USING ASSISTIVE TECHNOLOGIES TO INCREASE PARTICIPATION IN EDUCATION PROCESS FOR STUDENTS WITH DISABILITIES

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Abstract

One of the main challenges that individuals with disabilities face in school is the access to curriculum because of either their physical disabilities or learning disabilities. It has been found that the use of assistive technologies can reduce some of the barriers that these students face regarding access to curriculum and participation in education process. Assistive technologies aim to support all individuals with learning disabilities gain new academic skills, social skills and support them performing and carrying out every day's tasks. They accommodates students' needs to perform a given task required to accomplish at the grade level of their peers. The use of assistive technology to support students succeed academically is often related to education strategies and approaches when working with students with special needs. Some of these education strategies being used in classrooms are the Least Restrictive Environment (LRE) and the Universal Design for Learning (UDL). The assistive technologies are used as a compensation tool for students with disabilities to allow them achieve at a performance level at a given task; in other words, without this tool they will not be able to perform this task. Knowing students' abilities and disabilities would support the team of educators, specialists and parents on making decisions on the type of assistive technologies to be used to support students' learning. The process of choosing the proper Assistive technology is a bit complex and should take under consideration the need for this tool and students' ability to perform the tool.

Keywords: *Assistive Technologies, Learning disabilities, Accessibility, Universal Design for Learning, Least Restrictive Environment (LRE).*

Introduction

In general, children show interest toward smart devices and different technology applications. Computers, touch screen tablets and software applications are very attractive tools and can be used to support children with leaning disablities or any disability during their learning process with the purpose of gaining new skills. Their high interest and motivation to use these devices should be used in their advantage in early ages because by using these types of assistive technology devices children can learn new skills. Children can practice the new skills in a low stress environment and hopefully will aply these skills in academic settings and in real life and become more independent.

The combination of the smart environments with different assistive technologies can be used in schools and at home to support students with disabilities overcome communication

barriers, language barriers, physical barriers and develop new skills. By using educational software, children can develop new language skills and perform the same reading and writing tasks as their peers. These assitive smart technologies and smart environments do not intend to substitute the learning at the school setting, but rather provide learning activities for students with disabilities as a form of differentiated instruction. The combination of assitive technologies with educational softwares provide a learning environment which is predictable, concrete, self-paced, and promotes better visual information processing.

In this paper we are going to present the development in the field of assistive technologies and different categories of assistive technologies. Also, we are going to present some of the educational principles related to the use of assistive technologies as a form to increase participation of students with disabilities in education and increase their chances for academic success.

The rest of the paper is organized as follows. In Section II, we present the development in the field of assistive technology. In Section III we present different categories of assistive technologies. In Section IV, some of the educational principles related to the use of assistive technologies as a form to increase participation of students with disabilities in education and increase their chances for academic success. We present conclusions and future work in Section V.

2. Assistive Technologies (AT)

The definitions for the assistive technologies and assistive technology services are given in the Individuals with Disabilities Education Act (IDEA) in 1990. Assistive technology device means any item, piece of equipment, or product system, whether acquired commercially, off-the-shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities. Assistive technology service is any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device. Any item, unless surgically implanted, may qualify as AT if it provides compensatory benefit to a student with a disability resulting in enhanced performance on educational and functional tasks [1].

Assistive technologies aim to support all individuals with learning disabilities gain new academic skills, social skills and support them performing and carrying out every day's tasks. Assistive Technology accommodates students' needs to perform a given task required to accomplish at the grade level of their peers.

Latest research is focused on combining Assistive Technologies (ATs) with other technologies to create types of Ambient Assisted Living (AAL) to support children with disabilities in their daily routine. This assistive learning environment can be realized through the combination of smart devices and special educational software. Providing children with learning disabilities with smart assitive environments during their learning that might include different assistive technologies combined with different communication technologies can help them stay focused during their learning and can maximize their ability to reach their peak attention. The child's task performance is enhanced and the child will be able to learn new language skills, social skills, appropriate behavior and academic skills [2].

Computer use can provide students with a sense of control and consistency and students can use different educational software's to practice communication skills in a lower stress environment compared to real environment. By working in these environments students get and maintain their focus in learning by obtaining the calm-alert state window in which our ability to function is maximized [3]. In this state the child's nervous system is sufficiently aroused for peak attention and task performance which enhances a person's ability to register

and orient to sensory information. The smart devices can be integrated with other system as a useful tool for monitoring and controlling children activities

ATs are often presumed to improve health and social care services for children with autism spectrum disorders. Researchers are taking in consideration that difficulties in sustaining attention on imposed tasks may be attributable partly to a developmental delay and partly to the motivational contingencies of a task rather than to a primary impairment in the ability to sustain attention [4].

A child can develop new vocabulary, new language skills and cognitive skills by using carefully selected Assistive technologies and educational software. These skills are very important and critical in developing other academic skills and help children become readers at their age level. The educational software that are available in today's market allow children to learn in their pace rate and because of the modules of games, puzzles, videos that are part of the software it becomes very interactive. This will give the child the opportunity to be engaged and may help them learn new reading skills faster. When educators face children with learning challenges, a combination of neuroscience and technology can enhance learning capacity and efficiency, even in children with neurological differences [5]. By using the combination of language therapy interventions and educational software that target their learning barriers students will build foundational communication skills, language skills which will help them overcome their learning environment barriers.

Positive results are being provided by teachers, schools, centers that have used educational software's to support children gain new language skills and the results have shown that students can learn new communication and language skills [6].

3. Categories of Assistive Technologies

Assitive technologies are used to support people with diasbilities to perform daily tasks and lead independednt lives. In this section we present the definition about disabilities, some data regarding people with disability and categories of assitive technologies. Based on the data represented in this section, we can see that assitive technologies and the development in this field is very important because it supports many people with disabilities perform academic tasks thus making general education and higher education accessible to this category of population. Without assitive technologies general education and higher education will be impossible for many people with disabilities. The data represented below shows the importance of using assitive technologies to overcome physcial and learning disabilities barriers in education and in supporting students with disabilities acces the general and higher education.

3.1. Disabilities and data

Assitive technologies are used to either overcome a physical disability barrier or learning disability barrier. The International Classification of Functioning (ICF) defines disability as the outcome of the interaction between a person with impairment and the environmental and attitudinal barriers he/she may face; or, a restriction or inability to perform an activity in the manner or within the range considered normal for a human being, mostly resulting from impairment.

The data presented by the US Census Bureau i-2010 [7] shows that 56.7 million people had a disability, or 19% of the population, or nearly 1 in 5 people. According to the Disability Funders Network, 20 million out of the 69.6 million families in the United States have at least one family member with a disability and within higher education in 2008, 11% of all postsecondary students had a disability.

According to the report "Analysis of the history of the development of education of children with disabilities in Albania during 1945 – 2011", the number of people registered in 2010 under the category "with one or several disabilities" was 123,774, and 53,783 people are registered under the category "Mental, sensory, physical" [8]. The Albanian education system has started collecting information on the number of students with disabilities law No. 69/2012 "For the Pre-University Education System in the Republic of Albania" that entered in force in 2012, specifically articles 6, 19, 20, 57, 63, 65, regulate the rights to education of students with special needs.

Also, accessibility of the materials in the online learning is very important and assistive technologies can provide some solution to this problem. According to the report Changing Course: Ten Years of Tracking Online Education in the United States:

- the number of students enrolling in at least one online course increased over 570,000 students between fall 2011 and fall 2012 to a new total of 6.7 million
- by 2015, 25 million post-secondary students in the United States will be taking classes online.

More than 1 billion people in the world today have a disability [9], and Fig. 3.1 shows that disabilities and impairments increase with age, thus it is very important that new skills are leaned in early ages to help people later cope with difficulties to perform a task due to their disability.

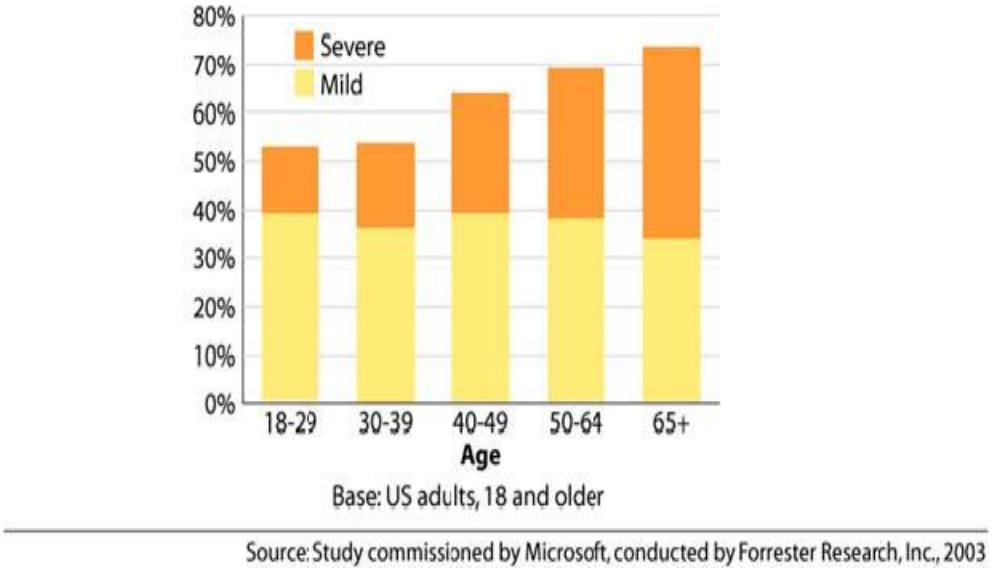

Figure 3.1: Difficulties and Impairments Increase with Age.

3.2 Assistive Technologies Range

The assistive technologies range from low tech to high tech and the determination which one to choose depends on the students' abilities and student's needs for support to perform a given task. By using different types of assistive technologies according to their abilities and disabilities will support them use in their advantage their strengths and gain new skills.

The areas that the assistive technologies might be used into students' daily lives in order to support them either gaining new skills or dealing with their disabilities are: visual

information processing, sensory integration, motor skills development, academics, organization skills, behavior problems, social interactions, transition.

Knowing students' abilities and disabilities would support the team of educators, specialists and parents on making decisions on the type of assistive technologies to be used to support students' learning. The process of choosing the proper Assistive technology is a bit complex and should take under consideration the need for this tool and students' ability to perform the tool. The team should identify the tasks that the student is required to perform to achieve the curricular goals and match this with the proper AT. Also, the team should take into consideration the students' abilities to use a specific assistive technology like physical, cognitive and linguistic abilities.

Various types of technology, fom "low" to "high" tech, should be infused into every aspect of students' daily lives. Educators and specialists should carefully choose and combine the assistive technologies, the activities and individualized curriculum to target a specific need of the student.

Fig. 3.2 shows the range of assistive technologies, and students can chose to combine technologies from any range and use them to perform their academic tasks and daily tasks.

Figure 3.2: Assitive Technology range

Assitive technologies can be used in different areas to support students with disabilities either perform a given academic task like writing, reading, etc or deal with their disabilities. Table 1 presents the areas where assitive technologies can be used.

Table 1. Areas of use of AT

AT Support Students	
Deal with their disabilities	Academics
Perform everyday tasks	Perform academic tasks
Visual information processing	Visual information processing
Sensory integration	Gain new skills

Motor skills development	Transition
Organization skills	
Behavior problems	
Social interactions	

Specialist and educators when making decisions in using different educational software as a form of assistive technology to support students' language learning should consider carefully students' abilities and disabilities in these areas: communication, academic, motor, behavior, organization, social interactions, transitions and other concerns related to the specific situation. Also, they should evaluate carefully the environmental considerations that impact the student's participation and the tasks that the students are expected to do as shown in Fig. 3.3.

Parents should be involved in this decision making process because learning should continue outside the classroom to ensure continuum of the students learning progress. By using this software students might build foundational elementary school reading and language skills which will help them learn successfully in the general classroom and succeed in academic settings.

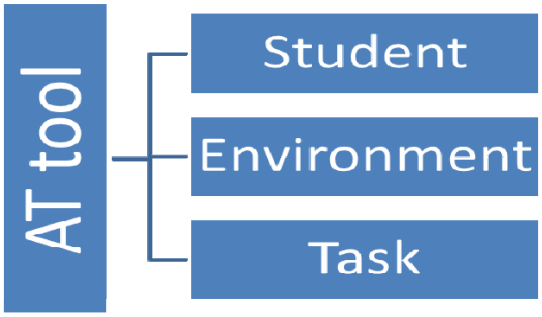

Figure 3.3: Matching AT tools

The main categories of the impairments are:

- Vision impairments
- Learning impairments
- Mobility and dexterity impairments
- Hearing impairments and deafness, and
- Language impairments

Also, there are invisible disabilities which are the disabilities that are not immediately apparent.Disabled World defines invisible disabilities as "an umbrella term that captures a whole spectrum of hidden disabilities or challenges that are primarily neurological in nature"[10]

Table 2 gives an example of assistive technologies that can be used for the category: vision impairment [11].

Table 2. Assistive Technologies used under visual impairment category

Impairment[3]	Level of Functionality	Suggested Technology
Visual Impairment	Can see clearly	• High-resolution monitor • Glare guard
Visual Impairment	Can see monitor up close	• High-resolution monitor • Oversized monitor • Glare guard • Talking calculator • Telephone LED reader • Closed Circuit TV
Visual Impairment	Can see with enlarged type	• High-resolution monitor • Oversized monitor • Screen magnifier • Glare guard • Talking calculator • Telephone LED reader • Closed Circuit TV • Oversized keyboard • Large button phone
Visual Impairment	Uses other senses	• Screen reader • Braille display • Telephone LED reader • Talking calculator • OCR system • Tape recorder – telephone • Tape recorder – notes • Personal reader

In the fig. 3.4 we have presented some tools to match up the assistive technology with the learning disability.

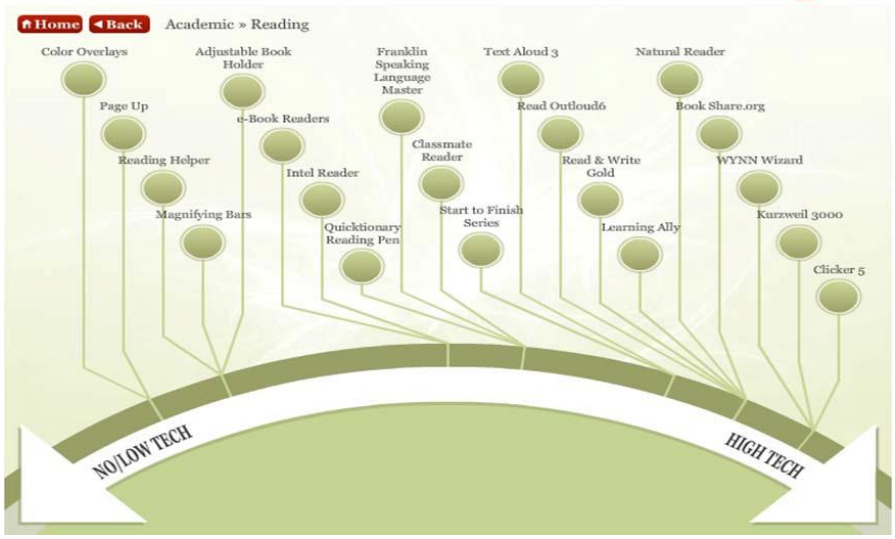

Figure 3.4: Impairment Types & Technology Solutions[12]

The figure below represents a case study on a higher education students and the types of assitive technologies used by the student. As it is shown in the Fig. 3. Student uses a combination of low range technologies with high range technologies to perform academic tasks.

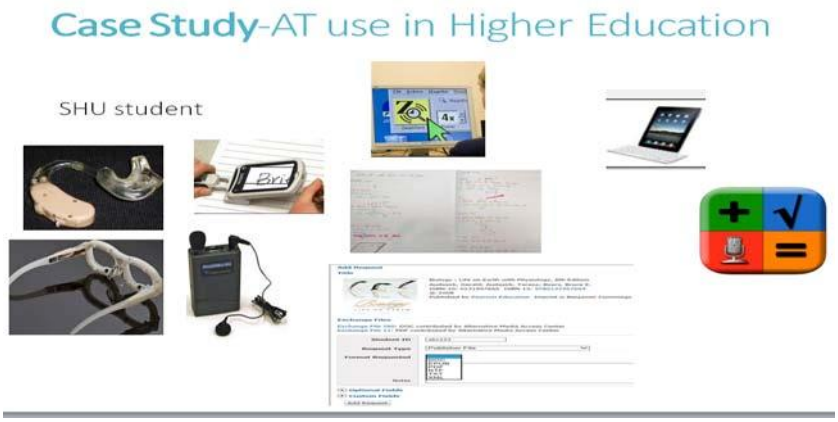

Figure 3.5: Case Study-AT use in Higher Education by one student with disabilities

4. The educational principles related to the use of assistive technologies to promote independent learning

The use of assistive technology to support students succeed academically is often related to education strategies and approaches when working with students with special needs. Some of these education strategies being used in classrooms are the Least Restrictive Environment (LRE) and the Universal Design for Learning (UDL).

The requirement of the Individuals with Disability Education Act in USA that "each student with a disability must be educated with non-disabled peers to the maximum extent" is better known as the obligation to educate students in the least restrictive environment (LRE).

The differentiation between the instructional technology tools and assistive technologies is the purpose of use. The instructional technology tools are used by teachers and students as a form of differentiated instruction with the purpose for students to gain new skills and knowledge. The assistive technologies are used as a compensation tool for students with disabilities to allow them achieve at a performance level at a given task; in other words, without this tool they will not be able to perform this task. The role of AT is to increase the students' access to curriculum information; increase students' participation in schools and to enhance students' performance on a given task.

4.1 Least Restrictive Environment (LRE) and Universal Design for Learning (UDL)

Least restrictive environment is one of the six principles that govern the education of students with disabilities and other special needs[13].

The requirements of the Individuals with Disability Education Act (IDEA) in USA:

- "each student with a disability must be educated with non-disabled peers to the maximum extent":
- obligation to educate students in the least restrictive environment (LRE).
- students should be provided with supplementary aids and services necessary to achieve educational goals if placed in a setting with non-disabled peers.

Universal Design for Learning (UDL) is a set of principles that guide curriculum development resulting in equal opportunities for learning. IDEA 2004 defines universal design using the same definition as the Assitive Technology Act of 1998. The term 'universal design' means a concept or philosophy for designing and delivering products and services that are usable by people with the widest possible range of functional capabilities, which include products and services that are directly accessible (without requiring assistive technologies) and products and services that are interoperable with assistive technologies" [14].

Table 3 : Universal Desing for Learning Principles based on neuroscience

Neuroscience primary brain networks that affect our learning	Learning Process	UDL Principles
The Recognition Network	What ✓ Different learning styles ✓ gather information ✓ process information ✓ organize information ✓ use information	Multiple Means of Representation to engage the recognition network of all students to the greatest extent possible
The Strategic Network	How ✓ plan and perform tasks ✓ organize and express our ideas	Multiple Means of Action and Expression Giving students the ability to express what they know in a variety of ways.
The Affective Network	Why ✓ get engaged ✓ stay motivated	Multiple Means of Engagement Addresses the need to make the learning meaningful and interesting to students.

4.2 Instructional Technology Tools vs. Assistive technologies

The same technology can be used in different situations in an academic setting: as instructional technology tool and also can be used from students with disabilities as an assitive technology tool to perform a given academic tasks.
The role of AT is to ncrease students' access to curriculum information; increase students' participation in schools, enhance students' performance on a given task.
Some benefits of using AT [15] are:

- Increased self-motivation
- Increased independence
- Integrated and required participation
- Accountability
- Expanded learning and life experiences
- New opportunities for interactions and communication
- Changed vision of potential by adults, peers and child

Table 4 represents an example of using assitive technologies in both situation as instructional technoloy tool and as an assitive technology tool.

Table 4. Purpose of use of AT

Purpose of Use	
Instructional Technology Tools	Assistive Technologies
Differentiated instruction	Compensation tool for students with disabilities
	Achieve at a performance level at a given task
Gain new skills and knowledge	Gain new skills and knowledge

Assistive Technologies use in Academic Courses

Assistive technologies help students academically by:

- Improving access to course information and/or media
- Helping students in the areas of listening, speaking, visual, auditory, reading, writing, and participating in class
- Assisting students with completing course assignments
- Assisting students with studying and retaining course information
- Assisting students with testing and recall of course information
- Increasing accessibility or comfort in physical environment
- Promoting more independent learning

Some types of assistive technologies that can be used in academic settings are:

- Alternate-format books
- FM systems
- recording devices
- low vision magnifiers
- reading technology
- remote captioning
- use of computer
- talking calculators

Some teaching strategies that can be used by teachers with students with disabilities are:

- Make the course materials accessible
- Put the course materials online and make them available ahead of class
- Familiarize yourself with student accommodations and instructions

- Make course syllabi available before course begins if possible; this is important for students who need time to arrange accommodations
- Use multiple formats and means of presentation and UDL principles in your teaching pedagogy

5. Conclusions and future work

In this paper, we presented different categories of assitive technologies that can be used in academic settings to support students with disabilities in their learning. The combination of assitive technologies and educational softwares can assist/support children with learning disabilities and physical disabilities to learn new skills and improve their cognitive skills.We presented different educational principles related to the use of assistive technologies to promote independent learning. Also, we presented some effective methods for teachers to implement in their courses to support all students overcome their disabilities and achieve academic success.

The use of educational software as form of assistive technologies in combination with different pedagogies aims to improve the cognitive skills and develop language skills for children with disabilities. When deciding about the assitive technologies that each child should use to perform a given task, the team of specialists should take under consideration that each child's needs are different and their abilities to perform an academic task is diffferent. For any team of professionals and caregivers it is very important to acknowledge the need of extra support for students with learning disabilities. This support should continue beyond classroom settings in order for them to succeed in school.

In the future we would like to study more the use of assitive technologies in the albanian education system and based on the data propose new ways of introducing assitive technologies in different educational settings from kindergarden to higher education.

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