

Introducing iPads into Senior Secondary School Teaching

Teachers' Use of iPads as Tools in Teaching

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Abstract: Contemporary education is changing with portable devices coming to schools. The borders between formal and informal learning are diminishing. The use of tablet-computers in teaching provides teachers and students with tools that can facilitate teaching and learning in and out of formal learning environments. Our paper is based on a pilot study launched in a teacher training school at senior secondary level where a group of teachers were given iPads to introduce in their teaching. This study reports the findings on how the teachers utilized the iPads as tools during their first year of use. We aimed to find out how the teachers were using the iPads and which apps and network (learning) environments they used in their teaching. The data collection was based on: 1) informal discussions with the teachers, 2) teachers' reflection tasks, and 3) interviews. The first step was used as a foundation for the second step, which was used as a foundation for the third. The data described in this paper are based on the interviews and their analyses.

1 INTRODUCTION

Using tablet computers in teaching is popular nowadays and has been the mainstream in Finnish schools for a while reflecting the guidelines in the national core curriculum in basic education (Finnish National Board of Education, 2004) and the national core curriculum for upper secondary schools (Finnish National Board of Education, 2003) about ICT use in teaching. The curricula in Finnish education are currently under reform, but already learning ICT skills widely is described in the draft of the new national core curriculum in basic education which will be implemented throughout the country in 2016 (pp. 16-17, 23-24 Finnish National Board of Education, 2014). In Finland there is an increasing number of schools using tablet-computers in teaching and the possibilities to choose different brands of tablet-computers are many, but basically it is between three different operating systems: Apple's iOS, Google's Android or Microsoft's Windows. Microsoft was somewhat late in introducing an operating system that works with touch, so mainly the choice in Finland has been between Android and iOS. In this research, the tablet computers are Apple's iPads which use iOS. However, there are many schools in Finland that have chosen the tablets running Android, mainly

because their price is lower than the tablets running iOS.

Until recently, Apple has been almost completely absent from Finnish schools. Some schools have had a Mac-lab, but the number has not been high. However, after iPads were introduced and their possibilities for teaching became known to larger audiences, some Finnish schools decided to implement iPads in the teaching. This is in line with global trends: Apple has been promoting learning with their devices for decades, especially in the U.S. There is a section in Apple's website for education (Apple Inc. a) and also one for education with iPads (Apple Inc. b). Apple's devices are also increasingly involved in people's daily lives in Finland as their phone sales have increased compared to other brands.

One-to-one (or 1:1) computing has been researched quite thoroughly (see Penuel, 2006), and is there a more effective way to implement one-to-one computing in teaching than to give a tablet-computer to every student in the school? Laptop initiatives have been implemented (see Holcomb, 2009) and studies have been done with mobile devices under the Mlearning-topic (e.g. Martin and Ertzberger, 2013). However, it is not clear if computing, or learning, happening with a tablet-computer should be called one-to-one computing, e-

learning or mobile learning. The difficulty of positioning tablet-computers to either e-learning or m-learning has already been addressed a decade ago by Traxler (2005).

A tablet-computer is in many ways a fusion of the fore-mentioned laptops and mobile devices. It has a touch-screen, mobile capabilities and the apps or programs are its core function, with the file system being virtually non-existent, as in smart phones. In comparison to a laptop, a tablet-computer also has a large enough screen and a quite powerful CPU (central processing unit); it is also possible to use office programs with varied ease with tablet computers and also different attachable keyboard devices are available. Tablet-computers are almost as portable as traditional mobile devices and have almost the performance of a laptop.

According to Cochrane, Narayan and Oldfield (2013), iPad's iOS ecosystem also offers powerful tools for collaboration and content generation. Tablet devices have an ability to transform the space where the students work as pointed out by Fisher, Lucas and Galstyan (2013). Fisher et al. also emphasize the portability of tablet devices and iPads and their efficiency as devices for media consumption. Bradley (2012) reported an increase in students' control over their classroom activities and that the students are so engaged in the use of iPads in the classroom often they want to do more work than required. Pegrum, Howitt and Striepe (2013) point out the importance of being connected to one's PLN (Personal Learning Network) by using the iPad. They also discuss that this way iPads support students' learning across formal and informal context, making it seamless.

A pilot study was launched in University of Eastern Finland's training school's senior secondary level. The aim was to give iPads to all the students who began their studies at the senior secondary level. Some teachers were selected from each subject to receive iPads beforehand to practice using them before taking them into their teaching. In this research the views of these teachers after one year of using iPads in their work, life and teaching are reported. When the study began, there was very little research literature on the topic. For this reason, we wanted to make the interviews used for data collection based on the reality of the teachers and their own experiences.

2 MATERIAL AND METHODS

This research was conducted during an experiment

in a university training school, where a pilot group was given iPads to introduce into their teaching in the middle of the autumn semester. The aim was to give iPads to the rest of the teaching staff and the students beginning their work at a secondary senior level at the end of the year after the pilot group had learned how to use the iPads in order to guide others in learning them. The pilot group consisted of eleven teachers in different subjects in the senior secondary school. The only subject taught by two different teachers was Finnish language and literature. Other subjects the teachers taught included: physics, music, arts, English language, Spanish language, German language, Chinese language, history, civics, law, religion (orthodoxy), ethics, psychology, biology, geography and mathematics. Most of the teachers had classes in the junior secondary school as well as in the senior secondary school. With this variety in taught subjects and levels, we tried to cover as many different contexts of teaching as possible.

The research was conducted in three steps. In the first step, we discussed with the teachers who had received iPads in the beginning of the school's experiment. When the discussions took place the teachers had had two to four weeks of practice and experimentation in the use of iPads in their teaching and in general. The discussion was done in groups based on the subjects the teachers taught. The groups consisted of the teachers from the school and two researchers and a lecturer in subject pedagogy from the university. The discussions were informal and the aim was to find out how and what the teachers were doing at the beginning of the experiment. We found that they were planning and experimenting using a large number of different apps and network (learning) environments in teaching when using iPads. They also tried out different approaches to taking iPads into their teaching. These discussions were used as a base for the second step: forming a reflection task to be undertaken by the teachers. The teachers were asked to write thorough and descriptive answers to four questions related to the use of iPad, apps and network (learning) environments in their teaching. The answers to these reflections varied from thorough descriptions to very short, few word answers. We noticed that the answers were not detailed and descriptive enough to answer our research questions and thus, based on the reflections, we formed a set of questions to create a semi-structured interview. We tried to refine the interviews so that the questions we asked the teachers addressed our research questions in multiple ways (see appendix).

The interviews were conducted approximately one year after the teachers first received their iPads and the teachers were asked to reflect on their past year using iPads in teaching. The research questions posed for the interviews at this stage of the research were: 1) How are the teachers using iPads as tools in their teaching? and 2) How many and which apps, software and network (learning) environments are the teachers using with their iPads? The interviews were transcribed and the transcripts analysed using situationally adapted grounded theory. The purpose was to establish what emerged from the data and compare it to existing theories and previous research. The researcher in charge of analysing the interviews was also the main participant in discussions with the teachers and creating the interviews. He also gave the reflection task to the teachers and conducted the interviews and transcribed them. In this way the process of analysis began forming, to some extent, at the beginning of and during the research. The researcher listened to the responses during the interview, then once more when transcribing after which he read the interviews twice, making small thematic markings on the second reading. After that the content was coded using Atlas.Ti -program, and the codes were sorted to different code families. The codes were found within the data and there were no pre-set codes or codebook for the process. After this, the codes and code families were exported to a spreadsheet program, where they were divided into themes, taking the quotations in question into consideration while doing the compression. The codes were then compressed and combined with others within the same theme to reduce the number of and possible overlapping of codes.

3 FINDINGS OF THE STUDY

As mentioned in the previous section, the questions we posed at this stage of the research were:

- 1) How are the teachers using iPads as tools in their teaching, and
- 2) How many and which apps, software and network (learning) environments are the teachers using with their iPads.

3.1 Teachers' Use of iPads as Tools in Their Teaching

We asked the teachers directly how they are using iPads in their teaching. We found most of the

descriptions to the categories below within the answers to that question and also from questions on what apps and network environments they are using. After the discussions with the teachers, and before interviewing them, we noticed that they were using the iPads in different ways, but mostly it seemed they were trying to replace old methods with the new device. We expected to find a wide variety of ways, but the focus was mainly on iPads replacing the old tools.

The teachers mentioned a total of twenty-eight different ways of how they use iPads in their work and in their teaching. Among these, we identified four different themes as a result of categorising the codes: 1) the iPad as a tool for demonstration and using mind-maps, 2) production and use of different types of materials, 3) using the iPad as a tool for taking notes, reading, writing and information searching, and 4) using the iPad as a tool for giving, commenting and collecting tasks, exams and feedback.

3.1.1 Using the iPad as a Tool for Demonstration and Mind-Maps

Table 1: Demonstration and mind-maps.

Theme	Code	Number of teachers
Demonstration and mind-maps	Making, doing, and showing mind-maps	5
	Tool for demonstration	4
	Enlivening of teaching	1
	Showing texts	1
	Transferring the observation-making from teacher to students	1
Totals:	5	12

The majority of teachers mentioned using iPads for demonstration or using mind-maps in teaching, and these fell into five categories (Table 1). Most of the ways were mentioned only by one teacher, but both demonstration “*teacher 5: to demonstrate phenomena, whatever they might be*”, and making mind-maps “*teacher 11: Time to time then it feels that those students like it, that if we do some mind-map, so in their opinion it just simply is more fun to do it as electronic*” were mentioned by more than one teacher. Other ways mentioned include for example: enlivening their teaching “*teacher 5: to enliven some things*” and transferring the making of observations from the teacher to the students “*teacher 1: normally a demonstration is something where a teacher does, the students don't manage to*

follow. So now, when they have to write that, why we do, what we observe, so it is so much more efficient this way.”

It seems that the teachers value the iPad’s capability to visualize phenomena and the way the iPad can be used instead of pen and paper, especially with mind-maps. However, the ways the teachers use the iPads in their teaching varies in this category: as we expected, they described somewhat similar things but in different ways and with different emphasis. This also underlines the iPad as a personally adaptable tool rather than a tool which different people use systematically in the same way.

3.1.2 Producing and using Different Types of Material

Table 2: Producing and using different types of material.

Theme	Code	Number of teachers
Producing and using different types of material	Taking, showing, and using pictures	6
	Using videos and animations in teaching and recording videos	5
	Producing learning material	2
	For sketching and using drawing programs	1
	Listening newspaper columns	1
Totals:	5	15

The majority of teachers mentioned using iPads for producing or using different types of material and five different ways were described (Table 2). Half of the teachers mentioned taking pictures with iPads: “teacher 8: they sent it to me as a photo there to iMessages” or showing pictures from iPads during class “teacher 9: maybe a bit of that visuality, that is important in our subject, so in other words exactly that using of photo/picture material.”. Using or recording videos: “teacher 10: video-works from one’s own living environment and own family” and producing learning material: “teacher 2: there are many kinds of manuals available for it [GarageBand], but I have that kind of a thought, that I would make my own” were mentioned by more than one teacher. Other uses in this category included for example listening to a newspaper column: “teacher 11: Harakka’s five minute columns and then we listened to them.” We did expect the camera to be used for creating material, although we expected even more teachers to mention it. Maybe the camera is an unfamiliar and under-utilised tool in some subjects? We noticed from the data, that teachers who use the camera in their free-

time, use it also in their teaching. Perhaps this emphasizes the ‘personally adaptable tool’ characteristic of iPads? We expected more teachers to mention producing learning materials. It seems that they mostly use the visual capabilities of the iPad more than anything else related to this category: nearly all mentions had some form of visuality within them, like pictures, videos or drawing.

3.1.3 iPad as a Tool for Taking Notes, Reading, Writing and Information Searching

Table 3: Taking notes, reading, writing and information searching.

Theme	Code	Number of teachers
Taking notes, reading, writing and information searching	Taking notes	8
	Information searching	7
	As a tool for writing	3
	As a dictionary	3
	Reading and online web-magazines	2
	Information sharing	1
Totals:	6	24

All eleven teachers mentioned using iPads in their teaching or work in ways that involve searching information, reading, writing or utilizing it as a tool for taking notes (Table 3). Six different ways were mentioned: most of the teachers said they used iPads in their teaching for notes “teacher 5: some make notes in that way and some make actually very well”. However, in this context taking notes means that the students are taking notes during the class. Most of the teachers also mentioned using iPads for searching information – either themselves or by the students: “teacher 6: Searching information with this is super-handy”. The use of iPad as a dictionary: “teacher 4: we used Australia’s slang-dictionary for one song’s lyrics”; and as a tool for writing: “teacher 11: I use it like, when we write, if I begin with mother’s tongue, we write with Pages.” were mentioned by some few teachers.

We expected the iPads to be used for searching information as it is so convenient: the iPad is with the student all the time and the Internet is available with just a few clicks. We did not expect the iPad to replace a conventional pen and paper notebook for taking notes and writing. However, during the interviews some teachers said that many students have gone back to using notebooks instead of iPads

when taking notes, but also mentioned that some students make astonishing notes with iPads and the teachers had no idea how they were able to do them so well.

3.1.4 Using the iPad as a Tool for Giving, Commenting and Collecting Tasks, Exams and Feedback

Table 4: Giving, commenting and collecting tasks, exams and feedback.

Theme	Code	Number of teachers
Giving, commenting and collecting tasks, exams and feedback	Communication	5
	Commenting and correcting tasks	3
	Exams and word-exams	2
	Students' self-evaluations	2
	Making and collecting tasks	2
	Problem solving tasks	1
	Laboratory work-report	1
	Collecting feedback	1
	Testing the students' prior knowledge	1
Totals:	9	18

The majority of teachers mentioned using iPads in giving or collecting tasks, exercises or exams for students and giving them feedback (Table 4). The teachers mentioned a total of nine different ways of using iPads in their teaching that belong to this category. However, only five of them ways were mentioned more than once, for example: communication in general with the students as a way of using iPad in teaching: “*teacher 10: I have chatted with the students a few times*”; exams and word-exams: “*teacher 4: Just a moment ago we had a word-exam that the students filled with the iPad*”; and commenting on the students’ tasks: “*teacher 8: Easily some feedback, that well done, excellent thoughts, or that could be a bit more.*”. The ways which were mentioned by a single teacher include for example: students writing work reports with iPad in a laboratory course: “*teacher 9: In the laboratory-classes when we make all this kind of experimental works [...] They make work reports to them [to pictures or videos they have taken] and then they go to the box.*”

We were not surprised to see the teachers use iPads to give different tasks to the students, as the large number of available apps encourages this use in teaching. The apps generally are for one or a few

purposes and usually they best serve a purpose for one or a few tasks. What was surprising was that one teacher made the students complete an exam with the iPad. Electronic exams are not very widely adopted in Finnish schools, especially in the senior secondary schools, which ends in a nationwide matriculation examination and the three year schooling is in many ways aimed towards that exam. However, there are discussions about making it possible to participate in this nationwide matriculation examination in electronic format instead of paper. Considering this, completing an exam with a device like an iPad may be a good idea – as long as the conditions are fair and the exam measures what it is supposed to and does not reward the students who are able to ‘cheat and search information’, as the teacher who had given the exam said during and after the interview. However, when discussing with the teacher, it seemed that their concern was the Finnish curriculum for senior secondary schools and the senior secondary school system. The three years the student studies in the school aims to the nationwide matriculation examination, which at least at present moment does not support the idea of students being allowed to search for information during the examination. Thus, the teacher was concerned that if they let the students use iPads for information searching during the exam, they might neglect their responsibility of preparing the students for the matriculation examination during the studies.

3.2 The Apps, Software and Network (Learning) Environments the Teachers Use with Their iPads

As we mentioned earlier, in the first meetings with the teachers we found that they were planning and experimenting using a large quantity of different apps, computer programs and network (learning) environments when using iPads in their teaching. We asked this a second time when we asked the teachers to write a reflection of the use of their iPads in teaching. However, we decided to find out the variety and the amount during the interview as well. The apps, network (learning) environments and computer software were mentioned by the teachers on different occasions besides when they were asked to list them. We have summarized these data on the apps used by teachers in table 5. We did not record the amount of mentions for each app, we only recorded which teachers are using the app and mentioned it during the interview.

Table 5: Apps, software and network (learning) environments used by teachers.

Number of teachers using tool	Category of Tool	Name of tool(s)	Number of tools
8	App	Various apps for taking notes	1
7	App & Online tool	Box	1
5	App	Pages	1
5	App & Software	iMovie	1
4	APP & Digital Newspaper	Helsingin Sanomat	1
3	App	Camera, Notability, Sanajahti	3
3	App & Software	Sticky Notes	2
3	App & Online tool	Edmodo	1
2	App	iMessage, Keynote	2
2	App & Software	Google Earth, Simple Mind	2
2	App & Online tool	Mindjet	1
2	Online tool	Today's meet, Wikispaces, Wilma	3
2	Software & Online tool	Etherpad	1
2	Website	Yle's homepage	1
1	App	Dictionary, Electronics kit, Explain everything, Facetime, Flashcardlet, Function generator, iAnnotate, iBooks, iBooks author, iCardSort, Acceleration, Laskin, Molecular Modeling, Newton's laws, Drawing apps, Polynom, Ripple Tank, Sieniopas, Smart Bridgit, Numbers, Video Physics, Visible Body	22
1	App & AVOD	BBC Player, Yle Areena	2
1	App & Software	Band in a Box, GarageBand, Evernote, Skype	4
1	App & Online tool	Socrative	1
1	App & Online radio	TuneIn Radio	1
1	Online tool	Physics tables, PollEverywhere, Google Docs, Moodle	4
1	Software	GeoGebra, Powerpoint	2
1	Website	YouTube, Institute for the Languages of Finland's homepage, Publishers' homepages and exercises	3
Total number of different tools used with iPad by the teachers:			60

In the table, ‘App’ means an application, ‘Online tool’ means a tool or software found online and that can be used with a browser, ‘Software’ means downloadable software, ‘Digital newspaper’ means a digital version of a newspaper, ‘AVOD’ means Audio or Video On Demand, a broadcast that can be watched when the user wants, including outside of the broadcast time like those provided by corporations like Yle and the BBC. ‘Website’ means a website in general which is not only an online tool, software, digital newspaper or AVOD.

As can be seen from table 5, more than half of the different apps and network (learning) environments are used by only one teacher. However, the students need to use more apps in their

studies in different subjects. If for example a teacher uses five different apps in his or her teaching, and a student has four different subjects in a period of studies where all teachers use five apps, the student will have used a total of twenty different apps during that period of study. And when the student has five periods of studies in a year, this can result in a total of a hundred apps. This is fortunately an exaggeration as the same teachers will be teaching the students in different periods and all teachers are not using five apps in their teaching, but the quantity of the apps and tools the student needs to learn and use is still high – all this in addition to their studies, exams, hobbies and other activities.

4 DISCUSSION

Chris Bruce (Apple Inc. c) gives tips in Apple's webpage about how to use iPads in teaching. He is using iTunes U to create courses for the students and using apps to enhance the teaching. In our study, not a single teacher was using iTunes U in his or her teaching. However, the teachers did use different methods that Mr. Bruce encourages teachers to use: student creation, camera, video editing, note taking, and writing lab reports. Brandi McWilliams (Apple Inc. d) says that the iPad took her out of her comfort zone, as happened with many of the teachers in our research. She also says she is willing to take risks and she is willing to 'advance' – other aspects the teachers in this research also mentioned. She also says that teachers should make students keep portfolios of their products, an evident result of doing learning tasks with iPads. This is also the case with the teachers in our research, they do encourage the students to keep their creations in their iPads and if not there, then in the "box" (term used by the teachers, when they mean 'Dropbox', a file hosting service).

The teachers also seem to have mainly replaced old working methods with the use of iPads; real innovations and new ways of using iPads in teaching are rare. However, there were a few interesting and not so common uses like giving exams for students to complete with the iPad and the widely adopted use of mind-maps in many different subjects. This replacement of the old instead of innovating and generating something new might be connected to the organizational constraints in senior secondary schools and the restrictiveness of the curricula in Finland as elsewhere (e.g. in the UK, see Robinson and Sebba 2010). The teachers' use of iPads in teaching varied between subjects in our study. Ng and Nicholas (2009) found the same in their research using pocket PCs. They also found that the introduction of technology to secondary schools was more difficult than to primary schools.

We realize that this study is not generalizable and it does not reflect the experiences of teachers or secondary schools as a whole. However, we began the research when no iPads were used in Finnish schools and we were part of one of the first pilot projects to introduce the iPad into teaching in senior secondary schools. For this reason we did not want to restrict our study into a tight framework but rather give the opportunity to the teachers who were trying something new to bring up their thoughts. We recognise that the teachers have been experimenting

with different ways of using iPads and thus the quantity of apps and different uses might seem high.

In conclusion, the teachers in this study are using iPads in their teaching in many different ways. Yet, there are similarities in their use as revealed in the interview data. The teachers' responses were grouped into four different categories/themes that include similar activities. However, the teachers' use of iPads in their teaching in so many different ways accompanied by so many different apps and network (learning) environments raises questions about how students cope with such diversity. If a teacher uses the iPad in five different ways or apps or network (learning) environments and a student has five different teachers during a period of studies, in this period of time the student has to be able to learn, in the extreme case, 25 different ways or apps to use the iPad as required in their studying. This raises a question, what do the students think and feel about the use of iPads in teaching? This issue needs further research where the study group are the students who are using iPads in their studying. Such a study has been made where the students are interviewed in a similar manner to the teachers in this study. The results are currently under analysis and a comparison between student and teacher experiences will be made in due course.

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- What expectations did you have towards the iPad-pilot? How were the expectations fulfilled?
 - Have there been problems (what)? What has gone well or badly?
 - Have you faced some epiphanies? How about feelings of success?
 - Has something surprised with its easiness or fluency?
 - How has the iPad affected the teaching – directly?
 - How do you use iPad in your teaching/to support your teaching? Why in this way?
 - What do you think in general about the use of iPad in teaching? Why is this your opinion?
 - What different apps have you used? How? Why?
 - How about network environments? How? Why?
 - How has the use changed during the year – has it changed?
 - How does the iPad suit the subject you teach?
 - How does the iPad suit your style to teach?
 - How do you usually teach?
 - Has the use of iPads increased / decreased your workload? How?

APPENDIX

Translation of our interview questions (only related parts) from Finnish to English.

- How do you use ICT in general? In teaching?
- How has the use of iPads in teaching gone?
- How did it go in the beginning of the pilot and how did you learn to use it? Was it difficult to learn?