactive videos in teacher training by comparing them with the current methods used. The research will explore the traditional methods used to teach autistic children and the difficulties teachers face. The study will then investigate the effectiveness of interactive videos in special education teacher training, focusing on their benefits and advantages. Interactive video in an e-learning system allows proactive and random access to video content. Designing videos will contribute to training teachers.

Autism Spectrum Disorders (ASD) present unique learning needs and behaviors for educators and educational systems. Teachers should be aware of the unique needs of students in this category (e.g., the requirement for clarity of language, structure, visual cues, or sensory-appropriate physical environment) and how meeting these needs can result in success. To provide high-quality education to all students and appropriately meet their needs, teachers in regular and special schools need adequate support and training, including opportunities for expanding their knowledge and developing their skills in teaching students with autism. Teachers must attend workshops and lectures in person, which can be time-consuming and costly. As part of this study, the proposed new solution will be compared with the current method used in teacher training. Interactive video technology will evaluate teacher training in innovative and effective ways to teach children with autism.

Using interactive videos will enhance the teacher's training in teaching autistic children. It puts the teacher in the middle of the action and involves him driving the experience. An interactive video viewer can decide "what to do next" and watch how the characters react to their choices. By making choices, teachers can play with the outcomes, jump to what interests them, and watch events unfold through the eyes of different characters.

Furthermore, the research extends its scope to explore the potential benefits of integrating AI-driven ChatGPT as a supplementary tool in teachers' training modules,

assessing how ChatGPT can further enhance teachers' ability to provide personalized support and guidance when working with autistic students.

RQ1: what is the impact of creating interactive videos to assist individuals in understanding autistic behaviors?

RQ2: what are the benefits of using interactive videos for effectively managing and supporting autistic students?

RQ3: How does integrating an AI Chatbot contribute to improving support systems and understanding in the education of autistic students?

1.4 Relevant Literature

Several studies have investigated the prevalence of evidence-based educational methods among teachers for students with Autism Spectrum Disorders (ASD). In Spain, 87.6% of special education teachers of pupils with ASD reported that the selected evidence-based practices in their teacher education programs either were never taught (47.5%) or were mentioned incidentally (40.1%) (Larraceleta et al., 2022). To provide high-quality education to all students and appropriately meet their needs, teachers in regular and special schools need adequate support and training, including opportunities for expanding their knowledge and developing their skills in teaching students with autism. Several international organizations and institutions have funded research to determine which models or practices are most effective in educational and clinical intervention for people with autism. Teachers should be trained to support the proposed educational intervention for these students in order to reduce the gap between research and implementation of educational interventions, thus enhancing the performance of science or transferring practices from applied research to the classroom. Type of training of identified evidence-based practices provides in teacher education programs are shown in Table 1.

Table 1: Type of Training of Identified Evidence-Based Practices Provides in Teacher Education Programs

Evidence-Based Practices	Number (Percentage) of Responses			
	The Strategy			
	Was Never Mentioned and Never Taught	Was Mentioned Incidentally	Was Mentioned and Discussed	Was Mentioned and Taught through Direct Instruction
Differential reinforcement	53 (49.10)	49 (45.40)	6 (5.60)	-[1]
Discrete trial training	76 (70.40)	29 (26.90)	3 (2.80)	-
Modeling	11 (10.20)	58 (53.70)	39 (36.10)	-
Naturalistic intervention	64 (59.30)	39 (36.10)	4 (3.70)	1 (0.90)
Peer-mediated interventions	64 (59.30)	40 (37.00)	4 (3.70)	-
Prompting	29 (26.90)	62 (57.40)	17 (15.70)	-
Reinforcement	5 (4.60)	51 (47.20)	48 (44.40)	4 (3.70)
Scripting	61 (56.50)	39 (36.10)	7 (6.50)	1 (0.90)
Social narratives	57 (52.80)	45 (41.70)	5 (4.60)	1 (0.90)
Task analysis	43 (39.80)	53 (49.10)	11 (10.20)	1 (0.90)
Time delay	71 (65.70)	36 (33.30)	1 (0.90)	-
Video modeling	93 (86.10)	14 (13.00)	1 (0.90)	-
Total	566 (47.54)	476 (40.07)	139 (11.70)	7 (0.59)

[1] The symbol "-" represents "no answers".

Several international organizations and institutions have funded research to determine which models or practices are most effective in educational and clinical intervention for people with autism. Evidence-Based Practice (EBP) must consider the child's characteristics, the context of the intervention, the practitioner's variables, and research-based knowledge. In the educational field aimed at students with autism, teachers should be trained to support proposed educational interventions to reduce the gap between research and implementation of educational interventions, thus enhancing the performance of science or transferring practices from applied research to the classroom (Larraceleta et al., 2022).

Concerns have been raised about the quality of psychoeducational practices for students with ASD, and studies have investigated the prevalence of evidence-based educational methods among teachers. A study conducted in Spain aimed to identify to what extent social communication evidence-based practices for students with ASD were provided in teacher education and in-service training programs for special education teachers. The study found that 87.6% of the participants reported that the selected evidence-based practices in their teacher education programs were either never taught

(47.5%) or were mentioned incidentally (40.1%). This highlights the need for training programs that focus on evidence-based practices in the education of students with ASD (Larraceleta et al., 2022).

Several studies have investigated the prevalence of educational methods among teachers for students with Autism Spectrum Disorders (ASD). Virtual Reality (VR) has been applied to various industries and topics, including entertainment, gaming, healthcare, and education. VR has found applications in areas such as Training and Simulation, Education, Healthcare and Therapy, and Social Interactions and Collaboration. It has shown promise as a tool for social skills training in children with ASD. Parsons and Cobb (2011) explored the effectiveness of VR-based interventions for improving social skills in autistic individuals (Parsons & Cobb, 2011). Studies have also been reported on ASD-specific methods for teacher training, including two techniques: Applied Behavior Analysis (ABA) and TEACCH. Jennett and colleagues used a philosophy questionnaire to analyze the difference between groups specializing in treating autism, finding a significant difference in their commitment to the philosophy of teaching. However, the effectiveness of the programs is similar (Jennett et al., 2003). Another study analyzed the effectiveness of various interventions using the ABA method in children with ASD. Based on the study's findings, educational institutions should reevaluate their teaching methods and curricula, incorporating practices based on the Acceptance of Behavior Analysis (ABA) to support children with autism and other special needs (Loiacono & Valenti, 2010).

Teachers of LEAP were more likely to be committed to the LEAP philosophy than TEACCH. Similarly, HQSEP teachers were more likely to align with the LEAP and TEACCH philosophies (Coman et al., 2013). The study aimed to analyze the effects of training sessions on novice teachers' perceptions of Autism Spectrum Disorder. The results indicated that even a small amount of training strategically placed within a teacher training course could significantly enhance participants' knowledge of this condition (Leblanc et al., 2009). In another study, Lerman and colleagues analyzed the effectiveness of a model program that trained nine special education teachers on how to effectively teach children with autism. The participants received instruction on improving their direct teaching and preference assessment skills (Lerman et al., 2008).

Furthermore, Probst and Leppert developed and evaluated a teacher training program based on structured teaching for individuals with Autism Spectrum Disorders (Probst & Leppert, 2008). This study aimed to examine how teachers' perspectives on literacy development and their understanding of autism were influenced by the instruction they received. It also analyzed how these teachers could enhance their knowledge and understanding of the condition within their specific context. The findings revealed that after receiving the instruction, the participating teachers demonstrated improved understanding of strategies to support students with autism in enhancing their reading and writing skills (Robledo, 2017).

Several studies have examined the prevalence of evidence-based educational methods among teachers working with students with Autism Spectrum Disorders (ASD) in different countries. In Spain (Larraceleta et al., 2022), Malaysia (Lin & Daun, 2017), and USA (Morrier et al., 2010) research has shed light on the training and knowledge of special education teachers in relation to evidence-based practices for ASD. A study conducted in Spain found that 87.6% of special education teachers reported that the evidence-based practices related to ASD were either never taught (47.5%) or only mentioned incidentally (40.1%) during their teacher education programs (Larraceleta et al., 2022). In Malaysia, nearly half of the surveyed teachers (49.5%) stated that they had never attended any courses specifically focused on autism (Lin & Daun, 2017). Similarly, in the USA, it was observed that most teachers received training through half-day or full-day workshops, while only a small number had received training through university or college programs (Morrier et al., 2010). Importantly, the findings indicated that the types of training received did not significantly predict the implementation of specific practices.

Chatbots, like ChatGPT, have emerged as valuable AI tools for Education. Conversations can be conducted in natural language, queries can be answered, and guidance can be provided. In teacher training, AI-driven chatbots can provide educators with instant access to information, resources, and strategies for teaching autistic students. Chatbot for Education has great potential to complement teachers and education managers. It can be a tutor around the clock to answer any questions. Chatbots can be

implemented either by rule-based or AI-based chatbots. They can learn and become more intelligent over time and are more scalable (Gil, 2021).

In the age of artificial intelligence, the Chatbot market is undergoing extraordinary expansion driven by the surging demand for smartphones and the widespread utilization of messaging applications. Over recent years, sectors like food delivery, finance, and e-commerce have enthusiastically embraced Chatbot technology. One industry poised to benefit from this technology significantly is the education sector, where its implementation has the potential to enhance productivity, communication, and learning, provide practical teaching assistance, and mitigate the uncertainties associated with interactions. This study (Sandu & Gide, 2019) aims to investigate the factors influencing the adoption of Chatbot technology to enrich the learning experience of students in the higher education sector in India. This study employs a quantitative approach, gathering data through surveys conducted among prominent higher education institutions in India that have integrated Chatbot technology (Sandu & Gide, 2019).

AI offers new tools to the educational environment that can transform traditional teaching and learning. Teaching skills and efficiency can be improved by using artificial intelligence techniques, providing inspiration, and enhancing self-reflection. As a result of artificial intelligence, teachers can better understand students' learning processes and offer ways to support them. The system is adaptive, considering students' actions and emotions. Furthermore, AI can help teachers develop their teaching skills by providing them with teaching rubrics and making suggestions for improvement. Artificial intelligence provides students with assessments based on their performance capabilities. Teachers can use AI-powered Chatbots to create an automated and intelligent system that analyzes and evaluates a student's learning ability. As well as monitoring student learning processes, artificial intelligence can also capture data about student learning. Advanced AI features, such as speech recognition and pronunciation correction, have the potential to facilitate the acquisition of foreign language skills. A collaborative effort involving educators, researchers, and policymakers is needed to ensure AI's ethical and responsible use in education. By solving the problems posed by AI technologies and leveraging their benefits, we can build a more equitable and prosperous education system

that gives children the individualized instruction, feedback, and support they need (Adiguzel et al., 2023).

In recent years, Artificial Intelligence (AI) and chatbot technologies have gained prominence in education, with a growing focus on enhancing the training of shadow teachers tasked with supporting children diagnosed with Autism Spectrum Disorder (ASD). In pursuing enhancing inclusive education for children diagnosed with ASD within mainstream school settings, it is imperative to consider recent developments and strategies. As outlined in Tufvesson and Tufvesson (2009), addressing the unique needs of children with ASD in inclusive classrooms has become a significant focal point in contemporary education. This article constitutes a crucial component of a research project, which competes in examining key determinants that foster the inclusion of students diagnosed with ASD within mainstream educational settings. In their review, the authors meticulously assessed a plethora of scholarly publications, elucidating a spectrum of strategies that facilitate the achievement of inclusive education for children with ASD in mainstream schools. These publications collectively expound upon myriad factors that exhibit the potential to facilitate the seamless integration of children with ASD into mainstream educational environments. Among these factors, one cluster pertains to the preparatory measures taken to equip children with ASD for a practical educational experience. In contrast, another cluster spotlights factors intrinsic to the educational institutions themselves. The implementation took place in five schools in Catalonia (Spain), comprising three preschool and primary schools and two secondary schools. These centers enroll 29 boys and girls diagnosed with ASD or Pervasive Developmental Disorder (PDD). Their study found that all schools had a support service for special education (USEE), although its services and facilities varied from one school to another. On the one hand, students with ASD spend most of their time in regular classrooms (which is desirable) with the support service. On the other hand, the support service is provided only in specific classrooms separate from other children (undesirable). This study aimed to comprehend the elements influencing the education of students with ASD in mainstream schools; they have identified four primary factors. These factors encompass the individual characteristics/needs of students with ASD, schools, teachers, support services, and family collaboration. Small schools tend to have

a closer and more intimate relationship between adults and students. In such environments, teachers can engage in more direct and personalized communication with students with autism spectrum disorder. Nevertheless, the observed variation in how these students perceive certain environmental factors stems from factors such as the overall school population size and the number of floor levels. This inconsistency can be attributed to the diversity within the group of children with autism, as some can effectively cope with these environmental factors. In contrast, others may struggle due to the wide range of concentration difficulties within this disability spectrum (Tufvesson & Tufvesson, 2009).

1.4.1 Characteristics of Students with ASD

One challenge in integrating students with autism spectrum disorder lies in the variability of disability severity among different students. The success or failure of the integration process hinges on factors such as language skills, stereotypical behaviors, and individual abilities:

1. Intellectual abilities: Generally, students with an IQ above 70 can integrate into mainstream schools.
2. Communication and linguistic proficiency: Both receptive and expressive language skills play a significant role in successful integration.
3. Behavioral issues: Severe self-harm, aggression, or uncontrollable tantrums can raise concerns about a student's inclusion, especially if previous interventions have not been effective.
4. Cognitive inflexibility: Some students may require modifications and therapeutic support to facilitate integration due to cognitive inflexibility.
5. Social development level: Students whose social development is akin to that of a toddler or younger often face limited learning opportunities in group settings, necessitating individualized attention from experts.

Consideration of these characteristics often guides the placement of students with ASD. A study conducted in Seville, Spain, by Aguilera et al. (2007) discovered that 52% of the 165 students with ASD in the sample attended special schools, while the remaining 48% enrolled in regular schools. However, the two school types had a

significant age-based distribution difference. As students with ASD progress in age, their educational placements tend to veer away from inclusive environments. While the education of students with autism spectrum disorder in high schools is rising, many are segregated into special schools. Consequently, there is a discernible need for enhanced teacher training to equip educators with the skills required to receive and integrate these students effectively into mainstream schools (Josep & Qinyi, 2012).

1.4.2 Teacher

As the prevalence of students with autism spectrum disorder continues to increase, there is a growing demand for educators who deeply understand the distinctive characteristics associated with autism. Three critical factors for enhancing the educational process for children with autism spectrum disorder are closely linked to educators themselves: attitudes, training, and support.

In the realm of inclusive education, the significance of teacher training and attitudes cannot be emphasized enough. An analysis of current research literature underscores the presence of outcome studies that illuminate the impact of teacher self-assessed training on altering students' behavior and their sense of belonging within the school environment over the academic year. A closer examination of this data reveals that teacher training appears to exert its most significant influence on students in terms of reducing social problems (Osborne & Reid, 2011). It is imperative to recognize that the success of programs that support students with autism hinges on the continuous pursuit of professional development. This requires that all educational community members, including special education teachers, regular education teachers, paraprofessionals, administrators, receptionists, custodians, and food service workers, undergo comprehensive training. When everyone within an educational institution comprehends and addresses the unique needs of students with autism, the educational environment is poised to function more seamlessly.

In mainstream educational settings, the emphasis on teachers' attitudes toward children with autism is paramount, as these attitudes can serve as valuable indicators informing the development of teacher training and professional development initiatives. More specifically, teachers' attitudes can significantly influence their students'

expectations, subsequently impacting students' self-perception and academic performance. The prevailing belief is that students thrive in an environment where teachers exhibit enthusiasm.

Several recommendations for mainstream teachers are applicable in the context of inclusive settings. One crucial aspect involves ensuring the availability of genuinely beneficial support services. Additionally, instructional models should prioritize collaborative planning and problem-solving as integral components of serving a diverse student population. By fostering collaboration within comprehensive support teams, classroom teachers and support specialists can leverage their complementary skills and knowledge to strategize, implement, and evaluate the effectiveness of instructional practices, thereby benefiting all students in their classrooms (Josep & Qinyi, 2012).

1.4.3 School Management

To ensure the success of inclusion, the school principal needs to cultivate an environment that embraces the achievements of all students. School administrators play a vital role in developing individualized program plans for students with autism spectrum disorder, which may involve implementing educational programs for the entire student body, hiring staff, allocating resources, and ensuring teachers have the necessary information and support to work effectively with students. They can also foster collaboration among school workgroups to support students with special needs and institute protocols for engaging parents in developing individualized program plans (Josep & Qinyi, 2012).

Specific characteristics can be beneficial for children with autism spectrum disorder, including:

1. Smaller schools with fewer students, although this may lead to limited social interaction opportunities for students with ASD.
2. Highly structured administrative and organizational methods within schools help students with ASD anticipate their daily routines.
3. A genuine commitment from all teachers to support students with autism.

4. Scheduled supplementary breaks during regular class time to provide students with ASD access to specialized services like psycho-educational counseling and speech therapy.
5. They are equipping peers of children with autism spectrum disorder with strategies to understand better and support their learning and social relationships.

Regarding educational factors impacting students with autism spectrum disorder and their relation to class size, there are four key considerations:

1. Using the student-teacher ratio as a class size measure may introduce measurement errors.
2. Failing to account for family influences, such as a student's innate ability, can result in inaccurately specified model estimates.
3. Refraining from considering class size's homogeneity concerning student achievement can lead to incomplete assessments.
4. An incorrect functional model can be applied when determining the relationship between class size and student achievement.

1.4.4 Support Services and Family Collaboration

Close collaboration between schools and families is a highly effective approach to establishing a successful home-school partnership. Within the realm of special education, the involvement of families and the establishment of robust communication channels between home and school are paramount. Utilizing a communication log or notebook, which can be exchanged between the inclusion teacher, special education teacher, and parents daily or weekly, plays a pivotal role in maintaining effective communication.

A student's feeling of belonging in a mainstream educational classroom is strengthened when their teacher and parents maintain a harmonious and consistent communication channel. Moreover, it is acknowledged that parents play a pivotal role in treating ASD. Specifically, medical professionals and other healthcare practitioners can provide crucial support to parents through education about autism spectrum disorder, offering proactive guidance, training, and involving them as co-therapists, assisting in

resource acquisition, and providing emotional support through empathic listening and dialogue.

Parental involvement yields benefit for students and fosters active participation within the school community, but it also enhances parent satisfaction with processes associated with inclusive education. It remains imperative for teachers to establish and sustain an ongoing dialogue with all stakeholders, including children and families, to ensure that both current and future needs are addressed. Moreover, some argue that parents possess unparalleled expertise regarding their children's requirements and effective intervention hinges on their support and participation in parent training workshops. This support extends to assisting parents in their interactions with children beyond intervention hours and facilitating emotional support groups.

In the case of autism, collaborative efforts between healthcare professionals and the educational context are indispensable. Given that diagnostic categories alone fail to elucidate a student's experience within the school environment, it becomes imperative to reassess and adapt our understanding of students with ASD while considering their adaptability and learning within an educational setting (Josep & Qinyi, 2012).

The objective of this study was to evaluate the impact of shadow teaching on the education and development of children with special needs. The research findings indicate a consensus between shadow teachers and regular teachers regarding the positive impact of shadow teaching on enhancing academic performance, psychosocial skills, and independence in children.

Shadow teachers primarily consider their most significant responsibility to be collaborative work with regular teachers, whereas regular teachers prioritize curriculum planning as their primary task. Shadow teachers rate themselves highest in terms of proficiency in teamwork but acknowledge limitations in curriculum planning. Conversely, regular teachers perceive shadow teachers as most skilled in behavior management but need to be more proficient in curriculum planning (Maryola & Edilberto, 2009).

Notably, the study did not reveal statistically significant positive correlations between regular teachers' and shadow teachers' assessments of the overall importance of shadow teachers' competencies. Several challenges include:

- Unrealistic parental expectations and interference in child management,
- the inability of shadow teachers to prepare and follow lesson plans and analyze assignments, and
- there is a need for coordination between regular teachers and shadow teachers.

The regular teacher oversees both student groups, depicted within the larger rectangle in Figure 1, outlining their respective areas of responsibility. The typical students and those with CSN coexist within this shared space, as illustrated by the intersection of the two circles. Their interconnectedness is evident through continuous engagement in various activities within the classroom setting. This interaction may be formal, such as when collaborating on projects, games, or activities. Additionally, informal interactions occur during breaks or even within regular class hours, where students converse or socialize.

The broken lines represent the collaboration between the regular teacher and the shadow teacher, emphasizing their seamless coordination. Working together, they jointly deliver instruction to students with autism and ADHD, ensuring a cohesive and supportive educational environment (Maryola & Edilberto, 2009).

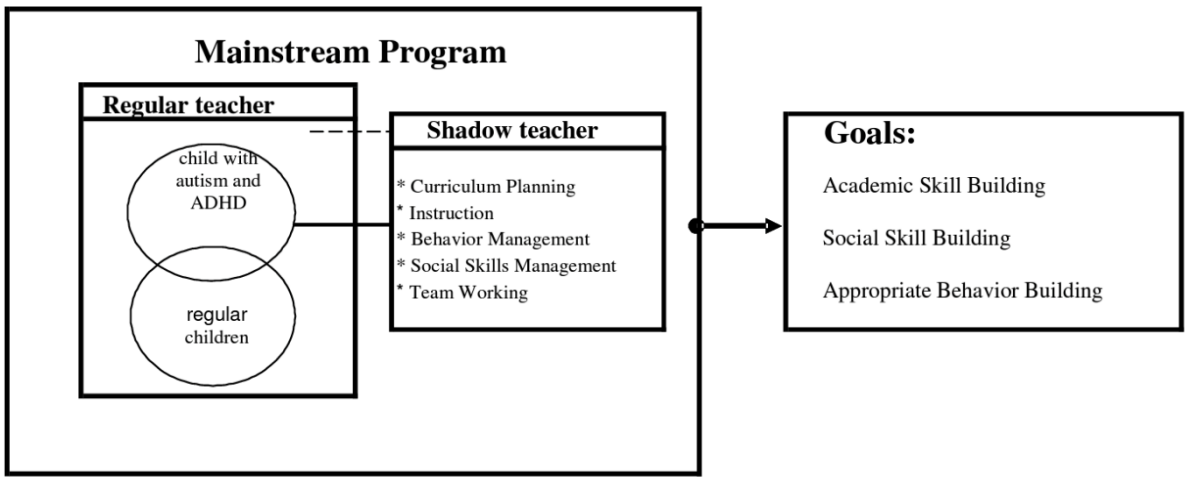

Figure 1: Shadow Teaching Scheme in the Mainstream Program

Chapter 2: Methods

2.1 Research Design

The research methodology employed in this study utilizes the Lean UX product cycle, which follows the iterative process of "Build, measure, improve" to continuously refine and optimize the interactive video model for teacher training in working with students with autism.

This study explores the traditional method used to teach autistic children and the difficulties teachers face. In this research, we will study a new technique for this problem, an interactive video, and its benefits and advantages, also implement AI Chatbot.

This research is conducted to study the benefits of interactive videos in special education teacher training. This is quantitative research built on existing knowledge. The research aims to evaluate the effectiveness of interactive videos in teacher training by comparing them with the current methods used. Sixty-eight teachers responded to the questionnaire that was delivered, utilized by Microsoft Forms.

This study aims to evaluate teacher training by designing an interactive video model prototype using Canva to prepare highly effective teachers to work with students with autism. Also, Mindstamp was used to create the interactive video. Microsoft Forms was used for the survey. Furthermore, the study extends its innovative approach by exploring the integration of an AI Chatbot within the interactive learning environment, specifically tailored to support shadow teachers. This inclusion aims to provide real-time assistance and personalized guidance, enhancing the training experience for educators working with autistic students in a shadowing capacity.

Figure 2 shows an algorithm flowchart that outlines a systematic approach to developing and refining an interactive video model, incorporating feedback, assessing effectiveness, and implementing additional features like an AI ChatBot to enhance the learning experience. Flowchart Designed using lucid.

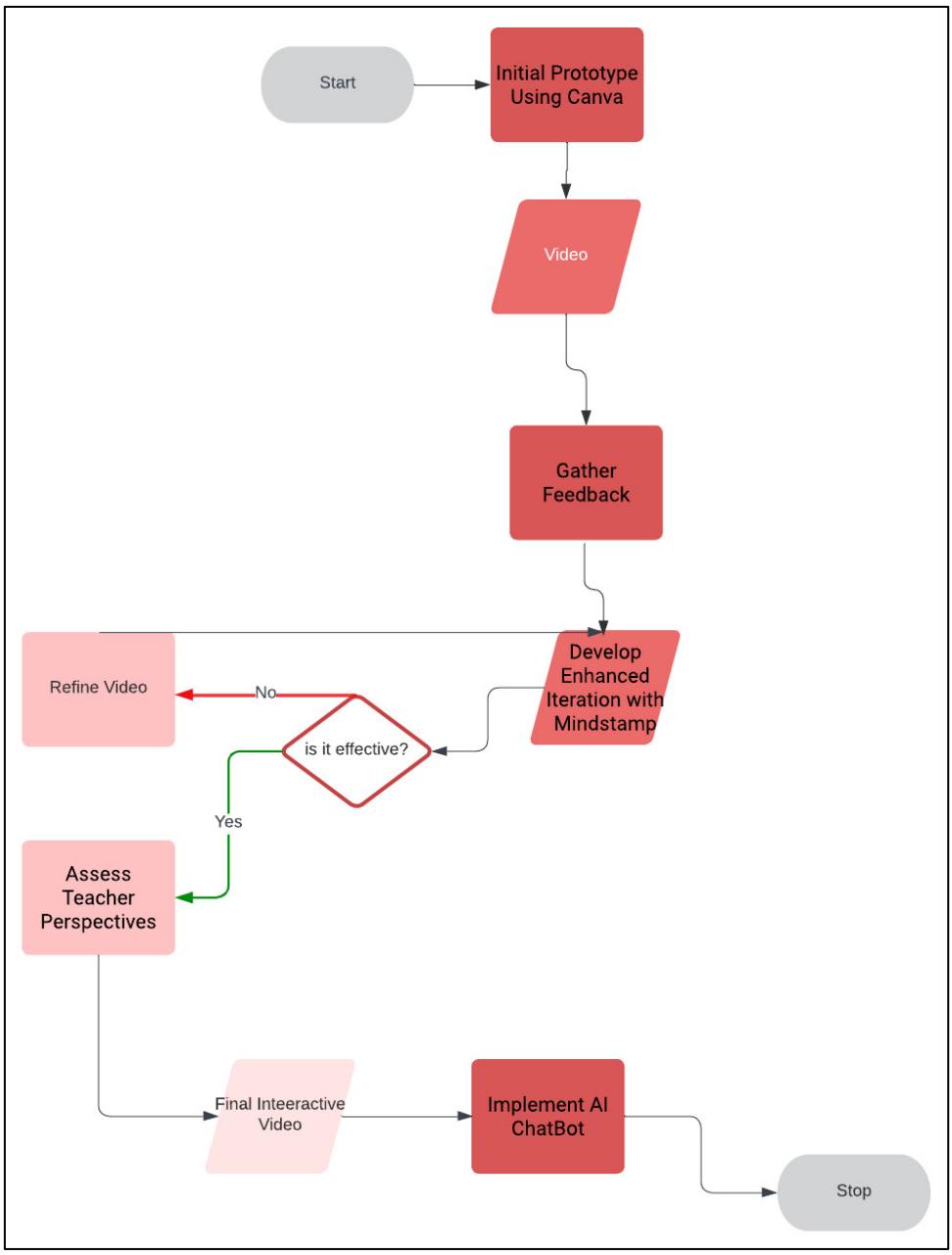

Figure 2: Systematic Development Flowchart

2.2 Development of Interactive Video Model

The initial prototype of the interactive video model was created using Canva, an online graphic design platform known for its user-friendly interface. This prototype covers various aspects related to developmental disorders, with a specific focus on autism. Topics such as repetitive behavior, social impairment, cognitive impairment, and the impact on brain structure are addressed. A lesson summary and an assessment

section were included to evaluate trainees' understanding of the course material, as depicted in Figure 3.

Feedback from a survey based on the initial Canva prototype informed the refinement and improvement of the prototype, leading to the creation of the second video iteration.

Figure 3: Scenes from Canva Training Video

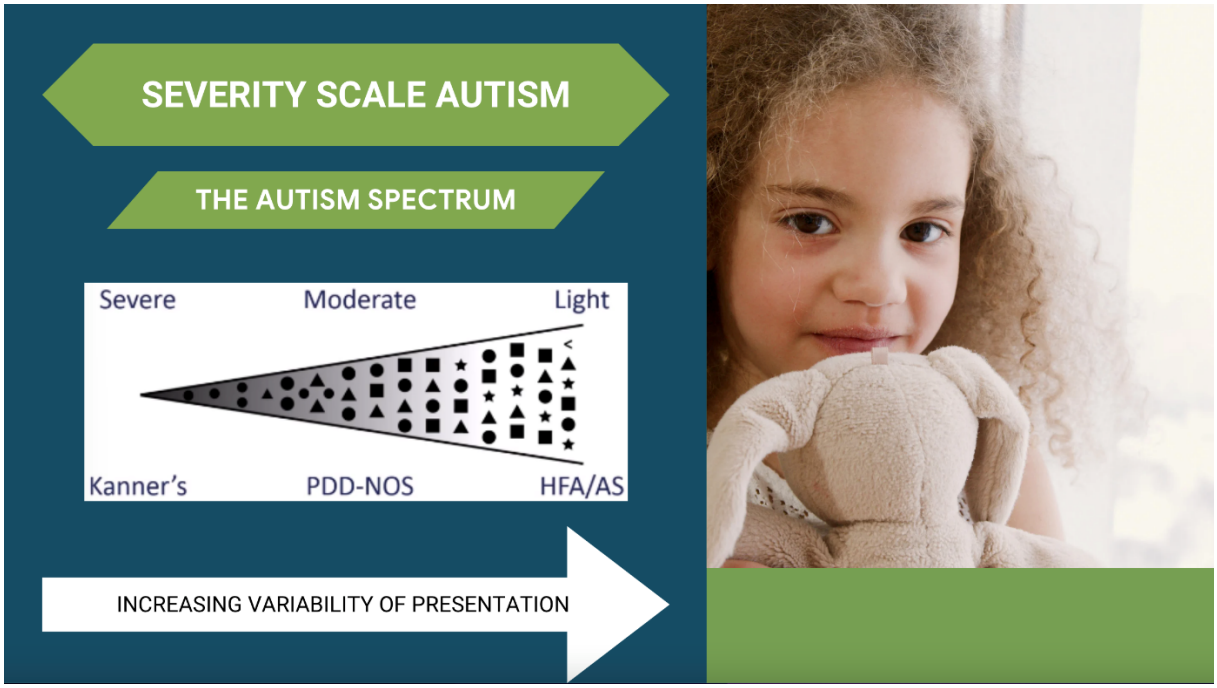

Figure 3: Scenes from Canva Training Video (Continued)

To improve user interaction within the video, an enhanced iteration of the interactive video model was developed using Mindstamp. Mindstamp serves as a versatile video engagement and interactivity tool, empowering content creators to augment their videos with dynamic features such as quizzes, surveys, annotations, and clickable links. By harnessing Mindstamp's capabilities, users are actively immersed in the video content, fostering an interactive and captivating learning experience.

This advanced iteration of our interactive video model, designed with Mindstamp, offers a potent array of interactive elements. These include quizzes, surveys, annotations, and clickable links, as showcased in Figure 4. This infusion of interactivity affords users the flexibility to engage deeply with the content. Within the video, users can seamlessly pause to reflect on presented information, rewind to revisit specific segments, and explore different sections in alignment with their unique learning preferences. This transformative interactivity elevates the video into a dynamic and customizable learning tool, promoting a profound understanding of the subject matter. By leveraging Mindstamp's capabilities, we have created a learning experience that empowers users to tailor their engagement, ensuring an enriched educational journey.

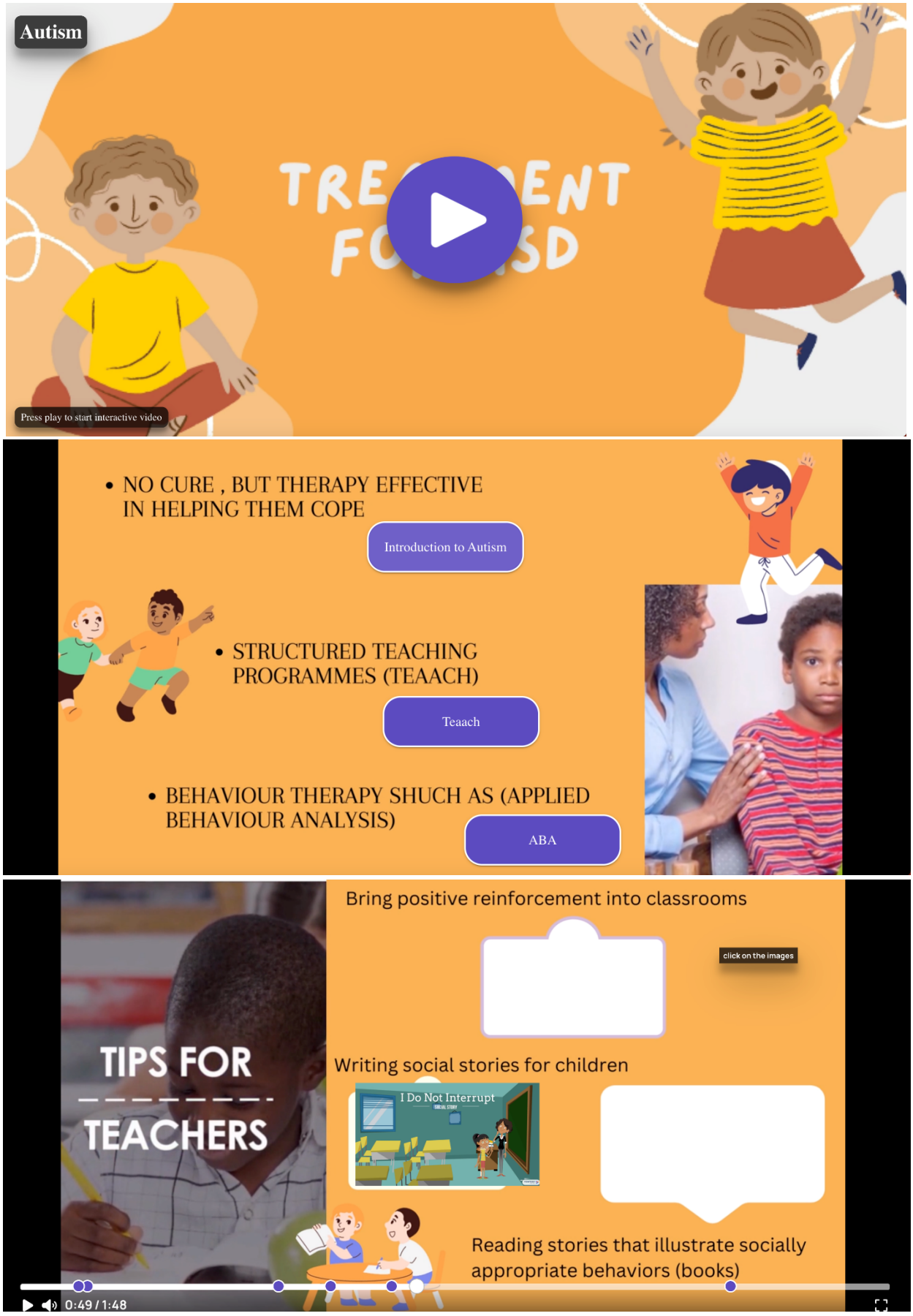

Figure 4: Scenes from MindStamp Training Interactive Video

2.3 Lean UX Product Cycle

By utilizing the Lean UX product cycle, this study aims to create a highly effective interactive video model for teacher training in working with students with autism. The iterative nature of the process, along with the improved Mindstamp video, allows for continuous improvement based on user feedback. This ensures that the final interactive video model is well-suited to meet the needs of both experienced teachers and individuals with no prior experience with autism, shown in Figure 5.

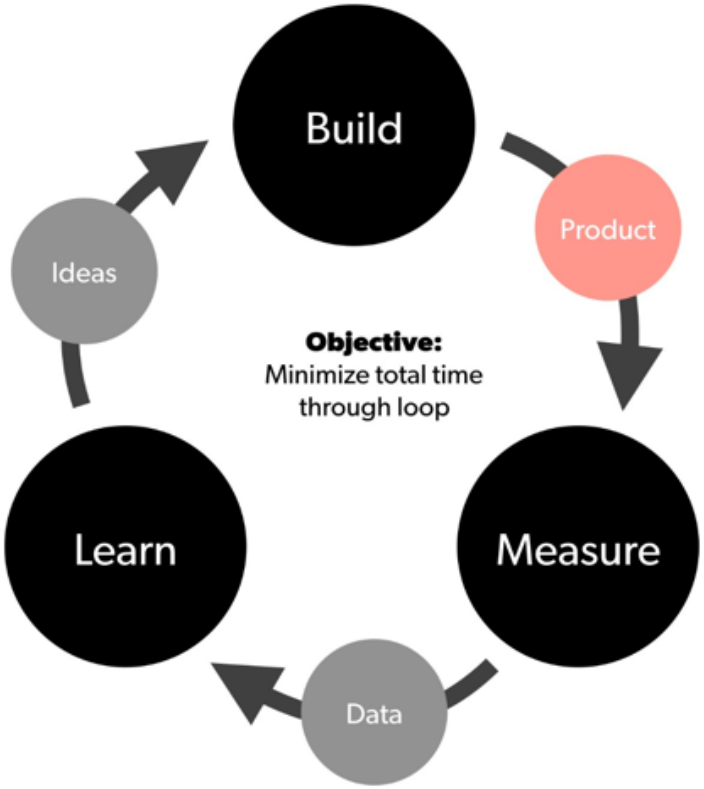

Figure 5: Lean UX Product Cycle

2.4 Data Collection

To gather data, a questionnaire was administered to 68 teachers using Microsoft Forms as the survey platform. The questionnaire aimed to assess participants' perspectives on the benefits and advantages of using interactive videos in teacher training. These responses provide valuable insights into the effectiveness and potential of interactive videos in enhancing teacher training outcomes.

An observational cross-sectional study was employed to answer the research questions. The population was recruited in UAE. The population for this study was collected, on the one hand, from one special education school, Sharjah City for Humanitarian Services (SCHS), that enrolls students with ASD and, on the other hand, from teachers in ordinary schools who participated in training actions of centers of teachers and resources, agencies responsible for teacher professional development. A total of 80 participants responded to this research. All participants' characteristics are shown in Table 2. Among these 80 participants, most participants were female (90%).

Table 2: Participants' Characteristics

Demographic Profile of Participants	
Gender	
Female	90%
Male	10%
Age	
Under 25	7%
Over 25	93%
Level of education	
Bachelor	79%
Master's degree	21%
Courses about Autism	
Yes	52%
No	48%
Years of experience as a special education teacher	
1 – 5 years	12%
More than 5 years	40%
None	48%
Number of autistic students at the class	
0	43%
1 student	24%
5 – 10	15%
More than 10 students	19%
Is interactive video effective for training?	
Yes	78%
No	3%
Maybe	19%

2.5 ChatBot Implementation

The Chatbot implementation is a crucial component of this research, providing a practical application of the developed Natural Language Processing (NLP) model using Python Script. The Flask web application serves as the user interface, facilitating user interactions with the chatbot. The application relies on several external libraries and tools: Nltk: Natural Language Toolkit for language processing, Keras: Deep learning library for building and training models, and Flask: Micro web framework for handling HTTP requests and responses.

2.5.1 Importing Libraries and Loading Pre-Trained Model

The code imports necessary libraries such as NLTK for natural language processing, the WordNetLemmatizer for lemmatization, pickle for handling serialized data, NumPy for numerical operations, and Keras for building and loading neural network models.

```
import nltk
nltk.download('popular')
from nltk.stem import WordNetLemmatizer
lemmatizer = WordNetLemmatizer()
import pickle
import numpy as np
from keras.models import load_model
```

```
model = load_model('/content/drive/MyDrive/Project/newmodel.h5')
```

A pre-trained neural network model is loaded using Keras. The model is expected to be stored in the file newmodel.h5.

```
intents =
json.loads(open('/content/drive/MyDrive/Project/data.json').read())
```

The code reads a JSON file containing intents for the chatbot. This file contains predefined patterns, responses, and corresponding intents which is the dataset.

```
words =
pickle.load(open('/content/drive/MyDrive/Project/Texts.pkl','rb'))
classes =
pickle.load(open('/content/drive/MyDrive/Project/Labels.pkl','rb'))
```

The script loads pickled objects that presumably contain processed text data (Texts.pkl) and associated labels (Labels.pkl). These are used for vectorization and classification.

2.5.2 Text Processing Functions

The clean_up_sentence function tokenizes and lemmatizes input sentences, preparing them for further processing.

```
def clean_up_sentence(sentence):
# tokenize the pattern - split words into array
sentence_words = nltk.word_tokenize(sentence)
# stem each word - create short form for word
sentence_words = [lemmatizer.lemmatize(word.lower()) for word
in sentence_words]
return sentence_words
```

```
def bow(sentence, words, show_details=True):
# tokenize the pattern
sentence_words = clean_up_sentence(sentence)
# bag of words - matrix of N words, vocabulary matrix
bag = [0]*len(words)
for s in sentence_words:
for i,w in enumerate(words):
if w == s:
# assign 1 if the current word is in the vocabulary position
bag[i] = 1
if show_details:
print ("found in bag: %s" % w)
return(np.array(bag))
```

The bow function converts a sentence into a bag-of-words representation based on the provided vocabulary (words). It sets a binary value (1 or 0) for each word in the vocabulary, indicating its presence in the sentence.

2.5.3 Model Prediction Functions

The predict_class function uses the trained model to predict the intent of the input sentence. It uses the bag-of-words representation and sets a threshold (ERROR_THRESHOLD) to filter out low-confidence predictions.

```
def predict_class(sentence, model):
# filter out predictions below a threshold
p = bow(sentence, words, show_details=False)
res = model.predict(np.array([p]))[0]
ERROR_THRESHOLD = 0.25
results = [[i, r] for i, r in enumerate(res) if r >
ERROR_THRESHOLD]
# sort by the strength of probability
results.sort(key=lambda x: x[1], reverse=True)
return_list = []
for r in results:
return_list.append({"intent": classes[r[0]], "probability":
str(r[1])})
return return_list
```

2.5.4 Generating Bot Response

The getResponse function retrieves a random response based on the predicted intent.

```
def getResponse(ints, intents_json):
tag = ints[0]['intent']
list_of_intents = intents_json['intents']
for i in list_of_intents:
if(i['tag'] == tag):
result = random.choice(i['responses'])
break
return result
```

2.5.5 Flask App for Interaction

A Flask web application is created. It serves HTML templates from the /content/drive/MyDrive/Project/templates folder and static files (like CSS and images) from the /content/drive/MyDrive/Project/static folder.

```
from flask import Flask, render_template, request, jsonify,
make_response, send_file
import base64
app = Flask(__name__,
template_folder='/content/drive/MyDrive/Project/templates')
app.static_folder = '/content/drive/MyDrive/Project/static'
```

```
@app.route("/")
def home():
return render_template("index.html")
@app.route("/get")
def get_bot_response():
userText = request.args.get('msg')
print("User Sent: ", userText)
answer = chatbot_response(userText)
print("ChatBot Replied: ", answer)
response_data = jsonify({'message': answer})
resp = make_response(response_data, 201)
return resp
if __name__ == "__main__":
app.run()
```

This section defines two routes - / for rendering the home template and /get for handling user input and returning the chatbot's response. The chatbot_response function is used to get the response, and the result is sent back as a JSON object.

This Flask app essentially creates a simple web-based interface to interact with the chatbot. The user input is sent to the server, processed by the chatbot, and the response is displayed on the web page.

2.5.6 Dataset Description

The dataset is designed for a chatbot that provides information and guidance on developmental disorders, treatment options, specific disorders like autism, and practical topics like toilet training. The intent structure allows the chatbot to recognize user queries and respond appropriately with relevant information. Each intent in the dataset has the following structure:

Tag: A label representing the intent.
Patterns: Possible user inputs or queries related to the intent.
Responses: Possible responses or answers to the user inputs.
Context: Additional context information (currently empty).

The dataset aligns well with the goal of creating a chatbot that can assist users with queries related to developmental disorders, treatment options, and specific conditions like autism. Including practical information on toilet training suggests a broad range of user assistance, including both informational and practical guidance. The dataset was collected from [Alison].

2.6 Execution Environment: Google Colaboratory

Google Colaboratory (Colab) was used to execute the code script provided, a cloud-based platform that offers free access to computing resources and facilitates collaborative coding in Python. Leveraging the power of Colab's hosted runtime, the script was executed seamlessly, eliminating the need for local hardware resources. Colab has pre-installed libraries encompassing renowned machine learning frameworks like TensorFlow and PyTorch. This feature enhances the convenience of executing code related to deep learning models within the Colab environment. To reproduce the results or further explore the code, users can upload the script directly to Colab, ensuring accessibility and ease of use. Figure 6 shows the screenshot of the Google colaboratory code. The code uses the eval_js function to execute JavaScript code in the Colab environment. The JavaScript code (google.colab.kernel.proxyPort(5000)) is intended to set up a proxy for port 5000. This is done to expose the Flask web application to the external world. The code mounts Google Drive to the /content/drive directory in Colab. It prompts to authenticate and authorize access to Google Drive. This is done to access files stored in Google Drive.

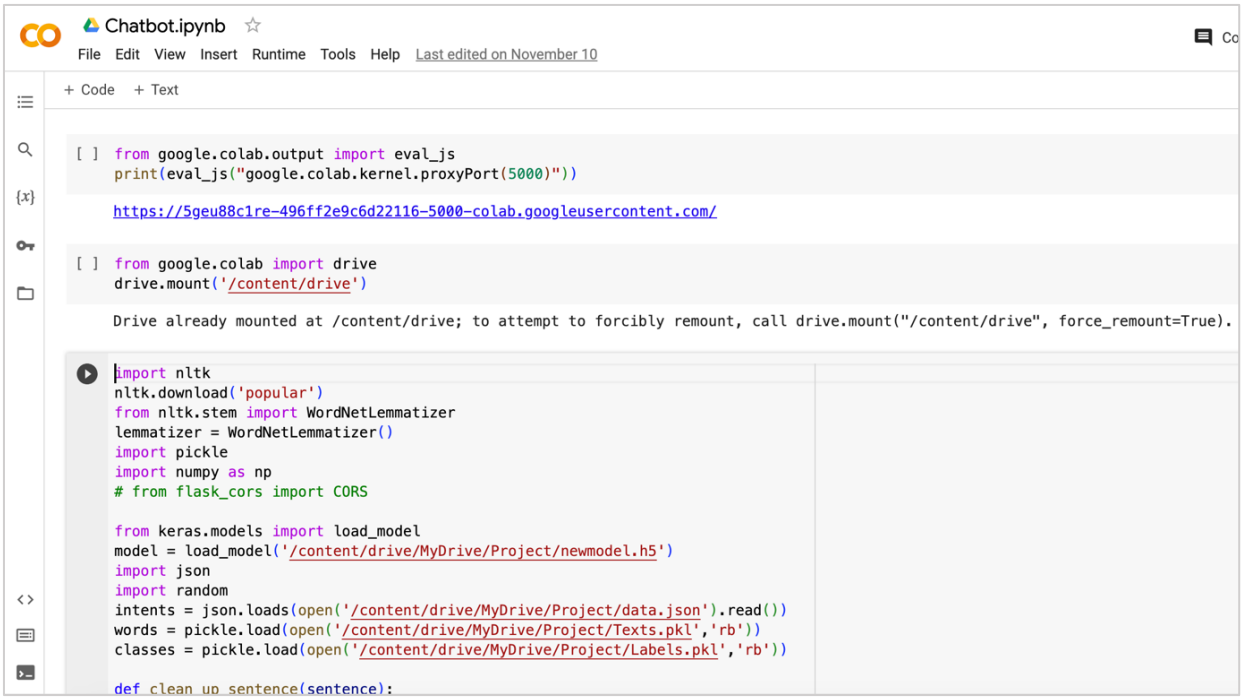

Figure 6: Google Colaboratory Code

The ChatBot interface was employed as a central tool for participant interaction during the data collection phase. Participants engaged with the ChatBot to provide responses and feedback, forming a crucial aspect of the research methodology. Figure 7 shows the output of running code.

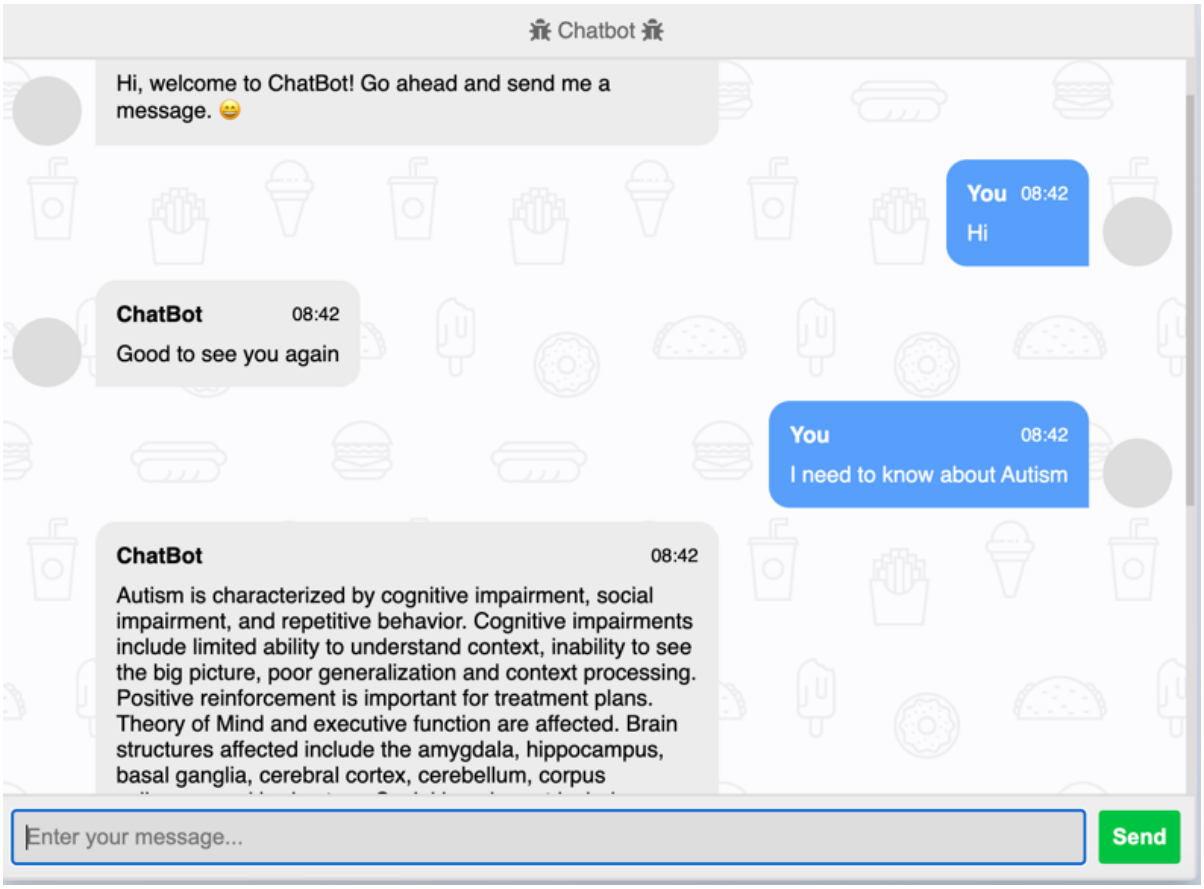

Figure 7: Output (Chatbot)

Chapter 3: Results and Discussions

3.1 Overview of the Main Findings

In recent years, interest in using interactive media in educational contexts has grown. Teachers may design compelling and dynamic learning experiences for their students using interactive videos, a form of multimedia technology. They give kids the chance to learn through direct activities, visual, and aural means. This study sought to examine the advantages of interactive videos for educators working with autistic students.

The study's key conclusions demonstrated that interactive videos dramatically raised autistic pupils' motivation and engagement levels. The pupils were seen to be more engaged in the learning process and to take part in classroom activities more vigorously. This result is consistent with earlier studies that shown how interactive videos may increase student engagement and motivation (Kuo et al., 2013).

Also, the usage of interactive videos enhanced autistic students' learning results. When compared to pupils who did not use the videos, those who took part in the interactive video-based lectures performed noticeably better on examinations and assignments. This result is in line with earlier studies that shown how interactive videos might enhance learning results for kids with special needs (Zhang et al., 2019).

Furthermore, the study's teachers' teaching methods were improved as a result of the usage of interactive video. The teachers claimed that using interactive video improved their capacity to include their students and explain difficult ideas. Also, they claimed that seeing the videos had improved their comprehension of their autistic students' learning requirements and preferences.

The study's findings underscore the considerable benefits for teachers working with autistic students by integrating interactive videos as a teaching tool. Interactive videos lead to more effective learning experiences for autistic students. Furthermore, the study advocates for the positive impact of interactive videos on teaching methods, signaling significant implications for the professional development of instructors dealing with special needs students. Notably, implementing an AI ChatBot further augments the

study's recommendations, demonstrating the potential synergy between interactive technologies and artificial intelligence to advance teacher training in special education. These compelling results affirm the efficacy of interactive videos and call for additional research and exploration in integrating AI technologies to enhance further educational outcomes for teachers and students in special education settings.

3.2 Profile and Statistics of Respondents

The study was carried out at Sharjah City for Humanitarian Services (SCHS). Teachers having previous experience working with autistic kids made up the study's participants. Survey has been done to measures whether it is easy to learn how to deal with autistic children from interactive videos, Does the interactive video effective for training People who have no experience?

80 participants completed the survey during the one-week data collection period. This survey targets two groups, one group considered for teachers with autism experience, and the other for people who have no experience.

89% of the participants are Females, and 94% their age above 25 years. 21% of the teachers had master's degrees in special education, and all had bachelor's degrees in education or a closely related discipline. The participant experience more than five years with at least one autistic child. 52% of the participants had training in Autism. 78% answered yes, interactive video is compelling for training purposes. Figure 3 confirms this answer.

The teachers were instructed to use interactive videos as a training tool. A collection of interactive movies covering a variety of curriculum-related subjects were made available to the teachers.

Overall, the teachers in this research had a lot of training and experience using technology in the classroom, and they were highly competent and skilled at working with autistic kids. Finally, this research shows positive results regarding the use of interactive videos in the training. Figure 8 shows all results in graph. Figure 9 shows the pie chart for the result.

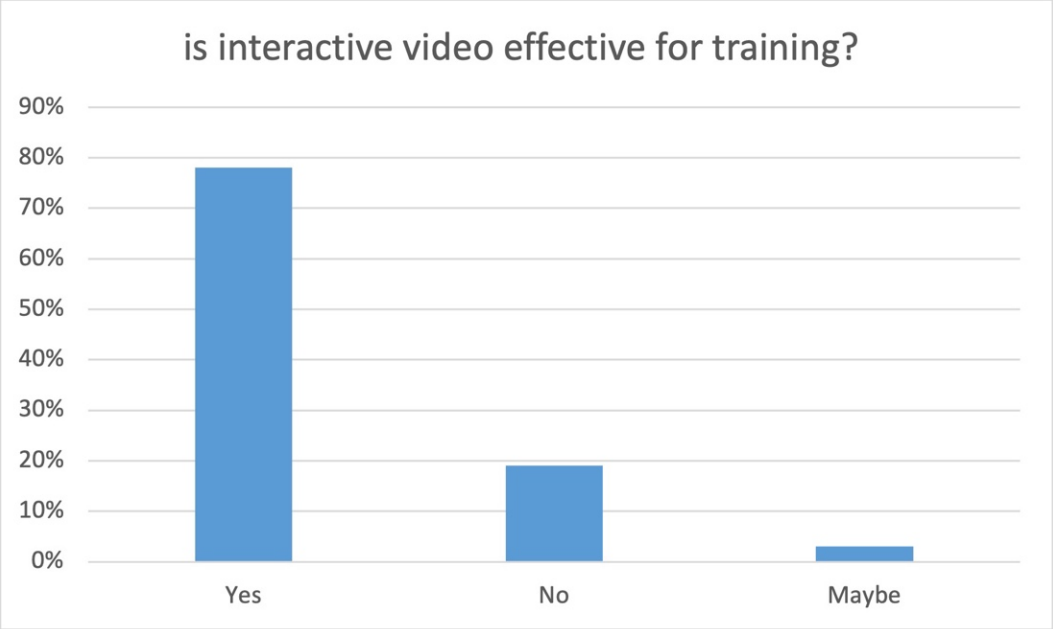

Figure 8: Distribution of Responses on the Effectiveness of the Interactive Video for Training

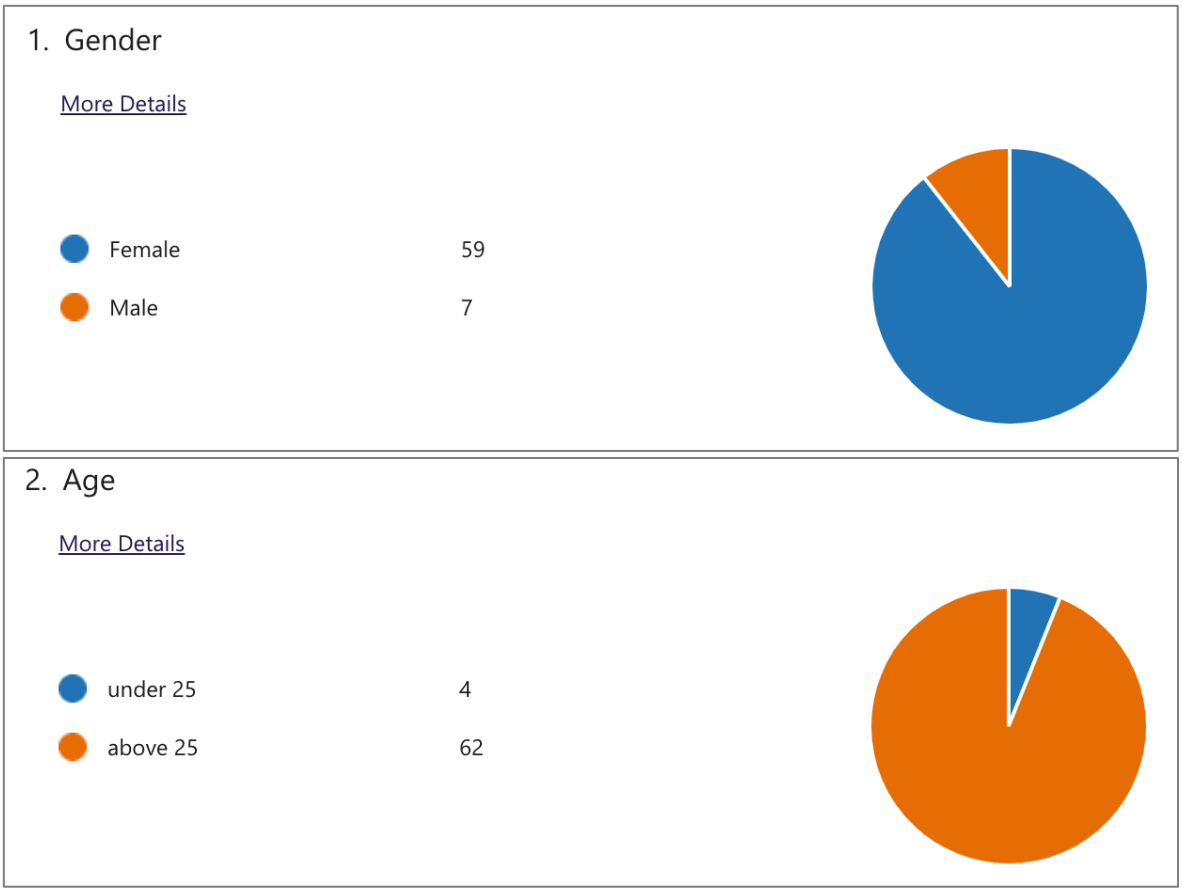

Figure 9: Result of the Survey

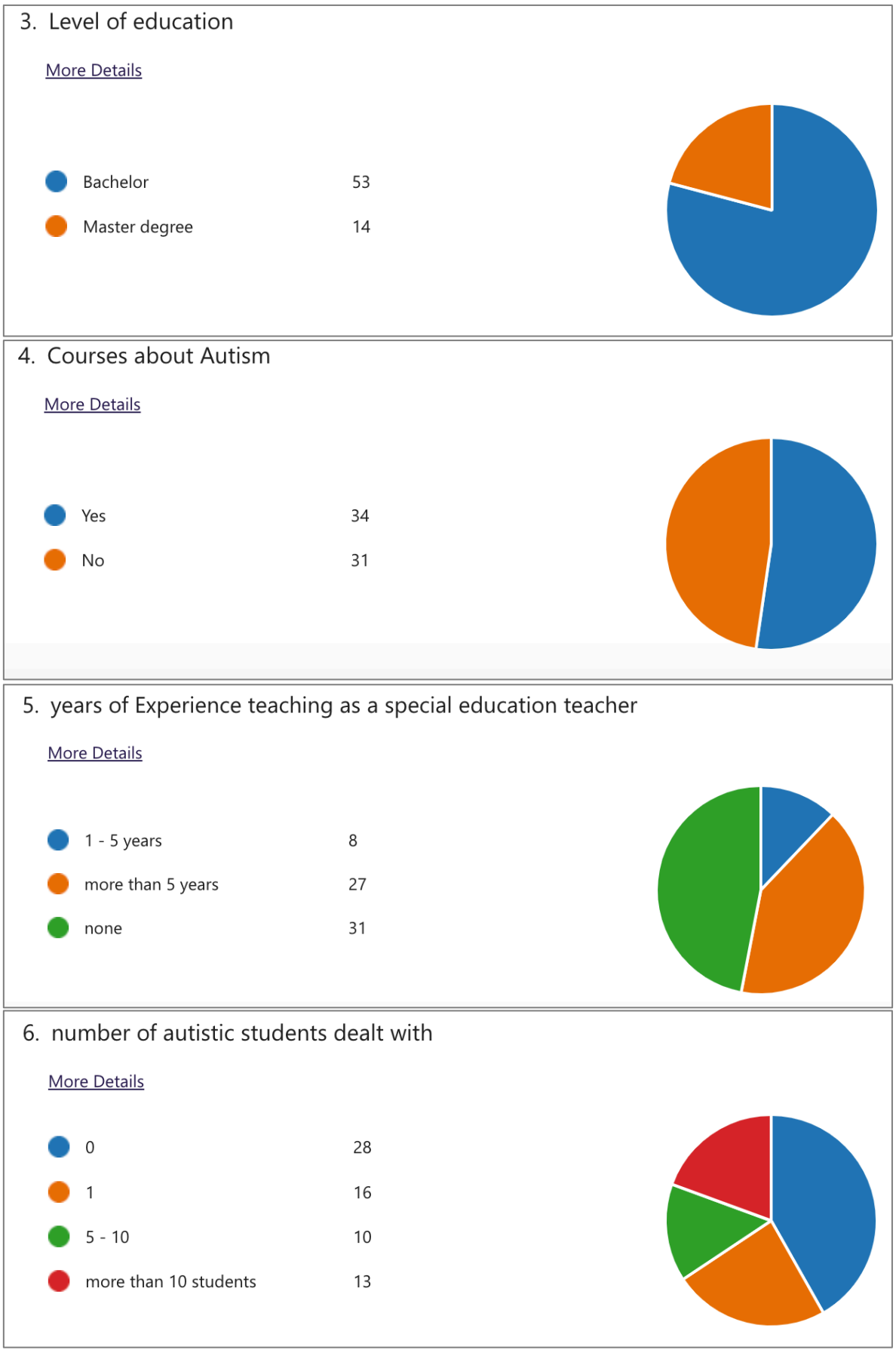

Figure 9: Result of the Survey (Continued)

3.3 Comparison of Training Methods

Training Shadow teachers to deal with autistic children through traditional face-to-face workshops and sessions can effectively provide hands-on experiences and direct interaction with experts. However, venue, travel, and accommodation expenses often come at a higher cost. Additionally, this approach can be time-consuming, requiring teachers to be physically present, which may only be convenient for some. In contrast, online or remote training methods can offer cost savings, greater flexibility in scheduling, and reduced time constraints while providing valuable content and interaction through virtual platforms. Finally, Training through AI-Chatbot can offer cost-effectiveness and flexibility. Still, it may only partially replace the benefits of face-to-face or online training regarding personal interaction and nuanced understanding of individual needs (See Table 3).

Table 3: Comparison of Training Methods

Method	**Criteria**			
	Cost	**Time**	**Effect**	**Interaction Level**
Current Teaching	Costly as traditional educational methods, including teacher salaries, materials, etc.	Typically requires regular classroom sessions.	Effectiveness can vary greatly depending on teacher skill and student needs.	Limited interactivity in traditional classrooms.
Interactive Video	Initial production costs for creating the video, but cost-effective for distribution	Available 24/7, allowing students to learn at their own pace	Effectiveness can vary but generally offers a visual and engaging learning experience.	Offers some interactivity through quizzes and assessments, within the video.
AI-Teacher (Chatbot)	Development costs for the AI, which can vary, but potentially high.	Once developed, it can be available 24/7.	Effectiveness can be high due to personali-zation and adaptability.	Highly interactive as it can provide personalized responses and adapt to individual needs.

3.4 Chatbot

Various scenarios were developed during the evaluation phase to evaluate the chatbot's interactivity and performance. These scenarios encompassed fundamental

interactions, intent recognition, and error handling. The following section outlines the outcomes of these scenarios, shedding light on the chatbot's responsiveness and adaptability in diverse conversational contexts.

Basic Conversations:

- Scenario: The user greets the chatbot with a simple "Hello."
- Expected Outcome: The chatbot responds with a suitable greeting or introduction.

Intent Recognition:

- Scenario: The user asks a question.
- Expected Outcome: The chatbot correctly identifies the intent and responds appropriately.

Out-of-Scope Queries:

- Scenario: User inputs a query not covered by defined intents.
- Expected Outcome: The chatbot handles out-of-scope queries gracefully, perhaps by providing a default response or expressing a lack of understanding.

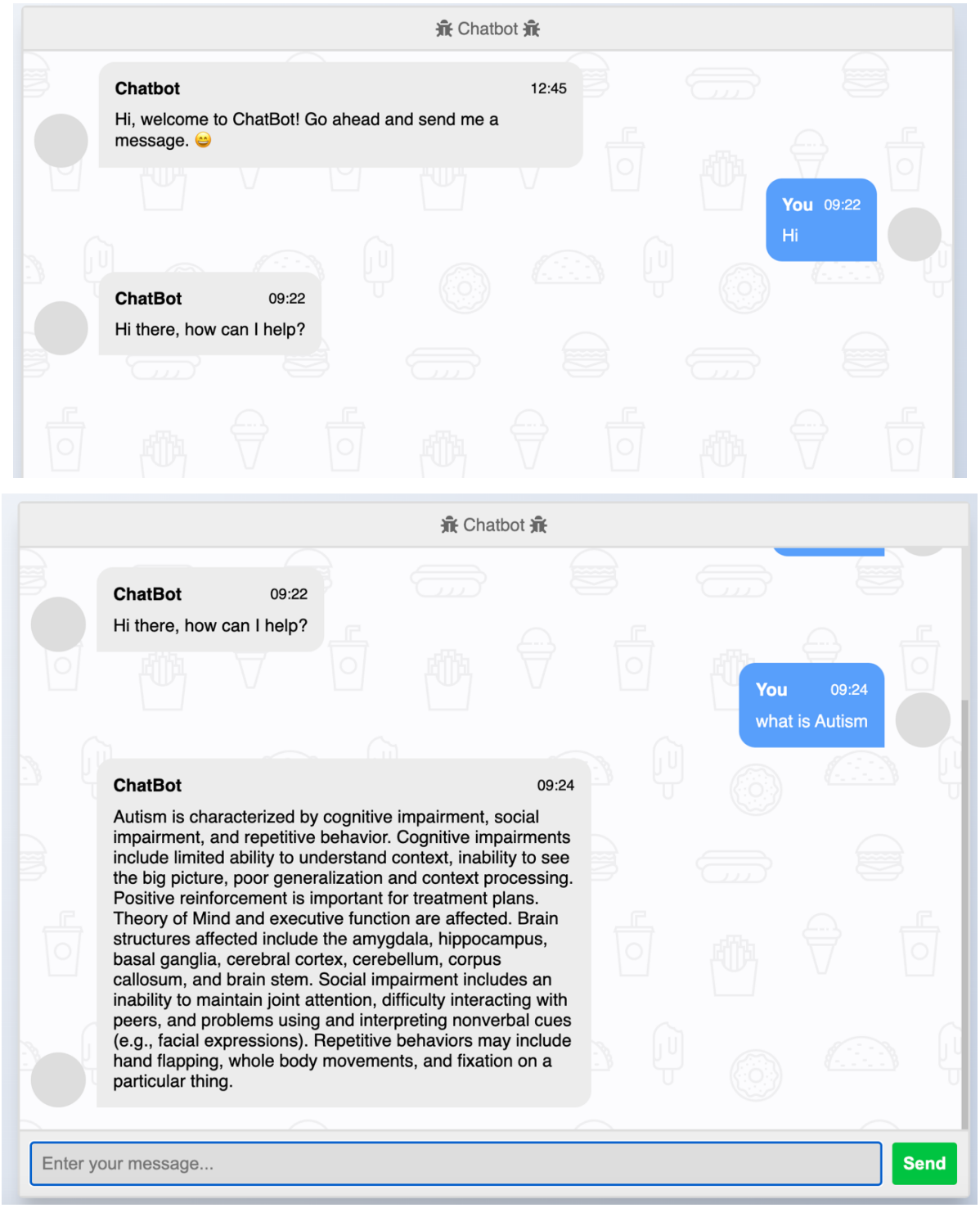

Figure 10: Tested Scenario

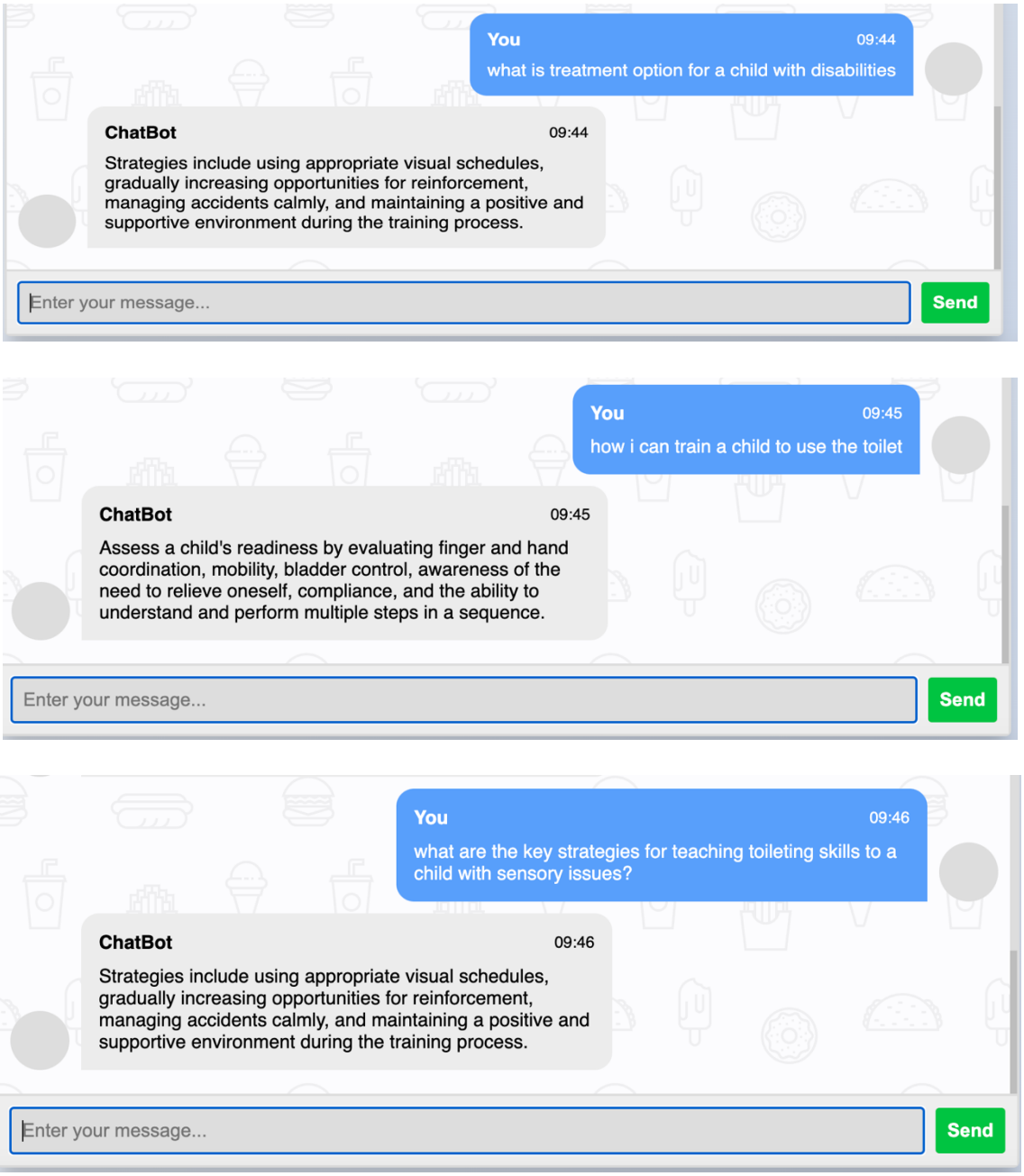

Figure 10: Tested Scenario (Continued)

Chapter 4: Conclusion

In conclusion, the research presented in this thesis highlights the need for better teacher training methods in teaching autistic children. With the increasing prevalence of autism spectrum disorder and the unique learning needs and behaviors associated with it, it is essential that teachers are equipped with the necessary knowledge and skills to provide effective education and support to these students. This study has explored the use of interactive videos as an innovative and effective way to train teachers in teaching autistic children, besides general people.

The literature review conducted as part of this research has demonstrated the importance of evidence-based practices and the need for teachers to be adequately trained in meeting the unique needs of students with autism. The study has found that traditional training methods are often inadequate and that the use of interactive videos can be a valuable tool in enhancing teacher training and improving the quality of education provided to autistic children.

The research leveraged an integrated methodology, encompassing Lean UX principles, Canva, Mindstamp, and an AI ChatBot, to develop and refine an interactive video model for teacher training in autism education. The iterative Lean UX product cycle and Mindstamp's enhanced features allowed for continuous improvement based on user feedback. The study, rooted in quantitative analysis, aimed to evaluate the effectiveness of interactive videos in teacher training, with 68 teachers participating in the survey. The observational cross-sectional study expanded the research scope, collecting data from special education and ordinary schools in the UAE. The ChatBot implementation, using a natural language processing model, served as a pivotal tool for participant interaction and data collection. This research successfully integrated innovative technologies and participant engagement to create a personalized teacher training model for working with autistic students, aligning with the study's overarching goals.

Finally, the use of interactive videos in teacher training has the potential to positively impact the education and support provided to autistic children, thereby improving their quality of life. It is recommended that further research be conducted in

this area to explore the potential of interactive videos in enhancing teacher training and improving the quality of education provided to students with autism spectrum disorder. In the end, we have answered RQ1, RQ2, and RQ3 the result of the questionnaire showed that the interactive video is useful and has a positive impact on training people.

There are several limitations to this research that should be noted. First, the results of the questionnaire were collected by a single authority, which limits their ability to be generalized. Also, the data was gathered from a small sample. In the future, studies on how teachers are trained in working with individuals with autism should be conducted with larger samples from various geographical locations—secondly, the difficulty in designing interactive videos for lack of experience. I had to search for several sites or programs that allow designing these videos for free and then learn how to use this platform.

In the current educational landscape, integrating a chatbot tutor within interactive learning environments has been successfully implemented to enhance customized teaching techniques for teachers. This innovative solution seamlessly combines the interactive learning environment with a chatbot's intelligence. Teachers can now access real-time guidance, support, and personalized responses, fostering a dynamic and customized learning experience.

This integrated approach empowers teachers to customize learning content and pace to meet the individual requirements of students, resulting in a more effective and engaging educational experience. Leveraging the technology of interactive learning and chatbot assistance, teachers can effectively address the unique needs of autistic children, advancing the delivery of education in a way that is both personalized and impactful. The current implementation signifies a transformative step forward in education, realizing the potential outlined in the initial vision for future work.

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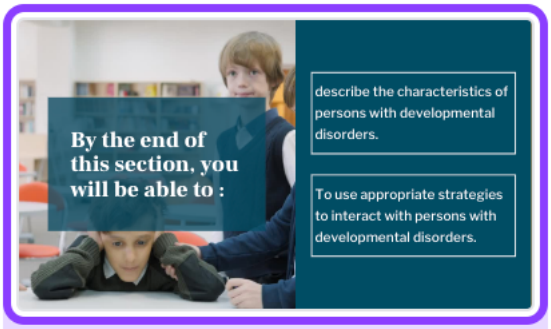
Appendices

Appendix A: Screen Shots

1



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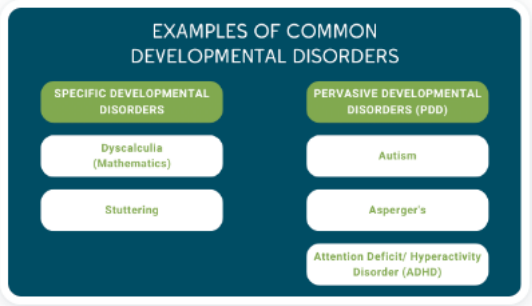

12

Appendix B: Links

https://www.canva.com/design/DAFbaGATN1E/dmRZ_zon6cjixvehAEz4Cg/watch?utm_content=DAFbaGATN1E&utm_campaign=designshare&utm_medium=link&utm_source=publishsharelink

https://video.mindstamp.io/watch/WUbmDplVzcXZ

https://forms.office.com/r/RFcyV4D6kL

https://lucid.app/lucidchart/2752256f-d689-40d1-bddf-e3f2671d5522/edit?viewport_loc=-278%2C71%2C2368%2C1100%2C0_0&invitationId=inv_5477c4c6-0793-479e-9dc5-17c4190e9071

https://drive.google.com/drive/folders/1TiqaxudUUe-rtTrPnFFr2k_mNgHZRLfV?usp=sharing

https://colab.research.google.com/drive/1kNcV3hCU4tE6XE7THCHNTusGH8EgrFbW?usp=sharing

https://www.kaggle.com/datasets/fatimaalraeesi96/benefits-of-interactive-videos-for-training

https://github.com/FatimaAhmedR/MentorMate/blob/main/Chatbot.ipynb

Appendix C: Training.py

```
import nltk
from nltk.stem import WordNetLemmatizer
lemmatizer = WordNetLemmatizer()
import json
import pickle

import numpy as np
from keras.models import Sequential
from keras.layers import Dense, Activation, Dropout
from keras.optimizers import SGD
import random

words=[]
classes = []
documents = []
ignore_words = ['?', '!']
data_file = open('data.json').read()
intents = json.loads(data_file)


for intent in intents['intents']:
    for pattern in intent['patterns']:

        #tokenize each word
        w = nltk.word_tokenize(pattern)
        words.extend(w)
        #add documents in the corpus
        documents.append((w, intent['tag']))

        # add to our classes list
        if intent['tag'] not in classes:
            classes.append(intent['tag'])

# lemmaztize and lower each word and remove duplicates
words = [lemmatizer.lemmatize(w.lower()) for w in words if w not in ignore_words]
words = sorted(list(set(words)))
# sort classes
classes = sorted(list(set(classes)))
# documents = combination between patterns and intents
print (len(documents), "documents")
# classes = intents
print (len(classes), "classes", classes)
# words = all words, vocabulary
print (len(words), "unique lemmatized words", words)


pickle.dump(words,open('texts.pkl','wb'))
pickle.dump(classes,open('labels.pkl','wb'))

```

```
# create our training data
training = []
# create an empty array for our output
output_empty = [0] * len(classes)
# training set, bag of words for each sentence
for doc in documents:
    # initialize our bag of words
    bag = []
    # list of tokenized words for the pattern
    pattern_words = doc[0]
    # lemmatize each word - create base word, in attempt to represent related words
    pattern_words = [lemmatizer.lemmatize(word.lower()) for word in pattern_words]
    # create our bag of words array with 1, if word match found in current pattern
    for w in words:
        bag.append(1) if w in pattern_words else bag.append(0)

    # output is a '0' for each tag and '1' for current tag (for each pattern)
    output_row = list(output_empty)
    output_row[classes.index(doc[1])] = 1

    training.append([bag, output_row])
# shuffle our features and turn into np.array
random.shuffle(training)
training = np.array(training)
# create train and test lists. X - patterns, Y - intents
train_x = list(training[:,0])
train_y = list(training[:,1])
print("Training data created")


# Create model - 3 layers. First layer 128 neurons, second layer 64 neurons and 3rd output layer contains number of neurons
# equal to number of intents to predict output intent with softmax
model = Sequential()
model.add(Dense(128, input_shape=(len(train_x[0]),), activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(64, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(len(train_y[0]), activation='softmax'))

# Compile model. Stochastic gradient descent with Nesterov accelerated gradient gives good results for this model
sgd = SGD(lr=0.01, decay=1e-6, momentum=0.9, nesterov=True)
model.compile(loss='categorical_crossentropy', optimizer=sgd, metrics=['accuracy'])

#fitting and saving the model
hist = model.fit(np.array(train_x), np.array(train_y), epochs=200, batch_size=5, verbose=1)
model.save('model.h5', hist)

print("model created")
```

Appendix D: Dataset


```
{"intents": [
  {"tag": "greeting",
   "patterns": ["Hi there", "How are you", "Is anyone there?","Hey","Hola", "Hello",
"Good day"],
   "responses": ["Hello, thanks for asking", "Good to see you again", "Hi there, how can I
help?"],
   "context": [""]
  },
  {"tag": "goodbye",
   "patterns": ["Bye", "See you later", "Goodbye", "Nice chatting to you, bye", "Till next
time"],
   "responses": ["See you!", "Have a nice day", "Bye! Come back again soon."],
   "context": [""]
  },
  {"tag": "thanks",
   "patterns": ["Thanks", "Thank you", "That's helpful", "Awesome, thanks", "Thanks for
helping me"],
   "responses": ["Happy to help!", "Any time!", "My pleasure"],
   "context": [""]
  },
  {"tag": "noanswer",
   "patterns": [],
   "responses": ["Sorry, can't understand you", "Please give me more info", "Not sure I
understand"],
   "context": [""]
  },
  {"tag": "options",
   "patterns": ["How you could help me?", "What you can do?", "What help you
provide?", "How you can be helpful?", "What support is offered"],
   "responses": ["I can guide you through Adverse drug reaction list, Blood pressure
tracking, Hospitals and Pharmacies", "Offering support for Adverse drug reaction, Blood
pressure, Hospitals and Pharmacies"],
   "context": [""]
  },
  {
    "tag": "developmental_disorders",
    "patterns": ["What are developmental disorders?", "Characteristics of persons with
developmental disorders", "Example of common developmental disorders"],
    "responses": [
       "Developmental disorders interrupt normal development in childhood and may
affect a single area (specific) or several areas (pervasive). For pervasive disorders, early
intervention is essential.",
       "For a diagnosis of developmental disabilities, the individual shows functional
limitations in three or more categories, including self-care, receptive and expressive
```

language, academic learning, mobility, self-direction, independent living, and economic self-sufficiency.",
"Examples of common developmental disorders include Mathematics disorder and Stuttering (specific) and Autism, Asperger's, and ADHD (pervasive)."
],
"context": [""]
},
{
"tag": "treatment_options",
"patterns": ["Aggressive treatment", "Speech therapy", "Occupational therapy", "Physical therapy", "Behavior modification techniques", "Clay therapy", "Medication"],
"responses": [
"Aggressive treatment options for developmental disorders may include speech therapy, occupational therapy, physical therapy, behavior modification techniques, clay therapy, and medication."
],
"context": [""]
},
{
"tag": "autism",
"patterns": ["Autism", "Cognitive impairment", "Social impairment", "Repetitive behavior"],
"responses": [
"Autism is characterized by cognitive impairment, social impairment, and repetitive behavior. Cognitive impairments include limited ability to understand context, inability to see the big picture, poor generalization and context processing. Positive reinforcement is important for treatment plans. Theory of Mind and executive function are affected. Brain structures affected include the amygdala, hippocampus, basal ganglia, cerebral cortex, cerebellum, corpus callosum, and brain stem. Social impairment includes an inability to maintain joint attention, difficulty interacting with peers, and problems using and interpreting nonverbal cues (e.g., facial expressions). Repetitive behaviors may include hand flapping, whole body movements, and fixation on a particular thing."
],
"context": [""]
},
{
"tag": "math_disorder",
"patterns": ["Mathematics disorder", "What is math disorder?", "Math difficulties", "Math learning problems"],
"responses": [
"Mathematics disorder, also known as math disorder, refers to difficulties in learning and performing mathematical calculations. It can affect a person's ability to understand and work with numbers. Early intervention and personalized strategies can help individuals with math disorders improve their math skills."
],
"context": [""]
},

```
{
   "tag": "toilet training",
   "patterns": ["What is the definition of toilet training", "What is toilet training"],
   "responses": ["Toilet training is teaching a young child to use the toilet for urination or defecation."],
   "context": [""]
},
   {
    "tag": "key_steps",
    "patterns": ["What are the key steps in the process of toilet training?"],
    "responses": ["The process involves assessing a child's readiness, gathering information about the child's schedule and elimination habits, preparing necessary materials, scheduling regular sittings, and using a chart to monitor progress."],
    "context": [""]
   },
   {
    "tag": "assess_readiness",
    "patterns": ["How do you assess a child's readiness for toilet training?"],
    "responses": ["Assess a child's readiness by evaluating finger and hand coordination, mobility, bladder control, awareness of the need to relieve oneself, compliance, and the ability to understand and perform multiple steps in a sequence."],
    "context": [""]
   },
   {
    "tag": "gather_info",
    "patterns": ["What information should be gathered during the preparation phase?"],
    "responses": ["Gather information about the child's schedule, preferred timings for toilet training, and elimination habits."],
    "context": [""]
   },
   {
    "tag": "prep_materials",
    "patterns": ["What materials are needed for preparation?"],
    "responses": ["Prepare materials such as loose-fitting shorts, a timer, cloth or wet wipes for cleaning up, and a visual schedule."],
    "context": [""]
   },
   {
    "tag": "scheduled_sittings",
    "patterns": ["What is the significance of scheduled sittings in toilet training?"],
    "responses": ["Scheduled sittings involve bringing the child to the bathroom at regular intervals, predetermined intervals (initially around 30 minutes), and requiring the child to sit at the toilet or potty for about 5-10 minutes."],
    "context": [""]
   },
   {
    "tag": "toileting_sequence",
```

```
    "patterns": ["What behaviors are involved in the toileting sequence?"],
    "responses": ["The sequence includes removing shorts, lifting the toilet seat cover, sitting on the toilet seat, praising and rewarding the child for correct elimination, dressing up, washing hands, and continuing with the activity prior to the scheduled sitting."],
    "context": [""]
  },
  {
    "tag": "accident_management",
    "patterns": ["How can accidents during toilet training be managed?"],
    "responses": ["Accident management involves giving verbal disapproval, prompting the child to clean up, changing into a new set of clothes, cleaning up the mess, and continuing with the routine without scolding or nagging."],
    "context": [""]
  },
  {
    "tag": "considerations_accident",
    "patterns": ["What should be considered during accident management?"],
    "responses": ["Use hand-over-hand assistance from behind the child, maintain silence during the procedure, do not make cleaning enjoyable for the child, and avoid scolding or nagging."],
    "context": [""]
  },
  {
    "tag": "visual_schedules",
    "patterns": ["How can visual schedules aid in teaching toileting skills?"],
    "responses": ["Visual schedules display what is happening during an activity, helping decrease anxiety and difficulty with transitions by clearly informing the child when certain activities will occur."],
    "context": [""]
  },
  {
    "tag": "strategies_sensory_issues",
    "patterns": ["What are the key strategies for teaching toileting skills to a child with sensory issues?"],
    "responses": ["Strategies include using appropriate visual schedules, gradually increasing opportunities for reinforcement, managing accidents calmly, and maintaining a positive and supportive environment during the training process."],
    "context": [""]
  }

]
}
```

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Teachers should be aware of how to develop effective teaching methods for students with autism. To achieve the best results, teachers need to thoroughly understand autism and the teaching methods and modifications that work best for these students. This thesis is concerned with training teachers' methods of teaching autistic children, using interactive videos to improve the level of education. The main objective of this thesis is to improve teachers' training in teaching autistic children using interactive videos.

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