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Designing for iPad-classrooms

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Abstract. Our study explores Digital Didactics Designs using mobile technology in co-located settings. What kinds of digital didactical designs do teachers apply in their iPad-classes in schools? Classroom observations and qualitative data were collected in a Danish community where 200 teachers and 2,000 students aged 6-16 use iPads in classrooms implemented in 2012. Based on the theoretical framework called Digital Didactics (DD), five patterns of Digital Didactical Designs and following the innovative designs, three key aspects could be explored: The teachers’ digital didactical designs embrace a) new learning goals where more than one correct answer exists, b) focus on learning as a process in informal-in-formal learning spaces, c) making learning visible in different products (e.g., text, comics, podcasts). The study informs system developers for mobile learning applications in schools and teachers as workplace designers.

Introduction

Traditionally, Information and Communication Technology (ICT) “has been segregated from the normal teaching classroom” (Henderson, 2012), e.g. in computer labs. This has been changed with the advent of smaller devices like iPads. There is a shift from separating ICT and education to co-located settings in which digital technology becomes part of the classroom. Mobile devices like iPads are not only a version of a lightweight laptop; they combine several features of both laptops and handheld devices and became a rather new multimodal device (Johnson et al. 2013). Research on mobile technologies in K-12 education reports opportunities for improving student engagement and achievement of learning aims (e.g., McCombs & Liu, 2011). For instance, Melhuish & Falloon’s study in K-9 schools (2010) shows that iPads have the potential for “consuming and
creating content in a collaborative, interactive way” (Hutchison et al. 2012). Mobile devices foster student-centered activities and enhance teaching practices (Chou et al. 2012). We wanted to know what kinds of designs do teachers apply in their iPad-classrooms to enable learning, is it surface and/or deeper learning?

Theoretical framework

Knowledge construction and collaborative learning are defined as a form of co-creation of new knowledge among a group of people that is “an active process of constructing rather than acquiring knowledge” (Duffy & Cunningham, 1996). An active process refers to the need for learners to become active agents within the learning process (pro-sumers). This approach stresses learning as an ongoing activity. Following this understanding of learning, teaching is more than information delivery and remembering facts (surface levels). An appropriate didactical design enables a “conceptual change” to deepen learning (Kember, 1997) including critical reflection and multiple perspectives. Active learners expand their thinking beyond consumptive behavior in schools and beyond the traditional reproduction of existing knowledge. Laurillard (2007) provides a concept for different pedagogical forms of mobile learning from Kolb’s learning circle (1984), wherein learning includes a) a concrete experience, b) reflective observation, c) abstract conceptualization, and d) active experimentation. The goal of a design is to integrate possibilities and opportunities to enable active individual and collaborative learning to reach the teaching aims.

The term didactical design is inspired by Klafki’s Didaktik (1963), Hudson (2008), Fink (2003) and Lund & Hauge (2011) who stress the differences between teaching activities and learning. A didactical design includes five design dimensions, which have to be in an alignment in order to boost learning (fig. 1):

1. Designing teaching objectives
2. Designing learning activities
3. Designing process-based feedback (for individual and group learning)
4. Designing social relations in forms of interactions (dynamics of social roles)
5. Designing the integration of mobile devices and apps into learning practices

The design of learning activities include the plan how to reach the teaching aims (e.g., individual and group phases; assignments) and integrates different
forms of feedback (e.g., when to give feedback, how often, how, peer-reflective and teacher-feedback). A didactical design also includes the social relations in forms of student-teacher-interaction and student-student interaction by the dynamics of social roles (Jahnke, 2010). The 5th design dimension stresses out the integration of different forms of technology (e.g., apps, ICT) that can be used to varying degrees: from a low and medium to a high extent. For each of the design dimensions the design-question is, how can mobile devices support teaching and learning activities? One argument for using ICT in general is that they can “make learning visible” (Mårell-Olsson & Hudson, 2008). Their ePortfolio study showed that students “become more active … in the development of knowledge” (p. 73).

An optimal digital didactical design is characterized by a “constructive alignment” (Biggs & Tang, 2007) of all its constitutive elements; the assumption is that the aligned design-in-practice enable learning and increase the likelihood to reach the teaching aims and expected learning outcomes. Our study aims to make the different implicit and hidden digital didactical designs applied by the teachers in iPad-classrooms visible. Our main research question is: What digital didactical designs do teachers apply in iPad-classrooms?

Methods

In Jan. 2012, the Danish community Odder implemented iPads for all their 7 schools. Around 200 teachers and 2,000 students in K-9 (from preschool class until 9th grade) got iPads in a 1:1 iPad-program. Odder is a municipality in a rural area (about 20,000 inhabitants). As the existing old laptops had become obsolete, there was a need to acquire new technology. Instead of laptops, the politicians in Odder decided to use iPads. Headteachers, school principals, the local department of the teachers union were consulted to make sure that all parties agreed.

An explorative approach with mixed methods has been applied, particularly, partially structured classroom observations, teacher interviews, school visits (usually 1 school per day) and meetings with head teachers, as part of a larger study of iPads in schools and universities. In 2012, 15 classroom observations (45-90 mins. each) and 13 interviews with the teachers (ca. 60 mins. each) were conducted in six (out of 7) schools. The teaching subjects ranged from Native Language, Math, English, Art to Physics; classes ranged from preschool to K-9; class sizes of 14 to 25 students. Classroom observations have been based on the didactical triangle design including teaching aims, learning activities, different forms of feedback/assessment and the purposes of the iPads and conducted usually by two to five researchers. They took notes, photos and video recordings. The interview guide was divided into five parts and contained 12 questions focusing on teaching and learning activities in the classrooms and how and why they use iPads. The recorded interviews were conducted by a total of three researchers (Bryman, 2008).
Results

We analyzed 15 classrooms in order to make possible different patterns of digital didactical designs visible. Table 3 shows the results.

Table 3. Analysis for all 15 classrooms

<table>
<thead>
<tr>
<th>No</th>
<th>Class (grade)</th>
<th>Class-Content and Evaluation of Digital Didactical Design (DDD) (from 1-5: 1= alignment; 5=non-alignment of DDD elements)</th>
<th>Ipad-use (low, medium, high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Reading skills (K-0)</td>
<td>Complex learning, individual learning by creating a book review: A – 5 elements of DDD addressed and aligned (1-2)</td>
<td>High extent of Ipad-use</td>
</tr>
<tr>
<td>11</td>
<td>Physics (K-9)</td>
<td>Collaborative production of experiments (small groups): A – 5 elements of DDD addressed and aligned (1-2)</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Math (K-2)</td>
<td>Transforming a math story into a new story: A – 5 elements of DDD addressed and aligned (2)</td>
<td>High</td>
</tr>
<tr>
<td>10</td>
<td>Arts (K-8)</td>
<td>Collaborative writing about arts: A – 5 elements of DDD addressed and aligned (2)</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Math (K-1)</td>
<td>Collaboration in small group discussions about math: A – 4 elements of DDD are addressed and aligned (2)</td>
<td>High</td>
</tr>
<tr>
<td>7</td>
<td>Music (K-6)</td>
<td>Collaborative productions of music in small groups: B – 3 elements of DDD are addressed, alignment differs (3)</td>
<td>High</td>
</tr>
<tr>
<td>15</td>
<td>Geography (K-3)</td>
<td>Groupwork, 2 students in a group to find distances: B – 2 elements of DDD are addressed, alignment differs (3-4)</td>
<td>High</td>
</tr>
<tr>
<td>8</td>
<td>Writing Skills (K-7)</td>
<td>Peer-reflective learning, producing text documents: B – 5 elements of the DDD aligned (1-2), medium extent of Ipad-use</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>History (K-2)</td>
<td>Collaborative production of a movie or a book: B – 2 elements of DDD addressed, alignment differs (4-5), but high extent of Ipad-use</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Proverbs (K-2)</td>
<td>Individual learning by creating a story using Puppet Pals: B – 4 elements addressed, alignment differs (2-3), medium extent</td>
<td>Medium</td>
</tr>
<tr>
<td>12</td>
<td>Geography (K-5)</td>
<td>Groupwork to create a presentation (Middle East): B – 3 elements addressed, alignment differs (2-3), medium extent</td>
<td>Medium</td>
</tr>
<tr>
<td>1</td>
<td>English (K-6)</td>
<td>Individual production by recording the own voice in English: B – 2 elements addressed, alignment differs (3-5)</td>
<td>Medium</td>
</tr>
<tr>
<td>13</td>
<td>Preschool class (K-0)</td>
<td>Role-playing: B – 3 elements, alignment differs (4), low extent Ipad-use</td>
<td>Low</td>
</tr>
<tr>
<td>14</td>
<td>Language (non-fiction)(K-3)</td>
<td>Individual learning: E – 3 elements addressed, but no alignment (4) -- Case shows iPad use reduced the quality of the didactical design and limited learning</td>
<td>Low</td>
</tr>
<tr>
<td>9</td>
<td>Natural Science (biology) (K1)</td>
<td>Group-assignment to make a mind-map: E – 4 elements addressed, no alignment at all (5) -- Case shows iPad-use reduced the quality of the didactical design and limited learning</td>
<td>Low</td>
</tr>
</tbody>
</table>

Five patterns occurred:
A. Innovative iPad-classrooms: alignment of didactics & technology (5 classes)
B. Almost ipad-didactics: alignment is not a strong as in pattern A (3 classes)
C. DDD is not in an alignment but through the ipad-use learning has been enabled stronger than without the iPads, high extent of iPad-use (1 class)
D. Potential for ipad-didactics: The alignment of the five elements of a DDD differ, but it does not limit learning, there is potential for a better alignment (4 classes)
E. The applied designs reduce the possibility of learning, restrict learning (2 classes)
We studied the 15 iPad-classrooms in detail. We cannot describe all of them here due to limited space; more cases are available in Jahnke & Kumar (2013).

**Classroom No 5** (pattern A). In the main part of the lesson, the students got the assignment to design mathematical stories transformed from a given problem delivered on a piece of paper. Such an already existing mathematical problem was a) “minigolf – count the points” and b) “My brother Mike was 5 years old when I was born. I am now 4, how old is Mike now?” The students got the task to transform this given math problem into a new story. To make the transformation of these existing “math stories” visible (here the principle of addition, to count what is 5+5), the assignment was to create a comic. The students used a template of the mobile app Strip Designer and uploaded pictures from the Internet or from the camera roll (photos they had taken). They created speech bubbles and included text. The students collaborated to discuss the different ideas in order to create their new stories. In this phase of the lesson, a change of communication patterns took place, the students were active and a collaboration between the students started. When the students were ready, the teacher showed the solutions, gave feedback and discussed them in the classrooms according to a) to what extent is the new story similar to the given story, and b) is the transformed story a successful story. **Summary:** The teacher created assignments where no correct answer exists; it was an open assignment where the students got an open informal space and needed creativity to transform the given story into a new story. In producing a new story (product), the students showed they understood the principle of mathematical addition.

**Classroom No. 3** (pattern C) addresses only 3 of 5 digital didactical design issues; the design of social relation and feedback were not included in the didactical design made by the teacher, and they were not supported during class. This from a didactical perspective, the quality of the design ranged towards a not so good quality (3-5) that indicated a not so well-designed classroom in order to reach the teaching aims. However, and that is a surprise, the characteristics of the iPad use shows a different picture. The students got the assignment to show the teacher what they have learnt about the historical person by creating a movie or creating a joint book. To enhance learning, the iPads were used to support a collaborative production of a new movie. The high extent of the iPad use was visible in its use as a multimodal device: the camera, the portability and the specific adoption of the app iMovie that was originally not intended for teaching. This mode of learning called “learning by producing something” has been transformed into collaborative production. The iPad-use in this class shows a high extent although the didactical design was not a well thought design. **Summary:** The teacher created learning goals in which more than one correct answer is possible. Instead of making tests where the teacher asked the students what they know about the historical person, the students produced a short movie or an eBook (they could choose) to make visible what they have learnt.
After analyzing all 15 classrooms in detail, following design principles could be explored. Teachers…

- do design new learning goals where more than one correct answer exists and assignments in which a right answer is not known (it supports to deepen learning)
- do design informal-in-formal learning spaces and focused on learning as a process,
- support to make learning visible in different products; choice of diverse assignments
- use apps that are primarily not built for education (e.g., PuppetPals, StripDesigner).

The study illustrate that didactical designs cannot be just added to ICT or vice versa. Teachers in the workplace have designed new forms of Digital Didactics (ipad-didactics) to enable and boost student learning. The complexity and richness of their Digital Didactical Designs inform system developers for mobile learning applications in schools.

References