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Teachers' initiating change in practice due to variation of progression of didactical time

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This study aims at identifying situations where time can act as a condition for change in teacher practice. A design based research methodology was applied and teachers were offered help designing mathematics tasks they would want to use in the classroom. All the discussions from this collaboration were analysed using timescales as analytical categories as described by Assude (2005). The findings show that in a diverse class, the difference in learning pace between students can condition change in the teachers practice.

Keywords: Teacher practice, change, diversity, time.

INTRODUCTION

This research report emerges from a PhD-study on teachers' perception of what makes a 'good' task in vocational school mathematics lessons. I have worked closely with different teachers over a school year designing tasks they would want to use in the classroom in order to learn more about the teachers' preferences for mathematics tasks. One of the concepts emerging from my research is 'time', and this paper focuses on how time can be a condition, i.e., a prerequisite, for change.

Time is a recurrent issue for many teachers, and time pressure is a real day-to-day classroom experience which teachers have to live with (Assude, 2005; Jordfald, Nyen, & Seip, 2009; Leong & Chick, 2011). Time can serve as an obstacle when implementing new reforms (Keiser & Lambdin, 1996), integrating new technology (Assude, 2005) and probing understanding through whole-class discussions (Black, 2004). A teacher might also make didactical choices in the classroom based on time triggers (Leong & Chick, 2011), and avoid lesson preparations that are too time demanding (Goodchild, Fuglestad, & Jaworski, 2013).

As a summary, lack of time is often seen as an obstacle for change in teachers' practices.

In my research I have noticed that time is an issue that surfaces often in the conversations with the teachers, but not always negatively. This triggered my interest to explore the data using time as an analytical category. The research question addressed in this paper is: *When can time be a condition for change in teacher practice?*

I will, in the following, present my theoretical framework of timescales before I give a brief summary of the political ideas behind the Norwegian educational system. With this as a background, I present my methodology followed by results before I round off with a discussion of the results.

THEORETICAL FRAMEWORK

In this paper, I will look at how time is viewed by the teacher, and how time can be seen as a condition for change by the teacher. In order to do this, I need to identify different categories of experienced time. Lemke (2000) argues that all human activity takes place on at least one timescale and in complex systems more than one timescales. For instance, an utterance of a single word can be viewed as a timescale even if it takes less than a second to articulate. Also one school lesson or a year curriculum can be viewed as timescales. Every process that stretches out over time can be viewed as a timescale. In my work I study how time can be a condition for change and, given that change is a process, it will be helpful to identify timescales for analyzing my material. With the help of timescales it is possible to identify at which point time is a condition for change.

Assude (2005) describes three theoretical timescales, and I will present and use the same timescales with a

slight modification. The three timescales are didactic time, time capital and the pace of a course. The concept of *didactic time* is related to the work of Chevallard, and is defined as “related to scheduling the teaching of some knowledge” (Assude, 2005, p. 185). However, Assude (2005) also makes the claim that: “Didactic time is used as a gauge of the advancement of knowledge, and, in this sense, it’s a framework, which regulates the activity of the teacher” (Assude, 2005, p. 185). This last quote is referring to learning (advancement of knowledge) and not only the scheduling of teaching. As I see it, the concept of didactic time might be used as referring to a teacher’s scheduling of some knowledge for a whole class of students, or the concept might be related to the scheduling of teaching with respect to individual students’ learning. I will in my analysis use both of these interpretations of didactic time.

The second concept which Assude (2005) identifies is *time capital*. This refers to the ‘objective’ time available for classroom work, for example, the lesson is 45 minutes long. The third concept Assude (2005) applies is *the pace* of a course or a part of it, which is viewed as how didactical time is advancing with respect to time capital. This is demonstrated by showing different linear graphs of how courses can be fast-paced, moderate-paced or slow-paced. This last concept might be viewed slightly different in many Norwegian classrooms, and I will give some information of the Norwegian educational system to demonstrate this.

THE NORWEGIAN EDUCATIONAL SYSTEM

Education for all and equality are important concepts in the Norwegian educational policy across political party lines, with a goal to reduce social inequality. (Markussen, Frøseth, & Sandberg, 2011) In the Norwegian educational system we also have “the comprehensive school” as an important political concept (Department of Education and Training, 2006–2007). We do not have special needs schools in Norway, and every pupil is entitled to be in a normal classroom. As a result, a typical class in Norway will have children with high and low achievers, different diagnoses and handicaps. The Education Act (1998) specifies: “Education shall be adapted to the abilities and aptitudes of the individual pupil, apprentice and training candidate” (§1–3). All pupils are entitled by law to get adapted teaching according to their abilities, and this is the teacher’s responsibility.

The political concept of the comprehensive school has also influenced upper secondary school, and since 1994 every teenager has a statutory right of secondary schooling regardless of abilities and academic results. As a consequence, near to every teenager is now starting upper secondary school and many of the low achieving students apply for the vocational programs (Department of Education and Training, 2006–2007). The Education Act also applies to upper secondary school, and adapted teaching is a requirement for all the courses in the vocational programs. As a result, many teachers take it personally when their pupils fail subjects or quit secondary school. They have as a goal to give adapted teaching to all of their pupils, but the classes are diverse and the pace of a course can be viewed quite different from student to student. It is therefore difficult to make a general claim about the course being slow-paced, moderate-paced or fast-paced.

Norway is a country where accountability systems have never been approved for use in the education sector, even if there are some accountability devices in local quality-assurance systems (Christophersen, Elstad, & Turmo, 2010). Still, the Norwegian Prime Minister said in a speech in 2008 that “Teachers should have a clear responsibility for what students learn in school” (Christophersen et al., 2010, p. 2). It has not been made clear how a Norwegian teacher can be made accountable for students’ learning and Christophersen and colleagues (2010) argue that this is not possible. The Prime Minister’s speech might indicate a political shift when it comes to accountability in the future, but as of today the main focus in Norwegian schools are still on adapted teaching and not on the pupils’ test results.

In this paper, I focus on two teachers working at an upper secondary vocational school in Norway, which is a school with diversity and where adapted teaching is mandatory (the Education Act, 1998). Both of the teachers reported in this paper, have read and approved of the paper before it was submitted for the conference. I will, in the following, show how an analysis of the advancement of different timescales previously identified can act as condition for change.

METHODOLOGY

In the PhD-project I was collaborating with four teachers; however only two of them are considered

in this paper. The reason is that the initial analysis revealed that the concept of time was much more seldom mentioned by two of them, in addition these two are working at University level where adapted teaching is not required by law. The two teachers considered in this paper teach mathematics at a vocational upper secondary school. They both volunteered to be part of the research, and the aim of the PhD-project is a greater understanding of the choices teachers make when it comes to mathematical tasks and not to change the teaching. Findings from the TIMSS advanced 2008 study, show that the most dominating activity in Norwegian classrooms is by far solving mathematical tasks similar to those in the textbook, and this is also a predominant classroom activity in other countries (Mullis, Martin, Robitaille, & Foy, 2009, p. 162). This is one of the reasons I view mathematical tasks as an important issue to research.

To accomplish a greater understanding of the choices teachers make when it comes to mathematical tasks, a design based research methodology (van den Akker, Gravemeijer, McKenny, & Nieveen, 2006) was applied in the PhD study, and the teachers were offered help designing tasks they wanted to use in the mathematics classroom and which they felt would improve their students' learning. The collaboration lasted a school year, and all conversations between the researcher and teachers were audio recorded. A total of 20 hours and 49 minutes of audio recordings with the two teachers have been used in the analysis; the recordings consist of interviews, and discussions about the tasks, refining tasks and evaluation of implementing the tasks.

All of the recordings have been imported into NVivo and data reduced concurrently with data generation. Data reduction entails writing down what is happening and what is being said without transcribing word for word. The data reductions are detailed facilitating retrieval of relevant data material at a later point, but they are also the first phase of analyzing, serving as a guide, focus and help when collaborating with the teachers. The data has not been transcribed; rather all analyses have been done using the original audio recordings.

The data has been analyzed using techniques from grounded theory (Corbin & Strauss, 2008), and time emerged as a recurring issue. As a consequence, I went back to the data and isolated all the parts where

time had been mentioned. This data have then been analyzed according to Assude's timescales as analytic categories. I have in the analysis considered how didactical time advances with respect to time capital, and how this can be a condition for change. For instance, could there be a point where didactical time is advancing so slowly that it conditions changes in the teacher's practice?

As before mentioned, my research question is *when can time be a condition for change in teacher practice?* Given my research design, I have unique data for analyzing reasons for wanting change from a teacher's perspective. The teachers are offered help to design new mathematical tasks to use in their classrooms without the researcher trying to influence them, and the reasons provided for the new tasks are therefore a good gauge of what the teacher sees as important to change. The research was not designed to bring about big changes, just adjustments to what was already being done. Teacher change is mostly viewed as a slow and difficult process (Sowder, 2007), however, some of the teachers in this project expressed clearly that they participated in the research because they wanted changes and they wanted to improve.

The teachers participating in the project want some changes, but it might differ how important this is to them. In order to view if the changes are something that really are important to them, I am also looking at the time and effort the teachers are putting into this project and how they view this investment. We know that time to prepare lessons is a valuable asset for the teachers, and they are often protective of how this time is used (Goodchild et al., 2013; Jordfald et al., 2009). So if the teachers are expressing that they want to invest time into my project, I view this as changes being rather important to the teachers.

RESULTS

I will start this section by presenting excerpts which are related to the teachers wanting changes, as explained above. One of the teachers expressed at the very beginning of our cooperation that: "I am doing this (participating in the research) because I feel I can benefit from it. I'm not doing this because I have a heart of gold". This is a clear statement from the teacher seeing this cooperation as beneficial for him, and he is looking for help to make changes. The other teacher is open and honest about how he is struggling

with time management in his job at the moment, and expresses:

I am not happy with how I've been doing my job now. I am underperforming. It's not satisfactory. I have been stressed, but I don't have any more to do than everybody else in this world. This is resulting in me not being able to 'be present'; I forget things and have an extremely bad memory at the moment.

Given that I have spent a total of about ten hours of discussions with this teacher in my project, I feel bad for costing him so much of his preparation time and I express this, but he responds:

Yes, but... no! I've never had a thought of that. I've been thinking it's been beneficial for me all the time. Because then I get the help, and if I didn't have the pressure to make the index task, the lesson would have been extremely boring. So for me it's only been good.

With a teacher expressing so strongly that he has been lacking preparation time, but still views our cooperation as beneficial and as an asset, speaks volumes of the need for help to change. This teacher actually ended our last conversation with: "You should just make contact if you need it again, and this year has been very good for me and a help, so no burden for me."

To summarize this part, the teachers are expressing that this is a research project they see as beneficial to them, and they do not mind that it cost them time. They view it as an investment to get help to make changes in their practice. When analyzing what might condition this change, I have used the analytical categories *didactic time* (with respect to the whole class or to individual students), *time capital* and the *pace* of the course. I will, in the two following sections, present results from the analysis of how the pace is viewed both with respect to the whole class and individuals, and how time capital and didactic time is relevant in these examples.

Pace of the whole class

I argue above that it is difficult to view the general pace of a course in vocational programs in Norway, but sometimes the teachers make references to it. In this section, I will present teacher comments related to the pace of the whole class, i.e. didactic time with

respect to time capital, and identify how didactic time and time capital are being viewed by the teacher.

In my recordings I found three categories of comments related to the pace of the class as a whole. These were:

- The curriculum in general: These comments are related both to being ahead of schedule or being on time. "I have found out that I'm almost a chapter ahead of the others. So I wonder if I need to slow down a bit."
- Time needed for open tasks: The teacher comments on the difficulty in knowing how much time the students will need for an open task.
- Structure or chaos in a specific lesson: For instance a teacher is commenting on the need for better structure in a task because the students are spending too much time on irrelevant stuff for learning mathematics

None of the teachers I talked to expressed any concerns about having enough time capital for the given curriculum, so it doesn't seem like they view this as a fast paced course, especially since one of the teachers even comments that he is ahead of time. When it comes to the pace for the whole class, the only concerns of the teachers were related to smaller sequences, i.e. a lesson or a task, and they are making suggestions for adjustments to improve themselves. I am therefore not considering these as big issues for the teachers in my research project. None of the teachers have mentioned the pace of the whole class as reasons for wanting changes in the mathematics tasks.

Pace of individual students

As I have expressed above, the teachers did not seem very concerned about the overall pace for the class as a whole group, however they did express concerns when it came to individuals. These concerns could be divided into two different types of comments: one related to students not doing anything at all in the lessons, and the other one related to students not understanding from the teaching. Here is one example of a teacher expressing concerns of students not doing anything in the lessons:

I think the idea [of the task] is good, but it requires that the students actually engage in the task... And that is kind of the roadblock. When

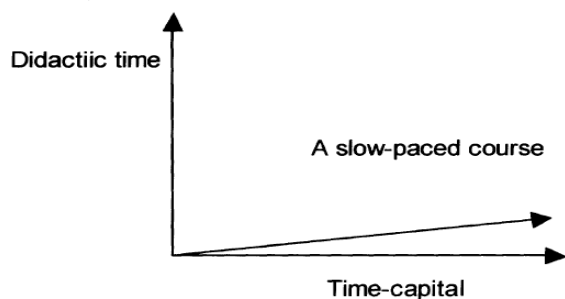


Figure 1: Diagram of a slow-paced course

you asked me if we could cooperate, my idea was... What should I do to get the very lowest achievers of the students to have some kind of benefit? And what should I do to get them to do something?

These students are not only performing poorly, they are not doing anything at all during the lessons. The teacher talks about getting the students engaged as a roadblock and one of his main goals with this project is to get the low achievers to do something. Given that didactical time can be viewed as the advancement of knowledge, this teacher is here expressing that this is not happening at all for some of the students. This means that for these students, a graph of the pace of the course would look something like the diagram Assude (2005, p. 187) uses for a slow paced course (see Figure 1).

Students who are not doing anything at all during the lessons are the most extreme cases, but the teachers are also talking about students who are not benefiting from the teaching. This excerpt is from a conversation with a teacher where he is evaluating a ratio task we had designed and implemented:

...if I do it the “quicker” way which is: Hey, here is the formula, now do task one, two and three. And then there are those who manage to keep up with the explanations, they are done in five minutes. And then I use the rest of the time to explain to those who never get any of the things I explain (to the full class).

The teacher is here referring to a “quicker” way of teaching a formula, but where many of his students do not understand the explanation so he has to use the rest of the lesson trying to help them understand. This example shows how the teacher is struggling with students experiencing different levels of advancement of knowledge, or didactical time. Some of the students

do not understand the mathematics from this type of teaching while others get it straight away.

The pace of individual students in a class is also what the teacher refers to when it comes to whether a new task is successful or not. Below is how a teacher is describing why he is happy with the task we designed:

While here, here there is something everyone can do basically, and they have something tangible which they even can count if they need to. I even experienced that some of the low achievers seemed to have some Aha-moments, which they normally don't have. To sum up the benefits of the task: they get quickly started, everyone can manage something, they get active straight away.

Everyone being active and being able to manage something in the task, are success criteria according to this teacher. So didactic time is advancing at some level for all of the students, and these are the reasons the teachers are giving for the task being good.

DISCUSSION

Assude (2005) was, in her article, addressing the class as a whole when it came to the pace of a course, however I have shown that this is not necessarily sufficient for all classes. The teachers in this research project are mostly referring to individual students or a subgroup of students when they are talking about the pace of the mathematics course. The pace for the class as a whole does not seem to worry the teachers, but they are expressing concern when it comes to the pace of individuals or a subgroup of students.

I will argue that this difference in perspective is related to the diversity of a class. The more homogeneous a class is, the easier it becomes to talk about the general pace of the course. However, given the political ideal of the comprehensive school in Norway, there is great diversity in the classrooms of vocational schools. In addition to this, the teachers are obliged to give adapted teaching, which makes the differences in the pace of the course from student to student more obvious. In these classrooms there does not really exist *one* pace of a course, and the learning outcomes among the students might be very different.

This diversity of a class is, as explained by the teacher, a reason for their desire for changes in the mathemat-

ics tasks. Didactical time is not advancing for all of the students even if time is passing, so changes need to be made if they shall fulfill the requirements of the law when it comes to adapted teaching. If a student group is rather homogeneous and can keep up with the requirements of the curriculum, I assume the teacher will not worry much about didactical time. On the other hand, when a student group is very diverse, the teacher will be a lot more concerned about didactical time, given that it is so different within the same class.

If the student group is diverse, the teacher can choose to view this from two different perspectives. It is possible to have the perspective that the students will need to adjust to the teaching and the pace of the course, or you can have adapted teaching as a focus. The difference between these two perspectives comes from either a focus on the advancement of didactical time for each student as an individual or just an 'ideal' advancement of didactical time for the course. The teachers in this research projects were volunteers, and this might indicate a greater willingness to change, however the issues of diversity are present in the classrooms no matter the teachers' intensions.

The diversity of some of the Norwegian classrooms are extreme, however, there is some degree of diversity in every classroom. We might think that grouping students into ability groups in the form of setting, as they have been doing in England and Wales might give a more unanimous progress of didactical time with respect to time capital, but research shows that even in these classrooms, students feel the work they are given is either too hard or too easy (Boaler, Wiliam, & Brown, 2000). This shows that even if the problem might be more evident in the Norwegian comprehensive classrooms, there is evidence that this is also a universal classroom issue. Wilkinson and Penny (2013) argue that

Within even the narrowest setting system, a set will contain students with considerable variations in attainment as well as learning style. It is therefore highly problematic to assume and treat setted students as intellectual homogenous. (Wilkinson & Penney, 2013, p. 10).

I have shown that some teachers feel the need to make changes, and I have argued that this is related to diverse classes where didactic time is not advancing for all of the students with respect to time capital, and this

serves as a condition for change. Given that teacher change is mostly viewed as a slow and difficult process, identifying teachers who are so clearly expressing that they want change, can be of great value to further research.

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