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The Role of the iPad in the Hands of the Learner

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Abstract: The iPad is a well-known handheld interactive multimedia tool that has been quite popular lately among teachers and students. Previous research indicates that handheld digital technology is, in general, capable of supporting learning and educational literacy; however, iPad-focused studies are still scarce. In this study, we access and review the instructional benefits of using the iPad in educational spaces, such as classrooms and laboratories, by reviewing a vast body of empirical and theoretical findings reported by multidisciplinary literature on digital technology and children, digital technology use in classrooms, and the impact of interactive technology on learning, instruction, and educational literature. We found that while some studies suggest that the iPad motivates and brings positive impact among students towards their studies, other studies suggest that the long-term impact of the iPad on learning could be even negative. Therefore, we highlight the common misconceptions and conflicts about the use of this new technology and discuss its advantages and challenges. We also sketch some of the future trends relevant to incorporating the iPad into our learning setups.

Keywords: Collaborative work, educational games, interactive technology, iPad, instruction, learning, pedagogy
Categories: H.5.0, H.5.2, L.2.1, L.3.1, L.3.4, L.3.6, L.3.8

1 Introduction

The last decade witnessed the beginning of interactive technologies that have truly revolutionized classrooms and our home settings and these include white boards, interactive markers, multi-touch interfaces, and augmented reality applications [Dhir, 12b]. It is even acceptable to admit that interactive technologies have not only transformed the way how our young children learn and play but also how they behave in society and orient towards their future. Furthermore, the existing and newly emerging technologies have had a strong impact on and become a challenge to the educational sector globally [Ostashewski, 2009]. Young children at the age of 8-9 are already considered as technologically savvy [Buckingham 2007; Druin 2009] and among different interactive technologies, handheld devices such as iPad and Nintendo

handheld have been quite popular lately among young children [Berson, 2004]. Lately, these handheld devices have already found places in the school bags that have been traditionally occupied with text-books [Timmermann, 2010].

The focus of this paper is on interactive handheld devices, specifically the iPad tablet. Considering the potential benefits of educational technology, most countries are now pushing for greater reforms so as to transform their traditional education systems [Timmermann, 2010]. Educational technology strives for the inclusion of technology into the mainstream educational system in order to support various educational objectives [Roblyer, 1997] and since its emergence, educational researchers, educational psychologists, and technology specialists have had always taken conflicting views on the role of the educational technology in educational system. For example, while education researchers have advocated the approach of curriculum-based integration, technology specialists have stressed on technology-based integration [Clements, 2003]. Similarly, some educational psychologists described educational technology as "agent of distraction" and "time wastage" [Clements, 2003; Hussein, 2010] while others called it "supporter of learning" and "a must for instruction" [Earle, 2002]. In this regard, [Carlson, 98] advocated that technology- based curriculum should be based on the needs and expectations of the three important stakeholders of any education system i.e., student, teacher, and computer-mediated learning tools.

Due to the prevalence of different misconceptions and anecdotal facts about the potential impact of educational technology on learning and classroom instruction, educational technology has witnessed a relatively slow adoption into the mainstream educational systems especially in developing countries. This argument is based on our recent observation exercises and field studies conducted lately in India and Saudi Arabia (studies are yet to be published). It was found that due to prevalence of various conflicting conceptions and misconceptions; significant challenges have dominated the adoption and integration of educational technology.

In the past recent years, the educational technology sector has witnessed the emergence of newer high tech devices such as smart boards, touch-based instruction through touch table, and the iPad. Among these, the iPad tablet is considered as an ideal tool for performing different actions required in any education system due to its screen size, multimedia support, lightweight, and long battery life [Ostashewski, 2009; Churchill, 2012]. The first version of the iPad was rolled out at the beginning of 2010, but within two and half years, the iPads are noticeably invading educational spaces [Churchill, 2012]. Nevertheless, research examining the use and integration of the iPad for educational purposes is still scarce [Churchill, 2012] and a recent study [Hutchison, 2012] emphasized that iPads are relatively unexplored educational tools. Even though devices like iPad can be quite handy for the novice teachers [Miller, 2005], incorporating iPad into the traditional educational system is not an easy task as it requires an orchestration of new and relevant instructional and teaching strategies [Miller, 2005].

Interestingly, iPad use and integration into the educational settings is also affected by few common misconceptions. On one hand, it is commonly believed that the iPad supports learning and educational goals; on the other hand, it is considered as "time wastage" and an "entertainment tool with almost no role in learning" [Churchill, 2012]. Considering the potential benefits of iPad tablet for educational instruction,

pedagogy, and learner, this study examines the recent empirical and non-empirical literature published on the use of iPad for educational reasons.

The primary aim of this study is to examine instructional and pedagogical benefits and drawbacks of the iPad and to scientifically evaluate the existing work on the iPad so as to propose guidelines and future research-related recommendation for educators, educational researchers, technology specialists, and design experts who are interested in adopting iPads in their environments. However, the secondary goal of this study is to answer some of the common misconceptions related to iPad use by learners e.g. whether the iPad has positive or negative impact on learners' learning ability, motivation to learn, engagement, and academic performance. Therefore, considering two of the above-mentioned goals, systematic literature review of existing published literature on "the iPad and its utilization in the educational sector" is performed. To that end, a large body of case studies and empirical experiments were reviewed in order to glean lessons and draw conclusions.

The rest of the paper is organized as follows: section 2 presents our research methodology; section 3 outlines the relationship between digital interactive technology and young children in order to build the foundation for presenting discussion on iPad use by young children in educational settings; section 4 discusses the onset of the iPad in the context of education by explaining the iPad's affordability and its impact on learning and collaborative work practices; section 5 presents the outperforming benefits of the iPad as an instructional tool; section 6 points out some of prominent hurdles in the successful integration and adoption of the iPad in any education system; and finally, section 7 draws conclusions and sketches research directions.

2 The Research Methodology

We wanted to find out the potential instructional benefits of the iPad in educational settings and its impact on different essential components of education e.g. learning. To accomplish this, we based our investigation on reviewing, analysing, and summarizing the findings from a large body of relevant case studies and empirical experiments. The research methodology behind this study consists of four phases namely (See Figure 2a):

i. Defining research questions
ii. Collecting research papers and related literature from four different databases
iii. Systematically reviewing the collected literature
iv. Analysis, classification, and evaluation of prepared themes and categories

2.1 Defining Research Questions

The following are the three main research questions behind this study:

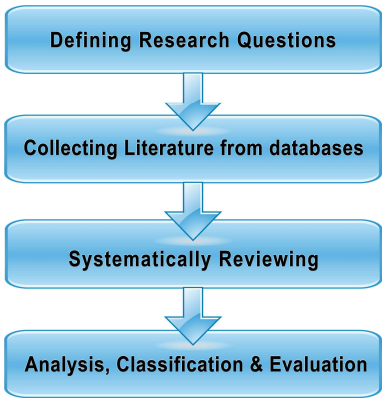
I. To access and review the instructional benefits of using the iPad in educational spaces such as classrooms.
II. To highlight the common misconceptions and conflicts about the use of iPad in educational environment and outline the iPad's advantages and challenges to its successful integration.

III. To sketch some of the future trends relevant to incorporating the iPad tablet into our learning setups.

2.2 Collection of Research Articles

In order to collect the related literature for this study, an online service named www.nelliportaali.fi was used. This online service facilitated the process of doing keyword-based search from multiple databases i.e. Science Direct, Google Scholar, IEEE, and ACM digital libraries were searched simultaneously during this study. The process of collecting the related literature for this study involved keyword search by using a combination of two keyword phrases namely "iPad" and "Education".

This keyword search used the previously mentioned search facility and it returned 153 articles. After keyword search, the first level of screening was performed i.e. articles were screening at the abstract level. In the first screening, searches leading to Google pages, blog entries, editorial and conference keynotes, and those articles that were obviously not related to the main research question behind this study were ignored. After the first level of screening, 91 articles were returned in case of first keyword search while 61 searchers were ignored in the first level exclusion. Later, a second level of screening was performed where the title, abstract, keywords, and content of the articles were examined and crosschecked with the research questions behind the study. Through this screening, a total of 72 articles were listed down while 19 searchers were ignored in the second level exclusion. Figure 2(b) presents the classification of the 72 research papers included for this study and Figure 3 depicts the complete research methodology for performing this study.



Classification of literature	Included Papers
Journal papers	25
Full conference papers	38
Short conference papers	2
Workshop papers	3
Work in progress	4
Total	72

Figure 2: (a) The research methodology for this study (b) The classification of the literature and papers included for this study

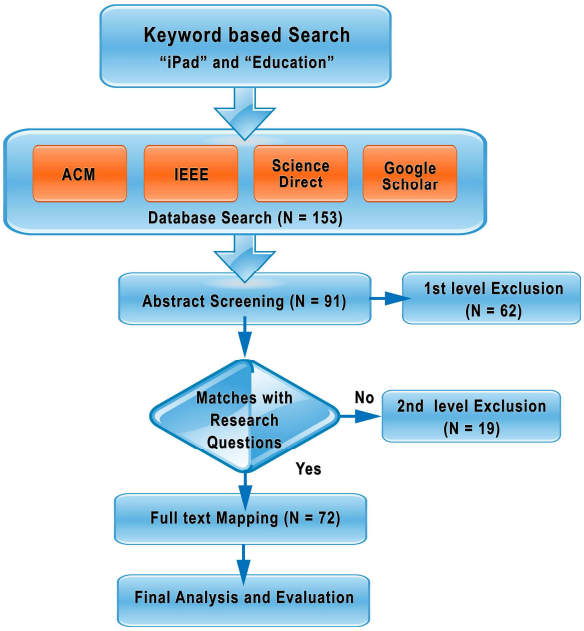


Figure 3: The complete research methodology for this study

2.3 Systematic Reviewing of Research Articles

Finally, 72 returned searches were subjected to full-text search i.e. associated articles and papers were downloaded and analyzed based on the grounded theory approach. First, the articles were categorized based on the main argument and research questions and then, an in-depth analysis of 72 returned articles were performed. This process returned in organizing the studies into resulting categories (no pre-defined categories were made).

2.4 Analysis, classification and evaluation

The resulting categories and themes were re-organized so as to answer the three main research questions of this study. In this phase, focus was mainly given on the following aspects: current research update with respect to the iPad's utilization in educational settings; instructional, pedagogical benefits, and drawbacks of iPad; and future research directions on this subject.

In the next section, the relationship between young children and digital technologies is examined by presenting a thorough review of the background literature on the subject. Since the focus of this study is on iPad use by any learner, therefore, the relationship between young learner and digital technology must be investigated in the light of available scientific evidences.

3 The Relationship between Children and Digital Technologies

The analysis of the relationship between children and digital technologies dates back to the 1980's. The first book on child's interaction with computers was published in 1980, [Papert, 1980]; however, since then, it took more than a decade for researchers to discern the importance of this relationship. In 1997, an important term called "child-computer Interaction" appeared in a dissertation [Russman, 1997] that explored the interaction between computers and children and discussed the need to examine the associated experiences, attitude, perception, and reaction of this relationship.

In the early 1970's, psychologists had found how children possess developing cognitive, motor, and communication skills that are different from adults' [Piaget, 1970; Leontjev 1978] and due to these differences, children have different needs, expectations, and requirements, especially when it comes to the usage of computers. For example, young children appreciate those computer programs that give them control and are challenging and explorative to work on [Wishart, 1990]. This has an important reflection on the classroom instruction; for example, if assignments are not challenging enough then students may lose interest and motivation.

The scientific work examining child's attitude and perception towards the use of technology started in the early 1990's. It was found that computers have positive effect on the child's attitude toward technology and repeated and long-term use of these machines at home often results in lower anxiety on computer use [Colley, 1994]. Children who often used computers were found to learn from their mistakes and to put more effort on and show progress in their studies [Shotton, 1989]. Interestingly, young children are found to be motivated and positive towards the use of technology. However, empirical studies have also suggested that learning achievements could be poor even after the use of interactive educational technology [Chu, 2010].

Educational games are very popular among young children and they are important in the case of computer use that has been very popular among young children [Durkin, 1995; Kirkman, 1993]. According to [Downes, 1996], children can learn different problem solving and other essential skills through educational games. Computer games provide students an opportunity to promote exploratory learning, memory, cognitive thinking, collaboration, and teamwork skills [Mumtaz, 2001]. Similarly, [Downes, 1996] found that students acquire critical thinking, patience, perseverance, memorizing, and imagination through computer games. Computer games also promote the practice of "trial and error" and "learning by doing" among young children [Downes, 1999].

Children appreciate games so much that they often want to use direct or indirect gaming in their instructional tasks [Downes, 1996]. Furthermore, experiences gained after playing a computer game greatly influence the child's mental process, self-identification, and beliefs about the external world [Heppell, 1996]. The most common activity with the computer use among young children is playing games [Downes, 1996; Downes, 1999]. In one study, it was found that 90% of total the students used their home computer mainly for gaming [Kirkman, 1993] and in another study, 70% of the children preferred their home computer to their school computer [Mumtaz, 2001]. This might be due to children who feel to have more control over

their computer use time, lesser restrictive environment, and more discretionary activities using their personal computers.

In the early 1990's, education researchers criticized the educational systems by claiming that most schools were giving limited access to computers. Due to shortage of time, educators often find it difficult to support independent learning and critical thinking among young students through the means of educational technology. It was found out that a majority of the access to the computers was limited to drills and practice activities that required only minimum teacher intervention and this restriction eventually led to boredom and lack of enthusiasm among young children [Jackson, 1988; Ofsted, 1998]. Furthermore, this limitation also induced young students to believe that current computing facilities at school are time-consuming and do not contribute to learning and instead, they are simply boring [Mumtaz, 2001]. [Healy, 1998] contended that computers are misused in classrooms when educators do not plan lessons well and are not oblivious to the pedagogical and instructional justifications for using them in the classrooms. Therefore, due to the non-fulfilment of computing needs of young children at school, they tend to use and appreciate computing more at home than at schools [Shoffner, 1990].

4 The Emergence of the iPad in Education

Newer forms of interactive handheld devices have successfully transformed the lives of common people into a "*digital*" one [Attewell, 2005]. Handheld devices like the iPad represent "*newest technology revolution*" mainly because it offers wide range of functionalities in a compact and portable form [Csete, 2004]. The iPad was rolled out in January 2010 with slim and thin body, good memory and display size, and high-end multimedia support with advanced graphics. Unlike laptops and PCs, iPad is used via fingers as it provided touch-based screen for its users and comes with an inbuilt support for Wi-Fi and 3G/4G network. These capabilities and features make the iPad superior to PCs, laptops [Churchill, 2008; Song, 2001], and even smartphones [Churchill, 2012].

The iPad is not just a consumption tool, unlike other handheld devices, but it is also meant for easy and socially viable creation and presentation of new ideas and content [Walters, 2011]. Existing studies have shown that the iPad is very effective at concept presentation and can also be used as a demonstrator for classroom material; however, the iPad's contributions to educational literacy and learning are still unknown because of the absence of thorough empirical studies.

It has been claimed that traditional educational systems meet challenges to respect the ever-changing needs and requirements of young children of today's generation [Timmermann, 2010]. A modern education system is one in which new forms of pedagogy and instructional strategies are implemented in a way that does not see students as recipients of information only but instead as active participants who decode information actively and engage in fruitful discussion with peers and teachers. The ultimate goal of this form of pedagogy and instruction is to support and reflect students' learning so that their needs and expectations are understood and met [Timmermann, 2010].

However, the goal of effective and efficient use of interactive technology in educational spaces is yet far from actually realized [Timmermann, 2010]. Educators and researchers should utilize interactive technology e.g. iPad for promoting creativity among young children, teach them collaborative ways of solving difficult problems, and learn through trial and drill. Handheld interactive devices are quite popular among young children and it is no longer a rarity to see young students carry less notebooks and pens and instead they work on and take important notes and homework on their smartphones [Timmermann, 2010]. Similarly, iPads are increasingly finding their place in classrooms and homes since it is not just an interactive technology but it is a socially engaging and communication tool among young people [Timmermann, 2010].

Nonetheless, many researchers and practitioners criticized this kind of technology adoption because they consider the iPad as still being in the evolving phase. They also argued that the history of the iPad and other interactive devices is very short and that there is no empirical evidence to support its feasibility [Walters, 2011]. In contrast, those who favour the iPad see it as flexible, much needed, easy and convenient to use for Web-based instruction and other educational purposes [Walters, 2011]. Teachers believe that iPads are positive motivation agents for young students and that iPad use can engage, inspire, and even motivate students towards learning and teaching [Walters, 2011]. However, we found no support or evidence that is based on scientifically controlled empirical studies that can back up this claim.

The next section will explain the impact of iPad use on learning, affordances provided by the iPad, and its role in different collaborative work practices.

4.1 The Impact of iPads on Learning

The potential impact of iPads on student's learning is still controversial but during our review, we found that a large number of research papers have been published around a common hypothesis assuming that different interactive handheld technologies are capable of supporting learning and related practices of young students [Culén, 2011]. These handheld digital devices are believed to facilitate easy integration with students' daily life [Wilson, 2011; White, 2010].

Recently, [Dhir, 12a] examined the impact of educational user interface and technology on learning, instruction and pedagogy through an extensive literature review of previous studies. However, scarce scientific studies exist that explicitly examine and evaluate the effect of iPads on student learning [Culén, 2011]. Therefore, through this section, we present our critical comments and reflection on iPad's impact on learning, based on the findings from the studies we have reviewed.

It is believed that iPad might become a transformative technology due to its flexible, collaborative, and inquiry-based learning environment. However, the learning experience of any student using the iPad is not totally dependent upon the device itself but also and especially on the attitude and perception of teachers and the educational institutes [Churchill, 2012].

Previous research on technology adoption by young children has been mainly concentrated towards the exploration of student's attitude, perception, and technology acceptance [Brand, 2010]. [Culén, 2011] found that teachers' attitudes towards the use of technology for educational purposes also inspire and influence the students towards technology use. Interestingly, it was found out that the school children were

positive and enthusiastic because their teachers were equally positive and energetic towards iPad use.

Most children consider the use of iPad as an engaging and enjoyable experience; for instance, 85% of children appreciated reading via the iPad because it supports changing scopes, and 81% students considered it useful because of its easy portability [Culén, 2011]. The same study assessed the students' attitude towards the iPad based on several factors such as the perceived usefulness of the device, ease of use, emergence of new social patterns, creativity, ownership and personal space, and finally personal attitude towards learning. [Jennings, 2011] found that 76.2% of staff and 80% students have strongly favoured the use of the iPad under educational settings. [Culén, 2011] discovered that young children were excited to explore and learn to use the iPad while older senior students showed less enthusiasm due to academic pressure, lack of time, ownership status, and obvious demand to learn new applications; notwithstanding, sharing the device among peers was problematic.

Students possess different learning abilities when compared with each other; however, there is a special group of students who have serious problems with their learning abilities and are commonly referred as students with special needs. Such students suffer from Learning Difficulties (LDs) that are cognitive disabilities gained by birth [Vera, 2005]. Recently, research examining the screening of LDs and assisting students with LD's through technology has attracted much needed attention [Al-Wabil, 2012; Girgin, 2011]. Over the years, the research community has realized that there is a need to do more for people with special needs: those who suffer from intellectual difficulties i.e., LDs. Recent research has shown that unique features of iPad such as high-end mobility, accessibility, and portability along with other advanced interaction capabilities such as reading text aloud, drawing, and annotation support can provide required assistance to students with LDs [Mozaffar, 2012; Conell, 2010]. However, based on our extensive literature review, we concluded that research examining potential benefits of using the iPad by students with LDs is still a young field of research.

Twitter provides documentation capability to its users i.e. students can obtain a summary of different learning-related activities on any course group [Ebner, 10]. Therefore, Twitter supports recall facility, which in a way is much, needed for students suffering from LDs. However, based on our extensive literature review, we concluded that research examining potential benefits of using microblogging platforms such as Twitter by students with LDs is still a young field of research.

Some studies suggest that digital handheld devices can foster learning in different ways [Attewell, 2005; Ray, 2002; Sharples, 2000]. However, we lack enough empirical studies that examine the effectiveness of the iPad specifically. One recent study [Garcia, 2011] conducted a quasi-experimental research that compared the performance of two groups of students, one with the iPad against the other without it. The iPad group showed a tendency of slight better academic performance but it was not a significant one when compared to the No-iPad group. One of the other few studies showed that although teachers and students were enthusiastic and energetic towards the use of the iPad for educational purposes, the assessment results found that most students showed even lower grades after utilizing it in their courses [Culén, 2011]. Unfortunately, both studies were conducted over a relatively short period of time and a longer time frame is needed in order to get more credible results.

Since the introduction of the iPad as a gadget, there has been a growing interest among developers to design and implement applications that serve various everyday functions and objectives, including education. However, there is an increasing need to establish trustworthy design guidelines especially in developing a curriculum on the iPad and building the necessary learning blocks. To the best of our knowledge, no such studies exist in the literature yet.

4.2 iPad and its Affordances

iPads have positive impact on the student performance due to its unique affordance, bright multi touch screen, and multimodal interaction support [Garcia, 2011]. Students can interact, manipulate, and transform digital texts as per their needs, requirements, and expectations in a way that is different from traditional printed texts [Eagleton, 2007]. The iPad can also provide useful opportunities for classroom literacy through the use of interactive books [Hutchison, 2012]; however, educational reading is not a well-understood topic and it is important to note that digital texts offer different affordance and experiences compared to printed texts [Lankshear, 2003]. Existing research on experiences related to digital texts have found that readers might require different skills, strategies, and the tendency to read and understand any digital text [Coiro, 2008]. Well-designed digital texts can support readers' comprehension skills and provide them engaging effect in the reading activity [Leu, 1996]. These differences are important to be examined as they might decide the successful integration of digital and interactive technology into the curriculum and instruction; however, nothing compensates for the poor educational quality and form of content.

The use of the iPad might also bring environmental benefits; for example, if students use the iPad for note taking and doing their homework then it will prevent the use of paper and printing [Green University, 2010]. Recent advancement in the iPad technology and related iPad apps has made it possible for students to feel similar experiences to that of physical paper and pen while using the iPad even in group work settings [Culén, 2011]. [Green University, 2010] study findings revealed that the iPad has been successful in lowering the amount of papers and the volume of printing.

4.3 iPad and Collaborative Group Work

Modern instruction strongly advocates collaborative group work among students and its studies have included tabletop displays with a single display receiving input from multiple input devices [Stewart, 1999] and digital ink applications merging pointing technology with real-time speaking [Lindell, 2010]. In collaborative group work, reading-related activities have been always problematic even when performed individually in the printed format or collaboratively through the use of technology, for example, when the physical artefact coordination and duplication efforts are the main problems [Pearson, 2010]. Similarly, when any technology is shared, then it suffers from various challenging issues such as constraints-related to multi-user interaction and other coordination-related problems especially in a limited physical space [Amershi, 2008]. Some of these issues are even present in the context of sharing large interactive displays mainly because group members do not get their own personal space [Morris, 2010].

Some educational researchers and teachers have supported the iPad's use for collaborative group work but limited scientific studies are available to actually examine this. In a recent study, it was found that both graduate students and school children share content by using the iPad among small groups for collaborative reasons [Culén, 2011]. In one study, collaborative iPad system was proposed for performing efficient group work that requires collaborative reading [Pearson, 2010]. In this solution, a set of iPads through wireless internet were interfaced for providing individual as well as group experience while performing collaborative reading. It provided real-time and interactive work environment by supporting various features such as possibilities of simultaneously working on individual document copy, together with real-time sharing and viewing of the notes of other group members, in addition to quick and easy interaction through the facility of remote pointing to the text without any physical hand gestures. Some of other benefits provided by iPad in performing collaborative group work include real-time connectivity through Wi-Fi and 3G/4G support, experience of using the physical artefacts such as book or a clipboard, ensuring individual ownership, high portability, automatic customization, i.e., the iPad takes care of the shape and shape of the document, usable interface, and easy interaction via the touch screen [Pearson, 2010].

5 Benefits of The iPad

Based on our extensive review of the existing literature, we can draw some conclusions relevant to exploiting the iPad as a teaching tool. These are the main benefits of using the iPad as an instructional tool and as an educational device (See Figure 4):

1) ***Easy Interaction***: The high-end touch-based interaction supported by the iPad provides essential quality experience during reading and writing activities [Ostashewski, 2010]. This device is easy and quick to use even for digital immigrants as iPad does not require prior digital knowledge for its intuitive navigation gestures [Hutchison, 2012]. Due to its high-end touch-based interaction support, the iPad is a feasible platform for supporting sketch-based activities such as mathematical expressions [MacLean, 2011].
2) ***Anytime, Anywhere Use*****:** The iPad enables both educators and students to use it anytime and anywhere when needed [Kerviv, 2006; Vardy, 2007].
3) ***Classroom Demonstration*****:** The iPad enables students and teachers several possibilities for showcasing and demonstrating their work such as content viewing, video playback facility through iTunes library, or the built-in multimedia database, spot demonstration of any concept and lesson, sharing of content with classmates and teachers [Ostashewski, 2010a; Bansavich, 2010].
4) ***Small group teaching***: The iPad is highly suitable for supporting teaching activities in small groups [Ostashewski, 2010a].

5) ***E-readership*:** The iPad supports e-readership among students through its electronic textbook capabilities. Additionally, it enriches the reading experience by its note-taking and annotation capabilities [Bansavich, 2010].
6) ***Interactive and Collaborative Learning***: The iPad fits best for this kind of learning due to its portability, network capability, ease of use, and support for engagement [iPad in schools, 2010; Bansavich, 2010]. The iPad is deemed effective for language learning, presenting new concepts, student counselling, and other research related purposes [Bansavich, 2010].
7) ***Localization support****:* Students can also use the iPad in their native language [Hutchison, 2012].
8) ***Wide-spectrum of Applications*:** The iPad supports a large number of applications that can easily serve classroom instruction [Bansavich, 2010]. These applications are easily downloadable as the iPad supports quick access to a large population of students [iPad in schools, 2010].
9) ***Communication Tool:*** The iPad improves communication between students and students can easily collaborate with their peers using email, chat, and other built-in communication tools.
10) ***Energy Efficient:*** The iPad can be switched off and on without taking much time; hence, it saves battery life-time [Hutchison, 2012].

Figure 4: The Advantages of using the iPad in Education

6 The iPad Adoption: Acceptance vs. Resistance

The use and the attitudes towards the iPad by teachers have been examined lately; for example, the iPad is referred as a "*book in their pedagogical library*" [Walters, 2011]. Existing studies show that the iPad has a strong device role for teachers as it facilitates and supports them in their daily activities. For instance, the iPad can reduce the teacher workload, can help in classroom instruction, can collect student assignments automatically, and can provide a quick and easy content production and delivery to students.

Teachers are responsible for the successful adoption of any new interactive technology in classroom settings and they have a high impact on educational-related behaviour and habits of their students [Baylor, 2002]. Similarly, [Eyadat, 2010] found that the attitudes of teachers have direct impact on the creativity of students; however, differences do exist between teachers at different hierarchies of the educational system. For example, a recent study [Culén, 2011] found that school-teachers were more active and enthusiastic towards the use of new technology for teaching purposes compared to University professors. Furthermore, it was found that school students were more enthusiastic and energetic towards the use of new digital technology for educational purposes. These insights have important design consideration for technology specialist, practitioners, and researchers as they have to ensure that teachers can be well-prepared, convinced, and ready for a favourable attitude towards the iPad or related technology use.

The attitude and perception of school administration to the use of interactive technology on the school premises has potential implications on students, teachers and most importantly on the integration of technology in any educational settings [Friedman, 2006]. Previous studies revealed that those educational institutes that show negativity towards the adoption of technology could affect the habits and attitude of their students, too. This is apparently true even if the students are used to dealing with technology at their homes [Timmermann, 2010; Mumtaz, 2001]. Figure 5 showcase the impact of teachers' and educational institutions' attitude on learning and habits of students. Additionally if teachers and educational institutions carry positive attitude towards iPad use, then this will result in positive adoption of educational technology such as iPad tablets.

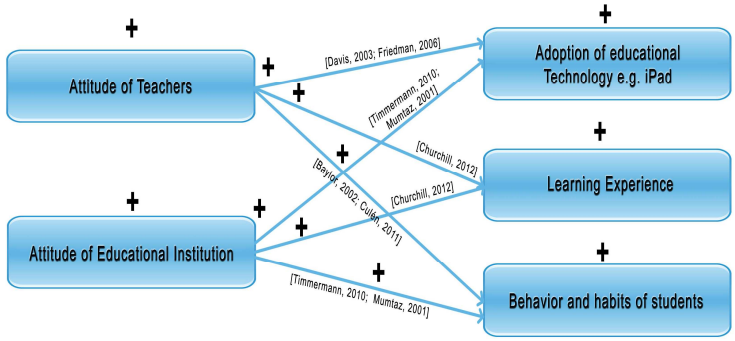


Figure 5: The Impact of teachers' and educational institution's attitude on learning and habits of students

Many technical challenges can hinder the adoption of the iPad in education. One study [Culén, 2011] found that having teachers with limited IT background and lack of troubleshooting skills can be an obstacle towards technology adoption in general. Other obstacles related to the school infrastructure, such as the lack of wireless Internet, may slash the benefits of technological tools such as the iPad.

Apart from technical challenges, the iPad adoption may be challenged by pedagogical and administrative obstacles such as strictly adhering to the traditional old curriculum without showing any flexibility to novel changes [Hutchison, 2011]. Other obstacles may include having limited school time for introducing the new technology to the teachers or even denying them the proper training or orientation.

There has been a growing debate on if and how to integrate iPad use in the educational curriculum and instruction. We did not find any well-documented, successful, or even unsuccessful attempts towards this direction; therefore, we emphasize for the need to examine and evaluate if and how the iPad can be seriously integrated into the curriculum. According to [Hutchison, 2012], there are two main lines of integration in the iPad adoption: *technological* integration and *curriculum* integration. Nowadays, we note that there is almost no problem with the technical integration but the conceptual foundations of curriculum integration lag way behind and needs immediate attention from all education stakeholders.

In a nutshell, we found some of the prominent hurdles in the successful adoption of iPad in educational settings and these are the following: inflexible curriculum, pedagogical and administrative related constraints required technicalities in using the iPad time constraints of the school schedule, lack of sufficient skills for using iPad, demands of traditional educational systems, and insufficiency of the iPad as an all-purpose educational device. (See Figure 6).

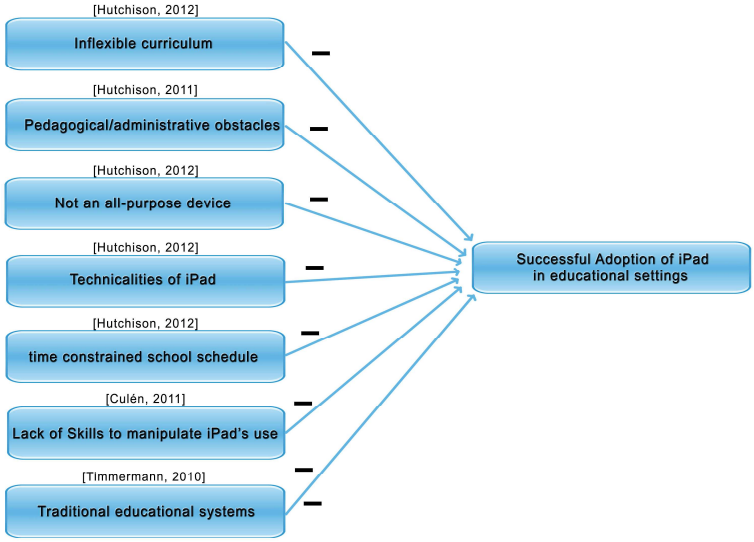


Figure 6: Hurdles to the successful adoption of iPad in education

Summarizing the findings of this literature review and the associated empirical outcomes, we reach the following recommendations and conclusions:

1. Customization is an essential part of the iPad. Students should be able to resize text, change images, sounds, etc. Otherwise, this may lead to a frustrating experience.
2. Integrating the iPad with the classroom instruction and curriculum entails that teachers have a chance to think of new ways of organizing and evaluating assignments. This might be difficult under an inflexible curriculum structure and time-constrained school schedule.
3. It is imperative to identify and understand what young learners expect from the iPad as a technological tool. Accordingly, the entire pedagogical method should be reviewed and customized in order to use the right applications, the right design of activities, and the most effective ways of providing the learning experiences and educational outcomes.
4. Teachers with technology fears and especially those having a limited IT experience will meet a constant troubleshooting challenge. Fluent support and/or education are needed for dealing with the occurring glitches.
5. Schools should calibrate their curriculum and pedagogy in order to incorporate challenging, yet interesting assignments and projects to the young children.
6. Predominantly, young children advocate teaching strategies that involve playful interaction and feedback should engage students into gaming-like activities that help develop their exploratory learning skills in and outside the classrooms and at home.
7. Educational researchers and practitioners must look for providing classroom IT experiences that can deliver out of school, games experience to young children.
8. It might not be possible for students to perform all kinds of work on the iPad that they usually do on their laptops or PCs. Therefore, only limited course work can be carried out on the iPad.
9. We surmise that the iPad integration into the classroom ambience is plausible if the needs, expectations, and requirements of the key stakeholders, the students and the teachers, are understood in planning the use of the iPad as an educational gadget.

7 Conclusions and Future Directions

The iPad's tempting technological features and ease of use unarguably favour its use by learners, teachers, and their communities. There is an increasing motivation for all stakeholders in education to incorporate the iPad into instruction and learning in a beneficial way. However, upon reviewing a large body of studies and research work, no solid evidence decisively confirms that the iPad has a positive academic effect on

the learning outcomes. This is mainly due to the scarcity of pedagogy-wide and long enough research works.

Based of our extensive literature review, it was found that the iPad possesses positive impact on literacy skills, student performance, instruction, pedagogical skills and it also supports mobile learning. However, existing research on the topic also lacks understanding on several areas related to educational instruction such as long-term learning outcomes, long term impact on instruction, academic performance, learning and different educational stakeholders. There is a need to develop guidelines for preparing new curricula and pedagogical strategies for successfully integrating the iPad into any educational settings. Additionally, guidelines should be prepared for the application developers so that they can fully exploit the rich feature and supported functions of the iPad for educational purposes (See Figure 7).

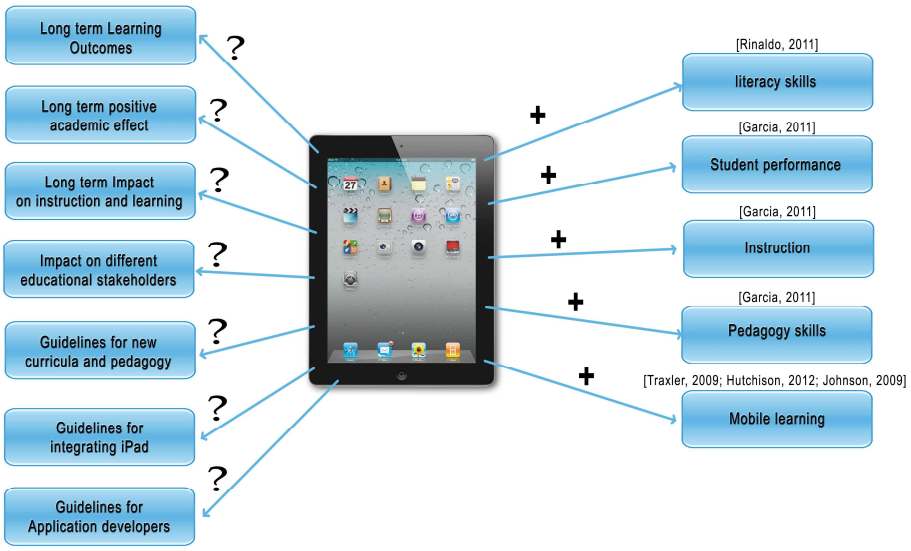


Figure 7: Future research directions on the iPad's usage in education

This makes this research field a tempting and problematic one to answer many of its open questions. Here we outline some research directions:

1. To properly capture the effect of using the iPad in the classroom, and in order to glean lessons, we need well-designed and controlled experiments that are long enough to assess the impact before and after the adoption.
2. We need proper investigation to assess the implications of using the iPad on the various stakeholders in the educational environment: the student, the teacher, the parents, and the school administration.
3. More research is needed in order to set guidelines for the design and development of new curricula and pedagogy.

4. Similarly, research studies should investigate what developers should focus on and take care of when constructing education-oriented software on the iPad.
5. Other facets of the learning process should also be assessed under the usage of the iPad such as reading, comprehension, and problem-solving skills in math.
6. Researchers may need to explore the potential of integrating the iPad with the already existing devices and technologies such as smart boards.
7. We are also keen to know how the iPad, especially with its networking capabilities, can create an orchestrated environment in which all stakeholders can interact and collaborate throughout the learning process.
8. Finally, we are facing the pending need to build technology-independent analysis and design frameworks for education. They should be based on a solid educational, collaborative, and psychological learning ground that allows a smooth implementation of the best educational technology and a fluid transition from one educational technology to another. Otherwise, we will experience the negative economical, technological, and motivational and other consequences of out-dated and constraining technologies at schools.

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