

# An Analysis of Teachers' Processes of Technology Appropriation in Classroom

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## ABSTRACT

*This paper aims to investigate the “sense” of appropriation of the iPad use by teachers in a professional secondary school. As iPads are increasingly employed in the teaching process in classroom the authors intend to understand how the process of teachers’ appropriation of iPad use is perceived as a learning tool. Through the analysis of focus groups with teachers, they intend to detect changes in the sense of appropriation of the iPad in classroom during a school year. The findings of their study allow to identify facilitating and hindering elements that support the process of teachers’ appropriation of iPads and open further spaces to investigate the role of new technologies in teaching/learning contexts.*

*Keywords: Appropriation, Educational Technology, Innovation, iPad, Teachers*

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## 1. INTRODUCTION

In the last decades, teachers have to manage the emergence of an increasingly pervasive technology during pedagogical activities in classroom. Among various devices used to teach and to learn (such as netbooks, mobile phones, computers, and mp3 players), a tool that is receiving a growing attention in the field of technology of education is the digital tablet, such as the iPad. The adoption of the iPad as a learning tool in classroom is gaining emphasis at different learning levels, in pre-school, elementary, secondary and tertiary education (Manches, 2011; Falloon, 2013; Kucirkova & al. 2014; Khalid, Jurisic, Kristensen & Ørngreen, 2014). However, there are still few studies devoted to investigate how the iPad is appropriated by users in classroom. For this reason, the aim of the present paper is to analyse the teachers’ “sense” (namely, the

DOI: 10.4018/IJDLDC.2015040101

perceptions) of the iPad appropriation as a supporting tool in didactic activities. In our view, an in-depth analysis of what teachers think and how they declare to use these technologies as resources for their teaching activities should enhance our understanding of how to support better the teachers' integration of iPads. Furthermore, by exploring the perceptions connected to this process of appropriation, we will be aware of which aspects are facilitating and hindering the effective use of the iPad in classroom. This may assist teachers to overcome barriers and to become successful "technology adopters" (Bingimlas, 2009).

## **2. THEORETICAL FRAMEWORK**

### **2.1. The iPad as an Educational Tool**

iPads are considered "post-PC" devices implying a "mobile complexity" (Murphy, 2011). As suggested by Cochrane, Narayan and Oldfield (2013), different reasons are recognized as key factors in pushing people towards the use of digital and mobile technologies in educational settings: the possibility to improve the access to the course materials; the capacity to align with broader institutional and business goals (Kukulka-Hulme, 2005); the role in fostering learning about complex topics (Jacobson & Archodidou, 2000); and the merit to provide learners with dynamic and nonlinear access to a wide range of information (text, graphic, audio, and video). In addition to the above-mentioned benefits, the introduction of iPads can be difficult and some challenges can emerge with respect to the traditional teaching and learning processes. For example, the distraction of students can improve; the classroom's management can be more complex; difficulties in planning and managing the students' work can emerge; and a lack of knowledge and available resources can impact the possibility to develop new systems of education. However, the introduction of the iPad as a learning tool has been treated with great emphasis by several authors that have questioned the added value that the iPad entails in education. In fact, like any other new technological innovation, the integration of iPads in classroom requires efforts in terms of adaptation, promotion of qualitative changes for students, teachers and the whole school community (Jones & Issroff, 2007).

The appropriation of the iPad, as well as of other technologies, has an impact to different steps in teaching and professional training processes (Lawless & Pellegrino, 2007). Different studies have documented forms of teachers' rejection or low-level use of a new technology despite the availability of tools in classroom. The traditional training courses for pre-service or in-service teachers do not provide specific learning skills to manage an effective appropriation of new technologies (Llorens, Salanova, & Grau, 2002). Recently, Cochrane, Narayan and Oldfield (2013) have considered six critical factors in the appropriation of iPads in classroom: the pedagogical appropriation of a technology into the course; the possibility to have a model for a pedagogical use of the new tool; the presence of a supportive learning community; the appropriate choice of the necessary devices; the technological and pedagogical support that is needed during the appropriation process; the development of an ontological shift; and the promotion of new forms of students' engagement. In this paper, we intend to take into account the teachers' perspectives concerning their experiences of iPads' appropriation in the classroom. We are convinced that a deep exploration of these processes can be relevant in the conception of more effective designs for the effective use of this technology in classroom.

## **2.2. Appropriation of New Technological Resources as an Interactive Process**

Different approaches have been developed in order to describe and analyse various teachers' processes of technologies' appropriation, in terms of acceptance, rejection and use of a device in educational contexts. Adopting a new technology is typically performed through replacements and transformations. Many schools have performed the replacement's stage, which entails to take an existing resource and to replace it with a quite similar new digital resource. On the contrary, transformation occurs when a process or a resource is completely changed, implying a rebuilding process of the learning method. The notion of appropriation is employed when the user begins to use the artefact in his/her environment until a fruitful utilization. Jones and Issroff (2007) have defined the appropriation in terms of process by which a technology or a particular technological artefact is adopted and shaped in use. The process of appropriation also includes aspects concerning the mutual influence between the technology and the users (Overdijk & van Diggelen, 2008), with a simultaneous transformation process including the learner and the tool. This process of mutual shaping between the tool and the subject recalls an instrumental approach (Rabardel, 1995), based on the distinction between artefact and instrument. An artefact is an object of the human activity that has been designed for specific activities. The user builds and develops some cognitive structures (the schemes) using the artefact to carry out a task. An instrument is a mixed entity, consisting of a part of the artefact that is mobilized by an individual during its use and another component that is psychological. According to Rabardel (1995), the instrument is constructed through an instrumental genesis, a process of appropriation during which a bilateral relationships between the tool and the subject is established.

According to an ecological perspective, the process of appropriation is interactive and implies the assimilation and the accommodation, as well as changes, the possibility to adapt the technological device in order to fit personal, interpersonal and social-cultural requirements. Cook, Pachler and Bachmair (2011) have described the processes of appropriation as characterised by the user's agency, the user's capacity to act on the world, based on cultural practices, routines and social structures that determine his/her being in the world. Indeed, the success of a new technology is determined by human factors that mediate the adoption and the use of it (Churchill, Fox & King, 2012; Kukulska-Hulme, 2005). Taking into account these perspectives, we intend to focus on the teacher's subjective components that could impact the process of iPad's appropriation in classroom, considering their self-efficacy and beliefs.

## **2.3. Teachers' Appropriation of a New Technological Resource: The Subjective Component**

In this section, we intend to consider the teachers' self-efficacy and beliefs on a new technology as subjective dimensions that could affect the processes of iPad's appropriation. Although these elements are generally considered as second-order barriers, defined as the intrinsic factors that hinder and interfere with teachers' technology appropriation (Ertmer, 1999; Hew & Brush, 2007), different studies have shown the impact of teachers' self-efficacy. Self-efficacy can be intended as the belief of his/her own ability to organize and implement a course of actions that are necessary to properly manage a situation in a particular context and in order to achieve a goal (Bandura, 1997). Different studies have underlined that teachers with a high self-efficacy have a greater tendency to innovation's processes (Deaudelin, Dussault & Brodeur, 2002) and are more open to new ideas and possibilities to experiment new methods. More specifically, technological self-efficacy concerns the belief in abilities and skills necessary to successfully

perform a technologically sophisticated new task. Carugati and Tomasetto (2002) have shown how the perception of teachers' own performances against the use of computers has an impact on practices of the new technology's appropriation. A second aspect to be taken into account concerns the subjective dimension of the process of technology's appropriation that is connected to the teachers' beliefs. Different studies have shown the impact of teachers' beliefs on decisions about learning and teaching processes (Kagan, 1992). Beliefs influence the organization of the classroom (Sendan & Roberts, 1998; Churchill & al., 2012), the teaching's practices (Pajares, 1992) and the teachers' use of a new technology.

We consider that these two dimensions – teachers' self-efficacy and teachers' beliefs - are two main variables that are crucial in the exploration of the teachers' subjective processes of iPad appropriation. We also are aware that material and contextual aspects play a role in this endeavour and for this reason we will consider these elements in the analysis of a case study that we will describe in the following part of the paper.

### **3. RESEARCH**

#### **3.1. Aim and Questions**

The aim of the present study is to examine the teachers' perceptions about the process of iPad's appropriation through the analysis of a case study. In particular, we intend to investigate the teachers' "voices" held from focus groups in order to explore how they account for their experience of iPad's appropriation. Our research questions are the following: How the processes of teachers' appropriation of iPads emerge and evolve during the school year? What are the factors that are considered as facilitating or hindering the teachers' appropriation of iPads?

To achieve these goals, we will examine two focus group sessions: the first one has been conducted at the beginning of the research project, when the iPad was just offered to teachers for the use in the classroom; the second one has been realized after six month of use.

#### **3.2. Context and Participants**

The present study is part of a project conducted in collaboration with the organization for IT in schools (as part of the services for compulsory education in the canton of Neuchâtel, Switzerland). At the beginning of the project, iPads have been made available to teachers who were free to organize educational activities using this technology. The research has involved nine teachers of a secondary school (with pupils from 13 years old on average). Teachers have on average 17.5 years of teaching (from 4 to 35 years) representing all disciplines (German, English, French, History, Geography, Art, Sport, Science and Nature, Computer science). The level of teachers' familiarity with technological devices is very heterogeneous: the majority of teachers declared that they never used digital tablets at school. The data have been collected along a school year through different methods (focus groups, diaries, and questionnaires) and in a longitudinal perspective (Arcidiacono & Boéchat-Heer, 2013; Boéchat-Heer & Arcidiacono, 2014).

In this paper, we exclusively refer to two audio-recorded focus groups conducted around teachers' subjective experiences of iPads' appropriation. Focus groups were carried out at the teachers' school. The first focus group was held at the beginning of the school year (when the teachers just started to use iPads in classroom), while the second one was done six months later. The length of each focus group was about one hour. They were led by a researcher, playing the role of facilitator and using the mirroring technique (Rogers, 1967). During each focus group, the facilitator was in charge to support the participants' talk, by appreciating their emotions and,

Table 1. Categories of iPads appropriation

Dimensions	Indicators
Management of technical features	Reference to iPad's features and constrains
Management of socio-relational aspects	Reference to the role of colleagues and the technical staff
Management of didactic and pedagogical beliefs	Reference to didactical and educative added/not added values
Management of subjective strategies	Reference to personal choices and actions

when necessary, by asking for an explanation of their answers, without judgments and evaluations. Focus groups were audio-recorded and fully transcribed.

### 3.3. Analytical Procedures

We have examined the perceptions about the process of teachers' appropriation of iPads as they emerged during the focus groups. Considering the interactional nature of our corpus, a qualitative approach has been adopted for the present case study and a "grounded" approach has been used to categorize the dimensions that have been considered as the main object of the analysis. Through a process of tuning (a progressive comparison between the theoretical aspects and the data analysis), we have identified different dimensions and indicators until a high level of consent among researchers - agreement rate = 80% - had been reached. As result of this first analytical step, data have been condensed into four dimensions (cf. Table 1).

## 4. RESULTS

In order to present our findings, we will report the results in two sub-sections: in the first part, we will explore the different dimensions of teachers' appropriation of iPads by a comparison between the two focus groups; in the second part, the changes in the teachers' appropriation will be critically discussed.

### 4.1. Exploring the Processes of Teachers' Appropriation of iPads

In this sub-section the four dimensions that have emerged from the inductive analysis (cf. Table 2) are presented for both focus groups. We will refer to some quotations of the participants' interventions during the focus groups, with some elements of description and interpretation. All the quotations have been translated from French into English.

#### 4.1.1. Management of Technical Features

In the first focus group, at the beginning of the research project, the teachers (E1, E2, E3, E4) have expressed their need to be "quickly" familiarized to the iPad's use. They have declared the wish to have the new technological device in the "hand", in order to have the opportunity to try and to discover the basic features of the iPad. Although this need has been advanced by all the participant teachers, different constraints have emerged.

**E1:** And, as long as the tablets are not there, it is a little blind.

*Table 2. The four dimensions of appropriation*

	<b>Dimensions</b>
I	Management of technical features
II	Management of socio-relational aspects
III	Management of didactical and pedagogical aspects
IV	Management of subjective strategies

**E2:** Considering the fact that we have no right to take the iPad at home so it will be quite complicated. It means that if we want to try a stuff, we have to stay here. So inside the school.

E1 is expressing some constrain about the fact that iPads are not yet available to all teachers at the beginning of the project. E2 expresses the prohibition of taking the tablet out of the school, a problem mainly related to the impossibility to test it and to discover the basic features of the iPad. In the course of the second focus group, these technical aspects are deeply problematized (cf. teacher E3).

**E3:** So in my mind, if used regularly, the iPad that we provide should already be configured with useful applications for Math, English, Gym, to use it like using a book and, worse, we also have to choose which method to use with it. So quite simply, I prefer to show them by myself than losing a week downloading applications and also these apps cost 120 Swiss francs. In addition, I have no wifi in my gym room, so it cuts every video, I cannot work with, and it would have been interesting. So finally, there is not much, there is not much. And for the experiment I have conducted with the video, yeah, it's funny but not essential.

In this excerpt, E3 is condensing different technical problems emerged during the first focus group. In particular, the issues are related to the following elements: the use of the right application and the possibility that the iPad should be configured with useful applications; the necessity to find a different teaching approach; and the costs of the application. A main problem is related to the "affordances" between the iPad and some contextual aspects (e.g., "I have no wifi in my gym, so it cuts every video, I cannot work with"). The teacher reveals a form of disappointment concerning the balance between the technical constrains and the traditional teaching modalities ("yeah, it's funny but not essential"): the advantages of the iPad have been minimised by the material and technical affordances that become barriers to the use of the new device.

#### **4.1.2. Management of Socio-Relational Aspects**

The social and relational aspects of the processes of iPad's appropriation are related to the contacts with colleagues, the relationships with the technical and management staff. In the first focus group, teachers feel strongly supported by the technical staff, described as available for any requests and information.

**E1:** It is true that M.C. always said she was available, she also offered to lend us the equipment that she had for to get used to iPads since I do not know anything about it. So it's really new.

**E2:** So this is really new. And if not, I think the direction is also in the background, in the background so they will be there to support us if you need.

**E3:** Now, I think it would be interesting to have a lot of cohesion between all the colleagues who will use this material in the classroom, not to be in our own corners. So I think it's really imperative that we can communicate among us on what works, what does not work, etc.

E1 highlights the emergence of a positive relationship with the staff, aspect that is particularly central considering the novelty of the device in the school's educational practice. E2 stresses the novelty of the iPad in relation to the position of the managerial staff ("the direction is also in the background"). Considering their colleagues, teachers express the need to share information in order to make possible an easier and more effective familiarization to the new technological resource that is available. E3 suggests the need to create an efficient network ("it would be interesting to have a lot of cohesion between all the colleagues") and to share competences and resources. This socio-relational aspect is expressed as an urgent need to "manage" the novelty of the iPad's introduction ("it's really imperative that we can communicate with us").

In the second focus group, the teachers announce a better familiarization to the technical use of the iPad, although they declare to have excessively delegated the resolution of some technical and managerial problems to other members of the staff.

**E4:** There should be a person who make only this and will be always available, because M.C. had to spend school's hours outside... and, as V. said before a presentation of the major applications that everyone would like to use has to be presented, to us... and when something does not work, there is the need to call someone ...

**E5:** But otherwise, in relation to the management, I feel a bit in a boat. They not really master, the direction...

Delegating is an approach expressed by E4 who is demanding the full availability of the technological staff ("a person who make only this and will be always available"). The teacher invokes a continuous support ("and when something does not work, there is the need to call someone..."), but without any effort to find alternative solutions. Immediately after, through the metaphor "I feel a bit in a boat", E5 declares a feeling of frustration for not being "guided" in solving issues raised by users' experience of iPads' use.

#### ***4.1.3. Management of Didactical and Pedagogical Beliefs***

In the first focus group, teachers were evoking the expectation of changes connected to the process of iPads' appropriation, although without the necessary capacity to anticipate possible consequences and effects.

**E1:** I see the iPad like a huge kick in the anthill where we change the way we teach.

**E2:** I really find it hard to imagine what it will change. I think it will change a lot in the students' motivation, but then I really do not know.

**E3:** We do not know how these things will happen. So this is an experiment

E1 has used a metaphor in order to express the idea that iPads are an opportunity of change ("huge kick in the anthill"). This idea of changing also was stressed by E2, in connection to an unfocused perception ("I really find it hard to imagine" and "I do not really know"). The same idea is underlined by E3, who was showing a lack of didactical and pedagogical knowledge about the introduction of the new technology in teaching and learning processes ("we do not

know how these things will happen”). The teacher was feeling that the introduction of the iPad in the classroom may lead to make some changes and to trigger processes of innovation in the practices of teaching and in providing opportunities for a more innovative pedagogy for students and teachers.

- E4:** So personally I think this is an opportunity to try what I wanted to do before with just a computer. Well, my students, they pose some questions because they do not see the connection between a tablet and crafts. There is one who told me, but are we going to cut wood with the tablet? Certainly not. (*laughter*) but here goes. So, I said, but if used, it is first starting work and after should be stored, we cannot let the iPad alongside established.
- E5:** I expect from my students that this device can help them to open their eyes and their horizons. So it does not stay with the little thing they know... indeed, the application for the arts, it's huge. I will see if they enjoy it.
- E6:** And then, I have a secret dream, is that, it's really, it makes them much more independent. the students... if they need something, not to go to the teacher saying Ms. I need this... but they are familiarized to say oh well, I see. So I really think to develop some autonomy and freedom in students that know that these resources are available.

E4 was connecting the expectation of change to the new opportunity that iPad gives to teaching practices (“to try what I wanted to do before with just a computer”). However, the didactical and pedagogical expectations were general and not clear for the students (“they do not see the connection between a tablet and crafts”). At the same, E5 was expressing the broad possible application of the iPad in his subject (“the application for the arts, it's huge”) and making connections between expectations and more complex pedagogical goals (such as the fact that “this device can help them to open their eyes and their horizons”). This “faith” in technology to reach students' autonomy was then expressed by E6 (“I have a secret dream, is that, it's really, and it makes them much more independent”).

In the second focus group, there was a contrast between the teachers' experience of use during six months and their initial expectations. Indeed, teachers do not recognize the device as a resource for learning processes, considering it more as a ludic tool.

- E7:** I feel that for them it is more a toy than a tool (...). It is as if something is done in the information room or on paper, I can do the same exercise on paper or late information, they feel that it's really fun if it is done in the laboratory. While the background is the same.
- E8:** But this is the same approach, this is another tool but the approach remains the same, and this is where I see that it stops.

E7 was expressing the students' perception of the iPad as “more a toy than a tool”, without any didactical and pedagogical value. E8 also reiterated the non-recognition of the iPad as a teaching tool. Both teachers have expressed few critical considerations on how to use the new technology in their didactic process: but the lack of advantages in the use of the iPad in the classroom and the encountered difficulties have led the teachers to “accommodate” themselves to a negative position and, consequently, to reject the use of the iPad.

- E9:** Now it is true that, well, just to bounce off the frustration... the little frustration is the time we spent to prepare the video, a production with a text tool and everything and then there was nothing working, and the lesson is difficult. it was a bit painful, so suddenly it's true, it

happened several times unfortunately, and, and suddenly, I saw some things down, I have a little bit reduced, I prepared a written text, to better manage it.

**E10:** Then, the experience would be complete again if we could send homework to students and then circle what. While there, at some point, we arrange iPads in the shelf and then it stops. So we must necessarily return to the paper by the force of system, the type of exercise we were, I know, imposed by the state...

**E11:** I teach English and History, uh, in terms of English, uh, I quite work with the processing software, where I make them doing productions with internet research on a theme X or Y (...). For History, the applications are fairly expensive so I opted to buy them for me (...). So it is often necessary to re-focus the thing. But when something is produced, it is sometimes very, very nice. That's it.

**E12:** The big advantage is being able to illustrate the lessons, all can be added. Links, videos, that's a huge advantage. Now drawbacks, our share, our technical problems that have a little bloated, then... I see too. Is it nothing changing during a lesson with iPad? No, not at all. I agree with what you say, yeah. Unfortunately. Unfortunately, because there would be good things to do. I have not noticed changes. I sometimes feel more like you were saying a coach behind the students when they work with their tablet, from time to time. But otherwise, I do not feel that they have produced changes.

E9 was labelling the shared mood (“just to bounce off the frustration... the little frustration is...”) connected to the lack of efficiency of the instrument during the lesson (“then there was nothing working”), compared to traditional methods (“I prepared a written text, to better manage it”). The same attitude is expressed by E10, coming back to the use of traditional supports (“we must necessarily return to the paper”). E11 was expressing the relationship between the iPad and the subject taught: for some subject, like foreign languages, the use of iPad was more useful (“in terms of English, uh, I quite work with the processing software”) with respect to other subjects (“for History, the applications are fairly expensive”). Teachers were not perceiving the expected didactical and pedagogical changes due to the introduction of iPads (e.g., E12: “I do not feel that they have produced changes”). In the first focus group, teachers were feeling to be part of an “innovative trend” that can lead forms of transformation in didactic practices. In fact, when faced to iPads, teachers were examining both the possibilities and the constraints of the tool with respect to didactic practices: as they have highlighted, the digital devices obliged them to change their practical and pedagogical behaviour in order to accommodate it to the use of the tool. However, teachers expressed some resistances during the process, highlighting elements of frustration connected to situations in which the device does not work or does not add real values with respect to traditional methods. Technologies were then presented as threats (Pegrum, Oakley & Faulkner, 2013), by emphasizing the need for a more complex knowledge and skills in relation to technology, pedagogy and contents of teaching.

#### **4.1.4. Management of Subjective Strategies**

As we have already observed, in the first focus group teachers have expressed an initial attitude of enthusiasm and motivation about their involvement in the project. Almost all the participants have highlighted the importance of being part of such technological appropriation, through a shared involvement with colleagues.

**E1:** As I ‘m very curious, I said yes. Finally, there is plenty to discover with it. I think it’s great because I wanted to use computers, it is a chance.

- E2:** So it's true that it's good because we feel we embarked on a new thing, there is the motivation on the side of teachers, also students. There are questions, we offer an answer.
- E3:** I have no iPad at home. I was able to borrow one last week and then I've been familiar with the tool, going in internet, trying to find some sites and things like that and then all the time
- E4:** I have a mac at home as it is the iPad, so I am not worrying too much, I think it will go fast enough. And, yeah, I see myself self-taught in this matter.
- E5:** I just did yesterday afternoon some research online and then I saw that there were sites with educational applications, and then I put it in my favourites but that's all I made for now.

Teachers have shown an initial form of active participation and engagement and were looking for personal solutions in order to facilitate the appropriation of iPads' use (in E3 "trying to find some sites and things like that"). In this sense, they were evoking dimensions of self-efficacy (E4: "I see myself self-taught in this matter") and forms of self-initiatives (in E5: "I saw that there were sites...I put it in my favourites"). In the second focus group, a teachers' disappointment was emerging, despite some attempts to overcome the technical difficulties.

- E6:** So, now I take my precautions and I charge at home, just in case, and that, that, that, that's the time but it is a precaution because, for one or two times, it did not managed.
- E7:** I bought a lot of applications for the summer holidays rather collaborative or work space, etc. and then, well, it was time consuming to prepare, already. The limitations at the beginning made me more or less thinking to leave the project, it is possible. So these are my limitations.

Teachers were trying to find a new way in order to introduce the iPad in their activity, providing some solutions (E6: "I take my precautions and I charge at home"; E7: "I bought a lot of applications for the summer holidays"), confirming the limitations already expressed and the consequences (E7: "to leave the project"). Teachers mainly have expressed positive attitudes to the use of iPad in classroom, although moving from a general enthusiasm for their involvement in the project to some forms of disappointment and frustration for the failure in matching some of their expectations. In fact, the initial element of curiosity and novelty that the iPad has introduced was strongly reduced by the material components that sometimes represented forms of resistance to the innovative processes they were experiencing.

## **4.2. Supporting the Process of Teachers' Appropriation of the iPad**

In this section, the four dimensions examined above will be considered in terms of elements that can support and facilitate the process of iPads' appropriation.

### ***4.2.1. From the Managing of Technical Features to the Social Shape of the iPads' Use***

Technical problems strongly affect the teachers' use of the iPad. However, the use is not static. On the contrary, it is continuously shaped by the choices made by the teachers. The iPad is not an artefact with characteristics that are independent from the practice: learners construct these characteristics while they are working with it. This process of social shaping of the technology emerges through the participants' voices during the process of appropriation, in which the use and effects of the tool are changing.

#### ***4.2.2. Management of Socio-Relational Aspects: From Individual to Collective Appropriations***

Teachers appropriate the new technology by “adapting” it to goal-directed activities. This process was facilitated mainly through a sharing of information and knowledge with colleagues. Indeed, teachers negotiated meanings for the appropriation of the new technology, building together common resources for their community of practices. Teachers were building a shared understanding of the constraints and the resources, finding common strategies to use the tool and to achieve some educational goals. This process of collective sense-making has improved the appropriation’s process, encouraging creative solutions to common problems.

#### ***4.2.3. Management of Didactic and Pedagogic Aspects: From Tools to Instruments***

According to Pegrum and colleagues (2013), the findings of our analysis highlight how the iPads are not fundamentally designed to be used as learning and teaching tools. In order to transform a technological tool to an effective instrument of activity, the technology has to be integrated to the social practices enacted by participants. This leads to the process of customizing the use of technology, in a process of interaction between the technology and the didactic and educational needs of the community. Supporting the idea that “it is the teacher rather than the technology that influences the effectiveness of digital technology use in schools” (Starkey, 2011, p. 24), teachers can act as intermediary players in the use of iPads in education. In this way, technology can become transformative, improving the creativity and the sense of a community.

#### ***4.2.4. Fostering Subjective Strategies: From Resistance to Engagement***

Teacher have to make sense of the properties of the iPad by exploring its constrains and by accommodating it to the educational routines. In our case study, we have observed how teachers are sometimes resistant to use the iPad. The experiences of appropriation can be considered as learning processes useful for the professional development of teachers. We consider that the four dimensions we have identified can be useful elements in order to structure teachers’ trainings aimed to support the process of iPads’ appropriation (cf. Table 3). This training should be oriented to foster the sense of self-efficacy, helping teachers to be more resilient and able to adopt innovative teaching processes. The possibility to recognize the educational value of technological devices both for students and teachers could become a meaningful aspect of learning in formal and informal settings, in which teachers can play the role of mediators.

## **5. CONCLUSION AND FUTURE TRENDS**

This paper was focused on the comparison between two focus groups, in order to identify some dimensions of the processes of teachers’ appropriation of iPads. We have underlined the importance of teachers’ voices in order to highlight the specificities of their experiences during the research, and to recognize the complexity of the processes of appropriation. The changes we have observed during the focus groups indicate the implication of different element during the process of iPad’s appropriation: the limitation of technical constrains; the resistance in changing traditional practices; the absence of specific social supports; and the missing transformation of iPads from tools to instruments for different didactic activities. These results confirm some trends highlighted in other studies (Fisher, Higgins & Loveless, 2006; Boéchat-Heer & Arcidiacono,

*Table 3. Summary of the four dimensions and their evolution*

	<b>Dimensions</b>	<b>From</b>	<b>To</b>
I	Management of technical features	Technical features	Social shape of the iPad's use
II	Management of socio-relational aspects	Individual perspective	Collective appropriations
III	Management of didactical and pedagogical aspects	Tools	Instruments
IV	Management of subjective strategies	Resistance	Engagement

2014). Moreover, our study shows that iPads bring new possibilities to the learning environment, especially if scaffolding and training systems accompany the processes of appropriation. Teachers' professional development related to the introduction of new technologies can be improved only if teachers are continuously involved in processes of sense-making for their activities, for example through processes of negotiation and discussions. It is also important that teachers can benefit from a pedagogical and didactic training in the use of tablets and that such training focuses on the presentation of applications that have an educational added value on teaching and learning.

According to Jones and Issroff (2007), we can conclude that teachers use digital tablets as a support for their educational activities, without a real change of their usual teaching practices. The tablet appears as a tool available to students as a calculator or a dictionary. The configuration of the classroom does not change, the students are not involved in networking activities, each pupil is behind his/her desk, more or less as it is the case during a traditional lesson. This configuration is preferred by teachers that are afraid to loose the control of the classroom, preoccupied by the possibility to experience some difficulties, to loose their authority or even their legitimacy as teachers. For this reason, we are convinced of the importance of integrating technology innovation into the project of the establishment, as component of the school's culture. Moreover, if the institutions promote innovation through sharing, teamwork and accepting the risks that are related, teachers will be more likely to engage. Teachers need to be coached and accompanied in the process of integrating technologies in their teaching practices, by establishing projects promoted with the management and/or the specialists in the field. In fact, the support and the informal learning in detecting and solving technical problems are factors facilitating the appropriation of new technologies in the educational system. In particular, the integration of tablets requires more flexibility from the teachers, elements of creativity, strong motivation, but also time and patience. These components must be taken into account in teacher trainings.

Finally, we consider that the understanding of the processes of appropriation could be completed from the observation of the direct teachers' use of the iPad in classroom. It will be interesting to continue this investigation by focusing more on the presumed educational value of iPads, in order to understand which is the impact for students' learning. According to different results highlighting the importance of coaching within the establishments, of providing good levels of self-efficacy and positive beliefs about the practices of teachers in the field of technology, it would be appropriate to focus on institutions in which all classrooms should be part of innovative projects and, by consequence, equipped with the necessary devices. Through the assessment of the influence of different factors (e.g., the support and the management, the institutional training, the technical assistance, the parents' support) it will be possible to improve teachers' acceptance of innovations and changes in education.

## REFERENCES

- Arcidiacono, F., & Boéchat-Heer, S. (2013). *Teachers' perception on the integration of digital tablets: A study in a Swiss secondary school*. Paper presented at Eapril Conference, November, Biel/Bienne (Switzerland).
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.
- Bingimlas, K. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics. Science & Technology Education*, 5(3), 235–245.
- Boéchat-Heer, S., & Arcidiacono, F. (2014). L'usage des méthodes mixtes pour analyser les perceptions de pratiques pédagogiques liées à l'intégration des tablettes numériques. *Formation et pratique d'enseignement en questions*, 17, 49-65.
- Carugati, F., & Tomasetto, C. (2002). Le corps enseignant face aux technologies de l'information et de la communication dans les pratiques d'enseignement. *Revue des Sciences de l'Education*, 28(2), 305–324. doi:10.7202/007356ar
- Churchill, D., Fox, B., & King, M. (2012). Study of affordances of iPads and teachers' private theories. *International Journal of Information and Education Technology*, 2(3), 251–254. doi:10.7763/IJIEET.2012.V2.122
- Cochrane, T., Narayan, V., & Oldfield, J. (2013). iPadagogy: Appropriating the iPad within pedagogical contexts. *International Journal of Mobile Learning and Organisation*, 7(1), 48–65. doi:10.1504/IJMLO.2013.051573
- Cook, C., Pachler, N., & Bachmair, B. (2011). Ubiquitous mobility with mobile phones: A cultural ecology for mobile learning. *E-Learning and Digital Media September*, 8(3), 181-195.
- Deaudelin, C., Dussault, M., & Brodeur, M. (2002). Impact d'une stratégie d'intégration des TIC sur le sentiment d'autoefficacité d'enseignants du primaire et leur processus d'adoption d'une innovation. *Revue des Sciences de l'Education*, 28(2), 391–410. doi:10.7202/007360ar
- Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development*, 47(4), 47–61. doi:10.1007/BF02299597
- Falloon, G. (2013). Young students using iPads: App design and content influences on their learning pathways. *Computers & Education*, 68, 505–521. doi:10.1016/j.compedu.2013.06.006
- Fisher, T., Higgins, C., & Loveless, A. (2006). *Teachers Learning with Digital Technologies: A Review of Research and Projects*. Bristol: Futurelab.
- Hew, K. F., & Brush, T. (2007). Integrating technology into K–12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research and Development*, 55(3), 223–252. doi:10.1007/s11423-006-9022-5
- Jacobson, M. J., & Archodidou, A. (2000). The design of hypermedia tools for learning: Fostering conceptual change and transfer of complex scientific knowledge. *Journal of the Learning Sciences*, 9(2), 145–199. doi:10.1207/s15327809jls0902\_2
- Jones, A., & Issroff, K. (2007). Learning technologies: Affective and social issues. In G. Conole & M. Oliver (Eds.), *Contemporary perspectives in e-learning research: Themes, methods and impact on practice* (pp. 190–202). London: Routledge.
- Kagan, D. M. (1992). Implications of research on teacher belief. *Educational Psychologist*, 27(1), 65–90. doi:10.1207/s15326985ep2701\_6
- Khalid, M. S., Jurisic, O., Kristensen, H. S., & Ørngreen, R. (2014). Exploring the Use of iPads in Danish Schools. In R. Ørngreen & K. T. Levinsen (Eds.), *Proceedings of the 13th European Conference on e-Learning ECEL-2014* (pp. 264–272). Copenhagen: Academic Conferences and Publishing International Limited.

- Kucirkova, N., Messer, D., Sheehy, K., & Panadero, C. (2014). Children's engagement with educational iPad apps: Insights from a Spanish classroom. *Computers & Education*, 71, 175–184. doi:10.1016/j.compedu.2013.10.003
- Kukulska-Hulme, A. (2005). Mobile usability and user experience. In A. Kukulska-Hulme & J. Traxler (Eds.), *Mobile Learning: A handbook for educators and trainers* (pp. 45–56). London: Routledge.
- Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research*, 77(4), 575–614. doi:10.3102/0034654307309921
- Llorens, S., Salanova, M., & Grau, R. (2002-2003). Training to technological change. *Journal of Research on Technology in Education*, 35(2), 206–212. doi:10.1080/15391523.2002.10782380
- Manches, A. (2011). Digital manipulatives: Tools to transform early learning experiences. *International Journal of Technology Enhanced Learning*, 3(6), 608–626. doi:10.1504/IJTEL.2011.045451
- Murphy, G. D. (2011). Post-PC devices: A summary of early iPad technology adoption in tertiary environment. *E-Journal of Business Education & Scholarship of Teaching*, 5(1), 18–32.
- Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62(3), 307–332. doi:10.3102/00346543062003307
- Pegrum, M., Oakley, G., & Faulkner, R. (2013). Schools going mobile: A study of the adoption of mobile handheld technologies in Western Australian independent schools. *Australasian Journal of Educational Technology*, 29(1), 66–81.
- Rabardel, P. (1995). *Les hommes et les technologies: une approche cognitive des instruments contemporains*. Paris: Armand Colin.
- Rogers, C. R. (1967). *Client-Centered Therapy*. Baltimore, MD: Williams & Wilkins.
- Sendan, F., & Roberts, J. (1998). Orhan: A case study in the development of a student teacher's personal theories. *Teachers and Teaching: Theory and Practice*, 4(2), 229–244. doi:10.1080/1354060980040203
- Starkey, L. (2011). Evaluating learning in the 21st century: A digital age learning matrix technology. *Pedagogy and Education*, 20(1), 19–39. doi:10.1080/1475939X.2011.554021

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