Towards M-LearningEffective Tool to Improve Education for Dyslexic Students

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Abstract: Information and communication technology (ICT), facilitates access to education and increases the efficiency of the educational process in addition, it makes education environment more interactive and collaborative. This research investigated and highlightedmajorlimitationsin previous researches, and proposesa solution to improve the education system, especially forreading skill in dyslexic students. The authorspresenta comprehensive critical literature reviewfor this important area, and as a result of this research, there are tremendous gaps in those researches. For that there is an urgent need todesignspecific ICT application byintegrating mobile learning (M-learning) in the education. This factor is a very important to learning and enhance student learning. Also, meet the dyslexia student's real needs and covering all stockholders in learning environment lead to improve their learning skills and deal with the previous researches limitations.This research recommended and drive the future applications based on M-learning,and take into consideration, the important of specify the real needs of dyslexic students, which that help to improve the reading skill by using mobile technology. This research is presenting a new research trends for interesting researchers.

I. M-LEARNING TECHNOLOGY

Information and communication technologies (ICTs), which involve several technologies such as radio and television, digital technologies like computers, laptop, mobile and the Internet, have been described as potentially powerful tools for change and reform education [1]. ICT facilitates access to education and increases the efficiency of the educational process in addition, it made education environment more interactive and collaborative the most important service provided by ICT for education is e-learning which can be defined as:"Computer based educational tool or system that enables you to learn anywhere and at any time. Today e-learning is mostly delivered through the internet, although in the past it was delivered using a blend of computer-based methods like CD-ROM"[2]. Fig 1 shows the factors which influence of m-learning technology. Another service provided by ICT is M learning which considers to be a type of e-learning is m-learning has many definitions:"Mobile Learning or M-Learning is a type of e-learning that delivers educational contents and learning support materials through wireless communication devices" [3]. Another definition "the M-Learning is e-learning through mobile computational devices"[4]. In 2003 another definition is provided as a learning mechanism that can take place anytime, anywhere with the help of a mobile computer device [5]. The mobile learning can be defined as a new learning technique using mobile network and tools, expanding digital learning channel, gaining educational services, educational

information and educational resources anywhere at any time [6].

There are many benefits of m-learning like: enables teacher and student to more interaction also educator can access the content of education anytime and anywhere it allows students to participate in learning activities without the traditional restrictions of place and time another important benefit of m-learning is backing distance learning, student can review content just in time, m-learning can be used fordifferent educating domains, it is personalized learning support different student's needs. M-learning helps students who has healthy problem that prevent them from attending class also students can learn at their speed and it helps students who cannot ask in the classroom. [7], [8].
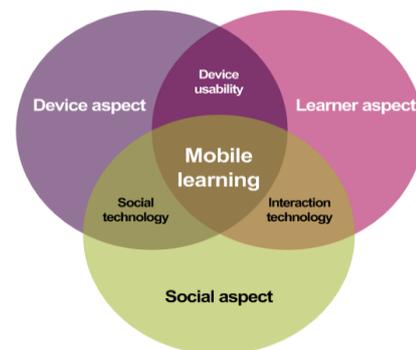

Fig 1: The factors of M-Learning [2].

Inspite of the several benefits of m- learning in education filed the students with disabilities; "those who, need special education and related services to achieve their fullest potential because of theirdisability"[9], do not have a front-pressed to take advantage of the m-learning and that the proportion of the lack of research in this area and multiple types of disability.

A. Disabled Student

Students with special education needs can be defined as "those who, require special education and related services to achieve their fullest potential, because of a disability" [9]. The main objectives of the special education process are to improve the behavior of disabled students and their relationships and interactions with their environment. Also, theymust improve their communication, develop cognitive abilities and acquire new knowledge [10]. Using Technology can help a lot in creating new ways of learning and teaching for disable students by accessible technologies or assistive technologies that help people with disabilities perform operations that could not do it

without it [11]. Mobile devices are powerful, assistive technologies that facilitating the learning process of disabled people and there are many researches Asserts that they can help students with disabilities [11].

B. Types of Disabilities

The number of disability student over the world is on the rise [12]. The following paragraph highlighting the most important types of disabilities:

C. Autistic Spectrum Disorder

Autistic spectrum disorder is a term used to describe disorders such as autism and Asperger Syndrome [13]. This lifelong developmental disability tends to affect the way the individual relates and communicates with people and could also involve a range of repetitive behavior and interests. People with such disorders tend to have difficulties with understanding written and verbal speech. Social interaction difficulties manifest in difficulties in making friends and interacting with other people. Very little research has been done on the semantic web regarding autism. Ontology of autism for phenotype-based querying of archived data has been developed by Young, et. al., [14], which could be useful for research into autism. A number of related researches utilizing an autism ontology [15], are amongst the recent research using ontologies for the benefit of those with autism.

D. Visual Impairment

Visual impairment affects an individual's ability to perceive information. Students with visual impairment, particularly severe impairments usually require some form of assistive technology in order to read lecture notes. This group of people is often disadvantaged when websites or e-learning systems are not designed following accessibility standards [16].

E. Mental Health Difficulties

It is estimated that 1 in 4 people of the adult UK population will experience some form of mental health problem. Mental health difficulties range from mild depression to acute schizophrenia. Other common mental health difficulties include psychosis, anxiety(including panic attacks), attentiondeficit disorder, obsessive compulsive disorder, self-harm and eating disorders (such as anorexia nervosa, bulimia nervosa and binge eating disorder). Agoraphobic avoids crowds and hence public places and would thus benefit from personalization of services online. In designing websites for people with disabilities, accessibility and usability guidelines must be followed, to include such people; hence, Friedman and Bryen [17] recommend twenty web accessibility design guidelines for people with cognitive disabilities with the top recommendation being the use of pictures, graphics, icons and symbols along with text. The semantic web also offers solutions to solve problems related to mental health difficulties. Coyle and Doherty [18] have described the potential of using ontologies in the development of interactive systems to support mental health interventions. Their system emphasizes psycho education, shared peer content and stories and adaptability. The ontology

describes there is specifically for use by clinicians and care workers to diagnose and provide support to those with mental health problems, but also allows for elements such as learning models and interaction preferences/requirements to be incorporated in the ontologies.

F. Mobility Difficulties

Mobility and dexterity difficulties which could also be referred to as physical impairments may be acquired or congenital in origin and affect individuals in a variety of ways. Such difficulties could be characterized by problems with sitting for long periods or slow movements which in some cases could be painful, resulting from injury or amputations, arthritis or spinal cord injury for example. Some students with mobility difficulties will need to use wheelchairs or electric scooters. Mobility difficulties are not only limited to the lower limbs, but also affect the upper limbs and this could make using the mouse and keyboard difficult for such people. Alternative input devices such as joysticks could be used. To make "reasonable adjustments", higher education institutions will need to provide tables that are accessible using wheelchairs as well as ramps, where this is needed [19].

G. Hearing Impairment

Hearing impairment refers to the loss of hearing in one or both ears, which could be complete or partial [20]. Estimates the number of people with such impairment worldwide in 2005 to have been about 278 million [21]. In using information and communication technology, people withhearing impairments will have specific requirements such as captioning for video and audio. System designers thus need to incorporate the needs of such people into their design.

The semantic web also has the potential to offer solutions to problems faced by people with auditory impairments through applications that could aid hearing. In a higher education context, services offered online for disabled students need to consider the need for non-audio alternatives. A personalized system which recommends services to such students will need to provide mainly visual information as audio resources might be irrelevant in this case.

H. Specific Learning Difficulties

Specific learning disabilities cover a wide range of difficulties including dyslexic (difficulty with reading), dysgraphia (difficulty with writing), dyspraxia (motor difficulties) and dyscalculia (difficulties with mathematical calculations). Given the increasing occurrence of learning difficulties amongst students in higher education, an inherent trend, giving the drive for wider participation, it is worth seeking various solutions that can enhance their learning and access to specific services [21].

Current research has shown that the semantic web could offer a solution to the problems faced by disabled people through personalization [22] and increased accessibility [23], [24]. In education, semantic technologies such as ontologies could be used to develop applications that will

support dyslexics in their learning. Schmidt & Schneider [25] and Tzouveli, et. al., [26] have developed an adaptive reading assistance for dyslexic learners using semantic web technologies. This application has been developed for pupils, but in a higher education context, the requirements and application may be different.

Some countries over the world spend the total amount of funding allocated to learning disability in 2005-06 is £1,134,017, this represents 14% of the total funding for learning disability in 2005-06.

Fig 2 shows the breakdown of funding on learning disability into different organizations. This reflecting the importance of learning disability over the world.
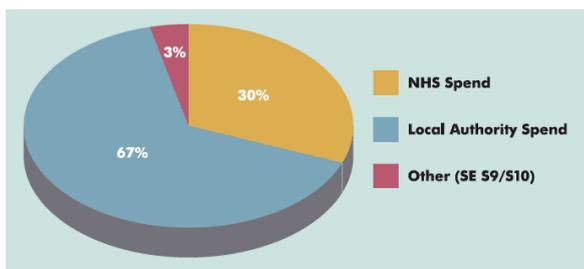

Fig 2: The spending on learning disability [27]

II. ASSISTIVE TECHNOLOGY

Assistive Technology (AT) is defined as "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 the functional capabilities of a child with a disability" [28]. AT is used to help create opportunities and promote independence for students with disabilities. It also helps empower students with disabilities to take the lead in their education and can help to develop self-determination when students can pick their own apps [21].

Benefits of Tablets and Apps

A research study about the amount of educational apps available on iPads found that 2 out of every 5 apps could be used to support students' needs in school and the community [28]. One of the major benefits of using iPads in the classroom is the ease of use for students and teachers. Many teachers struggle with adapting to assistive technology devices, they may be unfamiliar with. However, most educators have some type of smartphone or table that operates the same way as an iPad. Since many teachers already know how to use iPads, it makes training professionals to use the equipment as AT or instructional technology much easier [29].

III. PREVIOUS RESEARCH IN DYSLEXIA

Ting-Feng [30]. The author investigated a questionnaire to find the effectiveness of information and communication technology (ICT) access and ICT competency. The research covers the elementary school students to collect the data. The research covers 117 students with learning disabilities (LD) and compared with 117 students without learning disabilities were recruited in this investigation and were conducted with the questionnaire. The results of the research highlighted that there was no significant difference to access computers and the Internet at home and at school between children with and without learning disabilities. **However**, there was a significant difference between children with and without LD in ICT efficiently. Additionally, the research indicated that students without LD improved their computer competency after using the computer more time, but students with LD cannot. The conclusion of this research was supported the notion that the mere provision of ICT access is not enough for children with LD to improve their ICT skills. However, there is a lack of specific designed ICT instruction programs should be provided to children with LD.

Milagros F. Kudo [31]. The author investigated the recent literature by analysis academic, cognitive, and behavioral performance of students without or with reading disabilities (RD). The study covered forty eight (48), the study met the criteria for the meta analysis, resulting (735) effect sizes with an overall weighted of 0.98. Small to high ESs in favor of children without RD emerged on measures of cognition (rapid naming [ES = 0.89], phonological awareness [ES = 1.00], verbal working memory [ES = 0.79], short-term memory [ES = 0.56], visual–spatial memory [ES = 0.48], and executive processing [ES = 0.67]), academic achievement (pseudo word reading [ES = 1.85], math [ES = 1.20], vocabulary [ES = 0.83], spelling [ES = 1.25], and writing [ES = 1.20]), and behavior skills (ES = 0.80). The author used hierarchical linear modeling and the founding was , there is a specific cognitive process measures (verbal working memory, visual–spatial memory, executive processing, and short-term memory) and intelligence measures (general and verbal intelligence) significantly moderated overall group effect size differences. The research conclusion supported that cognitive deficits in children with RD are persistent.**However,** the chosen studies classified children with reading disability on reading comprehension continuum and/or word recognition where each of these classification use different processes and hence, the results may have obscured.

Nicole Quick [28]. The author investigated the literature review in recent years by examining the effectiveness of the use of the assistive device like iPads to support developing and improve achievement for students with disabilities. The analysis covers both sides benefits and difficulties of using iPads in the classroom. The research concluded that the iPads devices could be improved special education services for students. The result of this research confirmed that assistive devices like iPads were an effective technology in the classroom. **However,** there is a lack of application that best meet student's needs.

Kumar et al. [32]. The authors developed a new strategic reader tool to improve the reading skill for disabled students (dyslexia). The tool based in two dimensions, system blending Universal Design for

Learning (UDL) and Curriculum-Based Measurement (CBM). The proposed tool has three parts. The tool is an online based, the CBM part is for monitoringstudent's progress, and an interactive computer-supported reading environment based on UDL principles. The tool based in new strategies into age-appropriate, to achievehigh quality, focusing in middleschool stage. The authors evaluated theeffectiveness of the tool by using online and offline CBM strategic reader. Based on the comprehensive data analysis, the results show that there is a significant potential of UDL and CBMs for improving reading skill for dyslexia students.**However**, the solution did not take into consideration the background knowledge of the students.

Nisha Sharan [33]. The author research covers how the computer is helping dyslectic students, specially who have Swedish as a second language in learning. The research proved that the computer assistance motivated dyslectic students to achieve their goals. The research found that the school and the home environments affected dyslectic students who have Swedish as a second language. The author takes a sample that consists of four dyslectic students, 13 to 15 year olds who have Swedish as a second language. Also, the sample contained two Swedish teachers. The author collected the data using semi-structured interviews and analyses using content analysis. After transcribing the interviews' six themes: diagnosis, computer as a tool, inclusion, motivation and environment were identified. The research results were that computers are effective tools for dyslectic students who have Swedish as a second language. Assistive devices make these students more independent to find ways to support themselves. It motivates the students to learn more. It was very clear that the students were more efficient in computers compared to the teacher´s. Maybe, both the teachers and the students should be given the same competence education. Motivation as the most important aspect in learning was very noticeable in all the six interviews.**However**; the solution did not consider the student's and teacher's background.

NikSiti Fatima et al. [34]. The authors found that the advantages of computer based applications in healthcare have been well established. The research, analysis theprevious researches based oncomputer screening tests and found that there were limited in the tools designed to be used by dyslexics. The author developed a conceptual framework a Computer based for Dyslexia Screening Test (CDST). The proposed framework consists of many stages like assessment modules (for the purpose of the screening dyslexia test) and proposed design guidelines to meet the dyslexic child's needs. The research validates and finds that assessment module and design guidelines detected dyslexia student at an early stage without the children knowing that they are being screened. **However,** the framework ignored the writing skill.

Helena Song Sook Yee [35]. The author found that among mobile featuresthere were flexible multimedia content and storage, portability, mobility and affordability. The author investigated previous researches to show the significant role of these devices and proved that it could enhance the quality of life of the children with learning disabilities and their families. The research found that there was a lack of published research studies on the use of mobile technology with children with learning disabilities. **However**, the solution ignores the parent and school that assist these individuals.

Kumar, Anil; Karie, Nickson [36]. The authors developed an ICT services to increase the opportunities for disabled students focusing in dyslexic students. The solution make the those students to participate in the newly world by using technological educational tools that provide different functionalities and services. The authors presented a new concept, which help at developing a basic learning and communication system for school children with reading disabilities by using mobile application.**However,** does not check for the correctness or meaningfulness of the input provided by the students.

Settachai Chaisanit et al. [37]. The authors developed a mobile learning technology to enhance the education level of those students. The solution also provided many benefits byimproving their behavior, communication and relationships with their environment. The proposed application achieved the main goals of the research by increases learning outcomes of all disabilities students in the research. The research proved that the application which based on mobile technology could havea positive effect and influences on learning skills.**However**, Lack of considering disability student's curriculum.

Smart Jabjone [38]. The author investigated the m-learning for teaching in molding, casting with plaster by using QR Codes (MLM). The researcher using Thai sign language video tools. The author developed an effective tool to improve learning skills for stakeholder at NakhonRatchasimaRajabhat University students in Thailand. The proposed solution implements in a sample content from seven deaf participations. In this research, the sample covers deaf and hard hearing student who faced the problem when study in thetraditional classroom. The research used a Universal Design for learning (UDL) technique and met stakeholder and student's needs. In the practical part the student can access to the lesson by scanning Quick Response (QR) codes. All relative resources can storage using cloud computing technology. The evaluation stage showed that this proposed solution (MLM) increased the learning skills in all samples by using the video to demonstrate and showed the technique which student follow and could practice by them. Participants had a positive response to the m-learning. The students and instructors reports enjoying learning with their mobile devices, and found the MLM easy to access and use. **However**, there was a need to expand the scope of the curriculum to include more student participation in a

wider range of interactive exercises, thus creating a truly mobile classroom.

Table1: The previous research strengths and weakness

Author	Approach	Adv+	Limitation
Ting-Feng	A tool	No different between LD and without LD students in using ICT devices.	A lack of specific designed ICT for LD.
Milagros F	Literature review	Take the students background into consideration.	The children classification use has different processes, the results may have obscured.
Nicole Quick	literature review	The research covers both sides(benefits, difficulties) of using iPads in the classroom.	A lack of application that best meet student's needs.
Hall	A tool	The tool monitoring student's progress.	Did not take into consideration the background knowledge of the students.
Nisha	A tool	The school and the home environments affect dyslectic students.	Did not consider the student's and teacher's background
Nik	A tool	Proposed design guidelines to meet the dyslexic child's needs	The research ignored the writing skill.
Helena Song	A tool	M-learning could enhance the quality of life of the children with learning disabilities.	The research ignored the student environment.
Kumar	A tool	Mobile application	The research does not check for the correctness of input data.
Settachai	A tool	The research improving behavior, communication and relationships with their environment	Lack of considering disability student's curriculum.
Smart Jabjone	A tool	Met stakeholder and student's needs.	Expand the scope of the curriculum.

As a result of critical investigated in the related works, Table 1 shows the summery of advantages and limitations of previous researches and highlighting new research trends for interested researchers.

IV. CONCLUSION

As a result of investigated a proud comprehensive previous researches, we concluded that, integrating the information and communication technology (ICT) in education is a very important factor to learning and enhance student learning environments. Special, reading difficulties (Dyslexia), which a mobile technology can be used very efficiently to improve reading skill, for less financial cost and widespread in normal schools. To achieve these benefits, there are some important gabs and open issues are need to covers in the future researches. The research summaries those gaps for interested researchers:

- There is a lack of specific designed ICT instruction programs to meet the LD student's need.
- There is a need to expand the scope of the curriculum to include more student participation in a wider range of interactive exercises, thus creating a truly mobile classroom.
- There is a lack in collecting information about behaviors, skills, and routine activities, it should be clearly identified and described in detail.
- Some solutions ignore the student environment (parents and school) that are assisting these individuals.
- Some researches ignore some important skills.
- Some researches doesn't consider the student's and teacher's background.
- Some systems do not support standard lessons.
- There is a lack of application that best meet student's needs.
- Some studies classify children with reading disability on reading comprehension continuum and/or word recognition where each of these classification uses different processes and hence, the results may have obscured.

As a future enhancement of this research there is an urgent need for designing a specific ICT application based on M-learning, meetingthe dyslexia student's real needs, and cover all stockholders in learning environment to improve learning skills for dyslexic students.

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