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Title One Laptop on Each Desk: Teaching Methods in Technology Rich Classrooms

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Abstract

This article takes its point of departure from the main findings from research in four upper secondary schools in a 1:1 initiative (one laptop per student) and reports on a deeper analysis of four classrooms that are part of the empirical study. This study aims to investigate how teaching and learning in technology-rich classrooms are structured and thus contribute to the development of knowledge about the impact of technology on the structuring of teaching and learning in educational practices. Bernstein's theoretical concept of the pedagogic discourse is used to make visible how the main incentive for teaching methods is the evaluation system that recontextualises traditional discourses about teaching and learning. The conclusion is that fundamental transformations of education is less about technology and more about the changing of the structures and discourses concerning teaching, learning and education.

Keywords: Educational Technology, ICT, one-to-one, 1:1 Laptop Initiative.

Introduction

Many Swedish schools have in recent years undergone a radical digitization due to the one-laptop-per-student (1:1) initiatives and infrastructural school investments made by a majority of Sweden's municipalities. These investments have also become an everyday occurrence in schools all over the western world (Fried, 2008; Holcomb, 2009; Lowther, Ross, & Morrison,

2003; OECD, 2010; Warschauer, 2006; Zucker & Light, 2009). Typically, these initiatives result from arguments that are similar, irrespective of geographical location, and can be divided into three categories.

- Rational arguments
  The ambient society is permeated with computers, and schools are forced to adapt to the development (Hepp, Hinostroza, Laval, & Rehbein, 2004).
- Egalitarian arguments
  In a technology-rich and globalized society, where knowledge is a fundamental asset, pressure is put on schools to prepare all students for a society where ICT is a key technology (Buente & Robbin, 2008).
- Pedagogical arguments
  1:1-initiatives are considered as change-agents in efforts to transform teaching, particularly when student-centred approaches are being considered (Chen, 2010; Mooij & Smeets, 2001; Sharma, 2011).

Often, these arguments are also interwoven with pre-conceived convictions in the discourse amongst politicians and policymakers that education is the key to future economic prosperity. In this debate, ICT is often singled out as a key enabler for providing the fundamental changes, innovation and modernization of education and training that is needed and required for nations to remain competitive in the globalized economy (Bocconi, Kampylis, & Punie, 2013; Nivala, 2009; Player-Koro, 2012b; Selwyn & Facer, 2013).

However, still there is lack of evidence of fundamental changes to education through the implementation of technology. Neither more recent evaluations of 1:1 initiatives (Balanskat, Bannister, Hertz, Sigillò, & Vuorikari, 2013; Dunleavy, Dexter, & Heinecke, 2007; Goodwin, 2011; Larkin, 2011; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011a; Tallvid, 2010), nor about 40 years of study in the field of educational technology have been able to find a verifiable link between the transformation of education and the use of technology for teaching and learning (Livingstone, 2011; Skolverket, 2013; Yuan-Hsuan, Waxman, Jiun-Yu, Michko, & Lin, 2013). Nevertheless, every year huge resources are directed towards the exploration of how ICT could be used for the transformation of education and the enhancement of the act of learning (Selwyn & Facer, 2013).

Common explanations of why these expectations of change due to educational technology have not been attained are sometimes made with reference to theories that describe the implementation of ICT as a process of development, which, in turn, might imply that the initiative has not yet reached the expected phase of innovative change. Bocconi et al. (2013) comes to the conclusion that '... the 1:1 learning initiative may turn into a high impact development if it allows for the development of more effective ways for people to teach and learn...'(p. 125). Other explanations describe the lack of transformative changes as failures. However, these failures are seldom described as technological failures. Instead, teachers, students and schools seen to be reductive, slow or having the wrong or an unconstructive attitude towards the use of technology in education (Nivala, 2009; Ottestad, 2010; Skolverket, 2013). Paradoxically, despite the lack of supporting evidence for the prerequisites for the use of ICT in educational settings, positive predictions as to how ICT is capable of transforming education has continuously been brought forward in the academic research field (Khan, Butt, & Zaman Baba, 2013; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011b).

In this article, we challenge and problematize the assumption about ICT as a change-agent. This is done through a theoretical, informed analysis of video observations of four different classrooms (four lessons of approximately one hour each) that formed part of a bigger study that is described below. The theoretical framework used in the study describes activities inside the classrooms (the pedagogic discourse) as structured by many different and

often competing discourses (Bernstein, 2000). This framework facilitates an analysis of how a pedagogic discourse is structured, in conjunction with the infusion of intentionally transformative innovations such as 1:1 initiatives. It also facilitates an analysis to discover which discourses have the strongest impact on classroom activities. The intention of the article is to contribute to the development of knowledge of how and why ICT is currently used in educational settings.

The study

Four video observations of four different classrooms are chosen for an in-depth analysis. These chosen classrooms are part of a rigorous two-year study in upper secondary schools in Sweden that have invested in 1:1 initiatives. During these years, data was produced using several data collection formats (surveys, interviews, focus group interviews, and video observations in classrooms, in which digital technology is used for teaching and learning). These multiple data collection formats were used in order to provide a broader and more general picture, as well to foster a deeper understanding of how the teachers' pedagogical work is influenced by the digitization of schools. Moreover, the different data sources have also made it possible to analyse through triangulation, since the survey results have been considered in relation to the analysis of the interviews and observations. In this way, the various data sources have provided a rich picture of both the daily teaching and learning, as well as of the context of the teaching at the schools under study.

The main results from the study show that ICT is frequently used in core activities, such as teachers' planning and organization, as well as their teaching and that these activities challenge existing classroom practice in many ways. On the other hand, there was no evidence that could be verified in the analysis of a specific transformation of the organization of teaching due to instructional use of digital technology. These findings are reported elsewhere (Player-Koro, Björkenvall Starrost, & Lindström, 2013; Player-Koro, Tallvid, & Lindström, 2014).

The video observations that were used (of four different classrooms for approximately one hour each) were primarily concerned with the effects of digital technology on the teaching process, and the analyses concentrated on the interaction between the students and teachers in the classroom. The observations were documented using video recorders and by taking field notes.

One of the reasons for the selection of these particular classes is that the principal of each school recommended these classrooms. They were considered to be examples of particularly innovative teaching and learning practices and were thus considered to represent examples of the changing classroom practices. Another important reason, as described above, was that the findings from the larger study, from the survey and from the focus group interviews indicated that teachers and students frequently used laptops in education, and that this had not changed the fundamental elements of teaching and learning in the schools under study.

Analytical framework

The theoretical grounding for this study implies that schools and classrooms are not simply transmission systems of ´learning transfer´ of knowledge and skills. Instead, what happens in teaching situations is considered to be the result of a process of struggle between different agents that are present both inside and outside the educational setting. This process is a complex, shifting

blend of the values, ideas and interpretations of discourses of legitimate knowledge and skills, together with the rules for their transmission and acquisition (Ball, 2006; Beach, 2005; Bernstein, 2000).

Therefore, for this study, it is important to be aware of how local teaching practices are a part of, and is shaped by, actors both within and outside the educational institution. In this sense, teaching and learning are situated in a contextual practice that comprises the classrooms under study (Beach, 2005). Activities in these practices can be seen as the result of translations and interpretations of the different discourses stemming from traditions of how and what to teach in different subjects, and the educational policies shaped by political discussions. The activities in these classrooms are also derived from the public and media debate, from agents in the educational field (educators in schools, principals, etc.), and not least, from the IT-industry (Bernstein, 2000).

In this research, Bernstein's concept of the pedagogic discourse is used as a conceptual framework for the analysis. The pedagogic discourse which could be viewed as the carrier of pedagogy is, as described above, formed by various discourses, through the embedding of two discourses: the instructional discourse, a discourse of transmission and acquisition of specific competences, skills and knowledge, within the underlying general regulative discourse, a discourse of social order, conduct and manner (Ensor, 2004; Hoadley, 2006).

The organisation of classrooms activities, which is the prime concern in this study, is according to Bernstein, the way in which the purpose of education is realised and made visible through communication between teachers and students inside the classroom (the realisation of the pedagogic discourse) (Hoadley, 2006). The meaning and intentions of the teaching and learning activities in the classroom are in turn visualized through the method of evaluation of the students, (as for example different kinds of assessments of students work), that specifies the requirements for students learning. This means that the evaluative criteria have a central role in structuring and identifying of the pedagogic practices. This is especially important to note, because it means that evaluation is the key to the pedagogical practice, and that the examinations visualize the whole meaning of the educational process (Bernstein, 2000).

The pedagogic communication, or the realisation of the pedagogic discourse could be identified and described through the concepts of classification and framing, which refer, respectively, to power and control that are distinguished by the characteristic of their voice or pedagogic modality (Bernstein, 2000; Hoadley, 2006).

Classification expresses power relations and creates the degree of demarcation between agents (in this case between teachers and students), and between different school-subjects, and can either be defined as strong or weak. Classification is expressed as strong where boundaries are explicit, or weak, where there is integration, or blurred boundaries. In terms of subjects it means that the different school-subjects are explicit and insulated from one another. With respect to agents in the pedagogic relationship it identifies how teachers and students pedagogic identities are demarcated (Bernstein, 2000; Hoadley, 2006).

If classification concerns establishment of relations between categories, such as school-subjects and teachers and students, framing on the other hand refers to realisations and maintenance of categories within a specific context (in this case the classroom) and is underpinned by the principle of control. This means that framing supports or visualises classification through interaction; boundaries are defined, maintained and changed. At the classroom level, framing refers to the locus of control over the pedagogic communication. In

general, the stronger the framing the stronger is teachers control over selection, sequencing, pacing and evaluation whereas students have limited ability to control the 'relations within', the instructional and regulative discourse. On the other hand where framing is weak the students have more 'space' or control over the social interaction, but at the same time there are rules of regulative and instructional discourse, as for example the requirements to pass exams, that are more implicit and largely unknown to the students (Bernstein, 2000; Hoadley, 2006).

Results

This section aims to present the result of the theoretical analysis of video observations from four lessons in English Language, Civics, Economics, and Swedish Language. As already mentioned, these four lessons are examples taken from teaching and learning in schools and classrooms equipped with ICT and where these technologies are used frequently by both teachers and students during lessons and where most of the teachers have positive attitudes to technology and have found it useful for managing their professional work (Player-Koro et al., 2014).The aim of the analyses is to describe and make visible how teaching and learning in technology-rich classrooms are structured.

Analyses of classroom work where digital technology was used for teaching and learning.

Bernstein has in his study of pedagogy asserted the centrality of evaluative criteria in identifying a pedagogic practice. This was also evident in these classrooms, three of the four teachers said that the activities in the classroom were aimed at preparing students for the upcoming exam, as is illustrated by the citations below.

> ... today we are working with warehouse management and calculating optimal purchasing control ... yes, these calculations will be graded by means of a test in a couple of weeks (Teacher of Economics)

> ... the intention is to learn to listen and grasp the meaning of the story ... learn some new words ... this is actually part of their national test ... (Teacher of English)

> ... they (the students) work with a report of society's political development from a historical perspective. Students choose a country they wish to study ... The written report should be handed in through our learning platform ... they'll also give an oral presentation of their report (Teacher of Civics)

'Examination' was also evident in the Swedish Language classroom. The lesson we sat in on was actually part of their examination of an area called 'verbal instruction'. The examination task that the students were supposed to carry out to pass the exam was not new, but this year the teacher had changed the way the task was evaluated. The task had previously been evaluated through an oral presentation to the class, but on this occasion, the task was to create an instructional video that was presented to the class. The teacher described the examination as:

> ... this examination is part of actually creating better stories. The idea is that by creating an instruction and then recording an instructional video, the students will learn how to create the outline of a story ... an introduction, the story, which, in this case, is an instruction, and an ending ... in addition, they learn how to make an oral presentation (Teacher of Swedish)

Drawing on the teachers´ description of the examinations it could be concluded that the test was a form of post-test, in which the student's ability to answer questions or solve problems is evaluated. The lessons differed however

in how clearly the requirements for the examinations were expressed to the students. In the case of the English Language and Economics the teachers expressed the evaluative criteria for the students very clearly i.e. what they were supposed to do to pass the exam:

> Teacher: Open your books and do the these exercises ... when you've finished, you can read and try to learn the words that will be used in the test on Friday (from observation of the English Language classroom, 2012-11-12)

> Teacher: ... the exercises are available on the learning platform ... I have shown examples on the whiteboard ... after that, just 'do the task and you can ask me if you have any questions (from observation of the Economics classroom, 2012-11-09)

In the Civics and Swedish Language classrooms, the examinations were given in the form of a project that was supposed to be submitted as a written report (in the case of the Civics lesson) and in an instructional video (in the case of the Swedish Language lesson). The teacher described the work as follows:

> ... I gave them a compendium with all the information about what was required from them to pass the exam. Based on that, the students' chose a country to work on ... they have a deadline ... it's up to them to plan the work (Teacher of Civics)

> ... the students had an instruction. They could choose anything that interested them, and then start with the movie production. (Teacher of Swedish Language)

These examinations were mainly based on student choices and meant that the requirements for the exam were more implicit for the students:

> Teacher:... you have to include the country's economic and political development in the report if you want to pass the exam ... you can look for information online ... don't forget to submit the report for assessment at week 48 (from observation of the Civics classroom, 2012-11-12)

> Teacher: Today you have to show your instruction video to the class ... you have the description of the examination criteria in the compendium... in a couple of weeks, you will get your grades marks for this work (from observation of the Swedish Language classroom, 2012-11-12)

In other words the framing of the evaluative criteria is stronger in the case of the English Language and the Economics subjects. The different degree of framing was also evident in the teaching structure and the regulative part of the pedagogic discourse. This was observed during the classroom work. In the English Language and Economics classrooms, the lessons were aimed at preparing the students by extending their vocabulary and their ability to make economic calculations. Figure 1 illustrates the social interactions, or the framing, in the Economics and English Language classrooms.

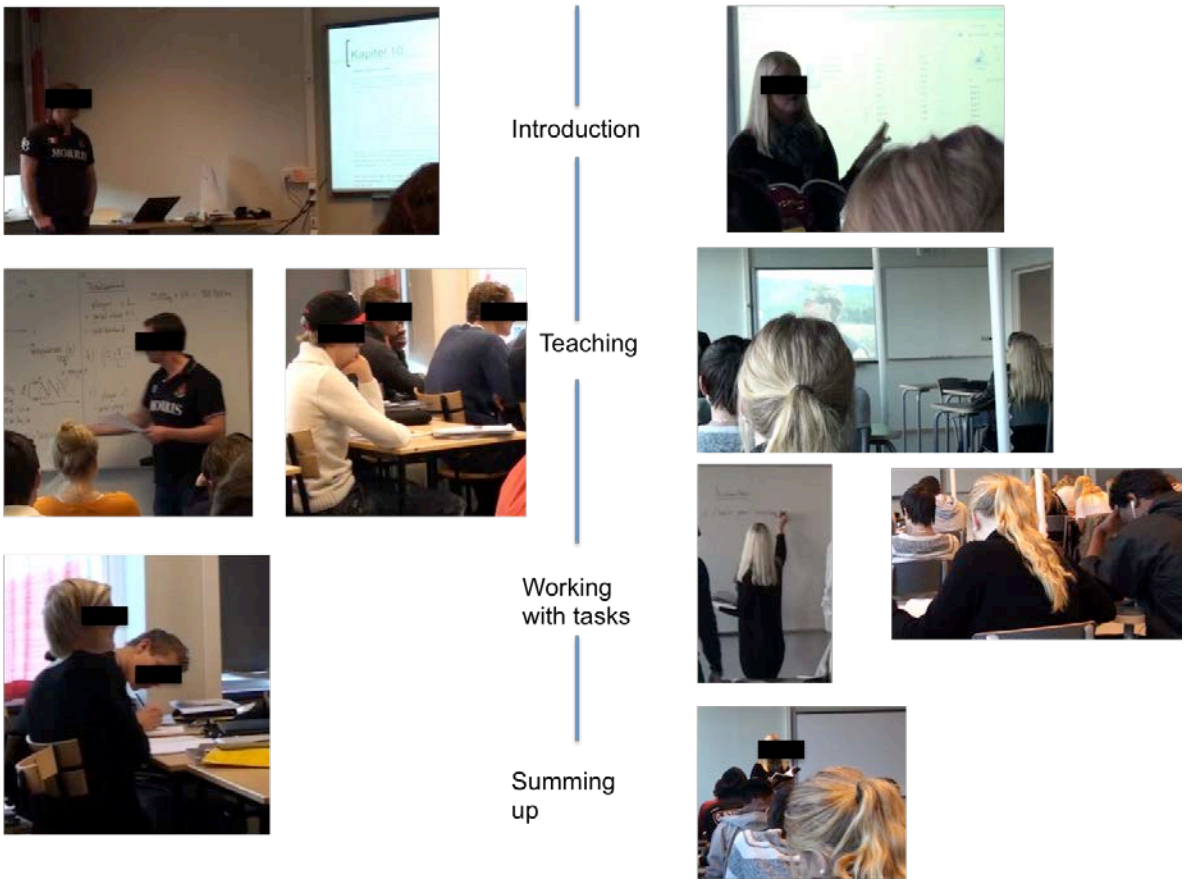

Figure 1. The framing in Economic and English Language classrooms

Strong framing means that students have relatively little control over selection of subject content, sequencing, and pacing. In other words the teacher has control over the subject content, and who is able to speak and when. This was evident in all parts of these lessons. These lessons started with an introduction. The introduction was aimed at presenting the topic for the day and was an activity that took place at the front of the classroom. In these two classrooms, it was not the teacher who introduced the topic; instead, the introduction was mediated through digital technology. The Economics class was structured from a lesson film that students could access via the learning management system (LMS). It was a video in which the teacher gave a lecture on the topic for in question. In the English Language classroom, the teacher introduced a video that was part of the course literature. She also reminded the students of the words that should be learned before the next lesson (see Figure 1).

In the next phase of the lesson (Teaching, see Figure 1), the teachers introduced the tasks that students were supposed to work with during the lesson.

> ... now check if you understood the film ... if look in your books you will find some exercises ... and we will look at these at the end of the lesson ... also take a look at the vocabulary on page 166 (from the English Language classroom, 2012-11-12)

> ... the tasks are on the on the Fronter (the LMS system) ... if you get stuck with solving the tasks, you can ask me or go back to the video clips available online (from the Economics classroom, 2009-11-09)

In both classrooms, these activities were concerned mainly with the transmission of knowledge, as defined by what was written in the course book or in the case of the Economics lesson, copied from the book. When students

were occupied with the tasks, the teacher walked around the classroom, tutoring individual students one at a time or in groups (see Figure 2).

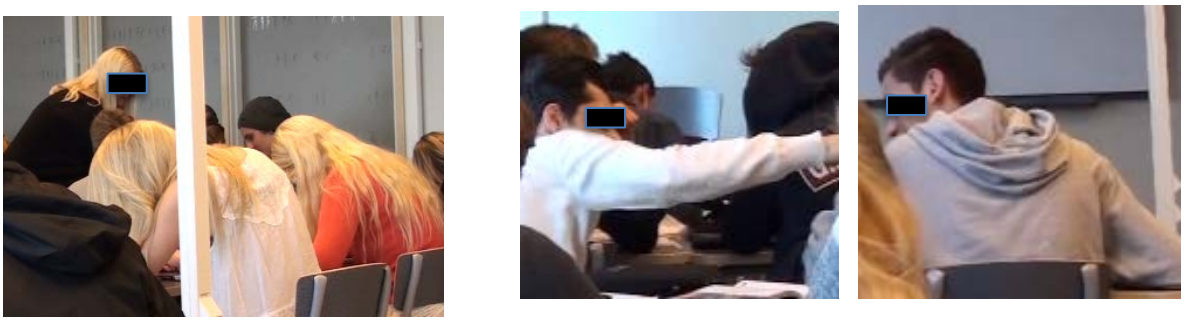

Figure 2. Individual work in English Language and Economics classrooms

A striking observation made during this part was that even if the students had laptops available on their desks, no one used them for solving the tasks. In the Economics classroom, where the teacher had prompted the students to use material available online, it turned out that the students had printed these files and brought these the print-outs to the lesson.

In the concluding part of the lessons, teaching was once again an activity that took place at the front of the classroom (see Figure 1). In this phase, the teachers in both classrooms reviewed the exercises that the students had worked on. The English Language teacher stood at the front of the classroom and read the questions from the book.

> Teacher (in English Language): OK ... be quiet ... we will finish today by going through the exercises ... so the first one (reading from the book): What did the driver say when they reached the Grand Canyon? ... John..
> John (answers in Swedish) ... eh ... I think I missed that one /*/ laugh
> Teacher: aah ... Anders?
> Anders: The weather is extremely bad.
> Teacher: That's right ... write that on exercise one ... next ... then I I'd like to finish by saying that next week you will have your assessment on this section. (from observations in the English Language classroom, 2012-11-12)

During the concluding part of the Economics lesson, the teachers solved the exercises on the whiteboard. The smartboard was used to project the task from the book (Summing up, see Figure 1).

> In this task, we are going to calculate the company's total cost ... the cost of warehousing ... then you'll know that if we're going to work out the average volume of the layer, we need to take the maximum plus the minimum and divide this by two ...(from observations of the Economics classroom, 2012-11-09)

These concluding activities in both classrooms were obviously intended to answer the students' questions and to show how the tasks in the book were to be solved. However, during this phase, the students were quiet and the teacher showed them how to solve the tasks on the board. The exam was obviously the focus. The questions concerned the content of the exam and the skill needed to pass it.

> ...and you know the test will be on the first ten chapters in the book ... any questions? (from observations from the Economics classroom, 2012-11-09)

The social structure of the lessons clearly indicated that the pedagogic discourse was strongly framed. In addition, as can be seen in the citations above, the lessons also evidenced the strong classification. Strong classification means, according to Bernstein, that the subject content, in this case Economics and English Language, is made very explicit and that the demarcation between teachers and students is clear. This 'demarcation' is reflected in the

requirements for the work that students are supposed to do, and is also made clear during teaching. Strongly classified and framed pedagogic practices are often perceived as traditional ones (Bernstein, 2000, 2003).

Based on these observations, it can be concluded that the regulative part of the pedagogical discourse, the part that shaped the form and structure of what actually went on in these classrooms, consisted of a discourse in which the classroom conversation and the use of space was similar to the most common way of organising teaching and learning in schools (Hoadley, 2006; Player-Koro, 2012a). The regulative effect of the examination on the instructional part of the pedagogic discourse can be seen in the selection of the content, and in the interactional patterns during lessons. There is no indication that the use of ICT had any impact on the way the lessons were structured. Instead, it appeared that the teachers were in control of the use of the technology. In the English Language and Economics lessons, the teacher was the only person that used the technology, and when it was used, it was as a tool for the presentation of the content of the subject. The examinations seemed to be the main structuring force of the pedagogic discourse in these two lessons, and this discourse can be characterized as strongly classified and framed. Such a discourse also had clear influence on if and how technology was used during the lessons, and this is an important finding, not least in relation to the common rhetoric about ICT as a catalyst for educational change.

The framing of the evaluative criteria was weaker in the Civics and the Swedish language lessons. This was visible when observing the activities in these classrooms. In the Civics classroom the students started their work with the report after a short introduction by the teacher. In this phase, all of the students used the laptops for seeking information, and also, for writing the report. The teacher circulated the classroom, tutoring individual students, one at a time or in groups (see Figure 3). Students were in control of the subject content and also of the use of the technology.

A well-known problem with this kind of weakly classified and framed practice was also evident in this classroom: some of the students were occupied with YouTube clips, Facebook etc., rather than with the report they were supposed to be working on (see Figure 3). This kind of pedagogic practice, where the rules for examination are more implicit, requires a higher degree of responsibility from the students, who have to be more self-directed in their learning attitude (Bernstein, 2003). On the other hand, this is also problematic for some of the students, in particular, those from non-academic homes (Bernstein, 2003; Hoadley, 2006; Whitty, 2001).

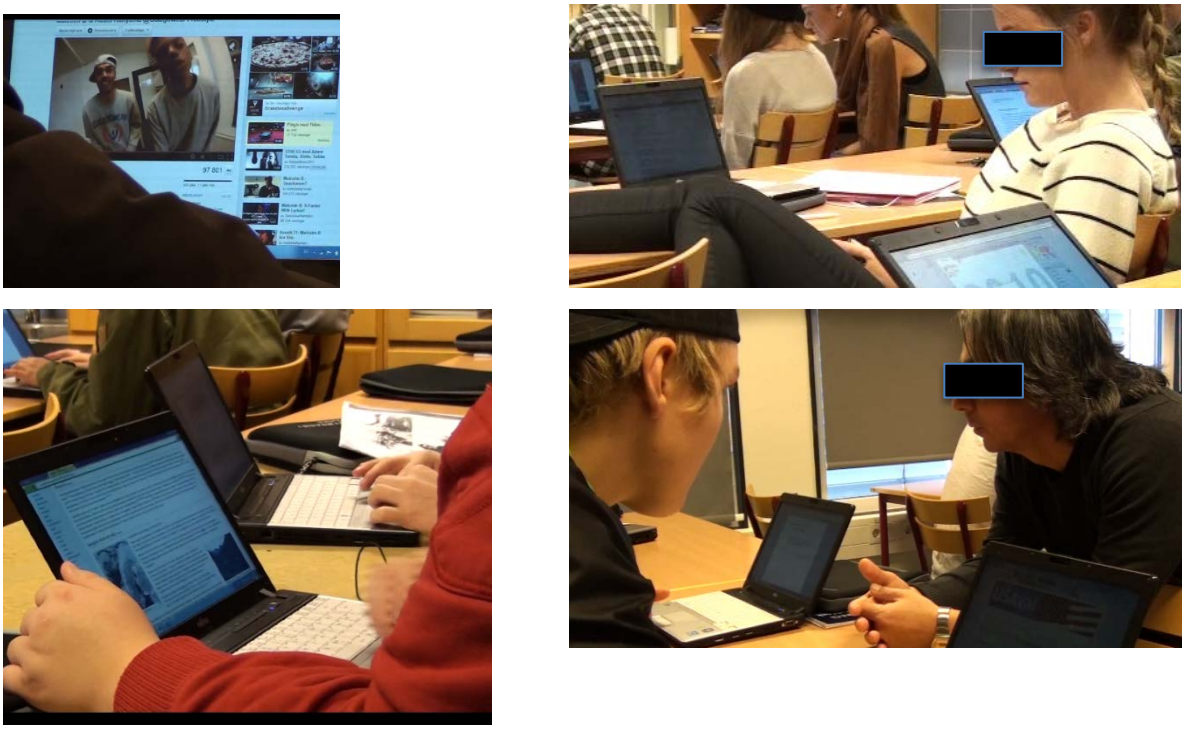

Figure 2. Work with report in Civics classroom

These findings may imply that common educational problems of, for example, social exclusion are the same with or without technology use in educational settings (Hoadley, 2006; Whitty, 2001). In fact, it seems as if the use of technology raises the same problems in a new way. The teacher in Civics also expressed this:

> ... to have this free choice is hard for some of the students ... in this case, the laptop is also problematic because it distracts them rather than helping them ... (teacher of Civics)

The Swedish Language lesson was focussed on the examination of one area in the curriculum; 'verbal instruction'. The structure of this lesson was simply that the student, or in some cases a group of students, walked to the front of the classroom, plugged in their computer, made a short presentation of their movie, starting it and returning to their desks (see Figure 4). However, due to a very tight timetable, there was no time for discussion during this lesson. This may have occurred at a later date otherwise it would be interesting to follow up on, especially in relation to the assumption of efficiency gains when technology is implemented in schools.

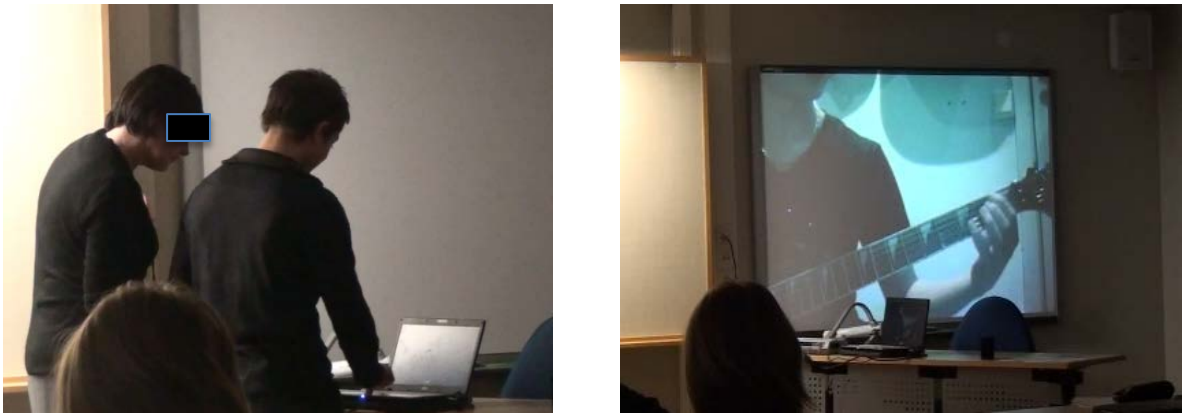

Figure 3. Presentation of instruction video in Swedish Language classroom

All of the students had made an instruction video using their mobile phones, and they had edited it with video-editing software. Even though the form and structure of this student presentation was very much in line with the form of presentations that was common in schools before digital technology was used, the content of the presentations differed. According to the teacher, the reason for this was that she and the students had focused more on the content of the instruction during their discussions about how the film would be cut. She also felt that the students had become more motivated, and this meant that the content of the instruction was more diverse and more eventful than it had been before digital media was used. Based on this difference in motivation, it appears that the pedagogical change in the form of examinations, in combination with use of new tools affected the way the students worked on their task. In other words, the digital tools used to accomplish this examination became a facilitator for the pedagogic discourse enacted during the lesson. In this case, however, the examination structure of the pedagogic discourse may imply that a change of examination procedure could be a way to bring about a change in educational practice in which the opportunities for using ICT in teaching and learning are improved. Nevertheless, the teacher was very proud and satisfied with the students' work, even though she also mentioned that this way of working was hard for some of the students (see above), and that sometimes the laptops made it harder for some students to focus the task at hand.

Some conclusions can be drawn, based on these observations.

- Examinations were the main structuring force of the pedagogic discourse in the observed classrooms.
- ICT appeared to be a facilitator of the pedagogic discourse when it is used during the observed lessons, rather than an enabler for transforming the discourse.
- ICT did not solve educational problems of social exclusion.

This study of how and why ICT was used in classrooms provided evidence that the knowledge and skills that were selected and transformed into the pedagogic discourse, and that were observable in the activities in the classrooms, emanate from the traditional discourses of teaching, learning, and evaluation. This is clearly evident by the focus on examinations, which dictates both what the subject content would be (the instructional discourse) and how this content should be structured and taught (the regulative discourse) (Bernstein, 2000).

Conclusion

The main findings from the two years of study in 1:1 schools indicated the frequent use of technology in classrooms to support teaching and learning. The methods of use can be considered as mainly traditional. Teachers are positive about the use of technology and find it useful for managing their professional work.

The detailed description and analysis of on-going education undertaken in this study was aimed to delve deeper into how a pedagogic discourse is structured when ICT is available in the classroom, and it was clearly evident that the pedagogic discourse is structured to focus on examinations. This has consequences for if and how ICT was used. If the examination takes a traditional form, in which students are supposed to complete exercises from the course book, as was the case in the English Language and the Economic classrooms, the teachers were in control over how and if technology was used. On the other hand, in the Swedish Language and in the Civics classroom, in which ICT was more or less a tool for passing the examination, the students also used ICT more frequently. Based on these findings, it can be concluded

that ICT, in this context, did not contribute to changing the pedagogic discourse; instead it seemed as though the use of technology actually functioned as a tool to facilitate the prevailing pedagogic discourse.

Another finding was that in English Language, Civics, and Economics, in which the examinations could be defined as traditional forms of post-test examinations, the pedagogic discourse about how teaching and learning had to be done was constituted by traditional discourses about teaching and learning. The fourth lesson, the Swedish Language lesson, also confirms this, but at the same time, points towards a possible way to achieve change in both the educational practice and in the instructional use of ICT, and also indicates that this change could be made through a change in how examinations are carried out.

This study also points to the fact that many things have changed in classroom practice. The personal laptop with on-line access has changed the ways student and teachers communicate. This study has provided clear evidence that learning management systems and e-mail are now routine media for communication and information in education. ICT also offered opportunities to work in new ways. The English Language, Economics, and Civics lessons demonstrated how teaching was mediated, both asynchronously and in real-time communication, via IP-telephone/video. The Swedish Language lesson was an example of how the methods of evaluations were altered thereby making possible new ways of working with and presenting assignments. These changes however, may be yet another example showing that technology expands teachers' teaching repertoire rather than changing them fundamentally (Cuban, 1986). Moreover, this study also sheds on the familiar problems, such as social exclusion, and these are critical factors in success or failure in education (Bernstein, 2003; Whitty, 2001).

Finally, it is also our hope that this study may serve as a contribution to the on-going discussion about the need for academic studies in education and technology in order to adopt a more critical approach to the study of relationships between ICT and education and the effects of the use of ICT in education (Selwyn, 2012a, 2012b; Selwyn & Oliver, 2011). In particular, about the need for researchers in educational technology to distance them from research based on the assumptions that technology is a force causing impacts on education.

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