Temporal Norms of the Typical Mathematics Lesson: Norwegian and Swedish Students' Perspectives

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Abstract In this paper, we present a number of Swedish and Norwegian high-school students' descriptions of a 'typical mathematics lesson'. These descriptions are subsequently considered in light of Foucault's discussion of timetables and discipline originally employed in armies and subsequently in schools throughout Europe. We contend that the structure of the typical mathematics lesson – though arguably unremarkable in and of itself – is both culturally normative and historically situated. Thus, in its very simplicity, it offers a window on the temporal norms imposed on and maintained in educational institutions in general and in the mathematics subject in particular.

Keywords Foucault • Mathematics • Cultural norms • Temporal norms • Educational institutions

Introduction

Several studies of the 1990s, particularly the Trends in International Mathematics and Science Study (TIMSS) video studies (Hiebert et al. 2003; Stigler, Gonzales, Kawanaka, Knoll, & Serrano, 1999) and the Survey of Mathematics and Science Opportunities (Schmidt et al. 1996), have concluded that mathematics teaching, drawing on a subconscious routine and consistent re-enactment of particular pedagogies, is culturally normative. That is, teachers of mathematics adhere, consciously or otherwise, to a culturally determined script (Andrews & Sayers, 2013).

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Motivations for investigating this script have frequently stemmed from the desire to understand the causes of the consistently high performance of East Asian students, when compared with their Western counterparts. However, these and many other studies have examined the typical lesson from an observer's perspective. Few have considered the student view. However, as Bourdieu (1990) notes, by postulating an objective model of any practice through outside observation only, 'the analyst reduces the agents to the status of automata or inert bodies moved by obscure mechanisms towards ends of which they are unaware' (p. 98).

To avoid doing so when seeking to understand educational practices, the student perspective must be considered. Learning what students see their typical mathematics lesson to be about is important, because it forms the basis of their experience with the subject and hence plays a central part in the development of their mathematics-related beliefs. These beliefs in turn play a significant role in determining students' engagement with and subsequent learning of the subject (Hannula 2006; Leder and Forgasz, 2002; Ma and Kishor 1997).

With respect to our understanding of students' beliefs about the nature of a typical lesson, little research has been undertaken with such an explicit focus. A small number of qualitative studies in the UK and the USA (e.g. Boaler, 1998; Nardi & Steward, 2003; Ryan & Patrick, 2001; Turner et al., 2002) have examined the impact of classroom practices on students' mathematics-related affect, and in so doing, they have alluded to the typical lesson experienced by students. In a similar vein, a number of quantitative studies have implicitly addressed the typical lesson by investigating various aspects of student affect in relation to classroom practices derived from the literature (e.g. Fall & Roberts, 2012; Rakoczy et al., 2013). Our aim in this paper is to make a more explicit contribution to the field.

In the following, we present and discuss a number of Swedish and Norwegian high-school students' descriptions of a 'typical mathematics lesson', and consider how this typicality might be captured by a set of 'temporal norms' described by Foucault (1977) in his discussion of timetables and discipline originally employed in armies and subsequently in schools throughout Europe.

Method

We have conducted semi-structured interviews with 47 Swedish and 41 Norwegian high-school students (aged 16–18) in both countries selecting about half the students from vocational and half from academic tracks. In Sweden, the interviews were conducted at four different Stockholm schools, each of which offered both academic and vocational tracks. In Norway the academic track interviews were conducted at two different schools, one in Oslo and one in Trondheim. Both schools have high entrance requirements and are considered to be among the best high schools in their respective cities. The vocational track interviews were conducted with students from a high school in Oslo which could be said to lie at the very opposite end of the spectrum, with low entrance requirements and a poor academic reputation.

Students were interviewed in pairs or threes so that they would have the opportunity to discuss among themselves rather than just with the interviewer, and the interviews were structured around the following four questions (with follow-up questions where appropriate):

1. How would you describe a typical mathematics lesson at school?
2. What do you think is the purpose of compulsory school mathematics?
3. What do you think mathematics as a subject has to offer to those who engage with it?
4. If you could say something about the nature of mathematics education to those in charge of the educational system, what would it be?

The students were asked to describe both their current experiences in high school and their experiences throughout earlier years of compulsory schooling. Video and sound were recorded on a laptop web camera, and all interviews were transcribed. The student responses were then subjected to a constant comparison analysis (Glaser, 1965) whereby each episode was read and reread and categories of response identified and compared with each other. With each new category, previously read episodes were reread to determine whether the new category applied to them also.

The Typical Lesson: Why Care?

The question about the typical lesson in many ways sets the scene for the interviews and for the questions that followed. The question does not at first seem to ask for much in terms of beliefs, opinions or knowledge about mathematics. It simply asks for a description, and as far as questions go, it could be said to border on the trivial. Indeed one might argue that the truly interesting data would be the students' responses to questions 2 and 3 above, concerning young people's conceptions of the purpose of this subject that they are made to endure for at least 10 years.

However, in eliciting students' perspectives on the typical lesson, we were essentially inviting them to synthesise their many years' experience of mathematics classrooms. Such syntheses, filtered through students' experientially constructed beliefs about mathematics and its teaching, can themselves be construed as beliefs. Firstly, it is because each synthesis reflects one student's beliefs as a perception of reality (Van den Bossche, Gijselaers, Segers, & Kirschner, 2006), and secondly, the act of synthesis both draws on and constantly recreates students' dispositional beliefs (Dilworth, 2005). Thus it could be argued that any beliefs expressed in response to questions 2 and 3 are a direct consequence of what takes place in the typical lesson, and as such the student responses to question 1 deserve some careful attention.

The Typical Lesson: Student Descriptions

Norwegian and Swedish Academic Track Students

The Norwegian and Swedish academic track students' accounts of the typical mathematics lesson were remarkably similar and highly consistent across interviews in both countries. Mårten, a Swedish student in the first year of the natural science and art programme, gave the following description:

> Well, the structure is that first the teacher talks about the chapter we are moving into. And then we work by ourselves mostly from the books, doing different exercises and so on… That's pretty much it. And so we work through… we follow the book, like chapter after chapter. Yeah, the teacher often has a genomgång (going-through) and so on about what we're doing.

Although the wording and detail differed, other Swedish responses from the different schools conveyed the same overall message. For example, Frans commented that:

> Normally we go through what we will be doing; first we have a short summary of what we will do, then the teacher usually holds a genomgång (going-through) on the section we are going to work with… And then we usually undertake exercises on what we have learned.

Norwegian academic track students from Oslo also had a similar story to tell, as seen in Mari's comment that 'usually the teacher comes in and if we are starting a new topic he will go through that topic emm... methods for doing exercises, eh and then we do exercises. That's the average…', or Emily's belief that it 'starts with the teacher explaining what we'll go through that lesson.. we go through something new every lesson more or less.. then you carry on with exercises'. It is worth noting that in the case of a double lesson – which is another way of saying that there is more *time* – it appears that the lesson structure is simply repeated twice, as confirmed by Mina, who commented that 'we usually go through a subchapter in plenary and then do exercises for it.. if we have a double lesson we often go through one more subchapter too… and do exercises for that'.

Remarkably (or perhaps not?) the answers did not differ much in interviews with students around 500 km away in Trondheim, as found in the interview with Line and Malin:

Line: It is typical that we start with a bit of teaching on the board, what we will carry on with…

Malin: yes, what we have done, and what we will be doing.. a bit of information like that, and then maybe we go through a new subchapter or topic, and then we work with exercises…

Øyvind, another Trondheim interviewee, noted that there often is a bit of talk first and that 'that talk can drag on a bit ... but it is mostly working on exercises'.

In sum, and acknowledging some variations in the descriptions, the typical lesson was described as consisting of two main parts: (1) The teacher goes through something on the board and, in doing so, defines the topic for the lesson. This is usually based on a chapter or subchapter from a textbook, and examples of how to solve specific types of exercises are given. (2) Students do corresponding exercises from the textbook.

It is also worth noting that the exercises were largely (though not exclusively) reported to be done individually. The following response from two Norwegian students captures what appeared to be a common experience among interviewees from both countries:

Interviewer: do you tend to work individually or in groups?
Kristine: we work very little in groups..
Emily: very little in groups..
Kristine: you could potentially whisper to the person sitting next to you.. ask 'did you get that?' and 'did you get that too on that exercise?'.. but.. yeh..

Norwegian and Swedish Vocational Track Students

The vocational track students' responses also referred to a two-part lesson in which the first part consisted of the teacher *going through* something on the board followed by largely individual work on exercises – as described for example by Björn, a Swedish student:

Björn: We normally listen to the teacher when he goes through (gå igenom) the next chapter and then work on the chapter after he has finished talking about it
Interviewer: What does it mean to work with the chapter?
Björn: Doing maths exercises from the book
Interviewer: OK, when you work from the book can you work with someone else?
Björn: You can work with someone else but usually you do it on your own.

The same structure was once again also described by the Norwegian students. For example, Andreas commented that:

> it is usual that we follow the chapters from start to end in the book, and for each chapter the teacher gives a sort of introduction to the chapter and then he shows on the board and then you just do the exercises..

While Simen believed:

> it is just that the teacher goes through something on the board first, and then he puts up some exercises and then we do those exercises according to what he showed on the board.. and then he goes around and helps those who need help.. really it is a pretty simple lesson

The main *difference* between the accounts given by academic and vocational track students was seen in the Norwegian data, where the latter group in several interviews referred to high levels of classroom noise. In this respect, Ahmadi observed that 'yes it starts as a normal lesson, a bit of noise and then…', while Ali, speaking in a different interview, commented that:

> because of others, I can't concentrate properly. There is a lot of chaos and they just sit there and make noise.. and they threaten us like 'give us the exercises or you'll get beaten outside' and stuff.. that's on exercises we have to hand in that is

In yet another interview, Robin noted that 'there are so many making noise all the time', and Asta nodded in agreement and added 'yes, very hard to get peace and quiet'.

None of the Swedish students or Norwegian academic track students interviewed made any reference to noise. This finding is perhaps not so surprising given the nature and status of the Norwegian vocational track school chosen for interview purposes. However, it is certainly remarkable that despite this 'noise', the typical structure of the lesson appeared to be maintained where possible. And although Swedish vocational track students did not report noise as an issue, it was clear that the lesson structure did not necessarily secure their full attention, as noted by André:

> I listened to him quite a lot and I answered a lot of the questions he asked but (…) I actually didn't try that much because I slept a lot in the lessons (...) and then we might just start working from the book… You could go outside and sit if you wanted a more quiet place. So that was very nice. But we worked a lot from the books.

Finally, it is also worth noting that whereas the start of a lesson was very clearly defined and described by the interviewees (of both vocational and academic tracks), the end of a lesson was much less so. There was no concrete mention in the data of what takes place at the end of each lesson, and in the vocational track interviews, there was even an indication that once you have done your exercises you can just leave the classroom. As Matheus explained:

> the teacher gives a kinda introduction to what we're going to do, and really then we just do exercises.. that is it.. and when we are done we the exercises we can just go out.

Discussion

Why write a paper about the typical lesson? What will be added to our knowledge by doing so? It has been said that writing an academic paper is all about stating the obvious with an air of surprise. Here even the air of surprise is arguably hard to produce, at least for those who are familiar with the educational systems in question. There is nothing remarkable about the responses described above. Upon reflection what is striking is the *absence* of variation. An absence of a single student out of 89 saying 'well, that is a very difficult question to answer, because it really varies so much from lesson to lesson'.

Hence the purpose of looking at the structure of the typical lesson must be less about informing the reader about *what* this structure is and more about bringing this absence of variation into our collective consciousness by considering *why* this structure exists and *where* it might have come from (where something is culturally normative, it is also historically rooted).

For to state that mathematics lessons are conducted repeatedly and consistently in the same way across classrooms, schools and even countries is one thing. Another is to acknowledge what this means in terms of options excluded. There is an infinite number of ways (or let's just say a large number of ways for those who find the infinite daunting) in which 45–90 min could be spent within the world of mathematics, and yet we do, repeatedly, consistently, across classrooms, schools and countries pick just one! If it were merely a game of chance, this would have been less likely than winning the lottery. But of course, the engrainedness and widespreadness of the lesson structure have not come about by chance (and nor does it seem like anyone is celebrating for that matter). Rather, the practice has emerged through history – for reasons we may have forgotten or never been aware of in the first place – and with time it has been reinforced and embedded in the culture and thus allowed to live a quiet life in the subconscious of a population without ever being brought out in the light to be studied with curious eyes.

But what if we try to do just that? What is it really that we see? We see that *time* is carefully divided and its use highly regulated. The time that students spend at school is – at most educational institutions – carefully divided according to a timetable, and a mathematics 'lesson' is a clearly delineated period of time in that timetable during which mathematics is to be undertaken. How the mathematics lesson itself is structured is a further subdivision of time, with an introductory part of 'going through' and a 'working on exercises' part. The 'going through' part closely follows a textbook and effectively dictates how the second part of the lesson is to be spent. Aside from being restricted in terms of mathematical topic, this second part is itself divided – in an ordered sequence – between a number of prescribed exercises, and even the very steps to be taken in order to solve these exercises are presented in the form of an example at the beginning of the lesson. Thus even the time spent on each exercise is effectively divided and regulated. In other words, the structure of the typical mathematics lesson could be seen as a mere continuation of the general timetable, on an increasingly smaller and more detailed scale.

But where does this detailed form of timetabling come from? Foucault (1977) argues that throughout Europe, the organisation of a strict timetable historically emerged from the army and was subsequently adopted by schools. Notably:

> The principle that underlay the time-table in its traditional form was essentially negative; it was the principle of non-idleness: it was forbidden to waste time, which was counted by God and paid for by men; the time-table was to eliminate the danger of wasting it - a moral offence and economic dishonesty. (p 154)

Paired with an ideology of discipline, the institutions could make the very most of any available time, because:

> Discipline ... poses the principle of a theoretically ever-growing use of time: exhaustion rather than use; it is a question of extracting, from time, ever more available moments and, from each moment, ever more useful forces. This means that one must seek to intensify the use of the slightest moment, as if time, in its very fragmentation, were inexhaustible or as if, at least by an ever more detailed internal arrangement, one could tend towards an ideal point at which one maintained maximum speed and maximum efficiency. (ibid, p. 154)

Foucault further notes that the Prussian army regulations of 1743 (which the rest of Europe imitated) laid down six stages to bring the weapon to one's foot, four to extend it, 13 to raise it to the shoulder and so on, and that schools, also arranged to intensify the use of time, followed analogous practices by carefully regulating the operations performed by pupils under the direction of monitors and assistants:

> ... so that each passing moment was filled with many different, but ordered activities; and ... orders imposed on everyone temporal norms that were intended both to accelerate the process of learning and to teach speed as virtue.

Scandinavian schools (or educational systems) today would hardly subscribe to such a military view of learning focused on timetables, discipline and imposed temporal norms. Quite on the contrary we find, for example, that the Norwegian curriculum aims for mathematics clearly state that:

> The learning shifts between enquiry-based, playful, creative and problem solving activities and the practice of skills ... Provisions must be made such that both girls and boys have rich experiences with the mathematics subject, creating positive attitudes and a solid subject competence. This forms the basis for lifelong learning. (Læreplan i Matematikk, our translation)

There is an emphasis here on *enquiry*, *playfulness*, *creativity* and *rich* experiences, which resonate strongly with many years of educational research recommendations (e.g. Cuoco, Goldenberg, & Mark, 1996, Goos, 2004; Stein, Engle, Smith, & Hughes, 2008; Wæge 2007). And yet, our data clearly indicate that the imposition of temporal norms is inadvertently maintained and reproduced through the typical lesson structure, even where both teachers and students are seemingly squirming under its restrictions. We see here a temporal practice in which it could be argued that 'the Dead seize the Living' (Bourdieu, 1980). That is, the dead institutions and conventions wrought by the movement of history grab hold of, inscribe themselves into and seize the practices of the living. Or as argued by Marx (1852):

> Men make their own history, but they do not make it as they please; they do not make it under self-selected circumstances, but under circumstances existing already, given and transmitted from the past. The tradition of all dead generations weighs like a nightmare on the brains of the living.

Even so, one might come to wonder how the temporal norms of dead generations of educational systems can be maintained if educational ideologies have changed – as curriculum aims and research recommendations suggest they have. Perhaps the answer is to be found in Paolo Freire's contention that it is not education which somehow moulds society but rather society which, according to its particular structure, shapes education in relation to the ends and interests of those who control the power in that society. Then, for as long as the primary interests of those who control power in society are in international test scores and differentiation of students (e.g. Sjøberg, 2014), the breaking down of the mathematics curriculum to ever-increasing and well-defined competence aims that can be tested in exams is an inevitable consequence. Such a fragmentation of learning goals in turn leads to a corresponding fragmentation of time akin to that which emerged from assuming army discipline to also be an educational virtue. In both cases, to borrow Foucault's words one final time:

> the ‘seriation’ of successive activities makes possible a whole investment of duration by power: the possibility of a detailed control and a regular intervention (of differentiation, correction, punishment, elimination) in each moment of time; the possibility of characterizing, and therefore of using individuals according to the level in the series that they are moving through; ... Power is articulated directly onto time; it assures its control and guarantees its use. (Foucault, 1977, p. 160)

Conclusion

We argued initially that learning what students see their typical mathematics lesson to be about is important, because it forms the basis of their experience with the subject and hence plays a central part in the development of their mathematics-related beliefs. Through interviews with high-school students, we have found that – from their perspective – there does indeed seem to be such a thing as a typical lesson, and this typicality appears to derive from a set of relatively stringent temporal norms reminiscent of times where discipline and timetables were thought to form the pillars of education.

In other words, despite the great emphasis in recent research and curricular aims on the importance of enquiry-based learning and creativity – which require relatively large degrees of temporal freedom (Nosrati, 2015) – we find instead that mathematics lessons bear clear marks of temporal control and restriction. The reasons for this may be historical, cultural and ultimately practical, and one could not expect that the publication of academic papers on the issue should have lead to major changes in the 50 or so years since mathematics education emerged as a discipline in its own right. However – and crucially – this does not mean that thinking and talking about alternative ways of doing things (with students as well as with teachers, researchers or politicians) should be considered a futile exercise. In this we align ourselves with Bourdieu’s (1990) view that even ‘the simple possibility that things might proceed otherwise is sufficient to change the experience of practice and, by the same token, its logic’ (p. 99). The very uncertainty that arises from encouraging alternative strategies allows for a reconsideration of temporal norms, with the potential to free time (at least temporarily) from the minutest of timetables: ‘To reintroduce uncertainty is to reintroduce time’ (ibid.).

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