Bachelor Thesis

Mobile Technology in Classrooms:

Can iPads Further Young Children's Learning Development and Successfully Be Integrated in the Modern Curriculum?

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Abstract

Tablet computers, in the most prevalent form Apple iPads®[1], offer auspicious new technologies and methods for teaching and learning in the classrooms. However, experts still debate over the effectiveness of such mobile media usage in education. An ongoing argument also revolves around the question to what extent iPads should be included in classrooms. This paper provides an overview of the current state of research including pioneer studies from around the world. With the new mobile technology, children are increasingly exposed to those new devices and learn to handle them from an early age. With such tools entering the classroom, the analysis of their efficiency and effects on students and teachers is a crucial task. These devices may alter the way we shape our educational environments and, therefore, may also affect the way we learn. This paper thus discusses the benefits and drawbacks of iPads in classrooms. The teacher's role in implementing the iPad into the classwork appears to be a crucial element of the learning effects and thus will be at the centre of this investigation. The studies discussed in this paper indicate that iPads, in general, positively influence learning effects but that their function as a tool in the classroom crucially depends on their targeted implementation by a motivated and competent teacher.

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[1] Apple and iPad are trademarks of Apple Inc., registered in the U.S. and other countries. This note applies for all further references in this paper.

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Introduction

Nowadays, media devices such as smartphones or tablets play a big part in our daily life. Not only adults spend more time on computers and smartphones but also children spend more and more time using the new media. Therefore, various debates on how long and at what age children should be exposed to such mobile devices arose and certainly, there are more to come. Consequently, the question whether and how the iPad, for example, should be included in the curriculum has been asked among educators. These new developments greatly influence the education sector. An increased number of schools or higher education institutions are implementing iPads into their classwork. In addition, students already seem to invest an abundant amount of time in using computers for doing their homework, writing scientific papers, or preparing talks for schools. It seems that students at an increasingly early age have to be able to handle the new mobile technology.

Therefore, the question arises, to what extent the use of mobile technology affects learning development? This literature review will be limited to learning effects on children between birth and approximately ten years, even though, such an analysis could be conducted at every school level. A lot of work in this field has been done for the age group of college students and the lack thereof for younger learners, combined with the interest of the author, account for the reduction in this paper. In addition, the impact of mobile media in education on younger children might be different and more important as they probably represent a more vulnerable age group. Furthermore, this review will focus on handheld devices, namely the iPad only, as it is clearly the prevalent device on the market.

Despite the iPads increasing popularity, there are not many scientifically sound papers in connection to educational purposes to be found yet. Relatively few studies on iPads in education meet the quality standards for scientific studies and due to that limited research, this review also takes a few studies into account which refer to stationary computers or laptops, instead of iPads.

The development of the iPad is about to revolutionise school education as it has many advantages: the iPad is a light weighted device, which simplifies portability. It is affordable and nowadays a connection to the internet is given almost everywhere via WLAN[2]. Its handiness is granting situated, *just-in-time* learning opportunities (Melhuish & Falloon, 2010). Students can be connected with each other and interact with classmates or teachers. Everyone can individually choose which application (app) to download for whatever corresponding educational purpose and when and where they want to use them. As a result, students may create their own learning environment. Furthermore, the iPad is very easy to handle and is ready to use within seconds. It has a long lasting battery life and does not need to be charged very often. As a conclusion, the iPad is a very versatile, flexible, and thus future-oriented device regarding the constant development of new apps (iPad-Schule, 2016). Apart from that, the iPad's new technology also caters children's curiosity and thus probably motivates them to engage with educational subject matters. According to Culén and Gasparini (2011), who investigated the adoption and use of iPads in an elementary school, "iPads are generally viewed as devices that have an easy to use, intuitive interface" (p. 200) which makes them a suitable learning device for children.

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[2]WLAN: short term for *wireless local area network* (Technopedia, 2016)

To straighten up the terminology of this paper, mobile learning (m-learning) needs to be introduced. M-learning is defined as "the ability to learn within one's own context when on the move in time and space" (p. 3) and "being just-in-time, situated learning, mediated through digital technology in response to the needs of the user" (Melhuish & Falloon, 2010, p. 3). In other words, m-learning represents an enhancement of e-learning, as m-learning is available anyplace and the user can always connect to the Internet. Additionally, m-learning promotes an easy way of communicating for students and teachers or other online learners be it an educational app itself, be it via instant messaging, which often is available on the same device. This means that receiving information, teaching instructions, or a piece of advice regarding a certain subject can all be transmitted within little amounts of time and there is lesser need for either physical books or notes as there are also more and more explanatory videos available (for example on YouTube©).

With these preliminaries in mind, this thesis investigates the current research field of iPad studies regarding their understanding and findings on the use, advantages, and disadvantages of iPads in today's classrooms.

Theoretical background

The first part of the theoretical background discussion investigates from which age on children, on average, start to encounter electronic media and how much time they are spending at it. The ongoing debate about the increase in proportion of younger children encountering mobile media and the duration of time spent with those devices will be a topic in the discussion. The second part explains how children learn with media, particularly the iPad. Thirdly, the

importance of the teachers in regard of their role as introducer of the new media to the students will be explored. The efficiency of iPads in classroom can only be as high as the teacher who has to integrate the new technology in his teaching. In the remainder of the theoretic section, a few more important studies covering the acquisition of mathematical and literacy skills (by the aid of electronic tools, such as computers or iPads) will be presented and further discussed. As mentioned before, not too much scientific research has been done on it so far since the iPad, first released in 2010, has not been around for very long, only a small scientifically sound selection will be listed.

Media use by young children

Every five years, the American Academy of Pediatrics (AAP) announces a policy statement regarding the media use by children younger than two years. Over the years, and with an increasing amount of media gadgets on the market, television is still ubiquitous and indispensable for most families. According to Zimmerman, Christakis and Meltzoff (2007), "by 2 years, about 90% of children were regularly viewing television or DVDs/videos" (p. 475). By the age of three "almost one-third of children have a television in their bedroom" (Brown, 2011, p. 1040). To illustrate the current iPad situation for young children this review refers to the KIM-study (KIM (German) = Kinder + Medien. Computer + Internet. Basisuntersuchung zum Medienumgang.).

    KIM-study.

The KIM-study (Feierabend, Plankenhorn & Rathgeb, 2015) was a basic study

in 2014 on how children in Germany from six to 13 years deal with media.[3] Compared to media devices in general, 19% of German households with kids between six and 13 years old are equipped with tablets in contrast to 12% in 2012. This number is expected to increase steadily. As for the use of the tablet, merely 54% of the children with an access to a tablet make use of it once a week. Feierabend et al. (2015) also expect that with increasing age, the daily amount of time spent with a tablet will constantly increase. Furthermore, 45% of the responding parents (n = 235) think that a tablet is an appropriate way for children to learn how to deal with media. This is important as also 45% of the parents consider that tablets offer a lot of possibilities for children to learn playfully, which means they are more likely to support the implementation of iPads in schools.

However, studies in England show a different picture. According to the Ofcom *Children and Parents: Media Use and Attitudes Report* (2014), "one in three (34%) children aged 5–15 [n = 1'660] now have their own tablet computer (…)" (p. 23). Regarding television, which is represented 100% in every household (n = 1'209) in Germany and 35% of the 6 to 13-year old children have their own television in their bedroom (Feierabend et al., 2015), even 46% (n = 1'660) of the 5 to 15-year old have a television in their bedroom in the United Kingdom. Yet the number of televisions in the United Kingdom is decreasing steadily in favour of increasing numbers of smartphones and tablets.

Globally speaking, mobile handheld devices such as tablets or

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[3] Original title: „Basisuntersuchung zum Medienumgang 6- bis 13-Jähriger in Deutschland", Landesanstalt für Kommunikation Baden-Württemberg (LFK)

smartphone are constantly increasing on the market and its conclusive appearance in the educational sector is a matter of time. Therefore, understanding their impact on learning and education is crucial so that an appropriate way to integrate mobile media into curricula can be found.

Learning with Media

According to the definition of *learning* by Kozma (1991): "(…) learning is viewed as an active, constructive process whereby the learner strategically manages the available cognitive resources to create new knowledge by extracting information from the environment and integrating it with information already stored in memory" (pp. 179–180). Media are a means of communication "through which information is spread to a large number of people" (Merriam-Webster, 2016). They can be defined, amongst other things, by its technology and processing capabilities with "mechanical and electronic aspects that determine its function and to some extent its shape and other physical features" (Kozma, 1991, p. 180).

Learning today is quite different from the way it used to be. Few years ago, children mostly learned with books. Books probably still are most commonly used in schools, but with time and the ongoing development of electronic devices, several other media, such as CDs, television, video tapes, DVDs, and computers, including the internet, were added to the list of *supportive learning media*. Recently, the use of computers and iPads has slowly expelled other media from the classrooms. Kozma (1991) also mentions that further developed media, as e.g. computers, might help to evolve a better understanding by transferring subject matter into the real world. Learning

with multimedia[4] is a very promising, still evolving field, yet there is only little research about it.

As Kozma suggests in *Learning with Media* (1991), it highly depends on individual conditions which media help a student to learn best. The preference often depends on how much previous knowledge about a certain topic a student already possesses. This means that with more knowledge, students use less media as they do not have to develop their skills as much as those who need to collect a lot of information to start with. The choice of media also depends on the medium's capabilities in a particular learning situation. Clearly, a stationary computer is not suitable to use on a bus ride, whereas a book or a smartphone or tablet certainly is.

iPads in early education

With mobile media more and more dominating our daily lives, the concept of m-learning is becoming more relevant in education. In analogy to the computer entering the classroom a couple of decades ago, iPads are about to revolutionise education all around the world as the following paragraph will show. Teachers may integrate them easily into the curriculum due to their manifold features and the devices' mobility and handiness, the long battery life, as well as the availability of apps allow them to replace multiple older formats in teaching, such as hard copies, or shelves full of different math games. Those apps provide a variety of opportunities for children to influence on their own learning environment and even enable them to create their own learning context (Kucirkova, 2014). Another positive effect of iPads in

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[4] Definition of *multimedia*: "using, involving, or encompassing several media; a *multimedia* approach to learning" (Merriam-Webster, 2016)

classrooms is that there are no specific constraints in time and place (Culén & Gasparini, 2011). iPads are not bound to a certain area besides a working WLAN connection if internet is needed. All those facts make the iPad the ideal device to be implemented in schools. Additionally, iPads have been shown to enhance student motivation (Pegrum, 2013).

Recent research suggests that early use of mobile media enhances learning capabilities, as for example, early literacy skills, by having children play games that make them practice letters, phonics and thereby further skills like word recognition (Radesky, Schumacher & Zuckermann, 2015). Other research documents an improvement in mathematical skills for children learning with iPads from an early age on. The following paragraph discusses a selection of such current research on iPads from classrooms from around the world with a special focus on the different authors' suggestions on how to implement iPads in the curriculum.

An overview of recent iPad-studies.
As mentioned in the previous section, a relatively small body of scientific classroom studies is available so far. Among those few even less are scientifically valid, so, broad conclusions cannot be drawn from them. For this overview, five studies have been selected which meet the scientific criteria and provide significant insight for the topic of this paper.

The mathematical study by Pitchford (2015) on the development of early mathematical skills in primary school children in Malawi provides a good starting point. During eight weeks, the study investigated four different apps, which are based on the Malawi National Primary Curriculum, to teach core

mathematical concepts. Those concepts were taught "in a structured manner through several colourful and engaging sets of activities delivered in the local language" (Pitchford, 2015, p. 3). The teacher allowed their students to work through the apps whenever they liked and at their own pace and they could also repeat the activities as often as they wished. Teachers supervised each students' activities and tested their progress with mathematical quizzes. As a result, the iPad intervention group showed significant greater gains in performance compared to the control groups. The results suggest that tablet-based learning is more effective than normal pedagogical practice at supporting development of mathematical concepts in primary school children. This suggests that tablet-based learning is more effective because it is a more individualised form of learning. According to Pitchford (2015), tablet technology can efficiently support acquisition of early mathematical skills. To be helpful, the software needs to be complemented by the respective learning process within an appropriate curriculum in regard of the child's developmental stage. If iPads are going to be used more frequently, software should always be designed cautiously in order to promote children's engagement.

This leads to another study from Australia, realised by Agostinho et al. (2015) which analysed whether finger tracing of temperature graphs on an iPad increases the children's understanding of the topic. The authors hypothesised that finger tracing, as a form of biologically primary knowledge, can support problem-solving, a form of biologically secondary knowledge. Indeed, during the test phase, the experimental group, which traced the graphs with their fingers, outperformed the control group, which simply looked

at the temperature graphs. This study has explored the effectiveness of tracing on a tablet device to support mathematical problem-solving. As a conclusion, the study indicates that iPads give learners a helping hand by visualisation when it comes to difficult mathematical concepts.

Another research done by Riconscente (2011) investigated whether Motion Math[5], a fractions game designed for the iPad, iPhone and iPod, improves children's fractions knowledge and attitudes. Fractions knowledge is an important part of mathematics, but "only 13% of United States fifth graders are proficient in fractions" (Riconscente, 2011, p. 3, quoted from Princiotta, Flanagan, & Germino-Hausken, 2006). This was the first controlled study of an educational app that "marks an important step forward for documenting the potential for new technologies which support learning" (Riconscente, 2011, p. 1). It is in this context, that educational designers create more and more apps for new technologies to assist them in teaching challenging concepts. Risconscente (2011) hypothesised that children's scores would increase significantly after playing Motion Math and she was able to document significant learning gains through playing Motion Math. The children's fractions test scores improved on an average of over 15% after playing Motion Math for twenty minutes daily over a five-day period. Students even started to enjoy fractions because of the playful app. This suggests that the learning process can be designed more appealing to children if the educational apps integrate an entertainment value along with an educational value.

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[5] Motion Math: an educational app, developed at the Stanford School of Education, to give learners a physical experience of the number line and an intuitive feeling for fractions (iTunes Preview, 2016)

Regarding the use of iPads for literacy learning, Hutchison, Beschorner and Schmidt-Crawford (2012) have carried out a research project in collaboration with a fourth-grade teacher in the United States. The teacher planned to integrate iPads into the literacy instruction every day for three weeks. The teacher's intent was to carry on with her usual print-based literacy goals that were outlined in the reading curriculum, while trying to increase her students' learning opportunities with the iPads at the same time. With the help of five different apps used for instructional activities, the students' motivation for literacy learning was enhanced and, additionally, the students even learned to digitally communicate with each other. In the end, the teacher managed to meet the print-based literacy goals while simultaneously introducing some of the new literacy skills associated with new technologies. Furthermore, the study showed that not all apps proved to be equally helpful and that thus the choice of apps appears as a crucial factor for the children's success. Also, teachers planning to integrate iPads into their classwork need assessment strategies to ensure a targeted use of devices.

A further research by Dundar and Akcayir (2012) measured Turkish children's reading performance on tablets compared to paper. The study analysed electronic text reading performance, reading speed and reading comprehension with students either using tablet PCs[6] or printed books. The study examined a sample of twenty fifth-graders. The researcher split the class into a control group, which read ordinary printed books and a treatment group, which read the same text on a tablet PC display. Statistically, no

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[6]Tablet PCs used in this study: iPad 2, CRT (cathode ray tube) display and LCD (liquid crystal display)

significant difference between the two groups resulted in any inspected variable of the experiment. In other words, completing the task on an iPad did neither show negative nor positive effects for the students. These findings also suggest that tablet PCs can be an effective solution for the ergonomic and physical problems of reading electronic texts because they are user friendlier than other types of displays. The treatment group also exhibited positive attitude toward tablet computers. Students preferred tablet PCs to reading printed books because of their handiness and light weight. Also, as observed in other studies, students find it more entertaining to read on the tablet PC which engages students' motivation.

Teacher technology competence

The studies mentioned above give an idea of the uses and advantages of iPads in classrooms. However, the question of how to use iPads for classwork and what challenges the teachers will face with such an implementation remain.

John Hattie, one of the most revolutionary scholars in education of our days claimed that "the greatest change that most students experience is the level of competence of the teacher (…)" (2009, p. 1). According to him, teachers explain 30% of variance in student's achievement and therefore can make a significant difference in the students' performance (Hattie, 2003). Thus, apart from the students that account for 50% of variance within the student's achievement, teachers represent the major source of variance. With this in mind, the teachers' knowledge and their methods are very influential on their students' success (Hattie, 2003). Transferring this insight to the use of new technology in classrooms suggest that the successful integration of such tools

as the iPad is crucially depending on the teachers' competence and methods. Naturally, this begins with the teachers' attitude towards computers or mobile media in general. The evolving technologies potentially make teaching and learning easier, but they do not necessarily. According to Chen and Chang (2006), "to maximize benefits, computers must become an integral element of teaching and learning across the curriculum" (p. 170). Teachers must be prepared, skilled and motivated to implement the *new way of teaching*. They must know exactly how to use the media effectively, because "geared with successful engagement, computer activity can boost children's self-esteem" (Chen & Chang, 2006, p. 170, quoted from Hohmann, 1990). This requires early childhood teachers to attend professional trainings which "rely on updated, specific information regarding what early childhood teachers know about computers and how they use them in classrooms with young children" (Chen & Chang, 2006, p. 170). The study of Chen and Chang (2006) also investigates teachers' attitudes, skills and practices towards computers in classrooms and the results "indicate that many early childhood teachers are not ready to integrate computers in the classroom" (p. 178). In the study, half of the interviewed teachers (n = 297) did not feel comfortable using a computer for themselves, not to mention teaching young children how to use it. The question, here, remains: Are teachers ready to integrate mobile media in 2016? This calls for more recent and selective research.

Discussion

Although the current research field is limited by only a small number of studies, "it provides an early snapshot of the developing field" (Pegrum, 2013,

p. 76). Due to technical progress it is inevitable for children at a very early age to come into contact with mobile media. This movement, of course, does not halt in front of school doors and thus, integration and adaption, with all its benefits and drawbacks, seems inevitable.

The Good, The Bad, The Unknown

New technologies always come with advantages and disadvantages. Positive impressions throughout all iPad studies are that children enjoyed learning with iPads a lot. This also means that learning was more fun when using the iPad. This was, for example, also confirmed by the Motion Math study by Riconscente (2011). With this new way of learning, children have an additional possibility to even understand topics, which previously presented difficulties. Furthermore, children can independently repeat their tasks several times in order to better understand the subject. This leads to a better individualisation of classwork and also encourages students' individual development and self-esteem.

Additionally, children with special needs can benefit of the use of iPads. Whether they require early intervention due to learning difficulties, either, for example, impairment in reading, writing or arithmetic, or if they just need an additional support. There are several apps which can provide such additional help. As an example, *text-to-speech-apps* help children learn how to read by leading the way. Likewise, the so called *dictionary-apps* help children to learn to write (Clare, 2012). For arithmetic learning, lots of apps exist. Apps such as Motion Math by the Stanford School of Education mentioned above help catering to a greater variety of children's needs. Children with visual

impairment profit from working with iPads as well, because unlike with books, on iPads they can resize and reformat their texts. In sum, iPads allow to adjust the learning material to the specific needs of the learner. Thus, children may, literally, take learning in their own hands, at least to a certain extent.

In addition to these individualising effects, children testing the iPad in classes usually engaged more at school and sometimes even spend more time doing homework, which eventually resulted in an increase of performance (Mouza, 2005). According to Culén and Gasparini (2011), iPads in classroom encourage both teaching and learning. In accordance with the theory of positive reinforcement, the possibilities of iPads allow educators to individualise their teaching much easier and thus may motivate them to provide the attention required to efficiently use iPads. These iPads, again, further motivate the students and, eventually, if the students are motivated and paying attention, the teachers might feel additionally challenged to even improve their teaching (iPads for Education, 2011). In the words of Apple, "iPads change the way teachers teach and students learn" (2014, p. 2).

However, as mentioned above, the students' motivation only enhanced and persisted if the teachers showed competence in using and motivation to integrate such devices in the classroom (Chen & Chang, 2006). Thus, teachers need to accept the new classroom technologies in order to be convincing for students to use the iPad as a tool to support learning rather as a toy. If teachers carry positive attitude towards the use of iPads, this will trigger positive adoption of the iPads in classrooms (Dhir et al., 2013). Therefore, teachers should be supported by school management in their decisions to implement mobile technology. It is even advisable to establish a

technical support group where teachers can exchange experiences or turn to in case they run into problems (Vavoula, Lefrere, O'Malley, Sharples & Taylor, 2004). Vavoula et al. (2004) even suggest that educational institutions should provide training for their teachers in order to encourage them to improve their technological skills and therefore improve the use of iPads in classrooms.

Besides motivated students and competent teachers, the right use of iPads in the classroom is the third key ingredient for successful mobile learning. Whereas iPads often serve as a distraction or gap filler at home, this cannot be its purpose at school. In the words of Radesky et al. (2015), many parents are using iPads as a "shut-up toy" (p. 2) to occupy their children whilst they go about their own business. As understandable as this might be, children need to "develop internal mechanisms of self-regulation" (Radesky et al., 2015, p. 2). Radesky et al. (2015), claim that children need to find their own way of calming themselves down without the use of an iPad. Individuals do not learn self-regulation from the media, but from their natural environment (Radesky et al., 2015). To make sure iPads will not be used as a distraction teachers need to make a careful selection of apps due to previous assessment. In the study regarding the use of iPads for literacy learning (Hutchison et al., 2012), the teacher stated that an appropriate selection of apps is necessary in order to make the iPad a useful tool. If the apps are not adequately selected for its educational purpose, the use of iPads will not be as efficient as it could be and might lose its primary function as a supporting learning tool. Since there are already thousands of apps made for educational purposes, it may appear difficult to find *the* perfect app for a specific purpose. One benefit of such a huge variety of apps is that, very likely, a suitable app for almost every need

may be found. So every student can get their own individualised learning context and use the apps which work best for them. This is where the teachers' educational expertise is needed to ensure a targeted use of iPads. The teachers understand the individual educational needs of their students or in some cases may at least take an educated guess at what might further students' development. Thus, they need to test the available apps in order to find one that suits a student's specific needs. Of course, testing so many apps is very time consuming and teachers could easily get lost in the abundance of available educational apps. A possible solution could be, that schools or the previously suggested *technical support groups* among the teachers test those apps and compile a list of recommended apps for different age groups. From that list, the teachers, or even the students individually may choose from. In this regard, several providers already offer their services. For example, in Switzerland, two experienced teachers with advanced skills in IT offer their support for schools and teachers that are willing to implement iPads in classrooms (iPad-Schule, 2016). They organise workshops for teachers and provide practical advice and recommendations.

Regarding environmental factors, iPads efficiently eliminate excessive paper from the classroom. Less printing is needed as students have their exercises on their iPads. Besides, children with personal iPads do not have to carry around several books but only their device. This handiness and light weight of the iPad is what makes it a suitable device for children. And also ergonomically, as Dundar and Akcayir (2012) observed, children do not have to remain at their desks with a bad posture. They can, if the teacher allows it, sit wherever they like or at least change their position as they do not need to sit

at their table in order to work. Furthermore, with iPads, children choose when and where to study, hence they have to take responsibility for their own learning, which is, nowadays, a great opportunity. This individual approach could have an encouraging effect for the children. With their personal iPad, they could choose when, where, and what to study. With the right apps, they can further their knowledge and train specific skills. On the other hand, children struggling in certain areas can individually select additional practice for as long as they need to.

Significant drawbacks, though, are the problems which always occur by using technological devices. Technological problems, be it equipment breakdowns or malfunctioning of apps due to their dependency on a wireless network connection, delay or hinder the use of the device. In addition, the iPads may need to be charged when the students arrive at school, except if the students charged them at home. Furthermore, the devices have to be maintained and downloaded apps need to be updated to have the newest version from time to time. However, Culén and Gasparini (2011) observed in their study that if one of the mentioned problems occurred, "everyone was very patient with it, indicating that the benefits outweighed the problems" (p. 205). Thus, in addition to learning patience, if the devices do not work in the supposed way, children also learn to develop alternative strategies to engage with themselves with educational material on their own. Of course, this may request an additional effort by the teacher, because, in this case, they need to have a back-up plan. In other words, if technology fails, non-technological learning opportunities must be provided by the teacher.

According to Dhir et al. (2013), "iPads reduce the teacher workload" (p. 718) which suggests a main benefit for teachers. This is true in the sense that during iPad-time, teachers do not have to lecture. However, they still need to prepare the lessons including iPads so that the students have their program to work on. Ideally, the teacher also assists the students or accompanies them even when they are working with the iPad. With this individualisation of classwork, teachers will spend more time thinking about and preparing individual programs according to the varying levels of knowledge within the class. On the one hand, they need to prepare additional and more demanding exercises or educational apps to encourage more advanced students. On the other hand, they also have to cater students working at a slower pace. In any case, teachers have to think about how to get a positive outcome for all of their students. As a conclusion, it is safe to say that iPads really can support teachers in their daily activities. However, teachers need to be open-minded towards new technologies and eager to integrate them adequately in their lessons.

The question might come up whether iPads in the classroom run the risk of becoming a distraction as children may start to play games in class instead of engaging with the material provided by the teachers. Johnson, Adams and Haywood (2011) address exactly this question in their study: "While the idea of cell phones in the classroom too often conjures up the images of disruption, tablets are a game-changer; they encompass many of the tools smartphones offer while presenting an ever-expanding collection of tools for learning" (p. 15). Whereas Dhir et al. (2013) express a different point of view, concluding that the iPad is "an entertainment tool with almost no role in learning"

(p. 707). These contrary findings suggest that long-term research is needed to answer the question whether the iPad furthers distraction in the classroom and, how such an influence could be evaded, for example, by limiting the students' permission to install apps themselves.

Rethinking paediatric guidelines

In 1999, the American Academy of Pediatrics (AAP) discouraged the use of media by children under the age of two. In 2011 this statement was reaffirmed and three years later, we still do not know enough about mobile media to formulate a reliable guideline. "Research is simply unable to keep up with the pace of technology advances and these devices are incredibly popular" (Christakis, 2014, p. 399). Christakis (2014) also claimed that interactive media is acceptable for children younger than two years. The corresponding worldwide debated matter discusses questions such as: do children under two years of age really understand what they are doing on an iPad? Or: is it really beneficial for a child's development? Children need to explore their environment and get to experience and learn about the world by themselves in order to prosper and progress. It is questionable to what extent this is possible with an iPad. Judging from the current state of research, it probably makes most sense to introduce children at the age of three or four years to the interaction with mobile media which then, however, should be actively guided by parents in order to enhance its educational value (Radesky et al., 2015).

Conclusively, an appropriate use of technology can meet a child's needs and further its personal development. In general, such uses of the device need to be accompanied by a supervisor, in other words a teacher or a parent. Since

a good mixture of both, technology time and non-technology time is advisable to further the children's development, supervisors should also formulate clear time restrictions.

Medical considerations

Besides the ergonomic improvement when using iPads, the medical issue myopia[7] is currently rising. Myopia does occur worldwide with a prevalence of 25–30% in the general population and the number of patients is steadily growing (Leydolt & Findl, 2007). Opticians around the world observe that they increasingly treat younger children in need of sight correction caused by myopia. Already in year 2000, a longitudinal study from Norway investigated engineering students and found that myopia was more likely to develop among students who spent most time studying (Kinge, Midelfart, Jacobsen & Rystad, 2000). Furthermore, in the United States the prevalence of myopia in persons aged 12 to 54 years has changed significantly from 25% during 1971–1972 to 41.6% during 1999–2004 (Vitale, Sperduto & Ferris, 2009). According to studies from East and Southeast Asia (He et al., 2015) and Israel (Dayan et al., 2005), the prevalence for myopia has risen steadily over the past years. Regarding He et al. (2015) and French, Morgan, Mitchell and Rose (2013), children who spend more time indoors have a higher prevalence for myopia. Children who are spending more time indoors are more likely to play games on the computer or their smartphone, or use their iPad more often. Hence, their eyes are being strained unilaterally due to near work. As a result, the

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[7] Myopia (nearsightedness): "the visual images come to a focus in front of the retina of the eye because (…) of an abnormal length of the eye ball resulting especially in defective vision of distant objects (…)" (Merriam-Webster, 2016)

probability of developing myopia statistically increases. In correspondence to the implementation of iPads in classrooms, there are not many scientifically sound studies associating iPads with a greater probability of myopia. However, it is known for a fact that near work can lead to myopia. As the precise mechanism for the development of myopia is not entirely clear yet, the only preventive recommendation Leydolt and Findl (2007) make is to regularly take short breaks to relax the eyes, especially if working on challenging tasks. As for iPads in classrooms, school management and teachers should consider preventive measures and integrate them into their lesson planning.

Future research

Clearly, further research is very much needed regarding the use of iPads in classrooms in general. According to Kucirkova (2014), "future research needs to critically examine the potential of iPads to act as an innovative pedagogical support to current classroom practices and instructional strategies" (p. 2). Especially long-term studies should be set up to elicit information about the effects of long-term iPad use. The knowledge of long term lasting outcomes and long term impact on instructions may help to "develop guidelines for preparing new curricula and pedagogical strategies for successfully integrating the iPad in an educational setting" (Dhir et al., 2013, p. 721). The development of new curricula is one of the most important aspects of implementing iPads in classrooms. If the curricula do not make place for iPads, teachers cannot fully integrate them in classrooms in order to get the support they could probably provide. Besides, as mentioned in the medical section beforehand, possible long term studies could also give a feedback regarding the development of myopia.

Conclusion

The studies introduced in this paper indicate several benefits of integrating iPads in classrooms, or in a wider context, in the curricula. In general, the motivation and engagement of the students enhance with the use of iPads. If they felt confident and skilled enough, teachers also showed to be motivated and willing to integrate the new technology into their classwork. The use of iPads also encourages children with different kinds of impairments. The iPad provides possibilities for intellectually or medically impaired learners.

As Pegrum (2013) claimed, possible drawbacks can be hardware, software or network issues. Those problems can mostly be fixed rather quickly or preventively engaged by setting up technical support and regularly maintaining the devices. The most fundamental and difficult task for the educational sector is the integration of the iPad into the educational system. According to Dhir (2013), "incorporating [the] iPad into the traditional educational system is not an easy task" (p. 707). Despite the difficulties, schools and educators will have to adjust the curriculum and make space for new technologies since the technological trend towards mobile media continues to accelerate. In addition, failing to integrate recent technological advancements in the classroom now might result in even greater problems with future technological developments.

The most important take home message from this review surely concerns the teachers' role in the implementation of iPads in the classroom. They need to ensure a targeted and individualised use of the devices. To this end, teachers will need to embrace the new technology and spend a lot of time to

prepare their classwork for its use. Put in the words of Hattie (2009): "The major is message is simple – what teachers *do* matters" (p. 22).

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