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An Empirical Analysis on Assistive Technologies Supporting Special Education Curriculum and Individualized Educational Programs (IEPs)

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Abstract – *Education is the key that allows people to move up in the world, seek better jobs, better opportunities, and ultimately succeed fully in life. Education is essential, and no one should be deprived of it. During the last three decades, the global community of mankind, started to raise slowly the curtain of a stage, unfolding a greater concern over a small portion of its fold – those who were born with disabilities, children who acquire the same. Since this is a global phenomenon, governments worldwide recognized their moral obligation to attend and give importance to this small segment of the global community, hence, special education was born under their respective educational systems. Nowadays, an assistive technology is considered one of the tools and channels used by special education schools to provide quality education to children with special needs. Using this technology, teaching and learning strategies can be improved and help increase students' social and academic performances. This research study consists of an empirical analysis of assistive technologies such as talking calculators, talking spelling checkers and electronic dictionaries, and speech synthesizers or screen readers usage tools for children with cognitive impairments and learning disabilities to simply support the individualized educational program (IEP) and SPED curriculum for the advancement of student's knowledge and meet their needs to make education successful. Participants of the study are children with cognitive impairments and their learning disabilities (LDs). Assistive technologies were utilized to find out if it can contribute to the improvement of critical thinking skills of the student and can be used to support special education curriculum for cognitive impairments with learning disabilities.*

Key Words: special education (SPED), assistive technology, individualized educational programs (IEPs)

1. INTRODUCTION

Innovation is a key to every student's success. In the last few decades, the integration of technology in education is very few, thus, adding technology into special education program or curriculum needs a merit attention.

In the mid of 1970's the first personal computer was developed. Apple computers were introduced. Microcomputers became popular and talk of the town. Overwhelming changes in technology were observed.

Computer-based instruction (CBI) was developed and introduced in the educational system. In 983, computer was named by Time Magazine as the "Man of the Year" as it caught the attention of the society. The machine was manufactured by the International Business Machine or commonly known as IBM and was considered the first and the sole manufacturer of personal and micro computers [1].

Republic Act No. 7277 of the Philippine Constitution popularly known as the "Magna Carta for Disabled Persons", is an act that provides complete rehabilitation, self-development and self-reliance of disabled persons and their integration into the mainstream of society and for other purposes [19]. (See, Philippine Laws, Statutes and Codes – Chan Robles Virtual Law Library). In Chapter II of this law emphasizes the opportunity of special children for education, thus, it supported the UNESCO's call for Education For All (EFA) policy [20].

The use of microcomputers in all areas of special education became prevalent. Blackhurst and Edyburn (2000) [1], states that technology played a significant role in the daily lives of children with disabilities. In addition, technology is defined as collection of gadgets, instruments or devices used by most educators to support teaching and learning [2].

As time goes by many researchers tend to evaluate how the assistive technologies can contribute to the special education system to address the needs of students with learning disabilities. Many software programs focus on drill, practice; games and simulations were introduced in the field of special education. However, these programs are primarily used as tutorials not as integral part of special education curriculum.

Today, many educators all over the world viewed assistive technology as an effective tool for learning and allows students improved their skills and talent that is beyond what traditional learning experiences can offer [3]. The use of assistive technology for learning disabilities students will

surely open their minds and hearts for exciting and amazing experiences for learning.

1.1 Background of the Study

Is technology can be an effective tool/s for special children with disabilities to enhance their learning and gained knowledge easily? This is the question that most of us would ask. But definitely this is possible. Assistive technology would teach a special child understands the basic rule of accessing or using a device, instrument or gadget that will effectively enhances his / her skills.

Hopkin, J. (2004) [4] explained that assistive technology is a system widely used to assist children with special needs to work on the specific areas of challenge. He also mentioned that this technology cannot "cure" a particular condition or disability instead it mainly focuses on how to help user accomplish his / her task and perform the given task independently.

The special education needs for people with disabilities are greatly diverse as basic skills and knowledge are required in the society in which they belong. In this context, assistive technologies play a vital role in providing quality education for special children with disabilities.

United Nations Educational, Scientific, and Cultural Organization (UNESCO) is among the well-known and most active international organization that focuses on the modern approaches to special education including technology. It includes mainly on the application of latest and innovative technologies that addresses the needs of the special education in achieving quality education. (See, UNESCO Official Website) [20].

Innovative trends such as assistive technologies offer vast potential to support long life learning and meet the needs of special children with disabilities. The creation of areas that is conducive to learners such as the learning environment, user-friendly facilities and pedagogical strategies or approaches that are necessary for the enrichment / enhancement of special education curriculum and individualized educational programs (IEPs). The use of these technologies will surely help children with special needs to improve their skills, abilities, independence, and qualities that will give them opportunities for their inclusion as valued and respected individuals / members of the global community.

Children with cognitive impairments with learning disabilities are the main subject of this research. These students are commonly known as "mentally retarded students". Mental retardation is a term used to an individual with abnormalities in mental functioning, socializing and communicating with other people. These attitudes prevent a child to grow, learn and develop skills useful for typical child. Children with mental retardation may face difficulty to learn how to speak, walk and take care of their personal needs.

1.2 Research Problems

This study aimed to evaluate the effectiveness of assistive technologies available for students with cognitive impairments with learning disabilities to improve special education curriculum or individualized educational programs (IEPs) and by analyzing the appropriate assistive technologies that can be used in the classroom or individual learning environment. It specifically sought answers to the following:

1. What type of learning problems can be addressed in using Assistive Technology?
2. In what aspect is speech assistive technology effective in enhancing special education curriculum / individualized educational program (IEP)?
3. Does speech recognition device – assistive technology stimulates children with special needs' critical reflective thinking?
4. Are the special education teachers competent enough to use and incorporate assistive technologies in their teaching and learning process?
5. What further recommendations may be instituted to help improve Special Education Curriculum or individualized educational programs?

2. LITERATURE REVIEW

Keenhwe & Ochwari clearly mentioned in their study that "technology integration focuses on best practices towards incorporating technology to curriculum as teaching tools" [5][7]. However, Seiler's study categorized assistive technology into "technology used for interventions are durable medical equipment wherein vocational rehabilitation community referred to as rehabilitation technology, and in education referred to as assistive technology" [6]. Alistair, E. (UNESCO, UNE2006) [8] UNESCO

suggests that there should be a proper way of choosing appropriate assistive technology for children. Thus, "an assistive device provided to the motor actions of a child may enable his/her development".

Talking calculators, talking spelling checkers and electronic dictionaries, and speech synthesizers or screen readers are just few of those speech recognition programs that is considered assistive technology that can be used to overcome writing and speaking difficulties of children with special needs. For example, talking calculators clearly defined as "built-in speech synthesizer that reads aloud each number, symbol or operation key a user presses; it also vocalizes the power to the problem. The auditory feedback helps him check the accuracy of the keys he presses and verify the answer before he transfers it to the paper" (Stanberry, K., et.al, 2009). [18] Using these technologies, the results were encouraging and children with disabilities exhibited solid improvements of their writing skills as well as ability to compose sentences as compared to the traditional way of writing the words [18]. In addition, with the use of speech recognition devices it clearly demonstrated a significant effect on the developed skills in terms of word recognition, reading and writing comprehension, etc.

The researcher took the opportunity to analyze whether the above-mentioned speech recognition devices such as talking calculators, talking spelling checkers and electronic dictionaries, and speech synthesizers or screen readers for children with cognitive impairments and learning disabilities is essential in the learning process of the students and to investigate as well on how these technologies can play a vital role in enhancing the special education curriculum and individualized educational programs (IEPs).

3. CONCEPTUAL FRAMEWORK

This study is anchored on the model used for general system in the use of assistive technology, Input-Process-Output (IPO) Model. The input refers to the actions or commands given or done by the user to the system from the outside environment. The processing is done when the necessary action is taken to process useful information by the system. The output refers to the results displayed by the system based on the input from the user.

Figure 1 below clearly shows how the Input-Process-Output (IPO) model is being used in this research for assistive technology (communication skills)

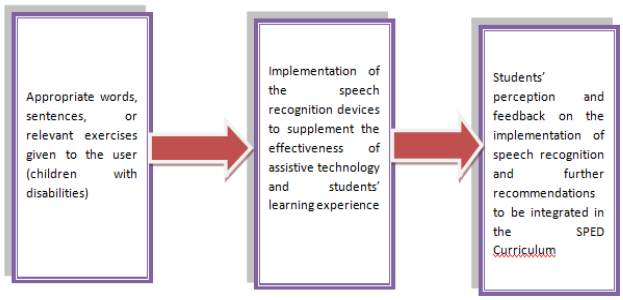

Figure 1. Conceptual Framework of the Study

4. RESEARCH METHODOLOGY AND PARTICIPANTS OF THE STUDY

This research study employed empirical research method to collect data in order to answer the practical research questions identified by the researcher. The researcher intended to conduct an actual use of assistive technologies by children with cognitive impairments and learning disabilities through the assistance of their concerned special education teachers (SPED Teachers). The same sets of activities were given and results were recorded using the traditional way and with the help of the assistive technologies in teaching. Further, the researcher reviewed the existing education curriculum / individualized educational program and described how they are used and how responsive they are to the needs of their clients. In relation to this, the researcher was able to come up with recommendations on how effective the integration of assistive technologies into the curriculum of special education to enhance special children's learning.

Children with cognitive impairments and their learning disabilities selected from different individuals in the society ages from 9 to 11 years old served as the participants of the study. In addition, concerned special education teachers (SPED Teachers) were also asked on how the integration of technology can affect the learning process of the students.

5. INSTRUMENTATION AND DATA COLLECTION

Students who participated in this research were two (2) male students ages from 9 to 11 years old currently enrolled in a special education class in public elementary schools in Metro Manila who were diagnosed with mild cognitive impairment or commonly known as mild mental retardation. In addition, a total of thirty (30) special education teachers involved and not directly involved in the assessment of students' performance were able to answer

the Part I of the research instrument. As stated in their educational profile (assessed by special educators, psychologists, and language therapists) these two (2) male students encountered difficulty in speaking as well as in reading. In order to enhance their speaking and reading skills, the researcher used speech assistive technologies to help them improve their speech and language skills. Special education curriculum focuses on the development of special child's skills which includes communication skills, daily life skills, cognitive skills, and speech and language skills.

The researcher collected information on how these two (2) students perform in their class by interviewing the special education team composed of special education teachers and language therapists. The researcher found out that the students are facing difficulties in speaking and pointing the correct cards that is being described in the activity. The speech activities were selected according to the students' performance using speech assistive technologies. After the activities had been selected, the researcher was able to design a research instrument (observation form instrument to be used during the activities of each student). The research instrument was presented and validated by the special education teachers, psychologist, and language and speech therapist. The research instrument has three (3) parts 1) profile of the special education teachers 2) observation form instrument used by the special education teacher during the performance of each activity of the student 3) SPED teachers' comments and suggestions. Part I of the research instrument was given to the special education teachers (involved and not involved directly in students' assessment) to collect data to determine the effectiveness of speech assistive technology in the integration of special education curriculum. Two possible answers were asked during the observation: 1) student can do the task given in the activity 2) student fail to do the task given in the activity. Part II of the research instrument guided by the Input-Process-Output Model was used by special education teachers to assess the performance of the two (2) cognitive impairment students through observation. The data were thoroughly analyzed and presented.

6. RESULTS AND DISCUSSIONS

After a careful analysis of data, findings of the study are summarized.

Profile of the special education teachers

Seventy six and sixty seven percent (76.67%) of the special education teachers' respondents are female. This clearly shows that majority of the special education teachers are female. In terms of educational attainment of special education teachers, most of them are Bachelor of Science in Elementary and Secondary education with 8 or 26.67% of the total respondents. In addition, many of the special education teachers' respondents have been in the service for 0 to 5 years with 53.33% of the total population. Majority of the special education teachers' respondents attended special education using assistive technologies trainings for a short grant term related with 86.67%. This implies that the special education teachers are fully aware on the latest developments of technologies that can be used in their classes or can be integrated in the curriculum or IEPs. In addition, this simply means that special education teachers are competent enough to integrate assistive technology in their classroom to improve their learning and teaching process. Consequently, they emphasized that integration of assistive technologies in the field of special education can definitely improve the performance of child's development in terms of academic skills such as mathematics, listening, organization and memory, reading and writing. Among the type of learning problems that can be assessed by the assistive technologies given in the research instrument, they mentioned that assistive technology is very useful but choosing the right assistive technology for your class or for your child depends on the needs of the child. However, speech assistive technology got the highest rank among the other choices with 83.33% as they believed that this technology would help a child perform well in other academic skills.

On the third part of the research instrument as well as in an interview conducted, special education teachers were asked on how the integration of technology can affect the learning process of the students. Special education teachers believed on the theory of John Dewey, "learning by doing". Application of this philosophical theory of Dewey is essential. The special education teachers argued that curriculum must and should be relevant to the development of students' lives as well as development of practical life skills. This philosophical statement supports the claims of special education teachers that students with cognitive impairment and learning disabilities must use assistive technology to acquire knowledge and academic skills easily. Thus, the researcher proposed a curriculum review / enrichment of the special education program that should be

done to fully integrate assistive technologies to address the needs of students.

Section A. The following questions were analyzed and comments regarding the analysis were stated.

The following notation is being used:

√ - the student performs the activity perfectly / YES to the statement;

* - the student did not perform the activity / NO to the statement;

S1 – refers to student number 1;

S2 – refers to student number 2;

Note that the participants of these activities were students with cognitive impairment and learning disabilities on different age brackets but on the same mental capacity or level.

The researcher with the concerned special education teacher/s served as the observers for the observation conducted. Before the start of the observation, the teacher accomplished the validated observation form instrument. The observers record comments and impressions as well as the length of each activity, and simply gather relevant information. After the observation, the researcher conducted an interview with the concerned teacher who facilitates the activities.

The observation form was adapted from Louisiana Pupil Appraisal Handbook, Bulletin 1508, and the Kentucky Assistive Technology Guidelines with further revisions and modifications based on the needs of the participants of the study.

Records of Special Education teachers' Observation Form (adapted from Louisiana Pupil Appraisal Handbook, Bulletin 1508)

The participants of the study were tested based on their academic skills a) motor skills b) communication functioning c) academic and vocational functioning. The result of these activities will determine the effectiveness and the need of the assistive technologies to be integrated into special education curriculum (academic setting) that somehow enables students with disabilities improve their skills.

Table 1.0 Records of Special Education Teachers' Observation Form - Results of the First Session

Task / Activities	Response for 1st Session	
The student able to turn on and off computer independently	*	*
The student maintains balance while performing an activity	*	√
The student uses writing tools such as pencils, crayons, markers, paintbrush independently	√	*
The student uses a standard keyboard to access a computer (write the input, appreciate the output)	√	*
The student can type letter and simple words using standard computer keyboard	*	*
The student can copy the words, letters accurately from the computer	*	*
The student can follow / speak simple words after the each activity done by the computer	√	*
The student can read simple numbers and words	*	*
The student responds to speech and noises in the environment	√	*
The student mode of communication is understandable by others	*	√
The student is able to transfer information from computer to book, or to paper	*	*
The student responds best to speech when the stimulus is within six feet of the speaker	*	*
The student responds in a loud voice after hearing something from the speaker	*	*
The student can make choices using an assistive technology	*	*
The student can read text, numbers independently	√	*
The student can accomplish task in a more manageable manner	√	√
The student can write his/her name legibly	*	*
The student can write simple words legibly	*	*
The student can correctly spell simple words needed to communicate	√	*
The student can properly perform mathematical tasks needed for daily living	*	√

Table 2.0 Records of Special Education Teachers' Observation Form - Results of the Second Session

Task / Activities	Response for 2nd Session	
The student able to turn on and off computer independently	√	√
The student maintains balance while performing an activity	√	√
The student uses writing tools such as pencils, crayons, markers, paintbrush independently	√	√
The student uses a standard keyboard to access a computer (write the input, appreciate the output)	*	√
The student can type letter and simple words using standard computer keyboard	*	√
The student can copy the words, letters accurately from the computer	√	*
The student can follow / speak simple words after the each activity done by the computer	√	√
The student can read simple numbers and words	*	√
The student responds to speech and noises in the environment	√	√
The student mode of communication is understandable by others	√	√
The student is able to transfer information from computer to book, or to paper	√	√
The student responds best to speech when the stimulus is within six feet of the speaker	√	√
The student responds in a loud voice after hearing something from the speaker	√	√
The student can make choices using an assistive technology	√	√
The student can read text, numbers independently	√	√
The student can accomplish task in a more manageable manner	√	√
The student can write his/her name legibly	√	√
The student can write simple words legibly	√	√
The student can correctly spell simple words needed to communicate	√	√
The student can properly perform mathematical tasks needed for daily living	√	*

Table 3.0 Records of Special Education Teachers' Observation Form - Results of the Third Session

Task / Activities	Response for 3rd Session	
The student able to turn on and off computer independently	*	*
The student maintains balance while performing an activity	√	√
The student uses writing tools such as pencils, crayons, markers, paintbrush independently	√	*
The student uses a standard keyboard to access a computer (write the input, appreciate the output)	√	*
The student can type letter and simple words using standard computer keyboard	*	√
The student can copy the words, letters accurately from the computer	*	*
The student can follow / speak simple words after the each activity done by the computer	*	√
The student can read simple numbers and words	√	*
The student responds to speech and noises in the environment	*	√
The student mode of communication is understandable by others	*	*
The student is able to transfer information from computer to book, or to paper	*	*
The student responds best to speech when the stimulus is within six feet of the speaker	*	*
The student responds in a loud voice after hearing something from the speaker	√	*
The student can make choices using an assistive technology	*	*
The student can read text, numbers independently	*	√
The student can accomplish task in a more manageable manner	√	√
The student can write his/her name legibly	*	√
The student can write simple words legibly	√	√
The student can correctly spell simple words needed to communicate	*	*
The student can properly perform mathematical tasks needed for daily living	*	√

Table 4.0 Records of Special Education Teachers' Observation Form - Results of the Fourth Session

Task / Activities	Response for 4th Session	
The student able to turn on and off computer independently	√	√
The student maintains balance while performing an activity	√	√
The student uses writing tools such as pencils, crayons, markers, paintbrush independently	√	√
The student uses a standard keyboard to access a computer (write the input, appreciate the output)	√	√
The student can type letter and simple words using standard computer keyboard	√	√
The student can copy the words, letters accurately from the computer	√	√
The student can follow / speak simple words after the each activity done by the computer	*	√
The student can read simple numbers and words	√	√
The student responds to speech and noises in the environment	*	√
The student mode of communication is understandable by others	√	√
The student is able to transfer information from computer to book, or to paper	√	√
The student responds best to speech when the stimulus is within six feet of the speaker	√	√
The student responds in a loud voice after hearing something from the speaker	√	√
The student can make choices using an assistive technology	√	√
The student can read text, numbers independently	√	√
The student can accomplish task in a more manageable manner	√	√
The student can write his/her name legibly	√	*
The student can write simple words legibly	√	√
The student can correctly spell simple words needed to communicate	√	*
The student can properly perform mathematical tasks needed for daily living	√	√

Table 5.0 Records of Special Education Teachers' Observation Form – Overall responses of the students from 1st to 4th sessions

Task / Activities	Overall Responses	
The student able to turn on and off computer independently	WT-0/0	AT-4/4
The student maintains balance while performing an activity	WT=3/4	AT-4/4
The student uses writing tools such as pencils, crayons, markers, paintbrush independently	WT=2/4	AT-4/4
The student uses a standard keyboard to access a computer (write the input, appreciate the output)	WT=2/4	AT-3/4
The student can type letter and simple words using standard computer keyboard	WT-1/4	AT-3/4
The student can copy the words, letters accurately from the computer	WT-0/0	AT-3/4
The student can follow / speak simple words after the each activity done by the computer	WT-2/4	AT-3/4
The student can read simple numbers and words	WT-1/4	AT-3/4
The student responds to speech and noises in the environment	WT-2/4	AT-3/4
The student mode of communication is understandable by others	WT-1/4	AT-4/4
The student is able to transfer information from computer to book, or to paper	WT-0/0	AT-4/4
The student responds best to speech when the stimulus is within six feet of the speaker	WT-0/0	AT-4/4
The student responds in a loud voice after hearing something from the speaker	WT-1/4	AT-4/4
The student can make choices using an assistive technology	WT-0/0	AT-4/4
The student can read text, numbers independently	WT-2/4	AT-4/4
The student can accomplish task in a more manageable manner	WT-4/4	AT-4/4
The student can write his/her name legibly	WT-1/4	AT-3/4
The student can write simple words legibly	WT-2/4	AT-4/4
The student can correctly spell simple words needed to communicate	WT-1/4	AT-3/4
The student can properly perform mathematical tasks needed for daily living	WT-2/4	AT-3/4

As shown in Table 1-5, the two (2) student-participants of this study are exposed on the activities that can enhance their motor, communication, academic and vocational skills. Four sessions were allotted; activities given for 2nd session and 4th session were basically with the use of assistive technology (the special education teacher involved in the activity identified the appropriate assistive technology to be used in this particular task). The table simply implies that 2nd and 4th sessions arrived with a score of 4/4; this means that students can interact and give correct results with the assistance and help of assistive technologies. There is a big difference between the performances of students using the traditional way of teaching than teaching with the use of assistive technology.

In addition to the students' positive feedback in terms of their performances, it is stated that the conclusions were reached upon the analysis of various similar studies that help recommend that the integration of assistive technology must be done in all aspects of learning to encourage children with disabilities to live like normal human being and can perform basic life skills independently.

7. CONCLUSIONS AND RECOMMENDATIONS

The new trends of technology can be an excellent starting point to motivate students with disabilities specifically cognitive impairments to learn. These technologies can promote teaching and learning process and considered an effective learning tool to acquire basic abilities and improve students' motivation and self-esteem. However, most of the students with cognitive impairments are facing difficulty in using technologies; educators are the most appropriate individual to guide them on how to access the technologies and manage real world situations.

Further, the researcher concluded that in order to meet the standard for special education curriculum, appropriate technologies must be integrated and therefore the solutions are at hand. Access to different assistive technologies will give educators an option which one should be adopted in their teaching strategies to maintain and achieve quality education. The perfect choice of the appropriate assistive technology depends on the student's class performance if he/she is in a classroom setting or individualized education programs (IEPs), competencies acquired and the educational objectives defined by his/her educator.

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