

IPADS IN LEARNING: THE WEB OF CHANGE

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ABSTRACT

Research in learning technologies has often focused on the affordances of single technologies such as pcs, smartphones or interactive whiteboards. However, in most learning environments technologies do not stand alone but are embedded in activity structures and webs of materials that make up the learning activity. This is specifically relevant when the object of study is mobile learning, where devices are flexible and follow the learner in his/her shifting learning activities and needs. This paper focuses on the ways in which iPads as learning technologies become involved in sociomaterial practices that are emergent and improvisational and how this contributes to educational change. The paper proposes that the introduction of tablets into classrooms will enroll devices in networks of learning that establish new and significant relationships between learning technologies such as iPads, whiteboards, pcs as well as books, pens and paper. These relationships challenge the idea that iPads can act as isolated and unique actors in educational development. The paper focuses on the ways in which teachers negotiate material cultures in schooling when iPads are involved in learning, i.e. how they become central actors in linking, translating and creating trajectories between the artefacts of learning. I study these processes from three perspectives that I identify as respectively capturing, bricolaging and building knowledge.

KEYWORDS

Mobile learning, material learning, Actor-Network Theory, teachers' professional competences

1. INTRODUCTION

John is a biology teacher in a school in the west of Denmark where teachers and pupils have recently been given iPads to use in the school year 2012-13. John likes to use both the interactive whiteboard and the blackboard to illustrate and explain processes such as the photosynthesis to pupils. He uses PowerPoints, illustrations from the internet, his own word files and chalk to work on the two boards at one end of the classroom. John also requires pupils to take notes on their iPads while he is talking, and sometimes to look in their books and check factual information while he is explaining the processes of photosynthesis.

John is one of several teachers in the teacher community at Middletown school in Denmark who organize their teaching by associating learning activities with different kinds of artefacts such as blackboards, whiteboards, pens, books, paper and iPads. The iPads, a promising new technology recently invested in by the school, are activated within this set of complex material and organizational practices that make up the learning of biology. In this web of learning materials, every artifact contributes to shaping the learning experience by adding to and acting in the chain of associations that John competently creates while he is teaching.

John's teaching is an example of practice that illustrates how learning technologies gain their significance by participating in a web of relationships which are materially and socially enacted as a part of schooling. As an example, John's teaching contradicts the idea that technologies such as the iPad are isolated agents of change in the culture and practice of schooling. In fact, such an idea will, as formulated by John Law, "conceal for a time the process of translation itself and so turn the network from a heterogeneous set of bits and pieces each with its own inclinations, into something that passes as a punctualised actor" (Law 1992, p 386, in Fenwick and Edwards 2012).

This paper aims to identify and follow the 'heterogeneous bits and pieces' orchestrated in teaching and how they make sense through links and translations. The paper builds on data from a research project that investigated the role of iPads in the learning of five classes of seventh graders (age 13-14) of which two were special needs classes. I followed these classes of seventh graders for 3 months of the school year, doing

observations and interviews with teachers and pupils. The paper builds on the argument that schooling is a material culture in which artefacts are embedded in different kinds of activities that make up the learning and that iPads make specific contributions to these material cultures of learning.

2. SCHOOLING AS A MATERIAL CULTURE

Materialities and their significance in cultures of education are rich and relevant points of departure for studies in educational technologies as resources and their social meanings, qualities and agencies are central to the ways in which teaching and learning can be envisioned and performed (Waltz 2006, Nespor 2002). In fact, without the aid of materials for e.g. writing, drawing, listening, calculating and laboratory work teaching can neither, it seems, be envisioned nor enacted (McGregor 2003, Meyer 2013). Highly profiled technologies such as the iPad is just a recent addition to this complex web of artefacts in schooling which shapes the ways in which learners can learn and teachers can teach.

Though studies in the materiality of schooling can provide rich empirical knowledge about the ways in which artefacts are embedded in learning and learning environments, material objects and their agencies have, according to a number of recent studies largely been disregarded. Most prominent among these studies is research inspired by Actor-Network Theory (ANT) (Latour 2005, Sørensen 2009, Johri 2011, Fenwick, Edwards and Sawchuk 2011, Fenwick and Edwards 2012). These studies in various ways argue for the legacy of ANT in foregrounding the role of material cultures in learning.

According to Bruno Latour one of the significant contributions of ANT has been “to have transformed the social from what was a surface, a territory, a province of reality, into a circulation” (1999, 17). In education studies this can be translated into an understanding of how artefacts are enrolled in webs of sociomaterial negotiations that constitute processes of learning such as for instance writing, reading or doing biology (cf. the example above). In this understanding, according to for instance McGregor (2004) artefacts should not be understood as passive presences or mechanistic manipulators, but as actively participating in constituting spaces, trajectories and relationships in education. The legacy of ANT in education is therefore to provide both thick and multi-directional descriptions of networked chains of activities in schooling as well as a renewed understanding of the ways in which artefacts participate in these networks.

As a separate but related approach to the study of material cultures in education, historians of education have studied the ways in which objects have figured in and configured educational practices from the beginning of schooling until the present day (Lawn & Grosvenor 2001, 2005, Burke et al 2010). Lawn and Grosvenor (2001, 2005) for instance argue, through historical approaches to the materialities of schooling, that relationships between teachers and material technologies have existed since the formation of schools as specialist institutions in the early 19th century. Schools, they argue, usually come equipped with – or develop – material cultures in which teachers have had to constitute learning by linking activities to different kinds of artefacts. These include basic tools such as pencils, textbooks, rulers and blackboards, but have recently incorporated a variety of technologies such as recorders, computers and mobile devices. These material cultures – established through centuries of material practices - are essentially sedimented material cultures that teachers and learners can draw on when engaging in a variety of educational practices. As material cultures, artefacts in schooling are often enrolled in “a system of the teachers’ own devising” (2001, 122) where teachers design or improvise with the artefacts available to them in classrooms. In this way teachers become central actors in linking, translating and creating trajectories between the artefacts of learning, i.e. in negotiating the educational significance of material cultures in schooling.

In this paper I want to look specifically at three ways in which iPads participate in teacher devised systems of related technologies. I identify these systems as respectively capturing, bricolaging and building knowledge through the linking of artefacts in networks of learning activities. Each of these systems provide different negotiations of iPad participation in learning – and therefore of different teachers’ associations of iPads with learning activities.

3. MATERIAL CULTURES IN MIDDLETOWN SCHOOL

Looking at schooling through the lens of material cultures can address the ways in which resources are acquired, circulated, preserved or discarded in educational cultures where educational change is associated with the investment in technologies (Lawn & Grosvenor 2001). iPads are, as highly profiled digital devices, intimately associated with the ways in which schools can invest in resources, implement them in practice and organise them as part of the teaching.

In Middletown school the issue of resources and their significance for learning has recently affected the practice of teaching in a number of ways. As is often the case with municipally funded schools in Denmark, Middletown school had for some time had no significant financial resources of its own. Over the years, the school has made some investments in laptops and interactive whiteboards, however, these were mostly made to support specific learners or to enhance classroom management through whiteboard technologies. When resources are scarce, teachers have to be resourceful and manage with whatever is available in school repositories, they are forced to preserve and engage with existing materials within the everyday practices of teaching. This is highly observable in the activities of teachers in Middletown school, cf. the example of John above.

The introduction of iPads into Middletown school in the summer of 2012 brought a new generation of devices into the school that in a very short time enabled teachers and pupils to take advantage of the learning potentials promised by mobile learning devices. As an educational resource the iPad from the beginning stood out from the materials and educational technologies teachers had been used to working with in the classroom for many years, i.e. mostly low-cost, dependable and reusable resources such as books, jotters and pens.

As an educational resource, the iPad promised to link Middletown school with the educational innovation and school development associated with mobile devices – a link that, according to the school leader, might over time improve the profile and financial situation of the school. However, the leap into a potentially flexible, personalized and learner oriented educational environment was not generally followed by sufficient professional development of the teachers, as they were only given a couple of introductory courses to the use of apps which did not really relate to their teaching practices. As a result, teachers were generally forced to cope with the new technology on their own in the time allocated for the preparation of lessons, which did not leave much incentive or potential for changing the everyday practices of teaching. Therefore, the systems of practice that had already been established with regards to linking learning processes to a variety of dependable and available resources was largely maintained, and the iPad was enrolled as an additional educational resource in these practices.

As an initiative to modernize schooling the incorporation of iPads into Middletown school may therefore be interpreted as a relative failure. However, as I shall argue, the circulations of materials in Middletown school nevertheless became potential systems of change, as teachers turned out to be highly competent in orchestrating, organizing and enacting learning processes that involved elaborate systems of activities in which the iPad could participate.

In the following I shall give examples of and discuss the ways in which the iPad acted as a significant element in teaching in Middletown school.

4. CAPTURING CONTENT THROUGH THE IPAD

According to Schön (1983) professionals such as teachers constitute practices through the constant experimentation with and reflection in and through practice. In this way professionals become reflective practitioners who continually build on and expand their theories of practice. In Middletown school, teachers connect with both established ways of engaging artefacts in learning and transform these practices by incorporating artefacts in new ways through improvisation and reflection in practice.

As mentioned above, pencils, books and blackboards constitute the basic tools of schooling, especially in literacy practices which are intimately related to these artefacts. In a historical perspective, “The pencil, like the slate pencil, was engaged with ‘imitation’ of the teachers’ work on the blackboard but it then allowed the use of copybooks to be developed and integrated with blackboard activities. Combining the blackboard, the pencil, and the copybook into an effective method of teaching, especially of the teaching of writing, was a

‘device’ or system of related technologies which has continued in modified form since” (Lawn & Grosvenor 2005, 11). Learning through literacy practices can therefore be understood as a system that involves several artefacts in copying from one ‘device’ onto the other.

As most of his colleagues, John, the biology teacher, has a practice based theory of learning that works as an often tacit basis for his orchestration of sociomaterial enactments in teaching. As most of his colleagues, John requires pupils to learn as a result of translating knowledge from authoritative learning resources such as books or PowerPoints onto their own paper or iPad. This can be observed both in John’s classes and in those of his colleagues, where materials abound, and where teachers orchestrate relationships between artefacts and activities in the process of teaching. These orchestrations define trajectories in the sociomaterial enactments of learning, as when John asks pupils to copy information from the blackboard or whiteboard onto their iPads.

According to John the newly required iPads are user-friendly, easily accessible devices that generally support pupils’ learning in biology and other subjects. However, the iPads, he feels, also contribute negatively to pupils’ learning by eliminating or shortcutting trajectories of learning that were available to pupils before the shift to the tablets. For instance the pupils have discovered that they can take photos with their iPads when John explains something on the blackboard or whiteboard. John, however, feels that the activity of saving information through photographing eliminates a significant process in learning, i.e the process of copying down information through hand-activated note taking. In this sense, according to John, the addition of the iPad to the chain of material practices represents an inferior translation of subject knowledge and therefore constitutes inferior learning. As a consequence, John does not allow pupils to take photos with the iPad in class, he requires them to take notes by hand.

Like John, his colleagues at Middletown school have discovered that pupils take pictures of and save notes with their iPads when they are in class. However, unlike John, the majority of his colleagues feel that it is an advantage for most pupils to photograph and save information on the iPad instead of copying by hand from the blackboard or whiteboard. Photographing, as a translation from the blackboard to the iPad, will enable pupils to listen more attentively to what the teacher is saying, these teachers argue, and in addition to this, pupils who are slow readers and writers, will not slow down the teaching when photographing replaces hand-activated note taking. These examples illustrate how different translations of iPad and blackboard relationships constitute learning in different ways, according to teachers’ theories of practice. These theories of practice contribute to defining the ways in which iPads can be added to the circulations of materials in Middletown school.

In digitalized cultures where mobile devices are increasingly embedded in everyday practices, media convergence is, according to Kress (2010), a central and ubiquitous phenomenon. Smartphones and other portable devices for instance bring together the functionalities of formerly separate digital devices, such as cameras and telephones. One of the consequences of this convergence is that the capturing of images and copying of semiotic material from the internet has gained priority over producing written content. Kress argues that this process of convergence “changes the way we conceive of representational means and meaning-making in the world, favouring selection, ‘capture’ and transformation rather than ‘production from scratch’” (2010, 188). This capturing of content adequately describes the processes associated with translating and saving material onto the iPad in John’s class, and the ways in which pupils transform note-taking from a production from scratch activity to an image that can be saved. Capturing therefore becomes a significant activity that the iPads add to the system of sociomaterial enactments in Middletown school, an activity that in different ways feeds into the visual culture in the school.

5. IPADS IN VISUAL CULTURES; CRAFTING AND BRICOLAGE

As argued by Kalthoff and Roehl (2011) classroom teaching makes extensive use of the sense of sight. In teaching, knowledge is for instance often made visible by teachers’ blackboard illustrations or by objects, maps or diagrams designed to represent knowledge areas such as geography, science or biology. In classrooms, visual cultures are both part of teachers’ use of educational tools and of learners’ end products.

John’s colleague Lucy is a teacher who often uses visual representations such as posters in her teaching. Posters, unlike capturing, are creative, often pupil-produced visual representations made from scratch to illustrate and collect aspects of a specific theme or issue.

Posters are visual representations of the ways in which learning is constituted through sociomaterial processes. Posters involve the association of both simple objects such as pens, paper, cardboard and technologies such as iPads. As assemblages of materialities and modes, posters both represent and involve a number of translations between materials, modes and activities that make up a topic or a field of knowledge. As a representation the poster is a “socio-material bricolage” (Johri 2011), i.e. it is produced as the result of a number of processes in which translations are made between different kinds of materials that act as mediators for learning. In Middletown school, posters are deeply embedded in the teaching and learning processes, partly as an aspect of project pedagogy, which usually involves some kind of crafting where pupils are required to work on their own in finding knowledge about a specific topic.

An example of Lucy’s teaching is a project based learning process in geography where pupils have to find information about a country of their own choice and illustrate their knowledge by making a poster. Lucy presents the assignment to the pupils by giving them a colourful poster she has copied from a book she uses in school. The poster both visualizes topic areas such as population, nature, economy, and environment and in simple textboxes suggests relevant questions the pupils can work with. The poster presents itself as a teacher directed illustration of how visual and written representations can be assembled to make up a country description.

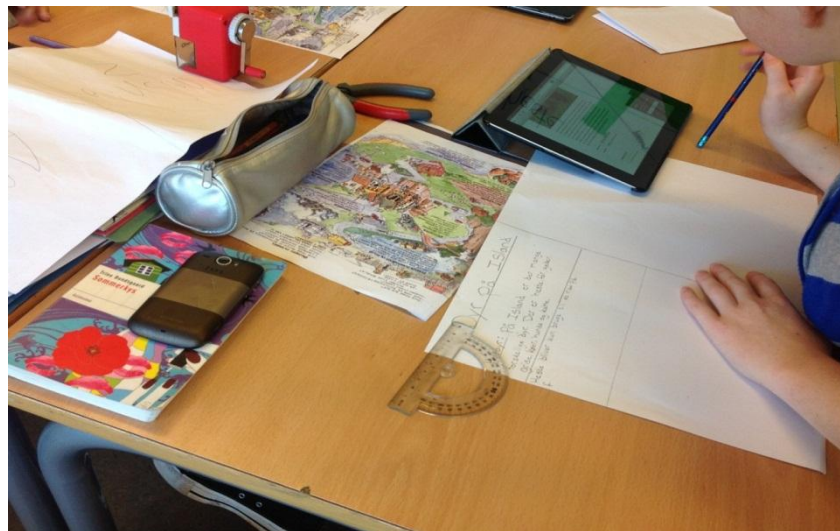


Figure 1. Working on the poster

In class I follow a couple of the groups of pupils and their work on the geography project. One group is working on Iceland as a country, describing aspects of for instance nature and animals. The group consists of a girl and two boys, the boys work together on making a flag and finding factual information about Iceland. The girl collects and copies material onto their joint poster. In order to produce the poster, the pupils use a number of resources, for instance paper, cardboard, pencils and iPads.

Making the poster involves the iPad in different ways. In the chain of materialities that are enrolled in the making of the poster, the iPad acts as a repository of different kinds of information that can be accessed through the internet. The girl for instance uses the iPad to access Wikipedia and other webpages where she can find information about natural phenomena and animals in Iceland. This information is translated, i.e. written, onto the poster by pencil and hand. One of the boys in the group is making a cardboard representation of the Icelandic flag. He uses Google to find pictures of the flag that he translates onto coloured cardboard. This translation creates links between the screen image and the cardboard which are different representations of the Icelandic flag as a materiality that ‘represents’ Iceland. In both cases, the pupils create their (visual and written) productions from scratch, i.e. they do not shortcut the learning process by capturing. The process of making the poster becomes a “socio-material bricolage” (Johri 2011), in which several modalities and materialities are activated.

In Lucy's system of educational tools assembling and bricolaging itself becomes a potential end product of learning as is illustrated in the making of the posters. Bricolaging becomes the system that holds teaching and learning together as networks of sociomaterial enactments. Bricolaging also becomes the practice that enrolls iPads in learning as part of the circulations of materials in the classroom.

6. BUILDING AND CRAFT CULTURES IN MATH AND HISTORY

In Middletown School low-key technologies co-exist with cutting-edge technologies such as the iPad and interactive whiteboards. The process of building new knowledge therefore often involves an association of these different resources and incorporates their potential 'affordances'. Building also becomes a metaphor for learning itself, as will be illustrated by the following example.

In project work learning processes are often linked to artefacts that have specific qualities for learning or practicing particular skills. In Middletown school the history and math teacher have collaborated on planning a project that integrates a number of material resources that will help learners to understand mathematical and historical aspects of buildings and architecture. The history teacher tells me about the project. In class, he says, the pupils will be working with papercraft, i.e. cardboard, to understand scaling as a mathematical aspect of buildings. Before working in class the pupils have visited a square in the local city that they have measured and are reproducing in different scales in class. In class they have learned how they can work with cardboard by gluing the sides of cardboard together to make three dimensional buildings. In order to work with this skill they have cut out and built a church in cardboard. On top of the square they built from their visit to the city, pupils are constructing a number of different buildings that fit the scale of the square. Some of these buildings have a historical significance, for instance Big Ben and Brandenburger Tor. These buildings are built in Lego, the plastic toy brick made in Denmark.

Onto this heterogeneous chain of materials the iPad is added as a new element that can further qualify the process of conceptualizing and visualizing the processes of building and scaling and the historical significance of buildings. The history teacher tells me how at the end of the chain, pupils are asked to build in Minecraft, using the original idea of the square as a basis on which to build. What building in the Minecraft app can add to this process is enabling the pupils to see the building from the inside, i.e. in a 3D perspective. Through Minecraft, pupils can build architecture, for instance tunnels, that they can look at and understand from the inside.



Figure 2. Building in Minecraft

The chain of learning through building is – as a system – similarly to the processes described above - a multi-purpose chain of learning that links not only heterogenous materials such as cardboard, glue, scissors, rulers, software etc., but also different subject areas, skills and aspects of buildings as a historical and material phenomenon. In addition to this the chain of learning links local buildings with buildings in other parts of the world, combining the different aspects of their historical and functional significance in the study of ‘building’ as a learning activity. The complexity of this process of linking, associating and translating between materials becomes even more complex in class, where individual pupils link up in different ways at different paces and with different materials in the chain - and where more artefacts are linked to the system. In class, I for instance observe how some pupils prefer to work with the iPad, and others are continually occupied with building in Lego. In class, I also observe how one boy, who is very competent at building in Minecraft, links his iPad to the class projector which displays his process of building Brandenburger Tor to the class. This performance of ‘building Brandenburger Tor’ is an activity, supported by the teacher, that takes place simultaneously with other building processes and trajectories through the chain. The generic work with building can in this way be constructed individually or specifically, as ‘chains within the chain’ of learning through sociomaterial enactment and bricolage.

7. CONCLUSIONS

In this paper I have identified ways in which teachers activate iPads and other kinds of resources in learning by linking them to systems of their own devising in which artefacts and their modalities constitute significant nodes in the web of learning. As a resource in the classroom the iPads participate actively in and in different ways contribute to both maintaining established ways of learning and innovating learning through for instance the processes of capturing, bricolaging and building. In the examples given, the iPad never acts as an isolated actor in learning but is continuously enrolled and made significant in pupils learning as an aspect of teachers’ construction of sociomaterial systems of learning. These systems of material learning engage both basic tools and technologies such as the iPad, and enable pupils to link onto different parts of the chain. Building in this way becomes both a metaphor for learning process itself, and for the ways in which the pupils can construct their individual learning trajectories and incorporate or give priority to specific learning materials.

As a flexible, mobile device the iPad may be specifically suited to engaging in fluid and emergent teaching and learning practices and to combine with heterogeneous content, modalities and learning rhythms. Bricolaging and capturing are examples of such processes where the iPad adds to and innovates the visual culture of Middletown school and where modalities are combined in new associations of literacy practices (ie. capturing). However, as the examples illustrate, teachers are nonetheless central in initiating, negotiating and managing these chains of resources and in understanding how the links between learning activities and materials support the learning needs of different learners. The paper therefore suggests that teachers’ digital literacy must include not only the ability to use and manage specific educational technologies in the classroom but to understand the significance of the ecology of learning, i.e. of the web of relationships between resources (including ‘technologies’) and how these resources can be linked to make sense in pupils’ learning. Such an approach to teachers’ digital literacy will make room for processes of translation and association between the “heterogeneous set of bits and pieces” that make up learning.

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