TABLETS IN THE CLASSROOM: IMPROVISATIONAL RHYTHMS AND CHANGE THROUGH BRICOLAGE

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ABSTRACT

This paper focuses on the multiple agents of educational change associated with the implementation of ICTs in elementary schooling. The focus of the paper is on emergent patterns of change, i.e. the way technologies are adapted over time in different configurations that involve both pupils, teachers, activities and the different resources used in the classroom. The paper focuses on the concept of socio-material bricolage (Johri 2011) as an approach to understanding how digital devices contribute to constructing both relevant and innovative practices in teaching and learning in schools. The concept of bricolage is based on the idea that teachers and learners develop their practices through the ad hoc use of available artifacts – i.e. through improvisations where digital devices participate in shifting relationships with available resources and relevant actors. The paper is a theoretical exploration of the use of iPads amongst teachers and learners and builds on data from a school development project in Denmark where five classes of seventh graders were given iPads on a one pupil one device basis for the school year of 2012-13.

KEYWORDS

Mobile learning, emergent patterns of change, bricolage

1. INTRODUCTION

The integration of ICT in teaching and learning is usually intimately associated with the innovation and transformation of educational practices (McCormick & Scrimshaw 2001, Pelgrum & Law 2003). One of the questions arising from this association is how to identify the agents and practices of change – if we assume that ICTs are not isolated agents in shaping change and guaranteeing reform.

Change is a broad concept that can be conceptualized both from the perspectives of policy, of teachers' professional practice and through research in educational contexts (Ottesen 2006). Central to policy perspectives and to some aspects of research is the discourse of implementation which focuses on linear and efficiency changes to practice in which technology is a significant actor (Iliomäki 2008). Kearns (2002) for instance argues, on the basis of an international study of policies for the implementation of ICT in schools that many countries have moved through at least two phases in their attempts to integrate ICT, where the first phase involves the investment in hardware and the second phase a more strategic integration focusing increasingly on teachers and educational strategies. Similarly, Bauer and Kenton (2005) propose, on the basis of Hooper and Rieber (1999) that teachers' journey towards the use of ICT can be identified as a five phase process involving familiarization, utilization, integration, reorientation, and evolution. According to Hooper and Rieber teachers often do not proceed through the utilization stage, and into the 'breakthrough' of ICT integration, due to for instance lack in engagement in the technology. Though the context of teachers' use of ICT may have changed since the early 2000s, evolutionary and linear approaches to educational change thus still abound, though research has to some extent shifted its focus from 'implementation' to the significance of the social distribution and enactment of change (Windschitl and Sahl 2002, Burden et al 2012).

Though it may be useful for research as well as for policy to conceptualise educational change through the idea of phases, implementation and evolutionary progress, these approaches to change often fail to explain exactly "how individuals make leaps of progress" (Windschitl and Sahl 2002) and how practices can be organized to support educational transformation. In addition to this, it is not always clear what exactly characterizes the full integration of ICT and how this should affect the strategies envisioned and implemented by schools and teachers.

Finally, the focus on change as an end product rather than a process and an emergent practice may overlook the daily shifts and reconceptualisations in educational practice that involve ICT as an actor in change. In effect, an evolutionary approach to change may therefore marginalize or fail to acknowledge the ways in which teachers and learners constitute change as an improvisational rather than a designed, linear and rational action. As a consequence, a perspective is needed that will capture the emergent development of practices as well as the ways in which practices are situated in specific school cultures and educational strategies. Such perspectives may be provided by ethnographical studies and studies in the materiality of learning that stress the improvisational rhythms of change in emergent practices of teaching and learning.

2. TECHNOLOGIES AND THE SOCIO-MATERIALITY OF LEARNING

Recently, a number of publications have underlined the significance of understanding educational practice and change from the perspective of 'material practices' and the ways in which educational spaces are constituted through social agency (Fenwick and Edwards 2010, 2012, Johri 2011, Sørensen 2009, McGregor 2004, Lawn & Grosvenor 2001). A number of these publications take their inspiration from practice theory, including activity theory (Engeström 1999) and Actor-Network Theory (ANT). The significance of these studies to the study of educational change lies in the focus on change as emergent practices in which social and material aspects of teaching and learning are intertwined. Inspired by Johri (2011) I use the term socio-material bricolage as an analytical framework to describe the entanglement of material and social aspects of teaching and learning with technologies which will underline the emergent and improvisational nature of change when seen from a practice perspective.

In his discussion of the role of socio-material theory for learning Johri draws on a number of sources, but significantly Latour (2005) and Levi-Strauss (1967) to define how the concept of socio-material bricolage can be used as an analytical framework for understanding emergent practices with learning technologies. Johri argues that the study of learning technologies can be qualified by looking at practice through the lens of socio-materiality, which may contribute to moving the perspective of research away from technological and empirical determinism and into the ways in which social and material agency creates constitutive entanglements in learning practices. Johri uses the term socio-material bricolage to show how artefacts derive their meaning and are constituted through social agency, i.e. how tools become 'tools in socio-material context' or socio-material assemblages. Building on Levi-Strauss, Johri argues that educational actors often use the tools that are available to them, i.e. they make do with what is at hand, rather than sticking to planned approaches that would require them to use tools that are not immediately available in their local space of practice. In this sense assemblages – or bricolage – of tools in practice become emergent designs of technology in use, adapted over time. Johri proposes that the idea of socio-material bricolage can help us to make distinctions between practice-as-designed and practice-as-practiced, where the latter highlights the improvisational and emergent aspects of practice. The concept of bricolage may therefore support understandings of "the emergent and socially and materially intertwined nature of human practices" (2011, 212). I shall argue that both teachers and learners in the local context where I did my fieldwork were continuously engaged in improvisational practices through bricolage, i.e. with combining different kinds of activities, technologies, and other classroom resources and that both teachers and learners enacted and understood change by engaging in these improvisations. In these improvisational rhythms the iPad became a central actor because of its flexibility and availability, i.e. the fact that it is *at hand* and immediately accessible to the user. In the following I shall describe and discuss these improvisational rhythms of change in which iPads are entangled in practice, and the ways in which these practices can be used to understand change as a shifting and emergent process rather than a linear and designed process of implementation.

3. THE IPAD STUDY

Middletown is a lower secondary school in the west of Denmark in a municipality that has a high profile in school development and integration of ICT into education. The school has recently been through a process of merge where pupils from an associated school for children with special needs were integrated into the school. The school has not had a prominent ICT profile before the project started, mostly due to budget restrictions.

The school teaches pupils at three levels, i.e. 7th, 8th and 9th year of schooling. Pupils come to the school from other schools in the area, and it is therefore important for the school to accommodate pupils from different neighborhoods and backgrounds.

The project followed 5 classes of 7 graders (aged 13-14) who were given iPads on a one pupil one device basis to keep for the entire school year of 2012-13. Two of these classes were special needs classes and the research project focused on how the use of iPads in teaching and learning could support inclusive learning environments. My research focused mainly on pupils' learning, but also included understanding the ways in which teachers reorganize and redefine their teaching as an aspect of having technology accessible on a daily basis in classrooms and at home. I followed pupils in all five classes for three months at the beginning of the school year observing them in their daily lives in school and interviewing groups of pupils. In addition to this I followed teachers in classes, at meetings and during breaks, lunch hours and introductory courses. I had numerous informal conversations with teachers and did formal interviews with the group of teachers who taught the seven graders as well as individual teachers responsible for the classes.

Educational change was embedded in this project as a result of linking school development with new forms of device ownership and usage connected with the iPad. According to Burden et al. (2012) and Melhuish and Falloon (2010) affordances of the IPad include ubiquitous and easy access, portability, and personalized and individualized experiences. These affordances should not be understood as properties of the technology itself, but as possibilities for practice and agency in educational contexts, for instance through situated, just in time usages of the technology. I am proposing that the flexibility and accessibility of a mobile device such as the iPad enhances its potential for participating in improvisational teaching and learning rhythms, as it is both *at hand* and will easily adapt to different kinds of teacher and learner needs. This is also what qualifies its use in the construction of emergent inclusive learning environments.

4. HOW TEACHERS CONFIGURATE CHANGE THROUGH IMPROVISATIONAL RHYTHMS

In Middletown School teachers were given a head start in trying out iPads for teaching and learning in the 7th form classes. As courses were planned for teachers in June and it was felt that they needed the summer holiday for familiarizing themselves with the technology, they received the iPads two months before the pupils. However, the courses given to teachers were primarily traditional 'instructivist' courses that did not directly link tablet 'affordances' to teachers' practices. After the courses teachers were expected to develop their teaching with the iPads on their own or through collegial collaboration in the time usually given for the preparation of lessons.

As argued by Johri (2011) and Lawn and Grosvenor (2001) teachers tend to improvise when using resources in the classroom for teaching. Lawn and Grosvenor (2001) focus on the ways in which schools have become new spaces for consumption since the 70s and how this affects the presence and use of technologies and other kinds of artifacts in the classroom. Material cultures are thus abundant in the classroom where different kinds of tools have historically replaced each other – or where they coexist and interact as part of teachers' use and production of relevant resources for teaching and learning. In their account of teachers' use of these artifacts Lawn and Grosvenor argue, similarly to Johri (2011), that teachers generally use the tools that are accessible to them, they 'make do and mend' and thereby craft their own assemblages of learning resources as a prerequisite for being able to operate in the classroom. This is not to say that teachers do not plan or reflect on their teaching, but to underline that teachers often craft their approaches to teaching and their use of resources from what is at hand and available to them on a daily basis in classrooms. Crafting and constructing relevant learning approaches as well as assemblages of materials that are subject and learner relevant are, I shall suggest, deep and useful skills that are extremely relevant in many teachers' daily lives, and ways in which teachers can both locate themselves in a material culture of learning and in the history of material cultures in the classroom. These improvisational strategies may intensify when teachers are confronted with a new technology and do not feel comfortable with the functionalities of the technology at hand or its pedagogical uses.

In addition to identifying teachers' craft approaches to the learning resources at hand, Lawn and Grosvenor describe how skills such as writing are enacted as systems of related technologies (2001, 125), i.e as assemblages of learning materials (for instance pen and paper or a pc and relevant software) that will support teachers and learners in operating a particular skill. Skills are in this sense both materially and historically enacted – and can be conceptualized through the concept of socio-material bricolage - I will argue. Thus, the learning of skills cannot be understood outside the constitutive entanglements of activities, actors and materialities that operate through both practice-as-designed and practice-as-practiced.

In my fieldwork I observed how teachers acted in classrooms where the iPad was one of the resources present – as well as a resource that was given a relative priority over other kinds of resources in the classroom. I also listened to teachers' reflections on the ways in which this technology had changed their daily lives with the learners, as well as during breaks and meetings and at home. One of the things that the teachers continually stressed was that the courses given in June had not really prepared them for the ways in which the tablets could enter into their teaching practices and their professional and personal lives. This was partly due to the fact that the courses had not actually focused on the needs, challenges and rhythms of their actual teaching, but had rather introduced them to the functionalities of the technology, including apps etc. In contrast to this, teachers had generally acquired their knowledge of how the iPads could be relevant for learning by having them *at hand*, i.e. by exploring their functionalities and uses in practice and by observing and reflecting on pupils' uses of them in different learning contexts. These approaches to the iPad may in some ways be described as experiential and explorative, i.e. as being embedded in teachers' rhythms of explorative uses, and their reflections and reconceptualisations of use (Burden et al. 2012). The idea that the change potential associated with the iPad becomes constituted mainly as a result of its *being at hand*, in the classroom, is significant in that it underlines the importance of the continuous presence of the technology in the spaces where teachers perform their professional roles and where pupils learn. In being at hand, the iPad thus became one of the resources that teachers could include in their craft approaches to teaching.

5. HOW LEARNERS CONFIGURATE CHANGE THROUGH IMPROVISATIONAL RHYTHMS

Compared to teachers learners are often less likely to improvise, given that teachers to some extent orchestrate and supervise their work in the classroom (and in other places, for instance in group work and with homework after school). However, to the extent that pupils are allowed to work in their own pace and with their own projects, questions and agendas, space may be allowed for increased improvisation and experimentation. In addition to this, the availability of resources in the classroom may, I shall suggest, inspire pupils to collect, combine and explore the resources that are relevant for their particular learning needs. This entails, however, that teachers are open to the diversity of approaches to content and learning that is embedded in this practice of bricolage.

Though learners may not have equal opportunities for improvising in the classroom when compared to teachers, children may be as inclined to experiment and improvise as teachers – though possibly for different reasons. When using technology in their spare time, children, especially boys, are for instance often seen to experiment in order to understand the relevance of the technology for their activities and aims, and in order to play and interact (Hou et al. 2006). This is equivalent to the crafting and bricolage involved in teachers' professional work as described by Johri (2011) and Lawn and Grosvenor (2001) above, though children may improvise to learn, not to teach. As with teachers, pupils seem to make do with what is at hand, and to adapt different resources to their immediate needs and activities. This is the way that pupils both orchestrate change and maintain stability in their ways of learning.

In my fieldwork I observed that pupils regularly engaged in bricolage when working on their own or together in the classroom. In these bricolages the iPad was often a significant and central element that supported them in exploring the multifunctionality and flexibility of the technology. In the improvisations enacted by pupils the iPad was one of the resources that was continuously *at hand*, and that pupils could adapt to their different strategies of assembling resources and connecting them through learning activities. Enacting bricolage was in fact one of the ways in which the iPad was implemented into pupils' emergent and shifting processes of learning activity.

Examples from my data show that in a number of cases the activity of bricolage was used to enhance, stabilize and make learning processes more efficient and relevant for the individual pupil or the group when engaging in learning activities. In some cases the improvisations also turned into rhythms of change that extended the established routines of stabilizing, enhancing and making learning more efficient. Examples of these improvisational rhythms will be given below.

5.1 Stabilisation, Efficiency, Enhancement

One of the routines in pupils' work in the classrooms in Middletown school is using materials for copying, translating, selecting and checking information. Books, for instance, often had a significant role in 'containing' information, illustrations, tasks etc. that teachers would refer to when asking pupils to work on assignments and tasks. For pupils, books would therefore act as a point of reference for the task set by the teacher, which is why books would often be included in pupils' bricolage activities. However, in pupils' practices, internet sites such as Google and Wikipedia would often be alternate, significant points of reference for knowledge and information that could enhance and expand the knowledge found in books. Therefore books and iPads were often combined in pupils' bricolage strategies in order to access different kinds of knowledge and to compare them.

Working with information and knowledge through repetition, translation and visualization was one of the chain of processes that was often initiated by teachers in Middletown School. These processes would be enacted through activity based assemblages of materialities (books, iPads, jotters), and materialities would often be the end result of the tasks (for instance posters). Teachers would for instance ask pupils to make a poster about the solar system or a specific country, they would asks pupils to make a film about themselves or take pictures or films to make a story.

Leander and Lovvorn (2006) describe how literacies are often enacted through circulations between texts when for instance pupils move (i.e. transfer and translate) texts from one, more authoritative, textual space – for instance the whiteboard or book – onto their own printed pages. These constitutive enactments of literacies contribute to producing learning rhythms and processes through pupils' transference of knowledge or information from one material resource to the other. In my study I observed similar rhythms of transference and translation in the circulation of materialities in the classroom, where transference and translation were often enacted through the piling or linking of resources in assemblages (bricolage) that included iPads, and that were unique expressions of pupils' emergent organisations of learning practices. These were the both ritualized and improvisational rhythms involved in enacting social-material bricolage as an aspect of learning. I shall give examples of pupils' work below.

Figure 1. Bricolaging in Geography

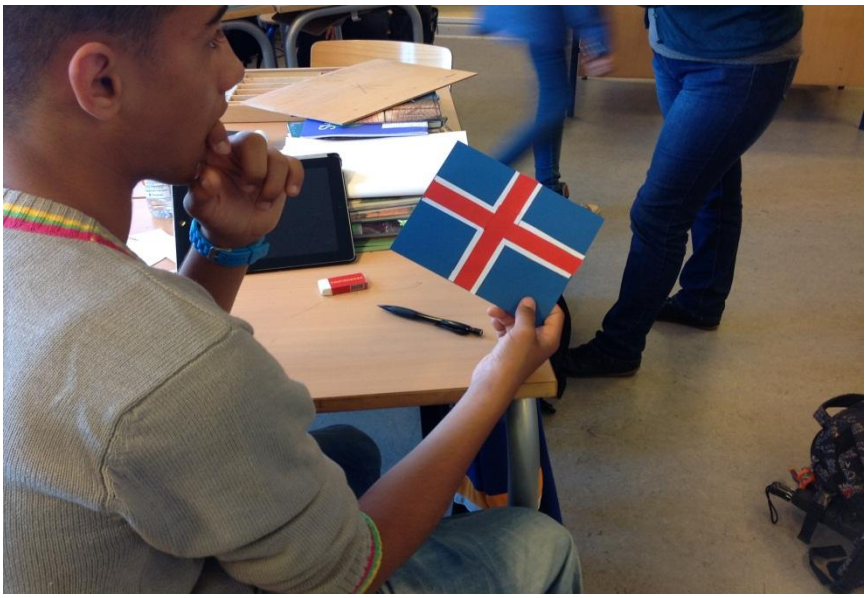

Figure 2. Translating from One Materiality Into Another

This boy (Figure 1, on the right) is working on a poster about Iceland for geography. He is using Google to visualize the exact proportions and colours of the flag. He is engaged in a process of copying and translating the image of the flag onto a poster in order to present aspects of the subject Iceland to his classmates and teacher. For this pupil, the process of copying and translating is mediated through different materialities (cardboard, pen, ruler, iPad) in order to produce a third materiality, the poster (and flag). Part of this process is the enactment of a bricolage, where the different materialities are brought together in order to support the process of copying and translating from one materiality to the next. The role of the iPad in this bricolage is among other things to support and enhance the naturalistic visualization and reproduction of the flag. In this way the iPad contributes to stabilizing the pupil's process of learning by copying and reproducing information through bricolage.

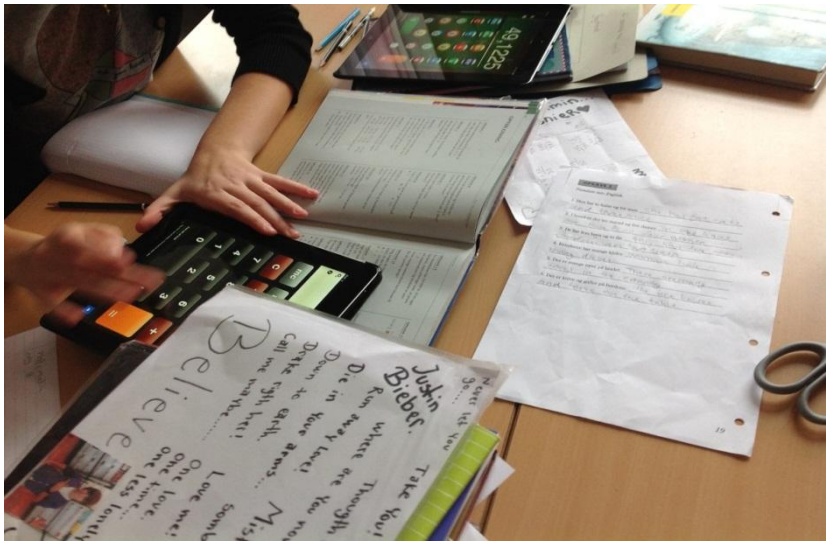

Figure 3. Bricolaging in Maths

This girl is doing a math assignment and is using the math book, her iPad, and a jotter to perform the task. She uses the book to check the tasks, the iPad as a calculator and her jotter to write down the results. Her work on the math task is therefore constituted through a chain of materialities which she combines in a bricolage in order to solve the tasks.

Learning processes involved in this bricolage is identifying the problem, calculating, and copying onto paper. In this enactment of bricolage the iPad enhances the process of calculating by being at hand and possibly providing a larger screen than the calculator usually used in math lessons.

The two examples show how pupils use materialities to support processes of understanding, copying, enhancing, and visualizing through the enactment of bricolage. These processes serve to stabilize rhythms of learning that are well-known and ritualized in pupils' daily work in the classroom. The enactments of bricolage are examples of students' improvisations as they use *what is at hand* to support and enhance the learning process. These improvisations are continuous shifts in the ways in which pupils work, shifts that both stabilize and transform the ways in which they are learning. In this sense the enactments of bricolage become emergent transformative practices initiated by pupils themselves.

5.2 Wider Circles: Extending Improvisations

Though the enactment of bricolage and pupils' improvisations are often used to stabilize rhythms of learning, pupils sometimes extend their improvisations to a wider array of materialities. These improvisations become more explorative and possibly transformative enactments of bricolage, where physical movement between materialities at hand becomes an added element, and where a wide range of materialities are incorporated.

An example of a wider circle of improvisation is given below.

Figure 4. Working With the Solar System

The girls shown in Figure 4 are working on a poster on the relationship between the planets in the solar system. This is an assignment given by the teacher, and essentially an assignment that engages the pupils in finding, copying, selecting and visualizing information – as in the examples given above. However, these girls choose to involve a wider array of materialities in their enactment of bricolage, than in the examples above. As their goal is to produce an accurate representation of the relationship between the planets, they start out by taking pictures with their iPads of a poster used by the teacher in the class.

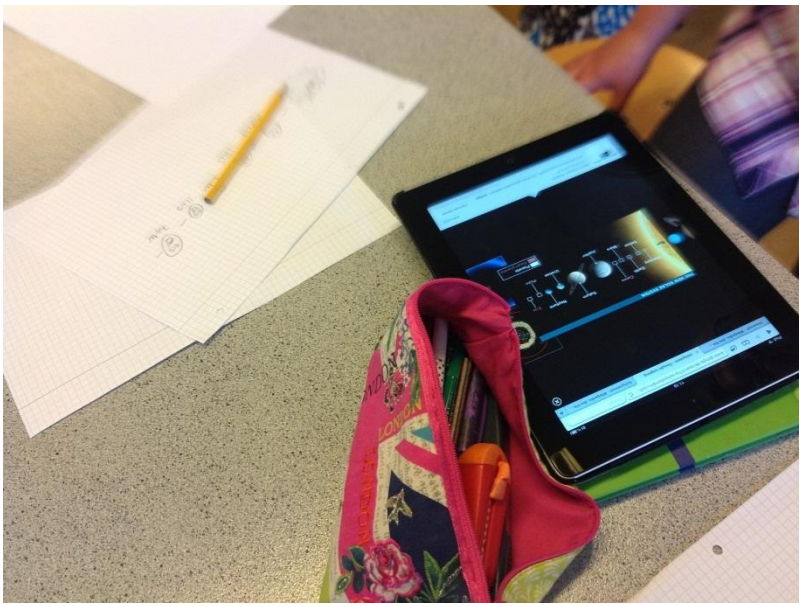

Figure 5. Using Google and Pen and Paper

In addition to photographing the poster the girls use Google to understand the constellations of the solar system through a different representation (a picture on Google), which they then sketch onto a piece of paper with a pencil (see figure 5). This corresponds to the enactment of literacies through circulations of materials described by Leander and Lovvorn (2006, see above), with the notable difference that the iPad provides a visual dimension to the processes of transferring and translating information from one material resource to the other. The visual dimension of knowledge acts as an added modality in the bricolage which helps the pupils to understand spatial organisations and dimensions of the planetary system. In addition to this, the iPad provides the pupils with knowledge that is not included in the authoritative material provided by the teacher (the book and poster). The representation of the planetary system found in Google for instance contains an extra planet, not shown on the teacher's poster, which sets the pupils off on an added journey of discovery of information about the planets.

Figure 6. Measuring for the Poster through the Picture of Another Poster

Following the processes in Figure 4 and 5 (googling, sketching and photographing) the girls expand their understanding of the solar system by using a compass to measure distances between and proportions of planets and to sketch them out onto their poster (see figure 5). After sketching they add colour to their poster and take a picture of it to show at home to their parents. Taking the photo with their iPad is part of the assignment, and another end project of the assignment is the poster which is supposed to be part of an exhibition at the school later that week.

The process of producing the poster of the solar system is an example of an extended process of improvisation where a number of materialities are bricolaged through the pupils' enactment of linkages between materials - for instance posters, paper, picture on Google, compass, pencils etc. The process of learning is therefore embedded in and enacted through materialities *at hand*, materialities that are combined to constitute the learning processes of these pupils. What is at hand in this example is defined both by the instructional trajectories of the teacher and the conceptual and physical combination of materials linked by these pupils, who use the iPad as a mediator for the use of different materials, modalities and activities in the learning process. Though measuring, copying and translating are still central processes in the learning of these girls, their improvisations are therefore more extended than in the examples described above, an extension that requires the physical movement of pupils between resources in the class, and their conceptual linking of an extended number of artifacts and modalities to constitute processes and end products. In these extended improvisations the iPad acts as a significant contribution to the emergent changes in practices – for instance by evoking flexibility, portability and multifunctionality.

6. CONCLUSIONS

In this paper I have argued that socio-material bricolage is a concept that can capture and encapsulate the emergent, practice-based rhythms of educational change that are associated with the presence of an always connected and accessible device like the iPad. Socio-material bricolage, I propose, enables us to understand how educational technologies are involved in and contribute to constituting practice over time as a response to teachers' and learners' shifting educational needs. The concept of socio-material bricolage is an approach to change that is in many ways at odds with a linear and evolutionary approach to educational transformation, such as that associated with the implementation of ICT in schools. I call the processes associated with socio-material bricolage improvisations in order to underline the shifting and unpredictable rhythms of change, and to stress the ways in which teachers and learners use what is available to them in specific places and times for their own purposes. IPads are central actors in these improvisations, I suggest, because iPads are at hand and can adapt to a diversity of learning needs, including different modalities of learning. Improvisational rhythms that include mobile devices such as the iPad may therefore support pupils and teachers in constituting learning processes and environments that are inclusive to their individual needs at specific times in their lives at school.

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