Variations of Symbolic Power and Control in the One-to-One Computing Classroom: Swedish Teachers’ Enacted Didactical Design Decisions

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ABSTRACT

This study provides new insights into Swedish teachers’ didactical designs when handling two contemporary challenges regarding the new national curriculum and the increasing digitalisation of schools through one-to-one computing initiatives. The research questions consider how teachers organise physical and digital resources in their classrooms as well as variations in teachers’ pedagogical communication. From a study of 23 one-to-one computing classrooms (using tablets), some ethnographic-inspired methods were applied based on classroom observation and recordings of teachers’ teaching. The findings show two distinct forms of teachers’ classroom organisation that indicate different didactical designs used by teachers to integrate one-to-one computing into the classroom. Variations in teaching resulted in a shift of symbolic power and control from teachers to students, which exploit the potential of using one-to-one computing in the classroom.

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The digitalisation of schools increases each year through so-called one-to-one computing initiatives (Bocconi, Kampylis, & Punie, 2013; Zucker & Light, 2009). Sweden is not an exception, with one-to-one initiatives in almost all municipalities (Becker & Taawo, 2016). One-to-one computing has changed the physical classroom context by equipping each student and teacher with a laptop or tablet and with wireless networks (WiFi) in school buildings, and by providing students with software applications for school work (Penuel, 2006). Such large-scale digitalisation of schools is not without problems (Tallvid, 2015); for example, policymakers complain that schools have been slow to take up the use of contemporary technologies in teaching and learning (Organisation for Economic Co-operation and Development, 2015). The implementation of contemporary technologies such as laptops and tablets in Sweden has taken place at the same time as a new national curriculum was introduced in upper-secondary school and in compulsory school. To recapitulate, the former Swedish curriculum was introduced as part of the school reforms during the 1990s. Among other things, the Swedish state decentralised the school system, introduced goal steering, and shifted control over content from the state to schools, which affected teachers’ work substantially. Carlgren (1999) describes this shift as a significant turnaround in teachers’ work “from being an implementor or ‘doer’ to someone who actively constructs, invents, develops and designs the practice of schooling” (p. 50). Other researchers (Jahnke, Norqvist, & Olsson, 2014) extend the role of teachers to include further design skills, claiming that there is a need to design teaching and learning with contemporary technologies.
The new national curriculum has not only become longer (from 17 to 280 pages), it also has a different structure. The new curriculum is structured around abilities and central content. The reformed curriculum reflects greater guidance about the content students are to learn. Moreover, the introduction of a new curriculum and the increasing demands on teachers to use contemporary technologies in teaching and learning present challenges individually, and, in combination, they become even more demanding and complex. Few studies have scrutinised the changed context of the reformed Swedish curriculum and the new context of one-to-one computing in teaching and learning. To close that gap, this study uses an explorative approach to studying teachers’ teaching in the intersection of a new Swedish national curriculum, where each student has a personal tablet.

Before we address the aim and research questions, we will introduce and frame the study within didactics based on Bernstein’s sociology.

Inspired by researchers on didactics (Hudson, 2011, Meyer, 2012), in this paper we focus on teachers’ enacted didactical designs in classroom practice as the study object. In this study we build on previous research and take a step further based on the increased use of one-to-one computing in contemporary classrooms. A didactical design in one-to-one computing classrooms embraces both how teachers organise the material conditions of classrooms and teachers’ decisions in teaching, for example, in the pedagogical communication with regard to who has the right to select content in relation to the curriculum. Based on the core pieces of teachers’ design thinking regarding content, sequence, pacing, and evaluation, we found Bernstein’s (1990, 2000) theory of the material conditions of classrooms in relation to the teachers’ communication in practice to be especially suitable for analysing teachers’ didactical designs in practice. We explored diverse didactical designs by studying classroom practices, especially through classroom observations, photo documentation, and audio recording of the teachers’ communication when teaching. Thus, a didactical design in this study is based on a number of sociological characteristics ranging from arrangement of the classroom environment (e.g., arrangement of desks) to teacher-student interactions in teaching and learning situations. In this study, 23 one-to-one computing classrooms in compulsory and upper-secondary schools in Sweden became the interface for describing and analysing teachers’ didactical designs. The next section begins with an overview of how the classroom can be understood as a space. Thereafter, we describe the interplay between the classroom context and teaching practice within a theoretical framework based on Bernstein’s (2000) concepts of classification and framing.

Theoretical introduction

This paper draws on a rarely used section in Bernstein’s (1990) theory regarding the potential of the classroom space in the construction of pedagogical discourse, here understood as the construction of teachers’ didactical designs. Bernstein argues that the spatiality, in other words, the organisation of the room, enriches and extends his concept of privileging text. He wrote:

> It is important to broaden the concept of privileging “text” to include privileging spatial features. For example, in the homes of the new middle class there is often a rule which constitutes the relationship between objects and their space. There should be an inverse relation between the number of objects and the size of their containing space, and this constructs a particular privileging space. … It is because every object therein shows strong selective rules which delicately and exquisitely exemplify sensibility and distinction. Further, because there are few objects, these can enter into a whole series of different relationships with each other, and so any one set of relationships is a further demonstration of unique taste. … Thus the concept of privileging text includes the rules whereby the material context is created. (p. 175)

The above quotation implies at least two aspects of interpretation. In Bernstein’s texts, the “privileging” concept often has implications for class and the inequalities between the working class and more privileged classes (e.g., Young, 2008). In the wider interpretation, the quotation sketches out how, for example, teachers and students become privileged based on the spatiality arising from the material conditions of the classroom context in particular. The quotation was written at a time when the digitalisation of classrooms had not yet blossomed. With digitalisation in classrooms
today, researchers have identified symbolic borders that are formed when new media construct such privileging features, which show distinct acceptance of new media inside and outside school settings (e.g., Moss, 2001). In this paper, we study how the material contexts of the classroom, including contemporary technologies, internally construct teaching practices, with an aim to examining the kinds of enacted didactical designs that arise as a result of the interplay between these various privileging spatial features and the teachers’ communication. Thus, empirically, this paper contributes to an understanding of how a cohort of Swedish teachers, which was assumed to use one-to-one computing in daily teaching, designs lessons in such classroom practices. The following research questions were constructed:

- Based on various privileging features of the one-to-one computing classroom, what kind of teaching practices can be found in such classroom situations?
- How can we understand teachers’ pedagogical communication regarding variations in the structures in teachers’ teaching practice in one-to-one computing classrooms?

Before continuing with the theoretical framework, the next section presents previous research on teaching with one-to-one computing.

**Teachers’ Teaching With One-to-One Computing**

A recent literature review (Harper & Milman, 2016) identified three major themes about one-to-one computing within 46 articles between 2004 and 2014: student achievement, changes to the classroom environment, and student motivation and engagement (p. 131). Changes to the classroom environment concern students’ learning experience, differentiated instruction, constructivist teaching, and cooperative learning. Research on one-to-one computing includes studies about the use of laptops, tablets and handheld devices (Islam & Andersson, 2016). Islam and Andersson argue that the different technologies have different benefits (e.g., in creating presentations or writing text), and that it is preferable to take a flexible approach in order to avoid creating unnecessary constraints for teachers and students. Previous research indicates that teachers use one-to-one computing in several subjects, including mathematics, science, language, and arts (e.g., Lei & Zhao, 2008), and that one-to-one computing enriches the learning experience. An increasing number of studies have noted that teaching and learning with one-to-one computing can entail some aspects of unpredictability. Such aspects were discussed when control was shifted from teacher to student (Tallvid, 2015). A suggested approach for handling unpredictability was found in the term “learning expeditions” (Jahnke et al., 2014). A learning expedition indicates an emphasis on a planned and organised adventure. Such teaching approaches aim to make students producers of content, encourage the use of diverse sources of content, and build a collegial teacher-student relationship. When using such or similar methods, earlier Swedish classroom research report that not only teachers, but students too, become designers (Kjällander, 2011). Other studies, which do not comment on teachers’ control explicitly, argue that one-to-one computing can be used to increase collaboration among students and to extend the learning environment beyond the school building (Falloon, 2015). A great amount of research reports on students’ use of one-to-one computing to design and produce material, for example by creating videos (e.g., Pegrum, Oakley, & Faulkner, 2013). One challenge for teachers is the current differentiation in classrooms among students where one-to-one computing supports teachers’ work to promote equitable learning experiences for all students (Milman, Carlson-Bancroft, & Vanden Boogart, 2014). Further, critical studies have problematised the techno-centric discourse implying that one-to-one computing will solve problems in school (Player-Koro & Tallvid, 2015). The researchers found that teachers’ teaching did not change, confirming what other studies focusing on classrooms without one-to-one computing found, that the assessment system has a great impact on teachers’ teaching. Based on the studies presented above, this study goes back to what we and other researchers
(Bernstein, 1990, 2000) consider to be core pieces in teacher work, that is, how teachers organise the classroom environment and their teaching practice.

Theoretical framework

As indicated in the introduction, Bernstein’s sociology contributes with analytical concepts, such as privileging texts, to the investigation of the complexity of contemporary classrooms. However, a distinction used in this article concerns that between “privileged and privileging” (Bernstein, 1990, p. 15). These concepts are further described below since they are part of two other concepts in Bernstein’s conceptual machinery: classification and framing.

The concept of classification: privileging features

The concept of classification is used to operationalise the privileging features of the classroom. The classroom concept is broken down to a micro perspective of its spatiality based on the features that are constructed by the relation between objects (Bernstein, 1990, p. 176), so-called privileging features. “Privileging” refers back to the individuals or groups that possesses the symbolic power. The symbolic power is understood as the selected meanings constructed in the relation between categories. Categories could include, for example, things in the classroom such as desks and textbooks. On a relative scale, the concept of classification informs us whether the relationship between categories is strong or weak. Strong classification indicates clear borders between categories, while weak classification indicates blurred borders between categories. Consider, for example, past practices of organising computers in schools into computer labs, separated from the classrooms. The computer lab and the classroom are two contexts that are sufficiently specialised based on specialised equipment. It is such specialisation that separates and distinguishes categories. Thus, the separation between computer labs and classrooms indicates strong classification between the contexts, thereby limiting the possibility for teachers to use computers in teaching and learning. Such limitations indicate an aspect of the constructed meanings, which privileges teachers and students through the concept of power. In contrast, one-to-one computing integrates tablets or laptops into the classroom context and thereby changes the symbolic relationship between the computing devices and the classroom. Such change is understood as blurring the symbolic borders, which indicates weak classification. The integrative aspect indicates the constructed meaning through the power conferred upon teachers and students. The analysis of the relationship between physical and digital objects reveals privileging features in teachers’ didactical designs. The privileging features underpin the next section, which discusses who becomes “privileged” in practice.

The concept of framing: privileged teachers and students

The concept of framing is used to operationalise daily teaching and learning practices (Bernstein, 1990), in other words the teaching and learning practices of “privileged” teachers and students. Framing illustrates the principle of who controls what mirrored through the pedagogical communication in the teacher-student relationship about, for example, whether it is the teacher or the students who have the right to select content (Bernstein, 1990). The principle of control conveys information about the characteristics in the pedagogical communication. Such communication is based on a set of conceptual tools for fine-grained analysis involving the concepts of selection, sequence, pacing, and evaluation. These four concepts are distinguishing values of framing, which indicates the locus of control. Further, to identify the extent to which discussions and reasoning are allowed in the teacher-student and student-student relation, relative values of framing have been used. Strong values indicate strong teacher control. In contrast, weak framing indicates a shift of control from the teacher to the students. The analysis of framing contributes to the analysis for understanding who controls what during teaching and learning in relation to the social organisation of the classroom space.
Methodology

In this paper, didactical design of teaching and learning in one-to-one computing classrooms is considered an emergent topic in classroom research. An in-depth study was conducted by applying a theory oriented approach in the analysis of the material (Boyatzis, 1998). Since this study generally focuses on teachers’ teaching with one-to-one computing and the new curriculum, some ethnographic methods were applied, in particular, classroom observations with audio recordings of teachers’ detailed communication, photos, and field notes.

Selection and sampling

This research project uses a qualitative research methodology. The qualitative method was used to explore the teachers’ designs in Swedish compulsory school classrooms. Applying a purposeful sampling (Patton, 1990), schools were selected where teachers and students had been using tablets longer than six months, preferably within a one-to-one computing programme. Regarding software applications, four out of five municipalities in the study provide a central cloud computing application with the use of Google Apps for Education. When selecting teachers, the focus was on teachers who were among the earliest (Rogers, 2003) to start teaching with one-to-one computing. It was the headmasters of the schools who selected and invited teachers to participate in the research. In total, we studied 23 classrooms in five municipalities in Sweden, specifically grades 2, 3, 5, 6, 7, 8, 9, 10, and 11 during the 2014/2015 school year. The researchers did not intervene in the teachers’ teaching; the objective was simply to visit and observe the teachers in their daily classroom teaching. In 13 lessons, teaching was based on thematic studies across several lessons. Teachers were observed either starting up the thematic studies, teaching in the middle of the thematic studies, or finishing up the thematic studies. The other 10 lessons focused on a specific topic just for the observed lesson. Within this latter group, some lessons could be based on one activity while other lessons could contain several activities. At the outset, teachers, students, and parents agreed on a statement of research ethics based on beneficence, non-malfeasance, informed consent, and confidentiality/anonymity (Swedish Research Council, 2011). Before the classroom observations started, the teachers in a few of the classrooms informed us about students whose guardians would not allow them to participate. We were very careful to avoid including these students in photos. Regarding the teachers’ participation, we asked the teachers about their participation since they had not volunteered to participate but had been selected by the headmasters. Here we cannot underestimate the headmasters’ power in case where teachers may have been reluctant to participate.

Classroom observations

The classroom observations were considered to be an interface to teachers’ enacted didactical designs. The empirical material is based on three sources: (1) At least two observers collected the empirical material. Individually, each observer took field notes and conducted informal discussions; (2) The observers documented classroom activities with photos and time indications when things happened; (3) Audio recordings were made to capture the teachers’ communication in detail. We began making these recordings after we had completed the first eight observations, realizing that we needed a more detailed record of the teachers’ oral communication. The decision to attach a microphone to a teacher’s collar or lapel highlights certain methodological and ethical considerations. The microphone could create an awareness of being recorded, potentially restricting what is said while teaching. On the other hand, audio recordings make it possible for observers to more closely follow and observe the whole classroom situation instead of focusing mainly on the teacher. The digital recordings of the teachers’ communication were transcribed literally. The empirical material was compiled, as closely as possible to the observation, into detailed descriptions described as narrative, describing, analysing, and interpreted. The lessons lasted for 30–60 minutes. The
subjects ranged from native language, mathematics, biology, chemistry, English, Spanish and social studies to sports. The class sizes ranged from 11 to 28 students.

**Coding**

A theory oriented coding scheme was developed based on Bernstein’s (2000) theoretical concepts of classification and framing and inspired by an instrument that had previously been developed by a group of Portuguese researchers (Neves, Morais, & Afonso, 2004). The previous instrument was developed in contexts without one-to-one computing. The researchers used the instrument to characterise teachers’ teaching from Bernstein’s concepts of classification and framing. In the analysis of the privileging features, regarding the preconditions for communication and interaction, the relations between objects in the classroom spaces were interpreted based on photos, field notes, and recordings. The analysis of classification was interpreted on a two-point scale as either strong (C+) or weak (C-). In total, we analysed seven categories of “relations between”: between desks, between the teacher’s space and the students’ space, between learning resources and tablets, between the selection of software applications (apps), between teacher and student, between student and student, and between the classroom and other facilities. The results from the classification analysis made it possible to differentiate different classroom practices. In the next step, the analysis of the one-to-one computing classroom practices, with regard to who controls what, was interpreted based on data from audio recordings and field notes. The material was coded from the concepts of framing related to six categories: selection, sequence, pacing, evaluation, teacher-student relationship, and student-student relationship. The categories were coded on a four-point scale from very strong to very weak framing (F++, F+, F-, F--). Table 1 shows one extract of one of the six categories: the category selection of content. The rich empirical material demonstrated nuances and overlaps, indicating a need for a more fine-grained coding.

The empirical material can be divided into two categories: data collected before and data collected after we started making digital recordings of the teacher communication. The first author initially conducted an independent blind coding procedure of the first eight classroom observations done without digital recordings. The coding procedure followed the six framing categories and the material was coded according to the four-point scale described above. In the next step, the second author coded the material and an inter-rater calculation was conducted to estimate the agreement of the coding between the two researchers. The coding matched to 80% in the categories selection, sequence, pacing, and evaluation. In the categories teacher-student relationship and student-student relationship, the coding matched to 71%. Based on the inter-rater calculation we decided to start recording the teachers’ communication for richer data. Working together, the first and second authors coded the next 15 classroom observations. The empirical material was based on detailed

| Table 1. Extract of one framing category. |
|------------------------------------------|
| **Indicator** | **F++** | **F+** | **F-** | **F--** |
| Selection of content | Teachers provide a fixed frame of mandatory content for the students | Teachers provide a fixed frame of mandatory content for the students, accepting students’ suggestions | Teachers provide different content to choose from without referring to priorities and ask students to make selection | Teachers ask students to suggest a selection (of content) |

F++ ID02 (F^2): “I asked two girls what the assignment is. They said, ‘To write about the parties, their leaders, what the party says about schools and those kinds of issues.’”

F+ ID30 (F^2): “One boy sits with a 3D figure of a castle, which he has not yet sent in for assessment.”

F- ID04 (F^-): “The class have had a day out in nature to study. Exploring what kinds of animals and plants they can find around a swamp. They took pictures of insects and plants with the purpose of looking them up in the classroom later.”

F-- ID20 “You can now choose what you want.”

Source: Derived from Neves et al. (2004).
descriptions containing digital recordings of the teachers’ communication, researchers’ field notes with time markers, photos, and short video recordings.

**Results**

In the presentation of the empirical material, an attempt was made to illustrate the interplay between privileging features of the classroom space and the teachers’ teaching; a typology was created with that in mind. In order to illustrate the different nuances, quantitative data illustrate the degree to which teachers organised both furniture and digital resources, while the qualitative aspects of the teachers’ communication and actions are made evident via frequent quotations from the recordings and the field notes. The quadrants in Figure 1 are derived from Bernstein’s theory of privileging features and teachers’ communication by using the concepts of classification and framing. Each quadrant demonstrates theory-supported discrimination of the 23 one-to-one computing classrooms’ practices based on data from audio recordings, field notes, and photos. None of the classrooms indicate characteristics of the Quadrant I. The other three quadrants outline two distinct teaching practices based on how the physical as well as digital resources and objects in the classrooms are organised. To make contrastive signs and nuances in the didactical designs visual, the results are presented in two sections. The first section presents characteristics coded to classrooms in the Quadrant I in Figure 1 based on separation between categories. The second section presents characteristics coded to classrooms in Quadrants III and IV in Figure 1 based on integration between categories. Each section is followed by presentations of the teaching practices.

**Didactical Designs Privileging Teachers’ Symbolic Power and Control**

In Figure 1, based on privileging features in the relationship between categories (desks, spaces, learning resources-tablets, apps, teacher-student, student-student, classroom-other facilities), Quadrant I
demonstrates the constructed meanings in 9 of the 23 one-to-one computing classrooms. This section focuses on the privileging features and teaching practices of these nine classrooms.

**Privileging teachers’ symbolic power**

The nine classrooms demonstrated a majority (four or more of the seven categories) of clear boundaries between categories, which indicated privileging features of teachers’ symbolic power. Photos and quotations were used to illustrate these symbolic power relations between categories in the one-to-one computing classroom.

Figure 2 indicates signs of privileging features based on clear boundaries (strong classification) in the relationship between categories: between teachers’ space and students’ space, between desks, between students, between the classroom and the corridor, and between tablets and other resources. All teachers \((n = 9)\) organised their space around the teacher’s desk, which indicates clear boundaries and teacher-student separation. A majority of the teachers \((n = 8)\) demonstrated the principle of separating students by organising desks into pairs in straight lines and by not involving students in group activities \((n = 5)\). Another aspect of separation was indicated in the relationship between the classroom and other facilities, when students did not study outside the classroom. Further, Figure 2 shows no tablets on the students’ desk. Two teachers indicated clear boundaries between tablets and other resources by keeping them in separate cabinets, as indicated in the quotation below:

“Okay, go get your iPads.” The students run to the locked cabinet in the front right corner of the classroom. The teacher starts to talk again and says, “in your English folder [on Google Drive].” The teacher draws on the whiteboard which folder the students should use on Drive and says, “you there, you make a new document with a nice name 15:6b.” The teacher responds to a student and says, “yes your English folder, new document.” The teacher responds to another student “yes and name it.” (Audio recording and field notes, 150326)

The above quotation illustrates clear boundaries between tablets and other resources and between teachers and students. Shifting from writing in the exercise book to writing on a flat page on screen in Google Drive indicated strong borders between the exercise book and tablets. Clear borders were indicated in the teacher-student relationship with all of the teachers \((n = 9)\) giving specific instructions to students both regarding which software applications to use, and also communicating verbally using a detailed language of regulation, which led to students asking detailed questions.

**Teachers in control**

The above section demonstrated privileging features based on constructed meanings of teachers’ symbolic power. In this section, and in line with the first research question, we further describe what kind of teaching practices can be found in the Quadrant I classroom contexts by reporting
on who controls what. The issue of control was highlighted through the framing categories selection, sequence, pacing, and evaluation, and in the hierarchy within teacher-student and student-student relationships. In general, selection and sequence were strongly guided by predefined teaching materials, whether in a textbook, an e-book, or a template. In the hierarchical teacher-student relationship, limited possibilities for discussions and reasoning were offered; the communication indicated strong teacher control. For example, one teacher who taught 28 grade 2 students about the commutative rule in mathematics asked the students to work in pairs on the tablets. The students documented their work with the camera and the app Bookcreator:

The teacher says, “The first page in the book [you create on the iPad], not the front page but the first page you add a photo. You need to write the numbers, whether it is 2×5 or 7×2, or whatever numbers you wish to use. Then, you add a third page and you change places of the numbers, here you had 2×5, what is it then?” [Quiet 4–5 seconds] No one replies. The teacher repeats, “2×5, what is it then?” Some pupils reply 5×2, and the teacher repeats “5×2”. The teacher adds, “and then you draw, build or whatever you decide, take a photo and write down the numbers.” (Field recording 151117)

The above quotation illustrates both the characteristics of the hierarchy within the teacher-student relationship and the sequence in which the content is to be learned. The teacher allows minor control, where students can select multiplication between three numbers (2, 5, and 10). Otherwise, no exceptions are allowed. Further, the teachers strongly controlled the order in which content was to be learned. Moreover, one-to-one computing affected pacing through use of the so-called “Flipped classroom.” The Flips, or recorded introductions, were used by two teachers in upper-secondary school to free up whole-class lecturing time and to adapt to students’ control over pacing, as the following quotation illustrates: “Two boys at the back on the left side watch the videos provided by the teacher on the iPads. They study different Flips since they are not working in the same section of the textbook” (Field note 141124). Such designs indicate the need to adapt teachers’ control to flexible pacing. However, among these teachers the evaluation criterion indicates diversity from explicit to implicit communication about criteria.

**Didactical designs privileging a shift of power from teachers to students**

In Figure 1, based on privileging features in the relationship between categories, Quadrants III and IV demonstrate constructed meanings in 14 of 23 one-to-one computing classrooms. This section focuses on these 14 classrooms, first by presenting privileging features and thereafter the teaching practices.

**Privileging a shift of symbolic power from teachers to students**

The 14 classrooms are based on a majority (four or five categories) of blurred boundaries (weak classification) between categories, indicating a shift of power from teachers to students. Both photos and quotations were used to illustrate the emphasis and nuances of the shift of symbolic power.

As indicated in Figure 3, signs of shifting power from teachers to students were common to all teachers in three categories that indicated blurred boundaries between the symbolic borders. First, all teachers (n = 14) demonstrated an approach of grouping students by organising desks either in groups or in a horseshoe formation. Second, in the relationship between resources, neither textbooks and templates nor the tablets were more or less dominant than the other. Third, Figure 3 demonstrates how students edited a recorded video. Video editing indicates privileging features of integrating tablets based on blurred boundaries by not distinguishing between subject apps and generic apps. Further, some teachers allowed students to select apps, which indicated blurred boundaries in the teacher-student relationship. For example, in grade 5 mathematics, where the students were working with fractions, on a problem about how to share a cake, the teacher was asked a question: “One student asks if they are allowed to make a drawing in Sketchbook. The teacher says ‘oh yes, use Sketchbook as much as you like.’” (Audio recording 150327). This short quotation hints at the tone of regulation and discussion in the teacher-student relationship. Some teachers (n = 5) allowed
students to use the facilities outside the classroom, indicating blurred boundaries between the classroom and other facilities. A few \((n = 3)\) teachers did not use a teacher’s desk, indicating blurred boundaries when the teachers sat among the students.

**Increased student control**

The above section demonstrated privileging features based on constructed meanings that shifted symbolic power from the teachers to the students. In this section, and in line with the first research question, we further describe the kind of teaching practices that can be found in Quadrants III and IV classroom contexts by reporting on *who controls what*. The pedagogical practice derived from the teaching of 14 teachers covered in Quadrants III and IV indicates aspects of dislocation of control from teachers to students. However, a particular complexity emerged in 11 of 14 classrooms based on an emerging duality indicating both strong teacher control and parallel shifting of control to the students. In Figure 1, Quadrants III and IV illustrate such duality with two colours: black for teachers’ control and grey for shifting the control from teachers to students. In particular, the duality emerged especially in the category selection and to some extent in the sequence category. The next paragraphs focus on such teaching practices.

As shown in Quadrant IV in Figure 1, the strong teacher control reflected the priorities of the national curriculum. For example, one teacher taught sports to 24 grade 7 students. In the category selection of content, students were asked to conduct motion analysis. In sports, the national curriculum guides teachers to design activities in which students, among other things, study words and concepts for different physical activities. This is to teach them to plan, carry through, and evaluate different motion activities. In a series of three lessons, students were expected to be able to describe and analyse motions. In the observed second lesson in the series, the teacher started by gathering the students in a circle around him. The teacher introduced the task and the role of one-to-one computing, saying:

*We are working with motion analysis. Here, you shall make a video for being able to watch yourself. The video should be used for self-assessment and you should be able to assess whether it was good quality or bad quality. So, what was good in my somersault and what was bad? To do this you use the Hudl [technique] app because in*
Then the teacher asked one student to help him demonstrate and explain the criteria for students’ motion analysis as described below:

The teacher says, “If you watch the somersault” [a student does a somersault], the teacher asks the class, “was that balance?” [Criterion] The teacher comments further, “Yes, she didn’t need to take any steps, and the motion was in a straight line. Now you can say, okay, the balance was good.” The teacher continues with the next criterion. The teacher says, “Next then [criterion,] did you observe any sharp or soft motions?” (Field recording 151203)

The above teacher-student communication indicates that the students’ criteria for evaluation become the content of the lesson. Further, the quotation hints at a blurred hierarchical teacher-student relationship when the teacher invites the students to participate by asking their opinion, indicating signs of a shift of control from the teacher to the students. To make the motion analysis, the students worked in groups and used the tablet to make videos as they practised four types of motion. In Bernstein’s category selection of content, two motions (e.g., somersault) were mandatory and students were free to choose and assess two other motions. The teachers’ design, based on students’ freedom to select content and to decide the sequence, indicates a shift of control from teacher to student. In the above example, when students produced the object for analysis, a video recording, they used tablets and the software application Hudl technique. The students produced videos on the tablets, which became a platform for teacher-student interaction. For example, on one occasion the teacher studied one student’s video and communicated explicitly about the students evaluation criterion “balance”, saying:

“First we study your video at normal speed.” The teacher starts the video on the iPad. The teacher says, “Look here, do you rotate forwards?” The student says, “Yes.” The teacher continues, “Okay, then we’ll study the video by focusing on the point of balance. The concept of balance indicates whether you fall in any direction. Do you do that?” [Field recording 151204]

However, implicit criteria for the category evaluation were found in 10 of 14 teachers’ communication, but one group of five teachers indicated such an emphasis more frequently. The style of pacing illustrated in the above example was indicated in 12 of 14 classes. These teachers had designed teaching and learning with a single theme running through several lessons. Such designs indicate pacing that is based on the students’ progress. The teachers’ communication about the amount of time left in relation to the students’ performance was frequently observed. Especially when the students were approaching a deadline for submitting their work for assessment, a certain characteristic of teachers’ communication with students, pressing them to finish the work, was frequently noticed. For example, one teacher of a grade 9 class in arts said, “Anna, you need to choose one of the drawings you feel most satisfied with. Do you agree? You have to carry on with that one.”

Discussion

Swedish teachers face challenges from both the new national curriculum and increasing demands stemming from the heavy investments by municipalities in one-to-one computing programmes. The former curriculum created a new role for teachers, as designers (Carlgren, 1999), and the recent implementation of one-to-one computing extends such a teacher role to include the design of teaching plans that incorporate students’ tablets (Jahnke et al., 2014). The new curriculum that was implemented in 2011 changes teachers’ work by placing stronger regulations on the content students are to learn. The classroom observations we made indicate that a majority of the teachers selected for this study, to various extents, had integrated one-to-one computing into their teaching practice, and the classroom observations also indicate signs of how the teachers were using the new Swedish curriculum. Other studies have raised the innovative potential of one-to-one computing (Bocconi et al., 2013), but few studies have, so far in the Swedish context, studied the interplay between the one-to-
one computing classrooms’ privileging features and their associated teaching practice. The use of a theory-driven typology provides discriminating affordances of the empirical material that illustrate different teaching practices and variations within them. The results presented in Figure 1 illustrate how two sets of classrooms could be distinguished. Thus, from this analysis it emerges that the seven privileging features and the six framing categories together construct something more than what each category contributes individually. The sum of all parts can be illustrated as practices on a continuum varying from struggling to innovative.

In metaphorical expressions, Bernstein (1990) painted the relationship between objects in a room that genuinely need to be considered relational. This is because all the different relations between the things in a room construct its unique meaning. The meanings apparent in this study are more than just the implementation of a programme that provides one tablet to each student. It is about, what we consider, design elements of didactics, such as the privileging features of organising the physical room and the framing categories for describing who controls what in teachers’ communication.

Figure 1 shows contrasts between teachers in Quadrant I and in Quadrants III and IV. The latter group of teachers arranged their classrooms in ways that in fact reduced the extent of teachers’ symbolic power. Teachers in Quadrant I seemed, to a greater extent, to be guided by textbooks and sometimes by what we understood as strong symbolic borders that originate from the subject disciplines. For example, for some teachers we noticed difficulties in thinking “outside the box” by merely replicating textbooks in the one-to-one computing environment. The use of generic apps (e.g., Hudl technique, iMovie) and the activities such apps afford became something unthinkable. In general terms, it is plausible to believe that such designs strengthen and repeat previous traditions since the symbolic borders of the subject are not challenged. In Figure 1, Quadrant I illustrates much of what we recognise as traditional teaching based on privileging features that enhance teachers’ symbolic power and control. Interestingly, Quadrants III and IV bring contrastive didactical designs to the foreground. These practices also include strong teacher control, but the diverse nuances in the categories selection, sequence, pacing, and evaluation also indicate shifts of symbolic power and control from the teacher to the students. Harper and Milman (2016) address similar signs as changes in the students learning experience.

The variations in the teachers’ pedagogical communication, illustrated through Bernstein’s theory, provide a complex set of relationships between the framing categories. For example, when teachers design teaching they decide on the extent to which students should be part of the decision-making (Quadrants III and IV). On the other hand, we observed that the new national curriculum strongly frames the content. This was especially evident in classrooms where teachers did not use textbooks as the main source of content. As illustrated in the results, these teachers provided a theme anchored in the curriculum. When some of the control was distributed to the students, these designs can possibly describe the nature of teaching as a planned and organised adventure (Jahnke et al., 2014) that contains unpredictability aspects (Tallvid, 2015) and students as producers (Kjällander, 2011, Pegrum et al., 2013). Further, Islam and Andersson (2016) argue that different technologies have different benefits. In this paper, the tablet plays an important role since it opens up to an array of content such as YouTube videos and possibilities, as in sports, for students to be active in analysing their own progress. The complexity in such classes emerges when the different power and control categories interplay. However, the enacted didactical designs show signs of students as producers of content underpinned by the principle of integration, which was noticed in the teachers’ arrangement of furniture, the use of other facilities in the school and the integration of tablets. The enacted designs demonstrate greater student control, especially in the categories of selection and sequence of content, with students making decisions. Such didactical designs shift control from teachers to students, but teachers’ control is also evident in their work of meeting the standards of the national curriculum criteria. We were struck by how the teachers used the expressions and formulations from the national curriculum in the students’ assignments.

Other design aspects concern the relationship between the framing categories evaluation and pacing. Even if pacing is always present in the duration of a lesson, a particular emphasis on pacing
was frequently observed in some classrooms, where efforts were spent on organising teaching and learning within the time frames. The drawback of such designs is that discussions about the content are limited. Designs that are more extensively involved with the framing category evaluation showed more frequent discussions about the content students were to acquire. Nuances of the evaluative aspects become a delicate problem because implicit communication could be justified by teachers’ desire for students to find the right or wrong answer by themselves or with peers. Previous studies about the teaching practice in one-to-one computing classrooms indicated the role of the evaluation systems on teachers’ teaching (e.g., Player-Koro & Tallvid, 2015). The classroom observations in this study indicate no particular emphasis on the framing category evaluation. Instead, the differences between the coded categories illuminated whether teachers had dislocated some of the symbolic power and control to the students, which was observed in teachers’ daily one-to-one computing practice. The contrast between the quadrants in Figure 1 highlights a complex set of relations both with regard to the classroom space and the teachers’ practice, but, at the end of the day, the shift of power and control probably highlights deeper questions about teachers’ beliefs and what knowledge is in today’s school and society.

Limitations

A methodological concern is the selection of teachers. First, the use of Rogers’ (2003) categorisation of teachers who were among the earliest to start using one-to-one computing in teaching reflects the normativity and relativity that are built into the terminology by labelling them as early adopters. Such categorisation is related to what the headmaster knows about teaching with one-to-one computing if a teacher is categorised as early or late to take up one-to-one computing. Further, some headmasters’ style is more that of administrative leaders rather than pedagogical leaders, which probably influenced the selection of participants. In a few exceptions, selections were based on students’ recommendations of teachers who frequently applied one-to-one computing. To increase the depth of the analysis, an analysis of the symbolic borders between the subject disciplines would be an alternative. We did not do that, but other studies have focused on that issue. It needs to be taken into consideration that in 8 of 23 classrooms, digital recordings are missing and, for those, the analysis is mainly based on field notes and photos. We assume that we could have had richer data and richer nuances for making our claims in those classrooms. It is hard to judge whether such data would have moved them into another quadrant. Another issue concerns the theory-driven approach for analysis. Such an approach probably has drawbacks in that we likely missed things we would have noticed if a data-driven approach had been applied.

Conclusion

The key findings from this study lead to increased understanding of the challenges teachers encounter from municipalities’ investments in one-to-one computing technologies. With support from Bernstein’s theoretical framework of constructed meanings and the concepts of symbolic power and control, this study made visible great differences in the teachers’ didactical designs in the one-to-one computing classrooms. For teachers who dislocated symbolic power and control to the students, it is not merely a matter of adopting one-to-one computing; it involves how they organise the whole classroom space, where one-to-one computing is one design element among others. The teachers who integrated the potential of the tablets, used formulations and expressions from the new national curriculum as a frame for their didactical designs. One plausible explanation is that since some teachers were not using textbooks to hold on to power and control, the unpredictability of students’ learning paths had increased based on the variation of symbolic power and control to the students. In such situations, the curriculum plays a crucial role regarding the selection of content that frame teachers’ didactical designs. We hope this study can support schools’ work with the integration of both one-to-one computing and the new curriculum by focusing on the different
meanings that make it possibilities to construct different didactical designs. In the next stage of the research project, we will go deeper into the teachers’ narratives about their motives for designing teaching and learning in one-to-one computing classrooms.

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