Use of Assistive Technology, the keyboard as an alternative pencil in the special education class room: An Investigative Study

إستخدام التكنولوجيا المساندة ولوح المفاتيح كقلم بديل في فصول التربية الخاصة: دراسة استقصائية

by

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ABSTRACT

This research study explores the impact of using the keyboard as an alternative pencil in the special education classroom. Assistive Technology (AT) plays a huge role in the academic achievement for students with disabilities. This study documents the benefits of using a keyboard as opposed to traditional writing tool of a conventional pencil. The findings indicate that when students with limited fine motor abilities are trained to use the keyboard as an alternative pencil, there is an increase in academic achievement with respect to advanced writing skills and an increase in student engagement and independence. The teacher plays an important role in selecting the most appropriate AT for the student. When making a decision of using AT for the student, the teacher should not delay but consider the unique, individualized needs of the student and select what's best suited for him in order to help him move forward.

Keywords: assistive technology, students with disabilities, special education, keyboard

الخلاصة

تركز هذه الدراسة البحثية على أهمية إستخدام لوح المفاتيح كقلم بديل في صفوف التربية الخاصة حيث تلعب التكنولوجيا المساندة دوراً كبيراً في تعزيز المهارات الأكاديمية للطلاب من ذوي الإعاقة، وتوثق هذه الدراسة فوائد إستخدام لوح المفاتيح كأداة ووسيلة بديلة عن طريقة الكتابة التقليدية حيث تشير النتائج إلى أنه عندما يتم تدريب الطلاب ذوي القدرات الحركية الدقيقة المحدودة على إستخدام لوح المفاتيح كقلم بديل، سوف يكون هناك زيادة في التحصيل الأكاديمي ذات العلاقة بمهارات الكتابة المتقدمة وزيادة مشاركة الطلاب وإستقلاليتهم، وتلعب المعلمة دوراً مهماً في إختيار وسيلة التكنولوجيا المساندة المناسبة للطالب، وعند إتخاذ قرار باستخدام التكنولوجيا المساندة، يجب على المعلم ألا يتأخر ولكن عليه أن يأخذ بعين الإعتبار الحاجات الفردية للطلاب وإختيار ما يناسب الطالب لمساعدته على التقدم الى الأمام.

DEDICATION

To the many students I have interacted with throughout my career, you have enriched my life and made it more meaningful.

To God almighty and our dearest Mother Mary for guiding me and inspiring me to complete this project.

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LIST OF ABBREVIATIONS

ADEK – Abu Dhabi Department of Education and Knowledge

ASD – Autism Spectrum Disorder

CDC – Centers for Disease Control and Prevention

CLDS – Centre for Literacy and Disability Studies

ICT – Information and Communication Technology

ID – Intellectual Disability

IDEA – Individuals with Disabilities Education Act

IEP – Individual Education Programme

KHDA – Knowledge and Human Development Authority

MOE – Ministry of Education

OECD – Organization for Economic Co-operation and Development

SEN – Special Education Needs

WHO – World Health Organization

UAE – United Arab Emirates

UDL – Universal Design for Learning

UNESCO – United Nations Educational, Scientific and Cultural Organization

Chapter I

Introduction

1.1 Background

The main goal of education is acquisition of adequate reading and writing skills. Acquiring reading and writing skills goes hand in hand for a young student. Exposure to the alphabet and letter sounds leads to reading while handling of a writing tool and formation of letters leads to writing.

Processing of individual letters is a key factor in the acquisition of reading skills. Promptness and precision in naming letters in the preschool years leads to good letter-sound association. When a young child writes, he writes one letter at a time, where he is processing motor information with visual information about the individual letter. (James & Engelhardt, 2012).

It is extremely important to learn to write in order to participate in academic instruction in educational institutions as well as to follow a lucrative career in the later stages of life. Writing is a universal form of social interaction, to express oneself and also to learn new skills. Most people engage in some or the other form of writing like writing notes in the classroom, writing reports with pencil and paper, text messaging, emails, posting on social media, etc.

Students learn to write for different motives, from communicating with others through letters, text messages, or emails, to being able to express their feelings and thoughts. They need to become excellent writers, as writing is the main form of instruction in schools and universities. Those facing inabilities to write confidently may encounter difficulties in advanced learning stages (Graham & Perin, 2007). Beyond their education, they are expected to have basic written skills as most jobs

require written communication and this dictates whether they will be hired or promoted in their field of work. It is therefore of tremendous importance that students achieve this life skill.

Experiments have shown that when children are given opportunities to explore letter shapes or trace them with their fingers, it improves cognitive skills. Montessori schools follow this style where they encourage children to trace the wooden or sandpaper letters and simultaneously say the sounds of the letters. (Mangen & Balsvik 2016).

Handwriting is a complex skill, following a sequence of pre requisites that are essential for writing to take place. Fluency in handwriting is the result of the growth and development of cognitive, visual-perceptual and fine motor skills. These movements have to be synchronized with proper sensory feedback. Visual perceptual skills including figure ground perception, spatial relations and visual discrimination helps the students to discriminate the letters and their proper positions on the paper. Fine motor skills are necessary to manipulate the pencil to produce letter forms with a coordinated effort on part of the fingers, arm and hand movements. (Tzeng & Chow, 2000). The child needs to be proficient in fine motor skills and identification of letters. Initially, the handwriting movements are slow as there are pauses between the letters strokes as the child needs to concentrate on the letter shape formation.

Poor handwriting are results of slow speed or illegible handwriting. Frequently expressed handwriting issues are due to improper formation of letters, incorrect position of letters, reversals, inappropriate letter size, uneven spaces between letters and words, and sluggishness while writing. Poor fine motor control effects the writing outputs as the students are unable to control their finger movements and this results in illegible and slow handwriting. Slow writers are often lagging behind

in the classroom as they are unable to complete their writing tasks in the given time frame. (Tzeng & Chow, 2000).

Studies have shown that handwriting difficulties interfere with academic performance. Many a times, students grow out of it with extra practice and guidance. However, sometimes the handwriting of some students remains ill formed and the students struggle to produce it. This inability to form letters is dysgraphia. These students have difficulties in organizing and expressing their thoughts and ideas through the written form. They tend to focus more energy on the handwriting process rather than on the content and quality of the written matter and they tend to write fewer words just to get the process over and done with. (Broun, 2009)

Since ages, learning to write involved writing upper and lower case manuscript letters, followed by cursive writing. In recent classrooms, with the introduction of Information and Communication Technology (ICT), many students get exposed to writing letters in various keyboards; probably on the phone or tablet or laptop and may or may not be expected to write using the traditional pencil and paper. They may or may not get training in writing using pen and paper in the initial stages as exposure to these items may be limited. (Mangen & Balsvik, 2016). This is a constant dilemma for researchers as to when to begin training children in writing on the computer. Studies have shown that writing by hand improves letter learning and memory. On the other hand, studies have shown that motivation to learn letters is higher when digital media is used. (Arndt, 2016).

Both the modes of writing: handwriting and typing, are used to communicate but they differ with respect to the tools used. Handwriting is an activity where a person uses one hand only to write with an instrument – the pencil; while typing requires the person to use both his hands to type on the instrument – the keyboard. When using a pencil and paper to hand write, the person has to pay

attention to the tip of the pencil for the correct formation, size and spacing of the letters while in typing, the person pays attention to the keyboard and the screen. While hand writing, the person has to form each individual letter on his own with his pencil; while in typing he clicks a letter on the keyboard and the letter is formed on the screen. (Wollscheid et al 2016).

Studies have shown that digital writing (typing) is increasingly being using at school in many countries, while handwriting, particularly cursive writing is rarely being taught in schools in some countries. In the United States, some state schools have replaced cursive writing with keyboard writing; along with print writing using pen and paper. In Finland, some schools have begun teaching hand writing on paper along with writing on the keyboard while learning upper and lower case letters in preschool. (Wollscheid et al 2016).

In the current age of advanced technology, the possibility that typing on a keyboard will soon replace handwriting raises a question of the need for handwriting skills. Child psychologists have argued over the years, promoting the worth of hand writing against typing in expediting writing and reading development in young children. They are of the opinion that only handwriting letters fully activates the brain processes which are essential for writing and reading as opposed to typing and tracing. (ASW SI Editorial, 2018).

This research study aims to highlight the urgency for a student with disability to move from being an emergent writer using a conventional pencil to a writer using an alternative pencil of a keyboard and the advantages of using it in a special classroom. In the mainstream classroom, there are many students who are not permitted to use the keyboard for writing tasks, in spite of the student being unable to use a conventional pencil to write efficiently or legibly. This research study is of personal and professional concern to the researcher as she specializes in this field. The reasons for choosing

this topic as a focus for research are threefold. Firstly, as a special educator, working in a Centre for Persons with Disabilities in Dubai (UAE), there is an ongoing stress about achieving the goals for individual students with disabilities. Secondly, there was a mounting apprehension that some students needed to find alternatives to writing with the conventional pencil. Thirdly, the need for inclusion of students with disabilities in the mainstream schools in Dubai needs to be achieved at the earliest. Hence this research study enabled the researcher to gain more insight on this topic. The objective of this research was to enlighten this issue to contribute awareness in the professional community.

1.2 Purpose of the Research Study

According to the Individuals with Disabilities Education Act (IDEA, 2004), students with disabilities have the right to obtain essential curricular adaptations which would include accommodations and modifications, so that they experience success in learning. In such a situation, training the student to use an alternative pencil of keyboard will help him to be part of the inclusive classroom as well as show progress in his writing and reading skills simultaneously.

Poor handwriting skills directly affects students' academic performance which leads to lower self-esteem and low self confidence in doing other activities. (Shen, Lee & Chen, 2012).

Keeping in mind the need and urgency for the student with disabilities to progress in writing skills, it is imperative that the teacher make the decision to find the most appropriate alternative pencil for the student. Children are exposed to writing on a keyboard frequently in the classroom and at home, which makes keyboard writing all the more imperative to discover.

This study focused on one student in a Rehabilitation Centre in Dubai (UAE). It focusses on the struggles that a student with writing difficulties has to experience in the initial years of schooling. Additionally, it aims at making educators and parents aware of existing assistive technologies available in the market which would help the student to progress. This will assist the educators in making the right decision of helping the student to progress to the keyboard as an alternative pencil in order to make them independent in the writing process. The researcher hopes that the recommendations for future research offered by this study will help educators in the field.

1.3 Research Questions

This research intends to find the answers to the following questions:

1. What is the impact of using an alternative pencil?
2. What are the benefits of using keyboard as an alternative pencil?

The research study expects to investigate the scope of using an alternative pencil. To research this, the triangulation design of qualitative research will be used which will involve a semi structured interview, along with observations and a case study. The setting for this research will be conducted in one Rehabilitation Centre for persons with disabilities.

1.4 Rationale of the Research

Writing is one of the most fundamental processes of communication in our society; however substantial research on the production of writing language is limited. Students spend most of their days in the school environment yet how they acquire writing skills is still being studied. Mastery of writing skills is of critical importance if they have to meet the grade expectations of the class. Most of the class tasks like performance on tests and examinations are time bound. Studies have shown

that most young students become fluent hand writers by 6 or 7 years of age; yet handwriting difficulties are seen in many preschool and special education classrooms. Hence, occupational therapists play an important role in remediation of hand writing difficulties. (Tzeng & Chow, 2000).

A writing assessment conducted by the National Assessment of Educational Progress indicates that only 27% of students performed at or above a skillful level in writing (National Center for Educational Statistics, 2012) while many of those struggling with writing were students with Autism Spectrum Disorder (ASD).

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder described by shortfalls in social communication and the incidence of limited interests and repetitive actions. (Diagnostic and Statistical Manual of Mental Disorders—5th edition)

The World Health Organization (WHO) approximates the global occurrence of ASD at 0.76%. The Centers for Disease Control and Prevention (CDC) approximates about 1.68% of children (or 1 in 59 children) are diagnosed with ASD in the United States of America.

Difficulties in writing is a key deterrent in giving students the freedom to translate their ideas and express their thoughts in the written form. Studies conducted by Rosenblum, Weiss and Parush, in 2004 with third grade students in Israel, showed 10 – 30% of the students have writing difficulties. Similarly, a study carried out in Netherlands by Smits-Engelsman, Van Galen and Michels in 1995 found that 11% of girls and around 21 – 32% of boys struggled with writing in primary school. (Kandel & Perret, 2015).

Many research studies on using assistive technology have proved that professionals must have the essential expertise and awareness on using Assistive Technology (AT) in order for it to be used

successfully with children with disabilities. The teacher should be a participant in the selection of the AT for the student and should possess the necessary skills for the smooth implementation and evaluation of the device. However, it has been noticed that teachers are hesitant to use technology due to insufficient training and support in using the device.

It has been observed that writing on a computer has become the new normal in most universities and workplaces. Students find writing on a computer for conducting their research most useful. On the other hand, psychologists are of the opinion that students would benefit from hand writing as against typing in assisting reading and writing development in young children. It was found that while compared to typing and tracing letters, writing letters is the component that activates the regions in the brain that are needed for reading and writing.

In this research, the researcher studies the use of the alternative pencil for a student on the Autism Spectrum Disorder. An alternative pencil, developed at the Centre for Literacy and Disability Studies (CLDS), is defined as something that offers a student with an instrument to use all the 26 letters of the alphabet while writing. (Hanser, 2010) This gives students an opportunity to develop writing skills by giving the access to different support systems for writing. The emergent writer is given access to all the 26 letters of the alphabet; he selects the letter he wants (irrespective of the fact that he is able to identify the letter or no) and meaning is ascribed to the words that the student has written.

This research study strives to investigate the impact of using an alternative pencil. According to the Center for Literacy and Disability Studies, University of North Carolina; writing forms an important element of a student's routine educational instruction. Hence, in order for students with disabilities to progress as readers and writers, writing is of utmost importance. However, this becomes

challenging when most students with disabilities do not possess the skills to use a pencil or form letters with it, specifically if they have had years of trying to write with the pencil, then we need to explore an alternative pencil for fulfilling their writing goals. This will provide them with prospects to progress in their literacy skills and reduce the gap in performance between them and their peers. For such students, an alternative pencil can suggest a means of writing and can be utilized by writers of different capacities and ages including students who are emerging writers and those who are able to write more conventionally (Browder & Spooner, 2011).

This research study also strives to investigate the benefits of using the keyboard as an alternative pencil. Learners, may find that using AT helps them become more independent in their educational experience and improves their self-esteem as they are now able to complete tasks that they were unable to accomplish earlier. In order to write a letter of the alphabet, the child requires to grip the pencil with an appropriate grasp, apply a reasonable quantity of pressure, synchronize fine motor movements, simultaneously remembering the motor pattern for that letter. Computers have numerous benefits over pencil – paper tasks for the student who finds it difficult to write a letter, where he is only required to isolate a finger, recognize and find the letter on the keyboard and press the key. When typing, there is no page for him to hold and the letters typed are neat and legible and this definitely is a big boost to his confidence and willingness to write. (Pollock & Missiuna, 2012)

1.5 Conducting the Research

This study focused on one student in a Rehabilitation Centre in Dubai (UAE). The student is on the Autism Spectrum Disorder. He has limited fine motor skills and hence the inability to use the conventional pencil appropriately. His writing activities were observed over few sessions. The

observations had to be done during online sessions as the Centre was closed due to the COVID 19 pandemic.

1.6 The UAE Context

The United Arab Emirates (UAE), is a federation of seven emirates beside the eastern coast of the Arabian Peninsula. Abu Dhabi, the capital is the largest of the emirates and encompasses more than three-fourths of the federation's total land area. Dubai, the commercial and financial centre of the UAE, has numerous multinational corporations and skyscrapers. The other emirates are Sharjah, Ajman, Umm al-Quwain, Ras al-Khaimah and Fujairah. Most of the entire country is a desert with large expanses of sand. The UAE has a hot and humid climate. There are many oases in the UAE, where date palms are grown and goats, sheep, camels, cattle and poultry are domesticated. Arabic is the official language of the UAE. Only one-ninth of the emirates' residents are citizens, with the majority being expatriates. With a large number of expatriates, being Asian, and coming to the UAE for work, a lot of families tend to enter and exit UAE depending on the availability of their jobs. Hence the need for educational institutions will always be there, with constant need for schools and Centres that cater to the needs of persons with disabilities.

1.7 Current Educational Practices in Dubai

The education system in the UAE has been experiencing an era of outstanding reforms. As part of the Organization for Economic Co-operation and Development (OECD) and United Nations Educational, Scientific and Cultural Organization (UNESCO), they have developed reforms to provide access and to improve the quality of education around the world. This has led to an

enormous growth in the number of learning establishments in the UAE, thus ensuring that happiness, quality of life, liberation, self-respect and safety of its people is maintained.

Sheikh Zayed Bin Sultan Al Nahyan, the first president of the UAE proposed education to be the main component of a modern economic society and has rightly said that the greatest wealth that could be achieved would be to invest it in creating educated and trained future generations. This is echoed in the UAE's existing strategic Education Plan for 2017-2021 which strives to increase the upper secondary graduation rate to 98 percent and to advance the UAE's ranking in the OECD.

The Ministry of Education (MOE) oversees all forms of education, from basic education to college studies. It sets the syllabi, admission criteria and the graduation requirements in the schooling system. However, the emirates also have their own governing bodies like Dubai's Knowledge and Human Development Authority (KHDA), or Abu Dhabi's Department of Education and Knowledge (ADEK) which are overseen by the federal MOE.

This research topic is also currently relevant to the topic of inclusion in the United Arab Emirates where the National Project for Inclusion of People with Special Needs was propelled in 2008 under the motto 'Our Life is in Our Integration' which stresses the importance of providing an appropriate setting and services for people with disabilities in order to smoothen their practical admission to the learning arrangement. The National Project for Inclusion aims at accomplishing a comprehensive assimilation of people with disabilities into the society at the societal, educational, wellbeing and conservational levels. The UAE has made giant steps to embrace people with disabilities in the mainstream educational settings. The Ministry of Education offers skilled teachers who specialize in working with children with disabilities. The emphasis on inclusive education is part of the wider visualization for Dubai to develop into a completely inclusive city by the year 2020. As part of the

'My community… a city for every one' enterprise and Dubai Disability Strategy 2020 which intends for Dubai to develop into a disability-friendly city by 2020, KHDA launched the Dubai Inclusive Education Policy Framework. The framework offers immense data on the necessary criteria in the field of education and proposes clear direction on the arrangements to be made to guarantee the delivery of excellent inclusive facilities for students with disabilities.

1.8 Organization of the Chapters

This research paper has six chapters with two appendices. This chapter focuses on the background and the rationale for conducting the study while chapter two highlights the research design and methodology used to conduct the study. Chapter three highlights a review of literature with key definitions for the terminologies used in this research study. Chapter four includes the findings of the research from the observation and interviews conducted, along with the case study of the candidate. The conclusion and recommendations are discussed in chapter five and it concludes with suggestions for future research practices in chapter six.

Chapter II

Methodology

2.1 Introduction

This chapter reaffirms the two prime research questions proposed by the researcher. This includes a description of the society that is being researched, followed by a section on the rationale for the research methods used in the study. These are followed by sections on the research design, the research questions, the site and participants and the data collection techniques used for the study. The next sections examine the methodological issues like validity, feasibility, accessibility and ethical concerns. The final section notes the limitations of the data and findings.

2.2 Description of the researched society

This research study will prove beneficial to students with disabilities, especially students with fine motor difficulties and those who are on the Autism Spectrum. The main participant for the study was selected from a Rehabilitation Centre for persons with disabilities. This Centre caters to students with varying disabilities trained by professionals of different nationalities with proficient degrees in their respective professions. The average class consists of 10 students with a teacher, assistant teacher, teacher aide and helper.

2.3 Research Design

The researcher will be using the qualitative research paradigm of Interpretivism to understand the research problem more completely. The researcher will able to observe the student using the alternative pencil of keyboard in the classroom set up as the interpretive paradigm allows researchers

to interpret the world through the opinions and involvements of the participants. While answering the research questions, the researcher who follows the interpretive paradigm will utilize those views to build her understanding from gathered data.

This research study investigates the impact of using a keyboard in a classroom. The researcher has selected the qualitative research method to conduct the study, using semi-structured interviews and observation and case study. This method aids in augmenting the consistency and soundness of the research discoveries. Qualitative research offers a chance to collect exhaustive data about people, situations or occurrences. (Creswell 2008).

This qualitative research conducts an intense investigation into the research setting to acquire an in-depth understanding about the way things are, why they are that way and how the participant in the context perceives them. In order to accomplish a comprehensive understanding of the phenomenon, the researcher must take on a persistent in-depth, in-context research so that the study is thorough. (Mills & Gay, 2016) This research focuses on a person and his method of written communication in the case study.

2.4 Research Questions

This research intends to find the answers to the following questions:

1. What is the impact of using an alternative pencil?
2. What are the benefits of using keyboard as an alternative pencil?

2.5 Site and Participants

The setting for this research will be conducted in a Rehabilitation Centre catering to students with disabilities in the UAE. The reason for choosing the special education classroom as the site of the

study is because some of the students are already using the keyboard as an alternative pencil in the Centre. The researcher is aware of this class as she is employed in the same Centre. Interpersonal issues were sorted out when the researcher convinced the management that she was trustworthy and sensitive to ethical issues. The main participant was a student in the classroom who has been introduced to the keyboard. The class has 10 students, in the age group of 8-12 years. The students have various disabilities like autism, Down's syndrome and Cerebral Palsy. The participant has been diagnosed with Autism Spectrum Disorder and has been struggling with writing issues.

2.6 Methods of Data Collection

Data was collected using qualitative methods. This method was used to gain an insight into the use of assistive technology by the student. The data was collected in a natural setting in the class set up. Qualitative research involves the collection of plenty of descriptive and graphic information over a period of time and in a regular situation. These two characteristics of qualitative research help in explaining the growing use of qualitative research in educational practices. (Mills & Gay, 2016)

As the research study was carried out during the COVID 19 pandemic, the observations were done on an online platform. The selected student was observed in his class with his peers and teachers during distance education sessions. He was observed while doing his work in front of the computer in his home setting.

The parent, class teacher and the occupational therapist working with the student were interviewed to get a global idea of his need for the assistive technology device.

Data gathering systems used in this study were observation, interview and case study. As specified by Cresswell (2008), the data assemblage in qualitative methods is characteristically widespread,

drawing on numerous sources of material such as observation, interview and case study. Observation of the participant can be used for amassing information on naturally occurring behaviors in their day to day environment. Interviews are ideal for assembling data on an individuals' viewpoints, and capabilities, predominantly when delicate matters are being discovered. Case study involves a comprehensive, thorough learning of an individual, resulting in a narrative description of his behavior or experience. Thus, using these data collection methods will enhance the ability to gain an insight into the use of the keyboard as an alternative pencil. Each technique is described below.

2.6.1 Observation

The first instrument to be employed for gaining information was observation of the participant in the class room. Cresswell (2008) states that, observation is an instrument of collecting data that helps to obtain a comprehensive picture of the situation. Therefore observation was used, in order to obtain a complete representation of the participant using the keyboard.

There are numerous kinds of observation and this study employed direct observation where the observer is present and individually screens what occurs. The observer is also permitted to move spaces, alter the emphasis of the observation, or focus on unforeseen actions if they should arise. To help the researcher to observe all the classroom activities involving the use of keyboard by the participant, non-participant observation by video recording was used in this study. As a non-participant observer, the researcher remains discreet during the observation which is found to be useful in research. (Creswell 2008). Fraenkel and Wallen (1993) state that one of the strengths of the video recording is that it can be replayed for several times in order to check and clarify the data. Since the observation was conducted during the pandemic, all on site classroom sessions were suspended and the participant was observed via the online distant education sessions.

The classroom observations were conducted four times during the class sessions, for a period of one hour each. An observation sheet (Table 2.6.1a) was kept, containing a tabular form for the day, date, time, place and session. A second observation sheet (Table 2.6.1b) to record the participant's activities on the keyboard was maintained involving a tabular form indicating the session, the activity and the performance level of the participant in using the keyboard. Field notes were maintained which consisted of materials gathered, recorded and compiled during the course of the study. These notes consisted of what the researcher had observed during the sessions and her personal reactions to the observations. These field notes were later analyzed to provide the narrative and understanding of the stetting and the participant.

2.6.2 Interview

The second instrument proposed for this study is the interview. According to Mills & Gay (2016), an interview is a focused interaction in which the interviewer obtains information from the person being interviewed. It was employed in order to gain information that cannot be revealed in classroom observation, such as mind, thought and feeling of the participant, their teachers and parents. (Merriam, 1998) The participants involved in the interview process were the parents, class teacher and the occupational therapist. The information was gathered over a one hour session through a set of questions. A recording of the interview was transcribed to gather information on the participants' responses.

An interview is the procedure of obtaining data for the precise objective of the study by suggesting some interrogations to the respondent initiated by the interviewer. The researcher conducted the study, using semi-structured interviews of students, teachers and parents with open ended question forms. Semi structured interviews were selected in order to keep the meeting more relaxed and in a

natural environment to get more information on the student. The interviewer and respondents involved in a formal interview where the interviewer established and made use of an 'interview guide' which is a list of questions and issues that was required to be covered throughout the discussion, in a precise sequence. The interview questions were consistent for each participant. (Appendix B) The researcher developed rapport with the respondents which consisted of the parent, the class teacher and the occupational therapist working with the student. Each participant was assured that their participation was voluntary and anonymity was guaranteed before the commencement of the interview process. Each participant was met alone in an online platform, in order to ensure that their responses were well recorded. The interviewer took down notes when the interview was being conducted. Advantages of semi-structured interviews are that the enquiries can be organized in advance which permits the interviewer to be ready and seem capable through the interview. Semi-structured interviews also permit informants the liberty to articulate their opinions. Semi-structured interviews can offer consistent, comparable qualitative data; however they do have their own share of disadvantages. Interviewing skills and data analyzing skills are required by the interviewer. Also the set of questions need to be prudently prearranged so as not to make the questions rigid or leading. It is also found to be a time consuming process and resource intensive.

2.6.3 Case Study

The third instrument proposed for this study was the case study. The case study was used to find meanings of real life issues and is able to answer how and why or less frequently what research questions (Merriam, 2009; Yin, 2014). Case studies are commonly used to collect exhaustive data

in a regular situation where the researcher does not control the trials in a real life context. The researcher proposes to use a case study of the participant in the educational location to discover the progress of writing skills using the keyboard. There are numerous kinds of case study methods. The illustrative method of case study was used to "illustrate" or describe the situation in the educational setting so that people can become more familiar with an alternative pencil and become familiar with the associated terminology. Advantages of case studies are that they are more adaptable than numerous other categories of research and permit the researcher to learn more about the research topic. The researcher was able to probe deeply and use many data sources to get a real idea of the research topic. The data was collected under normal situations and could lead to the creation of new hypotheses that could be tested later. However, some of the drawbacks was that the researcher was not be able to replicate the data due to its exclusivity. Case studies have some approximate level of prejudice and researcher favoritism may be an issue.

2.7 Methodological Issues

2.7.1 Data Analysis

After gathering the data through interviews, observation and case study, it was analyzed by descriptive qualitative data analysis. An analysis was used that was appropriate for reviewing the need for keyboard.

2.7.2 Data Validity

Data was critically evaluated to define its reliability and validity. By 'reliability', we refer to the uniformity of the results, while 'validity' refers to the steps taken to measure the results. The

researcher ensured the trustworthiness of the data by addressing the credibility, transferability, dependability and confirmability of the material collected. (Mills & Gay 2016) The validity of the study was ensured by persistent observation and triangulation. The data obtained from the three tools was cross checked by means of triangulation. Triangulation can aid the researcher to discover the deduction of the consequences amongst different research instruments. (Fraenkel and Wallen 1993) The research study expects to investigate the scope of using an alternative pencil. The study aims to answer two specific questions. The first one being the impact of using an alternative pencil. It also looks at the benefits of using the keyboard as an alternative pencil.

2.7.3 Feasibility

The feasibility of the triangulation design is determined by, the researcher's skill and how adept he is at utilizing qualitative methods. Furthermore, gathering data and recording and using it can also prove to be a challenging and cumbersome task. (Creswell 2008).

2.7.4 Accessibility

The researcher conducted the case study on the participant in her school; however due to the current distant education mode, she had to rely only on video recordings of the participant for her observation records.

Additionally, some of the barriers to assimilating assistive technology into the classroom would comprise teachers who are not always willing, skilled, or contented with altering their instructional approaches to accommodate students with disabilities and they might also find it difficult to ensure that the device is in proper working condition at all times due to advancements in technology.

2.8 Ethics

A keen attention to ethics was considered throughout the duration of the study. The study extended outstanding admiration to the participants and the location of the research study as well as ensured that the complete research is conducted in an impartial and reliable style (Creswell 2008). Ethical clearance for the project was obtained from the relevant educational authorities, the participant, the teachers and the parents of the participant prior to conducting the interviews, classroom observation and the case study. Moreover, the agreement ensured that the contribution is intentional with a provision for the participants to pull out of the study if they feel like doing so. Furthermore, privacy of the participants was guaranteed and secrecy of data upheld. Similarly, the participants' personal information such as their name, age, sex, email address or telephone number has not been disclosed while reporting the findings of this research. The protection and accessibility of the data stored in the researcher's computer was ascertained. The purpose of the research study was clearly clarified to the participants at the onset.

2.9 Methodological Challenges

The topic of the research study is of great interest to the researcher. The researcher feels that involving more than one participant for the study would have been more helpful. As a result, the findings of this study cannot be generalized. This research study was not able to reach students from a mainstream education set up. It would have been interesting to get information on how students in the inclusive class are using assistive technology. After all, the ultimate goal for a student with disabilities is to function meaningfully in the inclusive set up. Considering that the student in the inclusive class would use the keyboard as his alternative pencil, this would definitely involve counseling for the student as he would have to function using the AT in a class of neuro typically developing students. Additionally, it would be interesting to see the impact of the AT device with a

student in the secondary level, who has been using the device for some years. The limited time frame is also a major restraint in the study. Hence only one student was selected in order to speed up the process. The participants could also involve students with different disabilities which would add weightage to this study.

Chapter III

Literature Review

3.1 Introduction

Writing is a complex skill, whether by hand or keyboard and involves the coordination of fine motor processes, visual perceptual skills and cognitive skills. Research on whether a child should be taught to write using hand or keyboard has been carried out over the years. Cognitive-psychological studies proved that writing with customary writing tools like pen / pencil and paper is more beneficial than digital writing tools like computers and tablets. Some studies favored keyboard for writing individual letters while they favored pen and paper for other writing tasks like essay writing. Neuroscience studies favored handwriting over keyboard writing as they felt that the motor processes involved in modeling the letters by hand facilitated letter perception. Studies in a sociocultural perspective focused on "learning to read by writing" and they found it more advantageous to write on the keyboard rather than by hand. The objective of this programme focused on teaching handwriting only when children had acquired adequate fine motor skills. So, teaching handwriting was postponed to Grade Four in these schools instead of Grade One and children were given freedom to explore writing letters and words on the keyboard till then. (Mangen & Balsvik 2016). Visual processing of letters is a pre requisite for reading. The speed and accuracy with which a child engages in identification of letters predicts his reading abilities and literacy skills. (Fears & Lockman, 2018).

Learning to write is one of the most difficult tasks of childhood. Young children have to use their fine motor skills which are yet developing to form a series of writing strokes for each individual

letter. The exact location of the strokes, their overlap, their position and orientation are of utmost importance to letter identification and writing. Children learn to identify the letters simultaneously while learning to trace and write them. (James & Engelhardt, 2012).

3.2 Definition of Terms

3.2.1 Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder described by discrepancies in social communication and the existence of limited interests and monotonous behaviors which is predisposed by both hereditary and ecological influences. The diagnosis of autism can be done at any age, however, it is said to be a 'developmental disorder' as the signs and symptoms of autism are seen in the first two years of age. In 2013, the Diagnostic and Statistical Manual of Mental Disorders—5th edition (DSM-5) was circulated, apprising the diagnostic criteria for ASD from the preceding 4th edition (DSM-IV). The World Health Organization (WHO) approximates the worldwide incidence of ASD at 0.76%. The Centers for Disease Control and Prevention (CDC) estimates about 1.68% of United States (US) children aged 8 years (or 1 in 59 children) are diagnosed with ASD. A study conducted in the UAE exposed that incidence of Autism is gradually growing since the past 4 years as per cases archive at Dubai Autism Centre for both domestic and emigrant inhabitants. The study disclosed that about two third of Autism cases in Dubai is among expatriate population and one third among UAE national population. Dubai Autism Centre appraises that autism affects 1 in 146 births (0.68%). By relating these estimations to the complete number of births in Dubai for 2014, it was projected that around 199 children of which 58 (29.1%) were nationals and 141 (70.9%) were non-nationals were diagnosed with autism. (Al-Abbady et al, 2017). ASD is more common in males than females. Autism is called a 'spectrum' disorder as there is an

extensive dissimilarity in the signs and symptoms experienced by people. It can be seen across all cultures, races and socio-economic strata. However, some studies have shown that incidence of ASD is higher in the upper social economic class, probably due to easy access to pediatric and developmental facilities available to them.

There have been many medical improvements during the past years and this has led to the development of an increased number of standardized testing tools for ASD. Studies have shown that beginning with pediatric appointments, followed by screening of concerning behaviors, along with caregiver's valuable inputs and formal diagnostic assessment indicates that there's a cause for concern of the ASD diagnosis. Cognitive and developmental testing, accompanied by language assessment is key to differentiate ASD diagnosis from other developmental difficulties. The Autism Diagnostic Observational Schedule, the Screening Tool for Autism in Toddlers and Young Children (STAT) and the Communication and Symbolic Behavior Scales (CSBS) are recommended for usage in early childhood. The role of physicians in the identification, referral and evaluation of persons with autism is of great importance.

3.2.2 Emergent Writing

Children commence writing initially at around 2 years of age when they begin doodling, sketching and producing symbols on the paper with a pencil to express themselves. They then proceed to make letter like formations before learning to write random letters and their names. These early forms of written expression has been termed as emergent writing. (Puranik & Lonigan, 2012). Diamond and Baroody (2013) have investigated emergent writers where they begin writing their names, thus being involved in the left to right orientation process. Also they get opportunities to identify a series of letters in their names which they may later use to form new words to express themselves.

3.2.3 Handwriting

Writing is a linguistic movement, simultaneously involving the retrieval of spelling material and motor control of the writing tool. Thus, learning how to write involves the achievement of structured orthographic symbols and the mechanization of grapho-motor skills (Frith, 1986). Before age 8, handwriting actions are rather deliberate as the letters are "constructed" stroke by stroke. At nearly 10 – 11 years of age, writing speed escalates and motor production grows into involuntary strokes. One of the aspects that control mechanization is motor expectation. This is the ability to write a letter while processing information on how to yield the following letters. Some children with disabilities may not be able to grip a typical pen or pencil. Others may be able to grip a regular pen or pencil but may have immense trouble utilizing the pen or pencil to write and may find writing to be slow and labored. They may make many errors and produce disorganized work which may be inferior to verbal language abilities. Untidy handwriting may have a lasting negative impact on the child's grades and his self-image, leaving him feeling embarrassed or discouraged. (Pollock & Missiuna, 2012)

When children are involved in writing, they are involved in motor processes which differ in handwriting and keyboard writing. In handwriting, there is constant motor and visual feedback to the brain while the movement of making letter strokes occurs; whereas in keyboard writing, the feedback of locating the keys and tapping them is the only feedback given to the brain. Evidence shows that the motor and visual processes of handwriting, rather than keyboard writing contributes to the recall of the letter and its visual representation. (Mangen & Balsvik 2016).

3.2.4 Assistive Technology

According to the Assistive Technology Act of 1998, Assistive Technology (AT) is defined as an item or a portion of apparatus, that is used to intensify, sustain or advance purposeful competences in individuals with disabilities whether procured off the shelf or whether it has been adapted or tailor made to suit an individual's needs. These items can range from low-tech inexpensive items to costly high tech devices. Teachers may need to be trained in using some of the AT devices. By assimilating AT with the curriculum, educators are able to support students with disabilities by aiding them in their specific learning issues and encouraging independent learning. AT permits students to access the curriculum and enhance their learning experience. It encourages students to increase their participation in learning opportunities and involvement in different activities. However, the choice, procurement and usage of AT depends on the assessment of the child's needs and the professional input of the therapists who are engaged with the students with disabilities. (Campbell et al, 2006)

Educators have identified many technical supports that are available to develop spelling skills using digital technologies like spell-check and text to speech software. These assistive technologies are universal where they are widely available for students to use. The students can also be provided access to word banks from which the student can select words to frame his sentence.

Assistive technology (AT) has a very crucial part to play in helping students with disabilities to achieve their educational outcomes (Newton and Dell, 2011). Assistive technology helps to improve learning in children with disabilities and they frequently experience larger achievement when they are permitted to utilize their capabilities (strengths) to work around their incapacities (challenges). AT for students with disabilities is defined as any means, section of a tool or arrangement that aids

circumvent, work around or compensate for an individual's specific learning deficits. Many studies have been conducted to prove the efficiency of AT in helping the child reach his / her potential.

Educational technology that all students utilize during their literacy instruction should be differentiated from assistive technology. Software and hardware that are identified as beneficial for students with disabilities in order to access their functional and academic activities are considered as assistive technology. The IEP of the student should include any assistive technology needs required by the student and the entire team should encourage the student to utilize it at all times.

Writing is a form of communication that involves using thoughts and emotions to express oneself in a written form that can be read by all individuals. Each student uses his past experiences along with his knowledge but finally, it is up to the teacher to develop these abilities to make the student a good writer. This is difficult for students with disabilities and it makes it more challenging for their teachers to discover ways of getting their students to write. The use of AT in such situations helps the student with disabilities to overcome their limitations and progress up to the level of their peers.

3.2.4.1 Assistive technology solutions

AT can be of assistance to students with various types of writing challenges. AT tools are able to make the physical performance of writing stress-free for the student, simultaneously helping the student with spelling and syntax as well as with consolidating the material and articulating themselves. Low tech handwriting tools benefit students who have fine motor difficulties and those who struggle to write by hand. The pencil grip is helpful to a student who is unable to grasp the pencil correctly. A slant board elevates the writing surface to give additional control while writing.

Old and darkened lined paper helps those students who are unable to write on straight lines. High tech AT tools like keyboards and touchscreens also help students with handwriting difficulties. The student is given access to the letters and words on the screen by typing or touching the screen, rather than using a pen or pencil. Dictation (speech-to-text) permits students to write by means of their voice. As they utter words, their words appear on the screen. The student needs to be able to express clearly and needs to use vocal guidelines for punctuation. Word prediction may also be used where a selection of words is offered upon typing a few letters, thus helping students to complete their sentences. Spell-check and grammar check are accessible on most word processors.

Text-to-speech (TTS) is normally assumed to be a reading tool. But TTS is also beneficial for students with writing difficulties since it can be utilized to read out loud what has been printed, thus enabling the student to check for mistakes.

3.2.5 Alternative pencil

To help students to write efficiently, they can be introduced to various forms of assistive technology, like using an alternative pencil in the form of a keyboard for writing. Developed at the Centre for Literacy and Disability Studies (CLDS), and written about by Hanser (2009, 2010), an alternative pencil is defined as something that offers a student with contact to all 26 letters of the alphabet for use in writing. Zabala, (2005) says we need to put the student—not the tool—at the core of the executive procedure, just as top practice decrees (QIAT Consortium, 2005).

3.2.6 Universal Design for Learning

Universal Design for Learning (UDL) is a viewpoint that incorporates learning representations, approaches and tools to augment the educational involvement of diverse learners. In this method,

AT is frequently assembled into educational resources and can be personalized to help students with disabilities to be successful. (Stanberry & Raskind, 2009)

UDL gives all students the opportunity to succeed by giving them flexibility to access the material, engage with it and express themselves. This helps all students in the classroom especially those with learning and attention issues. Closed captions, automatic doors and accessibility features on smartphones are all instances of universal design. These design features essentially focus on helping people with disabilities but even neuro typical people use them. UDL is a framework to help teachers cultivate lesson plans and assessments based on 3 main principles. UDL endorses presenting material in more than one arrangement, thus enabling learners to access information based on their individual learning strengths. It offers students more than one way to interact with the learning material and express themselves in their preferred mode of assessment. It inspires teachers to look for numerous ways to stimulate students by giving them a variety of ways to do projects to sustain their interest.

3.3 Handwriting Issues

Harris, Graham and Mason (2008) have acknowledged that writing is one of the most fundamental skills that most students experience difficulties in, as it requires students to utilize their fine motor skills along with their cognitive abilities.

There are various issues with regards to learning to write by hand. Many children do not hold their pen correctly, or apply inadequate pressure while writing or do not sit properly. Consequently they complain of cramps and pain while writing. Some spend a lot of time writing laboriously while some writing is illegible. Some children display poor concentration and attention to writing tasks and get

tired of writing easily since they find it a burdensome process. These children seek support in the development of fine motor skills, language, letter identification and behavior. (Marquardt et al, 2016).

Copying letters is a pre requisite for hand writing. Letter copying is a complex process involving a synchronization of visual and motor skills. (Fears & Lockman, 2018). Bisschop et al (2017) have concluded that the lower order skills for writing, called transcription skills include spelling and handwriting. In order for these transcription skills to become automatic, they need to be accurate and mechanical. The child needs to know which phonemes (sounds) represent which letters. Difficulties in transcription skills could be due to handwriting or spelling difficulties. Handwriting difficulties could arise due to poor fine motor skills resulting in poor legibility and slow writing. The child needs to identify the letter and the sound of the letter before he begins to engage in the motor skill of writing words, resulting in spelling difficulties. In order for the child to develop transcription skills, he needs to identify the letters and retrieve it from his long term memory before writing it down. A study conducted by Masterson and Apel (2006) showed that children were able to spell words with the same degree of fluency while using pen and paper or on the keyboard, thus indicating that fine motor skills were not a prerequisite for spelling skills.

Graham & Harris (2005) have noticed that handwriting difficulties are noticed among children with special needs, behavior issues, attention deficit hyperactivity disorders, learning disabilities and speech and language disorders.

3.3.1 Advantages of hand writing over type writing

Letter recognition is a pre requisite for reading words and sentences. Studies show that learning to identify letters is better when accompanied by handwriting rather than typing. When the child writes by hand, he forms sensorimotor representations which may be recalled when he is asked to identify the letters. This process does not occur when the child learns the letters by typing. Thus James and Engelhardt (2012) established that the motor routine of hand writing helps in letter identification and reading acquisition.

Children's cognitive development also improves when they engage in handwriting as opposed to typewriting. Their spelling improves; thus proving that handwriting aids in memory of the letter and the spellings. Studies have shown that taking notes by hand helps students to retain the knowledge as compared to taking notes on the laptop. James and Engelhardt (2012) are of the opinion that when children write by hand, they understand the letters and words better. The writing movement that they engage in, while copying letters is very useful to them in recognizing and understanding letters. Longcamp et al. (2005) did a comparison on handwriting and type writing. They concluded that a special relationship was formed between the movement of handwriting and the visual representation of the letter when a child learns by hand writing. They clarified that even though typing involves hand movements, these movements do not involve the letter shapes; they merely involve pressing a key on the keyboard for each individual letter.

Likewise Marquardt et al (2016) have emphasized that handwriting skills are of immense importance in the nurturing of children's literacy and cognitive development skills. Therefore they are of the opinion that handwriting difficulties should not be a deciding factor for the use of typing, especially at the age when the child is acquiring handwriting and reading skills as this may impair

learning. While teaching students with handwriting difficulties, one should consider the advantages of handwriting movements which may be combined with typing on digital devices in order to expedite the acquisition of handwriting. Many teachers found that legibility was the main issue in handwriting, followed by problems with holding the pencil, orientation on the page, slow speed and improper pressure while writing.

3.3.2 Advantages of type writing over hand writing

Mangen & Balsvik (2016) argue that children's fine motor skills and writing by hand is not yet developed at the preschool age and they face difficulties. Additionally children find keyboard writing very appealing which helps them to write on the keyboard smoothly without the fine motor difficulties that they face while using paper and pencil. Also they do not have to face peer pressure and lower self-esteem when they have limitations in writing by hand. They could be introduced to keyboard writing earlier and consequently when the fine motor skills have developed, the children could be trained in handwriting skills at a later age of around 9 – 10 years.

Arndt (2016), in particular has pointed out that it might be more stress free for very young children who are still developing expertise in fine motor skills to use a keyboard to type instead of being pressurized to develop handwriting skills whilst using pencil and paper. However, he does state that there is evidence to show that handwriting helps in letter identification, memory and cognition rather than type writing on a keyboard.

Wollscheid et al (2016) are of the opinion that for children with poor fine motor skills, typing could be easier to learn than handwriting. It would also lessen their frustration and irritability at not being able to produce proper letters by handwriting. However, evidence shows that there is a relationship

between handwriting and good academic outcomes such as reading, memorizing and reasoning skills.

Chapter IV

Research Findings

4.1 Introduction

The results of the research study are summarized in this chapter. The findings from the observation, interviews with the parent, class teacher and occupational therapist, along with the case study are presented in this section. The chapter concludes with information on the current status in the UAE and areas that could be improved on.

4.2 General information on the Centre where the research study was conducted

This Centre has around 175 students with different physical and intellectual disabilities. It is a non-profit organization dedicated to educating and training students with disabilities in the community. It provides multi-disciplinary holistic programmes for children from 3 – 35 years which helps students to develop their talents so that they can integrate into the community. Along with special education, the students are offered physiotherapy, occupational therapy, speech and language therapy and co-curricular activities. It uses trans disciplinary assessment and intervention methods to customize and prepare Individualized Education Programmes for each student in the Centre. The Centre has a Scholastic Unit where the focus is on academics and literacy, and students are trained in readiness skills for inclusion in mainstream education. It has a Vocational Training Unit for students over 14 years where they receive training in wood design technology, printing technology, fashion technology and bakery. The Centre also has a Work Placement Unit where they source open placement for suitable students over 18 years of age.

4.3 Findings from Observation

The researcher observed the key participant during 4 sessions in Literacy and 1 session in Social Studies during the online mode of study. She chose to observe the various modes of writing tasks offered to the key participant to practice writing in the class. There were 8 students who had joined the session. All the students joined the session from their personal computers in their homes. They were all accompanied by an adult who was there to offer help if needed during the session. The class teacher was assisted by the Assistant Teacher who also attended the session. The key speaker was the class teacher with the assistant teacher offering social reinforers when required. Each session started with a greeting and the classmates were happy to see their teachers and friends in the session. As the observer was a non-participant observer, she attended the sessions with her camera switched off and her microphone muted. The first session was a class on story time in Literacy. The class teacher read a story on 'Myself'. She used a PowerPoint presentation. All the students were focused on the visuals and ongoing narration during the story. The key participant displayed behaviors of movement on his seat but was attentive to the story. The teacher was able to motivate and guide all the students to pay attention to the ongoing story. The visuals and voice modulation brought the students' attention back to the story. When asked questions by the class teacher, the key participant was able to answer almost always correctly about the story. He participated attentively in the session. The class teacher used Aided Language Stimulation cards with a choice of pictures on it for students who needed prompts in answering questions. She was able to effectively reinforce all the students appropriately for providing the right answers by giving them 'high 5s' and 'clap' and 'heart' emoji's online. None of the students displayed any non-compliance and it was an interesting and lively class.

After the story session, the class teacher moved onto the next session which was a session on writing tasks. The class teacher shared a worksheet on answering questions on the story. She discussed the answers with the students. Each student then had to answer the questions by typing out the answers on the worksheet that was shared online. The key participant was able to identify all the letters on the keyboard. He was able to use the space bar and backspace when required. He could answer the question well in complete sentences but when it came to writing it down, he typed out only the key words. He needed prompts for using capitals and punctuation. He did not seem very keen on writing the answer and was in a hurry, waiting to finish the task. It was noticed that most of the pupils were independent in typing on the keyboard and needed prompts only for framing grammatically correct sentences.

The third session that the researcher observed was a session on discussing about 'Myself'. The class teacher prepared a few questions and encouraged all the students to answer the questions, thus gaining knowledge on oneself. After the discussion, she requested each student to take a pencil and paper and write down 5 sentences on 'Myself'. She flashed the questions that needed to be answered on the screen. They were encouraged to write answers to the following questions:

- What is your name?
- Are you a boy or a girl?
- How old are you?
- Which school do you go to?
- What do you like to do?

The key participant seemed to fidget in his seat. He squirmed and made sounds of disapproval. He took his pencil and paper and began his task. He used a pencil gripper where his thumb, index finger and middle finger had to be placed appropriately on the gripper by the parent. At various intervals, he was found to be adjusting his fingers on the gripper before beginning to write. It was observed that he presented with poor orientation of the paper. He began writing on the left hand side and then used any spaces found on the paper to write his sentences, when he came to the end on the right hand side of the paper. He used a mixture of upper and lower case letters. They were grouped together with no spaces between words. It was an effort for the student to form each letter. He painstakingly wrote each letter and seemed to be retrieving it from his memory each time. His letter formation was very poor. And orientation of letters too was incorrect. In the end product, only his name was clearly visible.

Following this session, the class teacher then instructed the students to write a few lines on the topic of 'Myself' on their touch based devices. The key participant seemed more relaxed in this session. He could navigate the keyboard on his touch based device with ease. He needed to be prompted to use punctuation. He was able to select the key word from the predictions provided. The key participant answered in key words and was prompted to use complete sentences. He made short sentences and was keen to know if he could stop the activity.

The researcher attended a session on Social Studies where the students were learning about the earth. The teacher began the session with a short PowerPoint presentation, followed by a video on the earth. All the students were interested in the topic and watched the presentation and the video keenly. The key participant was very attentive and asked relevant questions in order to gain more information on the topic. This was followed by a worksheet that the students had to solve on their

touch based device. The parent opened the document on the ScanWritr app for the participant to solve it. The worksheet consisted of 3 one word answers and 3 fill in the blanks. The key participant was eager to solve the worksheet and was able to navigate and complete the worksheet with minimal prompts from the parent or teacher.

From the above findings, we can conclude that the key participant showed major anxieties when he was expected to perform with a conventional pencil. He had the clear picture of the letter formation in his mind but was unable to translate it on the paper probably due to limited motor skills and improper pencil grip and muscle control. Also his motor planning skills and visual perceptual skills could have been effected to some extent.

When presented with the task on the keyboard, he seemed more relaxed and happier to do a task comprising of single words at his level and interest. When required to use complete sentences and punctuation, he needed prompts. But, his self-confidence and independence increased with keyboard activities as opposed to pencil paper activities. It also increased the student's independence and decreased his dependence on the teacher or the parent as he was now able to use prediction aspect and did not require to pause for the adult to support him to spell words that he did not know.

4.4 Findings from Interviews

The interviews were conducted online due to the existing pandemic as the Centre was closed for distant education studies. Three persons were interviewed to gain information on the research topic – the parent of the participant, his current class teacher and the occupational therapist who worked with him. A series of questions were prepared and information was gathered from the interviewees.

The interview began with the purpose of the study. The results of the interview are summarized below:

When asked at what age, they noticed that the student had writing difficulties, the parent disclosed that she noticed that her child was having writing difficulties from age 3, when she found that he could not hold the pencil properly and was finding it difficult to scribble or colour.

Up on being asked to describe his writing difficulties, the parent shared that she felt that he seemed disinterested in writing as he could not hold the pencil to write. Hence he became more interested in reading and in Math but never seemed to want to do any writing work. The OT noticed that he had challenges in holding the pencil in an appropriate tripod grasp and the application of pressure to write with a pencil was slightly inadequate. The class teacher found that the student often preferred to use the alternative pencil of the keyboard to write as using a pencil was a big task for him. When he used the pencil, his letters would be wobbly and it would take a long time for him to finish his tasks. He found it difficult to maintain proper pencil grasp, so he would pause and fix his grasp in between tasks.

When asked about the student's feelings when he experiences these difficulties, the parent replied that he tries to attempt the task initially, but when faced with non-achievement, he gets frustrated. This was echoed by the OT too. The teacher shared that he would vocally express his preference for using the pencil but then he would display frustration when it would take time for him to finish his task or when he wouldn't get the desired output or formation of letters.

The participants were then requested to share what strategies they used to help the student with his writing difficulties. The parent replied that they initially gave him large sized chalks to write on the

floors and slowly moved to crayons. The OT shared that they introduced him to the pencil gripper to facilitate appropriate grasp. Additionally, he was introduced to an alternative sensory medium of sand and finger painting to help him focus on letter formation. The teacher shared that he was given a rubber pencil gripper to use which would help him to build up on his grasp.

They were then asked about solutions provided by the school with regard to his writing difficulties. The parent replied that the therapist gave him a lot of support, so he began showing interest in writing small words using the pencil gripper. However, when the computer keyboard and ScanWritr software was introduced to him, he seemed happiest. The teacher too felt the alternative pencil of the keyboard and the ScanWritr application where he could type his answers on worksheets helped him to focus on the real goals without being prohibited by his writing difficulties. Also, the additional session on developing fine motor skills in the class gave him practice in pattern writing and tracing letters.

When asked about the age when the alternative pencil of keyboard was introduced to the student, they were not quite sure but parent confirmed that he has been using it for over a year now.

Up on being asked whether the student was using the alternative pencil to complete all his writing tasks, they all agreed that he was using the keyboard to complete all his writing tasks while still being given practice to writing with the conventional pencil.

When asked to share about the child's feelings while using the alternative pencil, the parent shared that when using the alternative pencil, he was more interested in completing the task. The teacher felt he is eager to use the keyboard and is learning the different features and enjoys using it.

The participants were asked to share their feelings with regard to the alternative pencil. The parent was fully satisfied with the student using the alternative pencil. The OT felt that it helped him to move ahead with his academic work, hence it was beneficial to him. The teacher was happy and satisfied with the alternative pencil but was still keen on helping him to improve his fine motor skills in order for him to write with the conventional pencil.

When asked whether the alternative pencil had solved his writing difficulties, the parent replied that she was happy that he was able to complete his homework independently with just a little help. The OT felt that the alternative pencil had solved his writing difficulties but his parents still wanted him to continue practicing with the conventional pencil. Hence they were still providing the student with writing worksheets. The teacher felt he was able to accomplish his writing tasks with less frustration and focus on expressing his ideas rather than focus on making the right strokes for his letters.

The interview concluded on getting their inputs whether they would recommend this alternative pencil of a keyboard for students facing writing difficulties; they were all of the agreement that it was the best method for students facing writing difficulties, especially if the student is interested in using a keyboard.

From the above findings, we can conclude that in order for the student to experience success at writing tasks, it was very necessary for the intervention team to find a suitable AT for the student at the earliest and introduce him to it, in order to make him fluent and confident in using the AT. It was necessary to identify the issue and move ahead. Here, the key participant was facing writing difficulties and as a result was feeling frustration as being unable to write smoothly with a pencil. The introduction to the alternative pencil of a keyboard was the right decision as the student was

interested in ICT and learned to maneuver it successfully. His confidence increased and his frustrations decreased.

4.5 Findings from the Case Study

The key participant is an eleven year old student studying in a Centre in Dubai. He is able to communicate clearly using 5 - 6 word sentences verbally. He is in an academic class where the students are prepared for mainstream inclusion by maximizing their learning potential through an augmented academic intervention time. His everyday routine at the Centre comprises of 3 hours of academic involvement followed by 2 hours of co-curricular and pre-vocational activities. He was involved in the preparation of his IEP where he requested for Science as he is quite interested in the subject.

In class, the students follow the British Curriculum. The key participant follows Grade 2 level in Math, Science and English. The lessons are prepared by the teacher and delivered to the students using various teaching resources like PowerPoint presentations, experiments, educational videos and online teaching resources.

The key participant has a diagnosis of Autism Spectrum Disorder with Intellectual Disability (ID). (Intellectual Developmental Disorder). According to Diagnostic and Statistical of Mental Disorders (DSM-5), autism is manifested by deficits in social communication and social interaction, accompanied by repetitive forms of actions, interests or activities in the developmental period. Intellectual disability is a disability defined by restrictions in intellectual operations (cognitive, education, problem-solving) and in adaptive behavior which includes many daily social and

practical skills. A study by Rivard et al in 2014 states that there is a presence of ID among children with ASD and approximately 40% of children with ASD also meet the criteria for ID.

In the Centre, he is in a class where he receives 3 hours of academic instruction, followed by co-curricular activities. He was observed across 4 sessions in Literacy and 1 session in Social Studies during the online mode of study. He can do most activities independently. He is able to do most gross motor skills appropriately but needs some prompts for finer skills. His grip on the pencil is faulty and he tends to write using bigger strokes. The pressure applied on the paper is adequate but there are some visual perceptual issues also in relation to writing on the line. When writing on a lined paper, he does try to keep within the lines but not always. When writing on a blank paper, he has poor concept of writing from left to right and tends to write letters to make words all over the page. He uses a combination of upper and lower case letters. The formation of letters made by him is very tedious and does not allow for smooth flow of writing words as each letter is laboriously produced. Studies by Johnson et al in 2018 show that a delay in the development of fine motor skills, manifesting in poor pencil control for writing and drawing is commonly found in children with ASD.

When presented with the alternative pencil of the keyboard, he is able to open a word document and write meaningful words. He takes some time as he still searches for the letters and uses only one finger to type. He is still not using capitals and full stops but his sentences are more readable and fluent. He navigates the keyboard with ease and does not appear to be stressed or uninterested in any way. For completing his worksheets, he uses the 'ScanWritr' app on his touch based device which enables a worksheet to be scanned on the device and it can later be filled with the typing option or the pen option. So this enables him to write all the worksheets that are prepared for the

students using the conventional pencil. He enjoys using the keyboard as his alternative pencil and is comfortable and achieving mastery over it. It was observed that use of the keyboard has boosted his confidence in solving worksheets correctly as he is also learning to use word prediction to minimize spelling errors.

At home, the parent too finds it easier to use the keyboard with the participant as he is relaxed when using it and is able to confidently finish his writing tasks instead of depending on the parent to guide him as to where to write his answers. The parent feels that he is able to move forward in relation to his academic level. The parent, wants him to use the conventional pencil but she is happy to train him to use it separately by providing him support in using different types of pencil grippers and tracing words and giving him writing practice in order for him to develop the skill.

Carol Ann Tomlinson endorses Differentiation which refers to a wide assortment of teaching approaches and variations to programs and resources that teachers can use to impart knowledge to a group of students, with very diverse education needs, at the same time, in the same classroom, or learning set up. Differentiation is generally used in 'mixed grouping' – an instructive method in which students with dissimilar abilities, education needs and stages of educational attainment are clustered; guaranteeing all pupils obtain critical abilities, elementary theories and crucial data. Teachers can use diverse instructive methods and strategize numerous advanced classes to keep students implicitly involved and concurrently address their individual learning requirements – which could differ from student to student. The key participant follows his level of graded textbooks in the class. The teacher organizes student-specific resources for him to learn the topics; while the other students too, each learn at their levels.

Since the past 20 years, global organizations have been promoting the inclusion of children with SEN in mainstream educational settings (MacFarlane & Woolfson, 2013). UAE too, has joined the worldwide undertaking towards inclusive education for these children (Gaad, 2011). In 2017, the Knowledge and Human Development Authority developed the Dubai Inclusive Education Policy Framework which approves of Universal Design of Learning principles to be used by all bodies of knowledge while delivering education to the pupils at any stage of learning. It directed that all educational institutions should be willing to grant admission to these students and their parents should be assured that the student will receive a good standard of education, catering to the individual needs of the student anywhere in Dubai. These students need to receive suitable direction, adaptations, accommodations and curricular modifications to access all types of educational opportunities. This mandate could be beneficial to the key participant who is been trained in the Centre.

The Dubai Inclusive Education Policy Framework also states that Special education centres are a crucial section of the inclusive range of delivery for students who experience SEND within Dubai. The skill and knowledge they hold and the focused facilities they offer are of enormous significance to the progress of an effectively resourced system of inclusive education. Although, the key participant studies in a Centre, he has progressed in his academic and cognitive abilities. He has been given several opportunities to partake in competitions like EEG Public Speaking competition and elocution competitions, platforms that encourage participation on an inclusive setup.

Accommodations are adjustments made in how a student can access material and study. The alterations made do not suggestively amend the level of instruction, the content to be taught or the performance standards. Accommodations give the pupil equal access to learning and equal

opportunity to express what he/she knows and can accomplish. The IEP team determines whether the student needs any accommodations and the type of accommodations that the student would require and benefit from and documents these in the IEP. The key participant would definitely benefit from the following accommodations:

- Apps or devices to help in checking spelling and grammatical errors
- Customized keyboards or adapted keyboards to be used instead of traditional writing with a pen or pencil
- Scribe (a person who will write as the student dictates)
- Calculator device for math calculation
- Auditory cues like key verbal instructions
- Kinesthetic cues like 3D models of instructional material for students to manipulate in order to learn better
- Extended time like giving extra time to the student to complete class assignments, homework, projects
- Multiple or regular breaks like shorter assignments or intermittent breaks in a long assignment
- Flexible schedules like making use of the time when the student is at his peak in order to maximize learning, especially if he has peaks in concentration and attention
- Decreasing distractions to the student which would involve the most appropriate placement of the student in the class like being seated near the door or next to the teacher
- Decreasing distractions to other students which would involve isolating the student when disruptions or maladaptive behaviors occur
- Other adjustments can be made with regard to lighting, temperature or ventilation

These accommodations will increase the accessibility of "barrier-free" learning environments for pupils with special needs and thus support increased inclusion. These would definitely be beneficial to the key participant if he were to seek admission into a mainstream school set up.

Modifications are alterations in what a student is expected to learn. These alterations are made to allow a student to attend a meaningful and productive school learning experience alongside other students in the classroom. Modifications consist of changes to the curriculum concerning the instructional level, content, and learning outcomes. The requirement for learning modifications is individually decided by the IEP team and recorded in the student's IEP.

Looking forward, if mainstream education could be sourced for the key participant, it would be a great finishing touch to a potential student, increasing his self-confidence to the highest level as he is also now showing confidence and independence in using his alternative pencil of a keyboard for all his writing tasks.

Chapter V

Discussion, Conclusion and Recommendations

5.1 Discussion

In this chapter, the conclusions derived from the research study will be discussed, along with the answers to the two research questions. This research study aims to highlight the urgency for a student with disability to move from being an emergent writer using a conventional pencil to a writer using an alternative pencil of a keyboard and the advantages of using it in a special classroom. The study examined issues related to emergent writing, conventional writing and the purpose of using the writing tool meaningfully. The review of literature indicates that even though writing is a complex fine motor task, whether by hand or keyboard, it involves the coordination of fine motor processes, visual perceptual skills and cognitive skills. While some children may be able to hold a conventional pencil correctly and write with it neatly; others may find it hard to hold the pencil and write. When they are forced to use the conventional pencil to write, they may make many errors and produce disorganized work which may not be at par with their neuro typical peers. This may have a lasting negative impact on the child's grades and his self-image, leaving him feeling embarrassed or discouraged. Hence the use of AT in such situations helps the student with disabilities to overcome their limitations and keep up with their peers. Analysis of the data showed that in the special education classroom, the student is able to progress while using the alternative pencil for writing. The following discussions attempt to answer the two research questions:

5.1.1 Research question 1: What is the impact of using an alternative pencil?

Writing is an important skill for every preschooler. However, when the student is unable to show progress due to limitations in the handwriting skill, it is necessary for the teacher or interventionist

to intervene and support the student by providing him with an alternative mode of writing – an alternative pencil.

This will provide the students with opportunities to develop literacy skills and reduce the gap in performance between them and their peers. For such students, an alternative pencil can offer a way to write and can be used with writers of varying abilities and ages including students who are emerging writers and those who are able to write more conventionally (Browder & Spooner, 2011). There are many types of alternative pencils like alphabet flip charts, talking keyboard, eye gaze frame, etc. It is the teacher's skill in selecting the most appropriate alternative pencil for the student and encouraging and training him to use it in order to give meaning and purpose to his writing; thus motivating him and enhancing his self confidence in his ability to write.

5.1.2 Research question 2: What are the benefits of using keyboard as an alternative pencil?

Using an AT device like a keyboard, enables the student to become more independent in his academic ventures and boosts his self-confidence as he is now become independent in completing writing tasks for which he required assistance earlier. In the modern classroom, the student is introduced to the computer or touch based device at an early age, for playing games or various other activities. It is a source of enjoyment for the student. This fact makes it more approachable to the student and he is motivated to type out letters. The student gradually learns the placement of the letters on the keyboard and is then able to maneuver independently to write words and frame short sentences. This skill of independently using the keyboard to solve all writing tasks like his neuro typically developing peers boosts his morale to no end. He no longer has to struggle to hold the pencil correctly to form letters on the paper and apply the correct amount of pressure while writing. He can now confidently touch the letter on the keyboard and is able to see it represented visually on

the screen. His keyboard writing is neat and legible and this is a big achievement on his part which motivates him to write further, thus allowing for a positive experience in writing.

5.2 Conclusion

It has been proved that AT has a very important role to play in aiding students with disabilities to meet their learning objectives. Due to their literacy challenges, students may need AT devices and software for academic advancement. Many research studies have been conducted on how AT and ICT have assisted children to improve on their learning, participation and social interactions in the school set up. Since every student is unique, the teacher needs to determine the needs of the student and customize the AT provided to the student. It is of utmost importance for the teacher to be observant and find out which AT works best for the student. It would require the teacher to invest time to learn to use the AT efficiently and appropriately.

In keeping with the current times, it becomes imperative to embrace advanced education strategies in the classroom in order to assist the students with disabilities to augment their level of performance through the broad use of technology. The key role of the teacher is then to provide the students with positive learning experiences, in order to reach their maximum potential for a bright future. (Kumar & Raja, 2010). Teachers should be encouraged to use suitable technological devices for the students with disabilities. They should be given appropriate guidance on how to integrate AT into the curriculum. Their personal perspectives towards AT can influence the extent to which educational technology is used in the teaching and learning process. Studies conducted by Chiang and Jacobs in 2010 revealed that technology is a key component to increasing the functional task performance, self-worth and positive experiences among children with disabilities. A recent study by Nordstrom et al in 2018 showed that students became more motivated to completing their homework and

showed interest in learning how to use the AT device after being introduced to it, thus enhancing their confidence and self-esteem.

5.3 Recommendation

The results of this study suggest some recommendations that would help in ease of AT to be used in the classroom:

1. Teachers should be provided with updated workshops and training in using the latest technological devices available in the market. This would prevent inhibitions on the part of the teacher to use AT in the classroom and minimize loss of time in training the student to use the device.

2. Appropriate educational resources, teaching aids and materials need to be made available for students with disabilities in order to assist the teacher to modify the teaching methods to achieve inclusive educational goals.

3. School administrators and management should be invited to attend educational seminars to give them additional knowledge on adopting UDL practices in the classroom.

Chapter VI

Further Research Implications

This research study focused on the impact of the alternative pencil to a student with ASD. Few research studies have shown teacher perspectives to using AT in the classroom and little data is available on how the teacher is being prepared for AT use during the teacher training course. If the teacher is not prepared and open to using technology, the device may not be used to its optimum and could adversely cause a negative impact rather than enhancing the situation. Therefore, future research on imparting knowledge to teachers during their training program and preparing them to use AT would be beneficial. Future research should also focus on how to customize AT support in order to better utilize its potential. Additional research could also monitor the social variable to decide whether the students using the keyboard as AT actually perceive it as useful and helpful in their daily lives; whether it improves their self-worth and perceptions of themselves and confident writers.

Finally, it needs to be acknowledged that the teachers' perception towards using AT plays a very important role in the student achieving independence in his writing tasks. Teachers need to consider that there may be some neurological anomalies which cause some students with ASD to face difficulties in motor functioning, leading to limitations in handwriting. It may seem contradictory that these same students are able to play a musical instrument well or play with Lego blocks well but are unable to print efficiently. Mayes and Galhoun (2003) studies children with ASD and found that their graphomotor skills were lower than their peers irrespective of age or IQ and this impacted their written expression. Their classroom behavior too tends to be affected due to the stress on them to produce efficient written output. These non-compliant behaviors tend to affect their ability to write legibly and efficiently. Thus teachers need to exercise caution in trying to get the student to keep practicing the handwriting skill which seems unachievable and introduce him to an alternative pencil, preferably that of a keyboard. For many students with autism, the computer is a pleasurable activity as it is visual and there are abstract systems and operations which make it easily understood by the student. It would be beneficial if the teacher does not wait but rather permits and trains the student to use the keyboard as their alternative pencil. Keyboarding is an important life skill and as educators, we must focus on developing the skills that will be beneficial to the student now and in the future.

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Appendix A

Table 2.6.1a Observation Schedule

	Date	Day	Time	Place	Session
1st Observation	18-05-2020	Monday	12:00 – 12:30	Online session	Literacy – story time
2nd Observation	18-05-2020	Monday	12:30 – 1:00	Online session	Literacy – writing answers on the story on the worksheet shared on screen
3rd Observation	20-05-2020	Wednesday	12:00 – 12:30	Online session	Literacy – writing on 'Myself' with pencil
4th Observation	20-05-2020	Wednesday	12:30 – 1:00	Online session	Literacy – writing on 'Myself' on the touch based device
5th Observation	21-05-2020	Thursday	12:30 – 1:00	Online session	Social Studies – writing answers on the worksheet on 'The Earth' on ScanWritr app

Table 2.6.1b Observation Framework for Participant's involvement with the keyboard

	Activity	Performance
Session 1	Literacy – writing tasks: Participant writes answers on the story on 'Myself' on a worksheet shared on screen – uses the keyboard	Typed out key words. Needed prompts for using capitals and full stops and to use sentences.
Session 2	Literacy – writing tasks: Participant writes few sentences on 'Myself' on a paper – uses a pencil	His thumb, index finger and middle finger had to be placed appropriately on the pencil gripper. He began writing on the left hand side and then used any spaces found on the paper to write his sentences, when he came to the end on the right hand side of the paper. He used a mixture of upper and lower case letters. They were grouped together with no spaces between words.
Session 3	Literacy – writing tasks: Participant writes few sentences on 'Myself' on the touch based device	He could navigate the keyboard on his touch based device with ease. He needed to be prompted to use punctuation. He was able to select the key word from the predictions provided. The key participant answered in key words and was prompted to use complete sentences
Session 4	Social Studies – writing tasks: Participant writes answers on the worksheet on 'The Earth' on ScanWritr app	He was able to navigate and complete the worksheet with minimal prompts from the parent or teacher.

Appendix B

Access Letter for data collection

To,
The Deputy Director / Coordinator – Research and Training
Training Centre for Persons with Disabilities
Dubai
29 June 2020

Dear Ma'am / Sir,

I'm Gloria Rebello, a Special Educator. I'm a student in the British University in Dubai (BUID), doing my dissertation for my Master's degree in Education. I'm conducting a research study to demonstrate how beneficial it would be for the child of determination to move from being an emergent writer using a conventional pencil to a writer using an alternative pencil of a keyboard and how beneficial it can be to the student in the special classroom. The purpose of this study is to investigate the scope of using an alternative pencil. In today's society, keyboarding is an important skill for all children to learn, but it is critical that students with determination are exposed to it in order to help them write on par with their neuro typical peers.

I would appreciate if I could be given permission to observe a student using an alternative pencil in the Centre over a few sessions. I would also need to interview the parents with regard to this.

Kindly be informed that all the data obtained from this study will be used for the purposes of research only. Confidentiality and anonymity will be maintained for the student and his parents. I would be more than glad to share the results with you once they are published. If you would require any more clarifications; please feel free to contact me on my email 20184101@student.buid.ac.ae.

Thank you for your time and support.
Best Regards,

Gloria Rebello
ID# 20184101

Appendix C

Parent Consent Letter

Dear Parent,

I'm Gloria Rebello, a Special Educator. I'm a student in the British University in Dubai (BUID), doing my dissertation for my Master's degree in Education. I'm conducting a research study to demonstrate how beneficial it would be for the child of determination to move from being an emergent writer using a conventional pencil to a writer using an alternative pencil of a keyboard and how beneficial it can be to the student in the special classroom. The purpose of this study is to investigate the scope of using an alternative pencil. In today's society, keyboarding is an important skill for all children to learn, but it is critical that students with determination are exposed to it in order to help them write on par with their neuro typical peers.

Your child has been selected for this study as he has shown difficulties in using the traditional pencil and has been introduced to the alternative pencil of a keyboard. I will be observing him using his alternative pencil over a few sessions. Additionally, I will require to conduct an interview with you regarding his usage of the alternative pencil.

Rest assured that all the information you provide will be used for research purposes only and the study will be reviewed by the BUID Ethical committee. Any information you provide will be treated with confidentiality and anonymity and the data reported cannot be traced back to you. The study results will be published in my dissertation as part of fulfilling my course's requirement. If you would require any more clarifications; please feel free to contact me on my email 20184101@student.buid.ac.ae. I hope that you will be willing to participate and I thank you in advance for your time. Please don't hesitate to contact me if you wish to discuss the study's result.

_____	_____	_____
Parent Name	Signature	Date

Thank you for your time and support.
Best Regards,

Gloria Rebello
ID# 20184101

Appendix D

Interview Questions

1. At what age did you notice that your child was having writing difficulties?
2. Can you describe the writing difficulties that your child experiences.
3. How does your child feel when he experiences these difficulties?
4. What did you do as a parent / teacher do to help him with his writing difficulties?
5. What has the school that he attends done with regard to his writing difficulties?
6. At what age did the school introduce the alternative pencil of keyboard?
7. Does he use this pencil to complete all his writing tasks?
8. How does your child feel when he uses the alternative pencil?
9. How do his teachers and therapists feel with regard to his alternative pencil?
10. According to you, do you feel that this alternative pencil has solved his writing difficulties?
11. Would you recommend this alternative pencil for students facing writing difficulties?