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The Student Role in the One-to-One Computing Classroom: Tensions Between Teacher-Centred Learning and Student-Centred Learning

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Abstract: One-to-one (1:1) computing has recently been scaled up and integrated into learning strategies, but there have been rather few studies about it so far. This explorative observation and interview study aims to gain increased understanding about the student role in the 1:1 computing classroom in upper secondary school. The results demonstrate a media-rich classroom based on four categories of affordances: students' note-taking; searching the Internet; social media; and laptops for duplication. The four categories of affordances delineate how teachers' behaviour is influencing students and their use of laptops in the designed learning activities. The designs of the 1:1 classrooms are based on technology-enhanced consumption of media as opposed to designs for technology-enhanced learning. It is concluded that the student role is diverse and stretched between principles of both teacher-centred learning and student-centred learning.

Keywords: one-to-one (1:1) computing, student role, constraints, affordances

1 Introduction

The one-to-one (1:1) computing classroom is an environment based on one portable laptop per student, access to the Internet through wireless networks (WiFi), and a focus on using laptops in the school practice (e.g. for presentations and academic tasks) [15] (p. 331). Traditionally, schools have been organised based on principles of the analogue world, whereas 1:1 computing spans digital and analogue designs of the learning experience [7]. Goffman [9] used the concept of the façade to conceptualise both established roles and how settings construct roles based on the settings' design. For example, a young person, on walking into a school, takes on the formal role of student, and teachers and other students hold certain expectations related to that role. However, in the classroom, teachers' design of teaching and learning could either be teacher-centred or student-centred. Accordingly, the façade in settings of teacher-centred learning is based on hierarchical social relationships and knowledge that is transferred and remembered [1]. In contrast, the façade in settings of student-centred learning is characterised as holistic, active, and informal learning in diverse contexts [1] [13]. If the environment in which the role is played out changes, the role will probably be extended [11] to include additional façades [9]. Therefore, we need to know more about the student role based on how teachers' behaviour is influencing students and their use of laptops in the learning activities. To address this knowledge gap, we have asked the following two research questions: How can we understand the teachers' design of the 1:1 computing classroom? What expectations do the teachers hold about the student

role in students' learning experience? To answer these questions we conducted an ethnographic study focusing on three 1:1 computing classrooms.

2 1:1 Computing in K-12 Education

Lei and Zhao [14] demonstrate four themes of how students use personal laptops: for specific learning tasks (e.g. note-taking, online searching), for communication (e.g. e-mail and instant messages), for expression (designing something), and for exploration (e.g. games and multimedia products). Dunleavy et al. [6] argue strongly that students' learning experience must be based on four design principles: learner-, assessment-, community-, and knowledge-centred (p. 451). An important aspect of the design is that a power relationship is created between, for example, Internet resources and textbooks, and one of them becomes dominant [3].

2.1 Theoretical Framework

In this paper we argue that social actions in 1:1 computing classrooms affect the student role. Implicitly, the social actions are understood as being in relation to the design of the environment and the properties of the environment. Greeno [10] has developed Gibson's [8] theory of affordances from an ecological view towards a philosophical view by discussing affordances from Barwise's [2] situation theory. Greeno's [10] theory provides analytical tools for understanding how situations relate to other situations through the concept of "conditional constraints" (p. 339). Conditional constraints address regularities that provide a framework to outline situations from which affordances can be interpreted. Greeno's theoretical contribution highlights that if there are conditional constraints there are affordances that, by definition, can be both recognisable and perceived directly as properties of a design. For example, Chan et al. [5] state that 1:1 technology-enhanced learning (TEL) "means that each student uses at least one computing device" (p. 7), which brings out the following conditional constraint:

<<1:1 TEL>> → <<students use at least one computing device>>

The above constraint highlights when the situation of 1:1 TEL means a relation to another situation where each student uses a personal computing device. Accordingly, the framework of conditional constraints and affordances will be applied here to students' activities involving 1:1 computing.

3 Method: Context, Data Collection, and Analysis

The study took place at an upper secondary school in the northern part of Sweden during the spring of 2012. The school has about 2,000 students and was chosen because of the municipality's 1:1 computing initiative. Each student and teacher was equipped with a laptop computer, and the classrooms were equipped with digital projectors, an interactive board (Smartboard), and a

whiteboard. The whole school had WiFi access to the Internet and to a learning management system (LMS) called Fronter. Three social studies classes (A, B, and C) were chosen; there were 20 to 27 students in each class. We did not study students using laptops in the cafeteria or in their spare time.

We did 17 observations during three weeks of study. The observer sat at the back of the classroom and the observations were combined with informal conversations and interviews. Field notes were developed, as close as possible to the observations, into “thick descriptions” [12] (p. 153), which are characterised as narrative, describing, analysing, and interpreted.

Students were selected for focus group interviews based on the classroom observations where students were noted to be particularly verbal. The interviews followed a semi-structured interview guide covering two themes: how students study during lessons, and students’ use of digital technologies. The interviews were digitally recorded and transcribed verbatim.

We analysed the empirical material using Boyatzis’s [4] framework for thematic analysis. The process of thematic analysis is based on indicated essences, signs, episodes, and contrastive thinking that emerged. The themes were tested between the two authors. Here, the second author created the first set of themes, and then the first author assessed these themes in relation to the empirical material. This process was followed by discussions until the authors reached agreement about the themes.

4 Results

4.1 The Students’ Activities

The students used technology for both schoolwork and non-school activities. For schoolwork, the students used the laptops most frequently for word processing (N=12) for taking notes and writing assignments. The students’ used (N=7) a search engine for searching and accessing information. In a majority (N=13) of the learning activities, the students consumed media either from the teachers’ digital presentations or from videos. Thereafter, the students’ work was often done in pairs, as they answered questions about the subject of study from the teachers’ digital presentation or video. During all the observations, students used their laptops and mobile phones to conduct non-school activities such as accessing social media applications, reading blogs, and playing online games. The students’ activities and use of digital technologies indicate when one situation is related to another situation. Based on the students’ activities and digital technology use, the following conditional constraint [10] for the 1:1 computing classroom is constructed:

<<the use of digital technologies>> → <<refer to the influence on students’ learning activities>>

In the next step, the above conditional constraint will be constituted through a set of affordances raised by the related situations. Informants’ names have been replaced with pseudonyms, and quotations are included.

4.2 Four Properties of 1:1 Computing

The Affordances of Note-Taking

Note-taking is a key activity for students while teachers are presenting. The affordances are based on situations when students use the word processing application for note-taking in relation to situations of students' activities. The situations that influence students' learning range from their use of notes as they prepare for written exams to their development of note-taking strategies. However, a specific note-taking strategy was characterised as using the exact words and expressions (duplication) as in the teachers' digital presentations.

The Affordances of Search Engines

The affordances of search engines demonstrate two episodes where the situation of using search engines influences students' learning. In the first episode, in class C, the students' task was to complete a short test about the central bank. This activity prompted the students to use Google. Expected or not by their teacher, Maria, the students used phrases from the test and found the test on the Internet. Two students, Eva and Maya, said: "... if you used the exact phrases from the questions when using Google [Eva]... you got hits and it was rather simple to find the right answer [Maya]."

In another episode, the students used tools to collect and read a variety of text resources on the Internet, such as Google, Google Scholar, and an essay database (<http://www.uppsatser.se>). In their research the students used sources (e.g. research papers) that were at a more advanced text level than the information in their textbook.

The Affordances of Social Media Applications

The affordances of social media highlight students' use in both school and non-school activities. In the school activities, social media (Facebook) has the affordances of sharing information (N=1). This episode demonstrates how students use social media for sharing information that supports the learning process. It was observed how Sofia had difficulty finding the facts she needed for an assignment and how Elin, sitting behind her, gave her some support. Sofia said: "Could you send me the link about the nurses?" Elin answered: "I'll send it on Facebook."

As for non-school activities, in all classes, during the teachers' digital presentations or during other activities such as group work, students were observed to be checking social media applications, playing games, and reading blogs. However, the students' lack of focus was not due only to the Internet and laptops; it was also observed when students were using mobile phones or chatting with each other.

The Affordances of Laptops for Duplication

In one episode, Maria taught by using the interactive board and a pencil to illustrate, step by step, how money is transferred in the economic system. Maria suggested that the students draw a picture similar to hers on their laptops. In parallel with Maria's teaching, the students started personal and collaborative sub-activities with a view to duplicating Maria's drawing on their laptops. The

sub-activities reflected students' diverse use of technology in one situation that related to supporting the students' learning when they were drawing the picture. Three affordances are indicated from the sub-activities. One affordance was highlighted when the students' Googled the subject of the drawing and found the picture. Another affordance of 1:1 computing was indicated when students suggested using the word processing application (Word) to write what Maria was explaining. In a third affordance, a group of students imitated Maria by trying to draw her picture using the word processing application.

5 Implications

The three 1:1 computing classrooms demonstrated greater emphasis on façades of teacher-centred learning based on technology-enhanced consumption (TEC) of media, and minor implications of façades of student-centred TEL. Thus, the teachers' behaviour and TEL designs are based on situations that refer to situations where students duplicate the teacher's digital presentation. The results indicate that the affordances of laptops support duplication by using text. Tablets would probably give richer affordances of taking notes through the affordances of the camera or of digital pens used on the tablets to make simple drawings. However, the implications of student-centred TEL were demonstrated when students shared links through social media applications, or when they used search engines. Teachers' TEL designs would benefit by integrating the social media applications that students use in non-school activities. To change practices towards student-centred TEL, conditional constraints [10] of the 1:1 computing classroom should be based on situations for using social media applications that refer to situations that strongly integrate students' preferences into the learning activities. Such designs could manifest collaborative note-taking activities and group reflections for deeper learning where all students have the possibility to contribute to a shared understanding.

Conclusion. This small ethnographic study confirms what other studies [3, 14] have found: that 1:1 computing classrooms are based on TEC designs for teacher-centred learning. From the teachers' perspective, expectations about the student role are based on traditional assumptions of TEC. Students' non-school activities make visible the tension between teacher-centred learning and student-centred learning, or in other words, the tension between façades of TEC and TEL designs.

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