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ICTs, Mobile Learning and Social Media to Enhance Learning for Attention Difficulties

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Abstract: Recent development in the role of Information and Communication Technologies (ICTs) at the field of special education is thought significant. ICT nowadays is recognized as a tool that can foster the knowledge and the experiences in the areas of needs it serves as it is considered significant for teaching and learning process. In the last decade, a number of studies have demonstrated the benefits of various forms of ICTs tools for children with attention difficulties and hyperactivity disorders (ADHD). These tools can be employed to facilitate and train young learners, as well as can help them to increase their quality of life and functional independence. In this paper we present a brief review of the most representative research papers for computer-based applications for diagnosis and intervention purposes included the mobile learning and social media for technology enhanced learning for people with Attention Deficit Hyperactivity Disorder.

Keywords: ICT, education, ADHD, diagnosis, intervention, mobile learning, social media
Categories: H.4, H.m, L.0, L.1, L.2, L.3, L.5, L.6

1 Introduction

It is widely supported that new technology is a field that supports many aspects of our every day life. Many researchers argue that Information and Communication Technologies (ICTs) is a general mount that includes all kinds of technologies that enable people to estimate and manipulate the given information [Drigas & Ioannidou, 13]. Moreover, [Florian& Hegarty, 04] state that education is one of the fields that ICTs are considered very important underlining their use in primary education where is thought significant for this crucial age. However, the role of ICT in education has been studied since the beginning of the 1970s, where teachers and scientists started to

believe that ICTs and new technology can support students in education [Drigas&Kokkalia, 14].

However, rapid advances in information technology have dramatically transformed the world during the past several decades and the basic requirements of education for the future changed. Knowledge became the most critical resource for social and economic development being able to use computer and Internet effectively, having a qualified education, getting a job and communication skills became basic prerequisites for human life quality [Clarfield & Stoner, 05]. Taking this into consideration, access to computers and the World Wide Web is required for education employment and for many activities of daily life. While these changes have improved society in many respects, education is one of the basic public service that should be provided for all its citizens considering equality of opportunity by a social-welfare state. Equal opportunities and advantages in computer technology use should be provided for all individuals forming the society [Williams, 06].

Nowadays, there has been an increasing interesting on assessing children who face special needs with the support of ICT in order to overcome their difficulties at the learning process. There is also a general agreement amongst different specialists and scientists that ICT can maintain a child's skills as well as can build a developmental appropriate learning environment depending on their needs they face and the curriculum requirements [Plowman& Stephnen, 05]. Recent studies on the use of ICTs in special education claim that can provide children with many different opportunities for rich learning activities that are relevant to their growth characteristics and may have positive effects taking into consideration their learning difficulties [*Westwood, 06]*. [Westwood, 06], additionally, states that ICT can play a main role in achieving the goals of the curriculum in all areas and subjects if the provided developmentally appropriate software tools are inserted in suitable educational scenarios. In last, it has been noted that children who are displayed in high quality learning opportunities experience less difficulties at their later academic life [Westwood, 06].

Nevertheless, not all learners meet the same needs. That means that there are groups that face certain difficulties, which can lead to serious consequences for academic performance as well as for relationships and occupational outcome [Meijer et al., 07]. Attention difficulties are one of the most prevalent problems that become apparent during a child's school-life. Attention disorders –commonly referred as ADD or ADHD- are usually characterized by poor attention skills and/or hyperactive and impulsive behaviours. In other words it is a set of behaviour problems that are remarkably stable over time [Xu et al., 02]. These problems usually show up in early childhood and more specifically are present before the age of seven where often a diagnosis is taken place. A common misconception about children with attention problems is that they aren't paying attention and they cannot focus on a specific time for an acceptable period. This elevated risk for poor academic achievement indicates that many students with attention disorders are in need of an accurate diagnosis and effective intervention strategies as ADHD usually continues into adulthood [Blurton, 07]. Research suggests that successfully management and behaviour modification of this disorder often depends on the integrated program of medical interventions and behavioural techniques. A very important factor for this purpose is to involve parents and teachers in these interventions [Finnis, 04].

As a result, a growing number of studies seem to support the use of ICTs in both mainstream and special education with several ways such as alternative communication, assistive or enabling technology, internet applications, virtual environment and technology integration [Tinio, 03]. According to existing studies, mobile devices are one of the most successful technologies for learning, as they are considered attainable and easy to use especially for people who face such difficulties. Mobile device, which is also referred to as a handheld, is a pint-sized computing device and usually come with a touch or non-touch display screen and very often with a mini keyboard. There are different types of mobile devices, while the commonest among them are mobile phones, smart phones, PDAs, pagers and Personal Navigation Devices. PDAs and smart phones are considered the most preferred mobile devices, which offer all the advantages of a personal computer, along with a very small form factor. Additionally, their use provides greater feedback for educators and has a supportive role for learner as the provision of necessary basis like telecommunication equipment and perfect training content are thought significant for attaining the educational goals [Stephenson& Limbrick, 13].

Besides, the Internet has an indeterminable power to affect, connect, and conscript the population. Technological advances are simply expected because today's society has different expectations for all types of relationships. The primary focus is on the Internet with the development of social media [Cabral, 11]. Researchers state that Social media is a web-based technology that transforms how people communicate by enhancing interactive conversations and they conclude saying that is a group of Internet-based applications that build on the ideological and technological foundations that allows the creation and exchange of user-generated content. Social media is continuing to grow rapidly based on the wants of the user [Cabral, 11]. Technological developments usually influence those who cannot multitask or work with the demands of modern technology, including people struggling with ADHD. [Yen, 09] states that Internet activities are based mainly, upon their interactivity levels and immediate response rates and thus these quick actions relive the feeling of boredom and probably create a physical addiction claiming that the Internet is the cure for people who cannot hold focus.

The main goal of this study is to briefly present some of the most representative studies on ICTs, mobile learning and social media that are used in order to enhance learning for Attention Difficulties s in various settings such as school, home, or at a specialist's office. Considering that most of the time that children spent in school with their teachers or in home with their parents, it is desirable that they can assess certain attention difficulties [Barkley, 02]. In addition, computer-based attention-training interventions are usually associated with strategies such as increased attention, specifically designed exercises to train child's attention and on-going computer-based feedback to reinforce correct responses [Barkley, 02]. Our scoping study drew upon national and international publications as well as the research findings of the last decade which focus on the use of ICT, included the mobile learning and social media, in people with ADHD. For this reason we created a framework, which is consisted of two main sections of diagnostic and intervention, tools for ADHD.

2 Diagnostic Tools

Nowadays, it is accepted that today's college students are expected to use a variety of learning technologies in order to succeed in higher education. Students with learning disabilities (LD) and/or Attention Deficit/Hyperactivity Disorders (ADHD) may face difficulties to equal access and satisfying learning in this new digital environment, including the development of new technology tools and self-regulation of attention while working with the online information [Marino et al., 06]. Recognizing this fact a University team designed and piloted the Learning Technologies Management System (LiTMS) that follows the Principles of Universal Design for Instruction in order to support and diagnose students with learning disabilities-including the ADHD [Parker et al., 09]. According to the survey, LiTMS model can be used in the numerous university offices that provide these services and in this way, the model reaches the literature on Universal Design by offering a piloted framework that disability service providers can use in their own work with students. According to this model, writing centres, staff members and academic skills centres can offer individualized intervention and assessment to any student that needs that. Additionally, college technology labs and libraries may give individualized assistance involving technologies such as Internet search engines and PowerPoint software to a wide variety of students who request assistance with research and presentations. The developers believe that the LiTMS model is a promise that offers a new opportunity to extend the research base on effective support services. According to the team that designed this platform, many colleges and universities are now moving to this model by offering strategy instruction to promote greater independence and learning self-efficacy to the students they need that [Parker et al., 09].

In addition, [Rizzo et al., 04] created a Virtual Classroom (VC) for the diagnosis and rehabilitation of attention disorders, followed by a Virtual Research V8 head-mounted display system. The VC scenario is consisted of a rectangular classroom, desks, a teacher, a blackboard and a large window looking out onto a crowded street and a playground. The student's assessment takes places within this scenario of which there can be delivered more than twenty different distracters while three magnetic trackers from Ascension Technology are used in order to track head, arm and leg movements. The children sit at a virtual desk within the classroom and the teachers' measure on-task attention in terms of reaction time and error profiles. Experimental results indicate that VC has positive effects on the assessment of attention problems because with the help of the tracking technology, the students with the ADHD showed higher activity levels on all metrics compared to the non-diagnosed group of children [Rizzo et al., 04], [Rizzo et al., 02].

In the same year [Rebolledo-Mendez et al., 04] introduced the NeuroSky MindSet (MS) in order to assess attention levels in a variety of exercises by combining performance data with user-generated data, taken from interaction. NeuroSky Mindset comes with a headset with three electrodes, which are put under the ears and on the forehead. The electrical signals are used as inputs by NeuroSky's algorithms to examine the attention levels whereas an Artificial Intelligence driven avatar was designed to pose questions and have limited conversation with the users. This tool is thought a low-cost, non-clinical tool and different users producing different outputs can wear it. This intervention was tested on first-year undergraduate students and the

results suggest that there can be a positive relation between measured and self-reported levels of attention [Rebolledo-Mendez et al., 08], [Rebolledo-Mendez et al., 09].

Furthermore, [Lee, et al., 08] created a novelty detection model to improve the accuracy of computerized continuous performance test (CPT) for ADHD. The developers built a framework where a classifier, called 'T-score 70', is designed to use only one class of training data and a new input pattern is classified according to its similarity to the training data. This proposed novelty detection model could replace the T-score method, which has been used so far for supporting ADHD diagnosis as well as can be applied to other psychological tests where only normal data is available.

Additionally, [Anuradha et al., 10] presented a platform for a more accurate and less time consuming assessment of Attention Deficit Hyperactivity Disorder (ADHD). A well-known Artificial Intelligence tool, the SVM algorithm was designed for this particular platform; support vector machines (SVMs) are a set of supervised learning techniques suitable for classification and regression. A data set, which was verified by a clinician, including the results of a questionnaire used by the clinicians to diagnose ADHD, was given to the SVM module. Later, the data set was introduced and after returned to the SVM module, which finally provides us with the diagnosis. The most important benefit of this application is that it is able to control the complexity of the diagnostic procedure. This tool was tested on students between ages six to eleven years old and the results suggested a percentage of 88,674% success in diagnosing ADHD.

Also, [Bolfer et al., 10] introduced a computer-based assessment test in order to examine the reaction time in individuals with ADHD and normal controls with the help of a visual voluntary attention psychophysical test (VVAPT). This program was tested on boys aged 9-12 with ADHD diagnosis according to DSM-IV, without comorbit disorders, IQ≥89 and never treated with methylphenidate. The control group followed the same criteria for gender, age and IQ. The results indicated that the ADHD group achieved reaction time higher than normal controls and a graduated loss of sustained attention.

In a recently conducted study, [Chatzara et al., 10] presented an intelligent emotional agent for students with Attention Deficit Disorder (ADD) in order to improve the communication channel between the user and the machine for e-learning systems. The proposed agent, Sophia who imitates face-to-face communication, reacts to events that take place in the environment and the latest changes accordingly to Sophia's behaviour. The agent receives the events, through a perception module while a decision module is responsible to decide what behaviour the agent needs to have. Several users that have to provide a few personal details in order to use the system can use this e-learning platform. This program was tested on fifty-two pupils from higher education and the results showed that the agent managed to attract students' attention in a suitable, learning manner.

In the light of the above research, [Delavarian et al., 10] presented a decision support system to distinguish children with ADHD from other similar children behavioural disorders (e.g. depression, anxiety, co morbid depression and anxiety, conduct disorder based on the signs and symptoms). A differential diagnosis of the above mentioned a behavioural disorder is of major significance and practically

difficult due to their similarities and co morbidity of their symptoms. The above system was initially developed in assisting psychiatrists but it can also be used in school settings for a more specific examination of high-risk pupils. For designing the decision support system two types of neural networks were compared: radial basis function (RBF) and multilayer perception (MLP) neural networks. The system was trained and validated to assist the diagnosis of the disorders. The system was tested on 294 children of 12 elementary schools. The classification by MLP networks achieved 95.50% while the RBF classifier reached 96.62%. The limited number of diagnostic errors compared to the errors done by specialists indicated a system that can be used as a reliable and valid tool for ADHD diagnosis.

Last but not least, a current study compared the benefits of mobile phones as a management device for caring with lecture that is considered the traditional method for parent's education in this topic. In the quasi- experimental design of this survey 60 mothers who have a child with ADHD were randomly selected and divided in two peer groups. After running the pre-test that was based on knowledge and practice about ADHD and its management, one of the groups received educational comments from mobile phone and for the other group, lecture was held on. After 16 weeks, the investigators re- measured knowledge and level of applying of the trained techniques. The findings of the survey support the view that although both training methods had a positive effect on upgrade of knowledge and management techniques for mothers, the use of mobile phone as a learning supportive and assessment tool, seem to be more effective. Specifically, the mothers who joined the mobile learning group were successful to control the ADHD symptoms in their children than the mothers in lecture group [Karazhmi et al., 13].

3 Intervention Tools

In a recently conducted study [Shrieber & Sheifert, 09] explored the use of a handheld computer (HC)/PDA by college students with learning disabilities and ADHD, as an aid to plan and organize their daily schedule. The study describes 3 case studies tracking three students which two of them used a handheld computer and one student used a conventional planner. The study's findings clearly show that the students who used a handheld computer reported an increased reliance on the device compared to the other student who did not. The device compensated for the students' organizational and memory related difficulties: the students emphasized in tasks, notes, memos and especially reminders. In contrast to the interactivity of the electronic planner, the conventional planner requires the student's ability to open it manually at least once a day to recall the written events. On the other side, the handheld technology contains many other options, such as a GPS device, visual and audio recording devices, students can synchronize their HC by Bluetooth with the home computer and obtain the advantage of editing and organizing the data they gathered, they can mark the priority of the task for the reminder, set selected tasks to be repeated tasks and can use additional devices such as calculators, MP3 devices and keyboards for lessons' summary. Additionally**,** with a HC students can use Windows and Office interface, surf the Internet and use GPS devices [Kukulska-Hulme & Traxler, 05]. According to the researchers, these options - as well as further handheld/cellular phone integration, can improve the organization and study

processes as well as the student's self esteem. The students felt that their friends revealed interest in their ability to operate the HC and that they had something which helped them remember their tasks. Finally, the usage of HC helped the students to develop self-regulation and a feeling of control.

In 2002 [Hecker et al., 02], introduced an assistive reading software for students with attention disorders, in order to examine the reading performance of a group of students who were diagnosed with attention disorder. The software gives a synchronized visual and auditory presentation of text and incorporates study skill tools for note taking. During each session the program is scheduled to measure attention, reading speed, text comprehension and responses concerning students' attitude. The results of the study indicated that after using the computer assistive software intervention, reading speed showed a small increase, while the students reported positive attitudes about school and significantly less distractibility while reading.

In the same year [Ota & DuPaul, 02], created a game format, as a supplement to computer instruction in mathematics to improve attention levels of fourth to sixth grade students with ADHD. Following baseline (observation under normal classroom conditions), this software was presented sequentially using a multiple baseline design across students. Observational data was collected during the baseline and experimental conditions along with a set of curriculum-based math probes, which were used throughout the study. The findings showed that math software with a game format may improve the academic performance and increase the attention of all children whereas implications for practice and further research is need to be done.

Taking the above into consideration, [Gulchak, 08] created a program for an 8 year old boy who faced emotional and behavioural disorder to self-monitor attention accompanied with hyperactivity and impulsivity. In this study, the student demonstrated the ability to self-monitor his attention using a mobile handheld computer and showed increased on-task behaviour during a one hour reading period in a self-contained classroom .An A-B-A-B withdrawal design was used to collect observational data on the student's attention to task and the results of this empirical study showed that the student was able to use a handheld computer to self-monitor his behaviour and increase his on-task behaviour. The creator concludes saying, that mobile computing is quickly becoming a norm in today's global and demanding world, suggesting that this new procedure for self-monitoring opens doors to new possibilities for students as well as for mobile data collection by educational researchers and teachers.

Moreover, [Shalev et al., 07] presented a computerized progressive attentional training (CPAT) program to improve attention levels in children with ADHD. CPAT intervention program is consisted of four sets of structured tasks that are designed in order to reflect four attentional functions; sustained attention, selective attention, orienting of attention, and executive attention. They are also based on expansions and modifications of various tasks that have widely been studied in the attention literature. This program was tested on twenty 6 to 13 year old children with ADHD over an eight-week period and the authors indicated improvement in reading comprehension and mathematical performance while the behavioural symptoms were reduced.

Additionally, [Aguilar et al., 10] introduced a fuzzy instructional planner, which models the tutor module in an intelligent tutorial system (ITS). This is an interactive

instructional system which includes a combination of text, graphics, sound and video in the learning procedure and it is considered especially beneficial for individuals with ADHD or attention difficulties, as well as in distance learning situations. The aim of this system is to mimic the behaviour of the teacher in order to manage learning process satisfactorily. The fuzzy instructional planner is consisted of a rule base, an inference, a fuzzification interface and a defuzzification interface. Furthermore, the input information is derived from human expert who supplies linguistic information. The ITS is thought as a flexible system which adapts the teacher's rules to the child's performance and it has been proved useful in several applications with promising results.

Nevertheless, a very sensitive field that has to do with the ADHD is how teenagers behave during their driving as the teenage drivers with ADHD are thought at considerable risk for negative driving outcomes, including traffic citations, accidents, and injuries. Americans drivers between 16 and 20 years old have the greatest injury and fatality rate compared to other age groups. There is now clear, converging evidence from multiple prospective studies with well-diagnosed adolescents with ADHD and comparison, non-ADHD adolescents, that teen drivers with ADHD have more accidents that result in greater costs injuries and fatalities than those without ADHD [Fisher et al., 2007]. A recently conducted research designed the 'Supporting a Teen's Effective Entry to the Roadway (STEER) program' that is a multicomponent intervention tool which help families with a teenager with ADHD negotiate the transition independent driving. According to the present report, the utilization of this multiple baseline program shows the driving behaviour of the teenagers using on-board monitors that measured driving behaviours (i.e., hard breaking, speed), and also gives the opportunity to parents and teens to report on driving-related impairment each week. In the present investigation, multiple aspects of the STEER program are constructed in order to include the needs of teen drivers with ADHD, involving an initial motivational enhancement component, parent and teen sessions, the use of objective monitors of driving behaviour, an engaging and action oriented driving simulation component to enhance awareness and self-efficacy on the part of the teen and parent(s), and the establishment of clear behavioural contingencies in families. The results of this study indicate promising effects across participants, as the STEER program was viewed as an acceptable and useful intervention. Based on the preliminary data collected as part of this study, teen self-report measures of driving outcome generally reflect improved driving and the objective driving data for the hard braking and top weekly speed measures also supported improved driving for those with abnormal rates at baseline [Fabiano et al., 10].

Last but not least, [Fernadez- Lopez et al., 12] developed a platform called Picca, for users with educational special needs, including people who face ADHD. The designers developed a mobile platform, in order to investigate the main phases of the learning procedure that are the preparation, use and evaluation. The platform has four kinds of educational activities (Exploration, Association, Puzzle and Sorting), which can be used by educators and specialists at content and user interface levels based on student requirements. The results of their experiment shows that the use of the Picaa has positive effects in the development of learning skills for children who struggle with special educational needs, claiming that the basic skills can be improved. The study also suggests that the different types of activities are suitable for learning

purposes with students with impairments while the use of electronic devices and multimedia contents increases their interest in learning and attention.

4 Conclusion

The scope of this study was to present if and how new technology can support people and students with ADHD as this disorder may increase the risk of poor academic performance, of poor social skills and can have long-term consequences in a child's future life. The results of the studies we explored which are considered the most representative studies over the last decade, showed that people can benefit of the use of new technology and can obtain many advantages and profits using the appropriate educational tools that offer the use of ICT; it is obvious also, that its use has also played a major part in shaping the knowledge and skills of school staff, therapists and special educators. This paper has given an account of some of the most useful computer-based applications, mobile devices and social media tools for technology enhanced learning for people with Attention Deficit Hyperactivity Disorder concerning the diagnosis and intervention process. These tools give the possibility to parents, teachers and specialists to work with the child, apply different diagnostic ICTs strategies and understand its needs. Diagnostic tools provide them with the possibility to employ different ICT strategies which might lead to an easier understanding of children's learning differences while ICT intervention tools support activities of student's life. However, in spite of this increasing emphasis on diagnostic applications, the area of intervention tools offers a limited number of evidence based on studies that have been published in books, scientific journals and conference proceedings. Owing to the heterogeneity of children with attention difficulties, it is necessary to understand the need for further research in order to meet the needs of all learners. Last but not least, we consider that the field of ADHD education and the interventions that ICTs can show in many areas of child's development needs more investigation. However, we hope that the results of the current study are encouraging as there is the general agreement that ICT, mobile learning and social media is not only promising technologies but an existing variety of tools to enhance learning of people with Attention Difficulties in academia and education domain.

References

[Aguilar, 10] Aguilar, R .M., Munoz, V., Noda, M., Bruno, A., Moreno, L.: Teacher Strategies Simulation by Using Fuzzy Systems. Computer Applications in Engineering Education, 18,1, (2010), 183-192

[Anuradha, 10] Anuradha, J., Tisha, Ramachandran, V, Arulalan, K.V., Tripathy, B.K.: Diagnosis of ADHD using SVM algorithm. In Proceedings of the Third Annual ACM Bangalor Conference, 2010.

[Barkley, 02] Barkley, R. A.: Major life activity and health outcomes associated with attention-deficit/ hyperactivity disorder. Journal of Clinical Psychiatry, 63, 12 (2002)10-15

[Blurton, 99] Blurton, C.: New Directions of ICT-Use in Education. Learning without frontiers. UNESCO World Communication and Information Report, 1999.

[Bolfer, 10] Bolfer, C., Casella, E.B., Baldo, M.V.C., Mota, A.M, Tsunemi, M.H., Pachero, S.P. and Reed, U.C.: Reaction time assessment in children with ADHD, Arquivos de Neuro-Psiquiatria, 68, 2, (2010)282-286

[Cabral, 11] Cabral, J. : Is Generation Y Addicted to Social Medi?.. The Elon Journal of Undergraduate Research in Communications 2, (2011) 5-13

[Chatzara, 10] Chatzara, K., Karagiannidis, C., Stamatis, D.: An Intelligent Emotional Agent for Students with Attention Deficit Disorder, International Conference on Intelligent Networking and Collaborative Systems (INCOS), 2010, 252-258

[Clarfield, 05] Clarfield, J. and Stoner, G.: The effects of computerized reading instruction on the academic performance of students identified with ADHD. School Psychology Review, 34, 2 (2005) 246-254

[Delavarian, 10] Delavarian, M., Towhidkhah, F., Dibajnia, P., Gharibzadeh, S.: Designing a decision support system for distinguishing ADHD from similar children behavioural disorders. Journal of Medical Systems, 2010 [Epub ahead of print].

[Drigas, 13] Drigas, A., Ioannidou, R. E.: Special Education and ICTs. International Journal of Emerging Technologies in Learning (iJET), 8, 2 (2013) 41-47

[Drigas, 14] Drigas,A., Kokkalia,G.: ICTs in Kindergarten. International Journal of Emerging Technologies in Learning (iJET), 9, 2 (2014) 52

[Fabiano, 11] Fabiano G. Hulme,K., Linke,S., Nelson-Tuttle,C., Pariseau,M., Gangloff,B.,Lewis,K.,. Pelham,W., Waschbusch,D., Waxmonsky,J., Gormley,M., Gera,S.& Buck,M.: The Supporting a Teen's Effective Entry to the Roadway (STEER) Program: Feasibility and Preliminary Support for a Psychosocial Intervention for Teenage Drivers With ADHD. Cognitive and Behavioural Practice 18, (2011) 267–280

[Fernández-López, 13] Fernández-López,A., Rodríguez-Fórtiz,M., Rodríguez-Almendros,M., Martínez-Segura,M.: Mobile learning technology based on iOS devices to support students with special education needs. Computers & Education 61, (2013) 77-90

[Finnis, 04] Finnis, J.: Myths and facts of learning technology. TechLEARNING. Retrieved March 6, 2004, from
http://www.techlearning.com/story/showArticle.jhtml?articleID=22101447 2004

[Fischer, 07] Fischer, M., Barkley, R. A., Smallish, L., & Fletcher, K. : Hyperactive children as young adults: Driving abilities, safe driving behaviour, and adverse driving outcomes. Accident Analysis and Prevention 39, (2007) 94–105

[Florian, 04] Florian, L., Hegarty, J.: ICT and Special Educational Needs: a tool for inclusion. McGraw-Hill International (2004)

[Gulchak, 08] Gulchak, D.: Using a Mobile Handheld Computer to Teach a Student with an Emotional and Behavioural Disorder to Self-Monitor Attention. Education and Treatment of Children.31, (2008) 567-581

[Hecker, 02] Hecker, L., Burns, L., Elkind, J., Elkind, K., Katz, L.: Benefits of assistive reading software for students with attention disorders. Annals of dyslexia, 52, (2002) 1-12

[Ju-Yu Yen, 09] Ju-Yu Yen: 'The Association between Adult ADHD Symptoms and Internet Addiction Among College Students'. Cyber Psychology & Behaviour 12, (2009)189-195

[Kharazmi, 13] Kharazmi, R. Najafi, M., Khoshnavay,F. : Mobile phone an effective tool for management process of ADHD. International Journal of Managment, IT and Engineering, 3 , (2013)141-151

[Kukulska-Hulme, 05] Kukulska-Hulme, A., & Traxler, J.: Mobile Teaching and Learning. In A. Kukulska-Hulme & J. Traxler, J. (Eds.) Mobile learning: A handbook for educators and trainers pp. 45-56 London: Routledge, 2005

[Lee, 08] Lee, H.J., Cho, S., Shin, M. S.: Supporting diagnosis of attention-deficit hyperactive disorder with novelty detection. Journal of Artificial Intelligence in Medicine, http://dl.acm.org/citation.cfm?id=134661542, 3, (2008) 116-125

[Marino, 06] Marino, M., Marino, E.C., & Shaw, S.F.: Making informed assistive technology decisions for students with high incidence disabilities. TEACHING Exceptional Children, *38*, 6, (2006) 18-25

[Meijer, 07] Meijer, C., Soriano, V., Watkins, A: Inclusive Education across Europe: Reflections upon 10 Years of Work from the European Agency for Development in Special Needs Education. Childhood Education 83, 6, (2007)361-374

[Ota, 02] Ota, K. R.,&DuPaul, G. J.: Task engagement and mathematics performance in children with Attention Deficit Hyperactivity Disorder: Effects of supplemental computer instruction. School Psychology Quarterly, 17, 3,(2002) 242-253

[Parker, 09] Parker, D., White, C., Collins, L.& Banerjee, M : Learning Technologies Management System (LiTMS): A Multidimensional Service Delivery Model for College Students with Learning Disabilities and ADHD, 2009

[Plowman, 05] Plowman, L., Stephen, C.: Children, play, and computers in pre-school education. British Journal of Educational Technology 36, 2, (2005)145-157

[Rebolledo-Mendez, 08] Rebolledo-Mendez, G. and De Freitas, S.: Attention modeling using inputs from a Brain Computer Interface and user-generated data in Second Life. In: The Tenth International Conference on Multimodal Interfaces (ICMI 2008), Crete, Greece. 2008.

[Rebolledo-Mendez, 09] Rebolledo-Mendez, G., Dunwell, I., Martínez-Mirón, E.A., Vargas-Cerdán, M.D., de Freitas, S., Liarokapis, F., García-Gaona, A.R. : Assesing Neurosky's Usability to Detect Attention Levels in an Assessment Exercise. Human Computer Interaction, 5610, 1, (2009)149-158

[Rizzo, 02] Rizzo, A.A., Bowerly, T**.,** Buckwalter, J.G., Schultheis, M.T., Matheis, R., Shahabi, C., Neumann, U. Kim, L., & Sharifzadeh, M.: Virtual Environments for the Assessment of Attention and Memory Processes: The Virtual Classroom and Office. In Sharkey, P., Lanyi, C.S. & Standen, P. (Eds.), Proceedings of the 4th ICDVRAT. Reading, UK: University of Reading, pp. 3-12. 2002

[Rizzo, 04] Rizzo, A.A., Bowerly, T., Buckwalter, J.G., Klimchuck, D., Mitura, R.: Diagnosing Attention Disorders in a Virtual Classroom. Entertainment Computing. 2004

[Shalev, 07] Shalev, L., Tsal, Y., Mevorach, C. Computerized Progressive Attentional Training (CPAT) Program: Effective Direct Intervention for Children with ADHD. Child Neuropsychology, 13, (2007) 382–388

[Shrieber, 09] Shrieber, B.,&Seifert,T. : College Students with Learning Disabilities and/or ADHD Use of a Handheld Computer Compared to Conventional Planners. Proceedings of the Chais conference on instructional technologies research: Learning in the technological era.Y. Eshet-Alkalai, A. Caspi, S. Eden, N. Geri, Y. Yair (Eds.), Raanana: The Open University of Israel, 2009

[Standen, 02] C.S. & Standen, P. (Eds.), Proceedings of the 4th ICDVRAT. Reading, UK: University of Reading (2002) 3-12

[Stephenson, 13] Stephenson, J& Limbrick,L.: A Review of the Use of Touch-Screen Mobile Devices by People with Developmental Disabilities. Journal of autism and developmental disorders, 4, (2013), 1-15

[Tinio, 99] Tinio, V.: ICTs in Education. United Nations Development Programme. 2003

[Westwood, 06*]* Westwood, P: Teaching and Learning Difficulties: Cross-curricular Perspectives. Camberwell, ACER Press 2006

[Williams, 06] Williams, P., Jamali H.R., Nicholas, D.: Using ICT with people with special education needs: what the literature tell us. Aslib Proceedings, 58, (2006), 330 -345

[Xu, 02] Xu, C., Reid, R., & Steckelberg, A.: Technology applications for children with ADHD: Assessing the empirical support. Education & Treatment of Children, 25, 2, (2002), 224-248