



Functional coordination between present teaching and policy reform in Swedish science education

Eva Lundqvist & Malena Lidar

To cite this article: Eva Lundqvist & Malena Lidar (2021) Functional coordination between present teaching and policy reform in Swedish science education, *Education Inquiry*, 12:2, 163-182, DOI: [10.1080/20004508.2020.1823132](https://doi.org/10.1080/20004508.2020.1823132)

To link to this article: <https://doi.org/10.1080/20004508.2020.1823132>



© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 22 Sep 2020.



Submit your article to this journal [↗](#)



Article views: 438



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 1 View citing articles [↗](#)

Functional coordination between present teaching and policy reform in Swedish science education

Eva Lundqvist  and Malena Lidar 

Department of Education, Uppsala University, Uppsala, Sweden

ABSTRACT

Major policy changes make teachers reconsider how they teach. In Sweden, a new curriculum, a grading system, and national tests were introduced in science education in Year 6 (Y6) for the 2012/2013 academic year. After two years, the national tests were made voluntary, and they ended the following year. In this interview study, we investigate what implications these reforms had for teachers' teaching and assessment practices in science education. Interviews with 10 teachers over four subsequent years were analysed by applying Dewey's notion of habits in order to explore how teachers coordinate between their teaching habits and new policies. The result show that teachers work to adjust their teaching practices in order to; make teaching transparent, deal with the experience of increased levels of stress, develop professionally in collective practices, and reconsider the teaching content and methods. However, in the last round of interviews, it was evident that, after the tests were taken away, teachers downplayed the significance of the national tests as a factor that changed their teaching and changed what they consider as good science education.

KEYWORDS

Educational reform; teachers' habits; science education; coordination work

Introduction

In recent times, the middle grades of compulsory school in Sweden have experienced major changes, which affected the conditions for teaching several times. This study focuses on the implementation of national tests in science education and a grading system, which were introduced in Year 6 (Y6) in the 2012/2013 academic year. After two years of national testing, a newly elected government made the national tests voluntary for schools. After yet another year, the national tests in science education ended. New prerequisites are part of the reality that school practices face, which potentially include changes in teachers' instructions. Depending on teachers' previous experiences their responses to a reform can vary from predominantly rejecting the new conditions to seeing the new circumstances as an opportunity for learning (e.g. Coburn, 2004; Lidar, Lundqvist, Ryder, & Östman, 2020). Guskey (2002) states that changing practices is a complex and challenging process but it is a process that also has the potential for professional development.

CONTACT Eva Lundqvist  eva.lundqvist@edu.uu.se  Department of Education, Uppsala university von Kraemers alle' 1 75237 UppsalaSweden

© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group. This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

In this study, we have interviewed teachers during four consecutive years to explore their responses to the introduction of centralised control in the form of a new curriculum, an earlier introduction of grading, and national tests, followed by the removal of the test in science education in Y6. Science teachers in Y6 have thus been faced with several quick changes, which influence their space for professional judgements. Given this situation, the study explores the consequences of educational policy reform through analyses of how teachers reason about their everyday teaching practices. This is done by investigating how teachers reason about if and how they change their teaching habits when encountering new requirements in the presented reforms.

Background for the reforms and the Swedish school system

Between 2011 and 2013 three parallel reforms were introduced in Swedish compulsory schools. First, a new curriculum (Lgr11, Skolverket, 2011) and associated subject plans were established and applied starting in the 2011/2012 academic year. Moreover, the government introduced grades at earlier ages in order to raise the quality of education in schools and to attain better testing results in higher grades after declining outcomes in international comparisons (e.g. TIMSS and PISA). In the previous system, the first year of grades was in Y8, but starting in the autumn semester of 2012, grades were to be given from Y6. Additionally, national tests were introduced in more subjects and in additional age groups than before, starting in the spring of 2013. The tests had several purposes, but the main aims were to support teachers in making fair, equitable assessments and to provide a basis for analysing the extent to which the knowledge requirements were met at different levels. Further aims for the national tests were to support teachers' work by clarifying curricula and to strengthen students' results (Skolverket, 2015a). The science subjects (biology, physics and chemistry) were amongst the subjects in which annual national tests were introduced in Y6. The national tests were compulsory for all students, but within the science subjects (biology, chemistry and physics), each student only took a test in one of the three subjects, randomly distributed.

The national tests in science were mandatory for two years. After these two years, a new government was elected. This government made the national science education tests in Y6 voluntary for schools to perform. The following year, the Y6 national tests in science education were no longer produced and distributed, but the former tests were made available for teachers to use if they chose. One critical factor for ending the national testing was that it was overly time-consuming, as described in the National Agency of Education's own evaluation of the reforms (Skolverket, 2015b). However, the grading of students in Y6 was kept as a mandatory part of the curriculum.

The Swedish curriculum Lgr11 is in many ways an extension of the former curriculum. However, it prescribes in more detail what should be taught in terms of core content, and it specifies knowledge requirements for every subject. The curriculum could be described as focusing more heavily on control of subject matter and results than its predecessor (Sundberg & Wahlström, 2012; Wahlström & Sundberg, 2015).

Changes in practice from educational reform

Teachers have a crucial role in the design of teaching and in relation to the introduction of new policies, and they are often discussed as potential change agents (e.g. Fullan, 1993; van der Heijden, Beijaard, Geldens, & Popeijus, 2018). Fullan (2010) argues that reform processes must make sense for those who it concerns, both on an internal and external level and he emphasises the importance of aligning the purpose of the reform with what is motivating and functional for the participants. To change practices is a complex and demanding process which is related to the potential of professional development (Guskey, 2002). Guskey built a model of change predicted on the idea that change is primarily an experientially based learning process for teachers. Practices that are found to work are those that teachers find useful in helping students attain desired learning outcomes. Demonstrable results in terms of students learning outcome are the key to the endurance of any change in instructional practice. Learning outcome in Guskey's terms do not only include cognitive achievements but also the wide range of student behaviour and attitudes. The measures of learning outcome must be understood in the light of both result from standardised tests and students' motivation for learning and their attitudes towards school as well as towards themselves.

Teachers' responses to reforms are nevertheless different. Research has shown that teachers' responses to reform may vary, ranging from rejection to assimilation, and teaching practices can remain unchanged (e.g. Coburn, 2004; Lidar et al., 2020). Priestly, Edwards, Priestly, and Miller (2012) argue that the enactment of educational reform is dependent on the teacher's educational philosophy and on the current school discourse. Other studies have examined teacher agency and found that many teachers identified elements of reforms as providing continuity with their personal professional goals (Ryder, Lidar, Lundqvist, & Östman, 2018; Wieringa, Janssen, & van Driel, 2017).

Buchanan (2015) identifies two kinds of teacher agency in a study of how teachers resist and negotiate strong national and local accountability mechanisms: stepping up and pushing back. "Stepping up" means a teacher acts "above and beyond" the expectations of her role to work with other teachers within a supportive local school environment to enact policy reform. In contrast, "pushing back" is a form of resistance, where teachers subvert, adapt or reject a reform that they do not agree with.

To make reform initiatives long-lasting, Datnow (2012) and Coburn, Russel, Kaufman, and Stein (2012) argue for the importance of teachers' collegial interaction, which can be important support for positive change and the longevity of a reform. Coburn et al. (2012) followed 12 teachers in a longitudinal study over three years and showed that teachers' social networks can support efforts to sustaining reform-related instruction. A combination of expertise along with on-going interaction can support the development of strong enactments of reform-related instruction that enables teachers to sustain a new practice over time.

Research about the consequences of national tests have found that testing affect teachers' instruction and students' learning, but there seems to be a lot of variation in the effects (e.g. Anderson, 2011; Barnes, Clarke, & Stephens, 2000). Au (2007) found in a meta-analysis of 49 American studies that a common response to state standards and tests was that the content of teaching was adapted to what was tested, that school subjects were fragmented into test-related pieces, and that teachers increased their use

of teacher-centred pedagogy. Similarly, Collins, Reiss, and Stobart (2010) showed that standardised tests limited the teaching content and that students in some schools in Y6 where their investigation was done did not have opportunities to engage in, for example, exploratory activities, field trips or drama, activities that could be possible alternative routes for reaching the curriculum goals. However, this picture of standardised tests as limiting the educational content is not one-sided. Au (2007) also found the opposite influence in a significant minority of the cases of standardised testing, where the consequences were found to be a use of more student-oriented teaching and that the teaching content actually expanded. In a Swedish context, Jonsson and Leden (2019) show the different effects from national tests on teachers' practice. In their interviews with science teachers, they found that the tests for some teachers could work as a substitute for the national curriculum. As the tasks were perceived as operationalisations of the curriculum they could thereby work exemplary. The study also shows that, in the strive to help the students to pass the tests, the teachers introduce new content from the test, content that had not been included in their teaching before. The presented studies show that testing may have different effects on teaching practices.

There are several studies investigating the relationship between standardised testing and grading (e.g. Black, Harrison, Hodgen, Marshall, & Serret, 2010; Tierney, Simon, & Charland, 2011). These studies suggest that teachers often refer to standards of different kinds when grading, not only to the results from standardised tests. In regards to grading, Wahlström and Sundberg (2015) show in a mixed survey and interview study that a large proportion of Swedish teachers claim to be more thorough in their assessment of student learning after the introduction of grading. This is confirmed in an interview study from Bergh and Wahlström (2018), which shows that the reforms in Sweden from 2011 made teachers feel pressure to control and assess the students' learning process to a greater extent than before. Grading resulted in a need for increased clarity in teaching and assessment. Furthermore, the teachers in the study expressed that the reform made them adapt their teaching to the new requirements and that it also had made them reflect on some earlier assumptions about good teaching (see also Wahlström, 2018).

Concerning the present policy reform in Sweden, reports from the Swedish National Agency of Education show that the new regimen of grading, together with the new curriculum, has influenced teachers by extending their use of curriculum documents when planning and performing teaching (Skolverket, 2017, p. 63). As in the research studies above, the report shows that teachers specify that they assess the students and use written exams to a greater extent than before (p. 66). In a related evaluation, Hirsh (2016) reports that teachers find that the national tests are good tools for making assessments equitable and that working with the tests help them to pay attention to what is central in the new curriculum. The marking of the tests is also said to work well as continued professional development.

Theoretical foundation

A common way of investigating teachers' knowing as well as their responses to reform is to study teachers' beliefs or views of a phenomenon (e.g. Cotton, 2006; Guskey, 2002; Wallace & Priestley, 2011). The definitions of teachers' beliefs are not uniform;

however, a common characterisation is that beliefs are “the cognitive structures that teachers bring to bear on classroom decision-making” (Wallace & Priestley, 2011, p. 360). This approach explains teachers’ individual beliefs or knowledge as something that lies *behind* the responses to reforms. Instead, in this study we approach teachers’ responses as related to the habits of teaching the teachers are using in their everyday practices, which is studied in how they talk about their everyday teaching practice. In the latter view, responses to reforms are not seen as individual phenomena, like cognitive structures, but as patterns in ways of teaching that are shared by teachers in different times and places.

Building on John Dewey’s (1922/1983) work, we consider teachers’ talk about their everyday practices as expressions of their habits of teaching and dispositions to act when approaching reforms. In this study, it means that when teachers are presented with new requirements in their practice, they act in relation to what they are used to as well as their previous knowledge. Dewey (1934/2005, p. 246) elaborates on how old and new experiences must be organised and fit together in order to guide human action. To make progress and organise experiences is a continuous back-and-forth process of actions and handling the consequences of these actions. In other words, a coordination work is required, in order to make a change or to make situations intelligible. Dewey often referred to this process of organising experiences as “functional coordination” (Garrison, 2001). The incorporation of reforms in teaching practices may require a re-modelling of teaching habits in order for them to be functional in relation to new requirements. Teachers’ habits of teaching are related both to individual experiences as well as institutional traditions. A foundation in the pragmatist understanding of the concept of habits is that habits weave together cognition, emotion and action (Garrison, 2002), which is useful for capturing the complex situations where teachers work.

In *Human Nature and Conduct*, Dewey (1922/1983) writes about human action as not always deliberate or planned but, rather, based on habits. Dewey envisioned habits as similar to biological functions, like breathing or digestion, and, as such, they have enormous impact on our will, our capacities, our perceptions, and other important realms:

In any intelligible sense of the word will, they *are* will. They form our effective desires and they furnish us with our working capacities. They rule our thoughts, determining which shall appear and be strong and which shall pass from light into obscurity. (Dewey, 1922/1983, pp. 21-22)

The nature of habits is, in other words, not solely practices connected to something that a person does repeatedly. It is rather a foundational aspect of human activity that is always present but is not obviously controlling the activity.

Based on being educated in, being in and working in contextual situations created by earlier generations of teachers and traditions within disciplines, teachers develop personal habits of acting. Habits are thus acquired but are alterable depending on the circumstances. The concept of habits can therefore be used to describe individuals’ predispositions for certain responses to situations and problems that arise within a specific sociocultural context (e.g. Nelsen, 2014).

According to Dewey, 1922/1983, p. 62) habits are stable and not liable to change. However, when our encounters with the world come into conflict with our habits, this

calls for a coordination that may result in modifications of habits. In the context of educational reform, when a teacher's habit does not correspond with how he or she perceives new requirements, tensions may arise that will require coordination, where existing habits are evaluated in relation to what is new in the requirements and vice versa. Dewey presents "intelligent habits" as ideal, where the habits are plastic and adaptable to new situations while still retaining their usefulness.

Purpose

In this interview study, we explore the consequences of educational policy reform through analyses of how teachers reason as they organise their experiences in everyday practice. The coordination work is analysed in terms of teachers' descriptions about affordances and challenges in working with educational reform.

The purpose is to study how teachers reason about, if and how they change their teaching habits when encountering new requirements from the policy reform in science education in Y6. The research question that is used to approach the teachers' responses reads:

How do teachers describe their work to coordinate current teaching practices with new policy requirements?

Data collection and analysis

The analyses are built upon interviews with Y6 science teachers from a diverse set of schools. The interviews explore their habits of teaching four times during four consecutive years, 2013–2016. The study contains interviews with ten teachers, who have participated in all four rounds of the interviews.¹

The basic criterion for the selection of teachers was that they taught Y6 science the first year that grades and national tests were given. In addition, a purposeful sampling was made in order to ensure broad variations in teaching experiences, educational background and school settings (i.e. different geographical areas, school sizes and governance). When the project started, the teachers in our sample had been teaching between six and thirty-five years and were all well established in their schools. An overview of teacher characteristics can be found in [Table 1](#).

The interviews were conducted by both of the authors, using semi-structured interview protocols (Kvale & Brinkmann, 2015). All interviews were audio-recorded and transcribed verbatim. The analyses are based on the Swedish transcripts, but the excerpts used to illustrate the analysis have all been translated and subsequently carefully edited for credibility and readability in English. In all of the interviews, we had an overarching focus on the teachers' views on science and science education and their enactment of the reform, and we asked questions in these areas on every occasion we interviewed the teachers. Additionally, the different interviews had slightly varied approaches (see further [Table 2](#)). In the first round of interviews, the purpose was presented to the participating teachers as a way of getting an initial picture of the content of science education and to what extent science had been taught up to that point, to get their views of science and science education and also their views of the

Table 1. Details of teachers and schools involved in the study.

Teacher	Gender	Teaching experience	Employment	School size and environment
Andrew ^a	M	35 years	Subject teacher (Y6-9)	medium, rural
Bahar	F	13 years	Subject teacher (Y6-9)	large, suburb
Celina	F	15 years	Subject teacher (Y6-9)	large, small town
Dagmar	F	6 years	Subject teacher (Y6-9)	large, small town
Edith	F	18 years	Subject teacher (Y3-9)	large, inner city
Farida	F	13 years	Class teacher (Y4-6)	medium, suburb
Gisela	F	14 years	Class teacher (Y4-6)	small, suburb
Helena	F	12 years	Subject teacher (Y6-9)	large, inner city
Inger	F	30 years	Class teacher (Y4-6)	small, rural
Jonathan	M	33 years	Class teacher (Y4-6)	small, small town

^aAll names are pseudonyms.

Table 2. Sequencing in the study.

School year	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
Reforms	New curriculum and subject plans	National science tests mandatory (first year)	Tests mandatory	Tests voluntary	National testing ended, used as assessment support
	Grades introduced	Grades	Grades	Grades	Grades
Data collection		<i>Interview 1 (I1)</i>	<i>Interview 2 (I2)</i>	<i>Interview 3 (I3)</i>	<i>Interview 4 (I4)</i>
Interview focus		Views on science education and reforms	Content of the tests	Effect on teaching and assessment	Effect on teaching and assessment, Views on science education and reforms

reforms. In the second round of interviews, the focus was on the content in the national tests and its relationship to grading practices. In between the second and third interview, the national tests in science became voluntary. Consequently, in the third interview the teachers got to answer questions about their opinions of the current situation, specifically regarding the tests being voluntary, how the tests and grading had affected their teaching practice so far and their thoughts about the future. Finally, in the fourth interview the teachers were asked again about their science education practices, their views of science and science education in Y6 and their views of the reforms.

By interviewing teachers over time we could track changes in their ways of talking about their teaching in relation to the reforms. The multiple-step analyses were performed throughout the study by both authors. With guidance from qualitative content analysis (Bryman, 2016) the first step in the analysis was an open reading of the transcribed data from the first interview for obtaining an overall impression of its content. In the second step, the comments and statements were systematised for each teacher in order to answer questions about teachers' experiences of teaching science and how they responded to the reforms in relation to their teaching habits. Analytically, this was approached by looking at what the teachers talked about as affordances and challenges during their experiences of national tests and grading, in relation to their regular practice over the four years. Using the different affordances and challenges that were noted as a starting point, we read the interviews from the remaining three rounds to investigate how the teachers' habits were adjusted along the way. Hence in the third

step, experiences from all of the teachers were compiled and categorised into four broad themes, distinct but related. The themes were then subjected to critical discussions resulting in adjustments of the themes. As a fourth step, the themes were analysed in terms of showing how teaching was organised over time and according to function. In a fifth step, a final selection of examples from the transcripts were chosen in order to illustrate and substantiate the themes. In this selection, the ambition was to represent all teachers' statements. Even though their statements were compiled into themes, their individual statements were of course exclusive. Important was also to illustrate how the coordination work evolved over the four years.

Ethical considerations, limitations and credibility

The research ethical principles in humanistic-social scientific research developed and revised by the Swedish Research Council for the Humanities and Social Sciences (2017) has guided the research's planning, execution and reporting. This study is a small-scale study with a limited number of teachers. As such, we are not concerned with finding generalisable results, neither to claim that the results are representative for the population of science teachers in Sweden. However, an ambition is to contribute to a deeper understanding of the complex and dynamic practice in teachers' enactment of new requirements from a reform. In order to do so, we have interviewed the teachers during several years. This means that we have no first-person information about their actions in everyday practices, we have rather access to their talk about their practices, which is a limitation in the approach. Nevertheless, to interview teachers over time enable us to get insight in how teachers reason and how their reasoning develops. We have been able to follow teachers in their processes to find connections between the interviews and ask follow-up questions. The repeated meetings with teachers have had the function of "member reflection" (Tracy, 2010) that allowed for sharing and dialoguing with participants about the study's findings. In this process we could learn whether the participants found the research meaningful and comprehensible, since the interviews also provided opportunities for questions, critique, feedback and affirmation.

With a qualitative approach where we search for patterns in teachers' talk and show illustrative examples for an understanding of the different aspects of the reform that the teachers coordinate in their work, the study was carried out in an environment that we ourselves are acquainted with. We have tried to achieve a state of "initiated stranger" a condition that can be of value for research. We have worked with credibility through intersubjective probing and by working to provide in-depth illustrations that explicates culturally situated meaning (Tracy, 2010). Multivocality, that is multiple and varied voices, has been a guiding principle in the qualitative report and analysis.

Results

In the interviews we found a range of different approaches to the reforms but also aspects of the responses that are very similar. In the following section, teachers' responses regarding how they have been coordinating their habits when working with new requirements over a period of four years are categorised into four themes.

Working to make teaching transparent

In working to coordinate new requirements into practice, a theme in teacher responses is that the reforms brought clarity to the standards but also increased the need to be transparent in teaching. The teachers mention different ideas that call for transparency, such as plans for the teaching, assessment, and documentation of students' progress, which are supposed to be accessible for both students and parents.

Initially, working towards the national tests was the main focus in teachers' talk when discussing the three parallel reforms. One general response regarding consequences from a focus on national tests was viewing the content as a validation of what was now required. Almost all teachers mention a clarification of national expectations as an affordance with direct consequences for their own work:

And so it makes us ... we will be clearer with what we expect. It requires a completely different, oddly enough, a completely different mindset from the teachers, to be more clear in the beginning of a project with what you expect from the students for them to pass. (Gisela, I1)

As this teacher expresses, the clarifications work on two levels. The tests clarify what to assess, and as a consequence of this, teachers need to have a more distinct plan for what to teach. This is an example of what is referred to in literature as backward planning or backward steering (Bergh & Wahlström, 2018).

Most of the teachers express that the tests have been helpful in finding the right level in assessment (c.f. Hirsh, 2016). Habits of assessing students are challenged in different ways as a consequence of the implementation of national tests and grading. One consequence from the introduction of grading is a greater focus on assessment, which is considered both as an affordance and as a challenge. Teachers describe how assessment must be an explicit part of their planning with the new requirements. A common view was that grading forces many teachers to be more transparent with their learning goals in order to be certain that all teaching content is covered. This feature creates pressure to work with all necessary content within the time frames. Another consequence from working with grading, is an increased amount of written assignments in order for teachers both to check, but also to motivate students to achieve a level of knowledge or a certain grade:

I have probably been affected in the sense that I give more tests. I try to give more hand-in exercises, but I resist a little. I want them to think that science is the most important subject. I don't mean it to be a playhouse; I still believe that you should learn things, but they shouldn't feel that they are assessed all the time. (Celina, I1)

This statement makes visible an emergent tension in how the teacher experiences both challenges and affordances in reflecting on her assessment practice. In light of this teacher expressing that she now gives more tests when she is obliged to grade the students, it is evident that her habits of assessing students previously did not include as many written exams. A perceived tension between learning for the sake of knowledge and learning for the grade is evident. The coordination work is done to assess students more often and to have more assessments in writing in order to be fair and to be able to justify the grades the teacher assigns.

Reasoning around accountability is an aspect in the responses that remains and is further elaborated on through all four interviews, where the external demands from both students and their parents also make teachers be more careful and precise in their work with assessment.

[...] then, parents can come and question and wonder “What do you mean?” and then you must always have good arguments to show. This leads to many written tasks. Because I don’t dare just trust, as before, in what I could get a feeling of, if you understand what I mean (Farida, I4)

This teacher expresses how the demands from parents make her more careful concerning how to be transparent and have concrete documentation to show students’ level of knowledge.

However, there are teachers that clearly express that they do not want to play along with the increasing demands of assessing students. For example, Inger says that she does not do more assessment in her classroom now than before and that she deliberately avoids talking a lot about assessment and grading in her classes. She expresses this by saying that she is working to “play it down a lot, this grades thing” (Inger, I4). Throughout all four interviews, this teacher talked about grading as a bad idea. Despite this, she works towards integrating grading into her existing assessment practice. In other words, this is a functional coordination of new requirements with existing habits of assessing students in classroom practices.

When the national tests ended, in close connection with Interview Three, there were varied reactions from the teachers. Some teachers expressed that it was unfortunate to take away the tests after such short time and with such short notice. One teacher expresses the situation as a “quagmire” (Bahar, I3), not having the test as a guideline for assessment. Meanwhile, several responses affirm that teachers felt national tests were superfluous, and that they could perform their work without the external involvement of national tests:

Well yes, we laughed happily when [the decision to make the tests voluntary] came; we have from the start thought that it was unnecessary (Inger, I3).

Gisela talks about the ending of national testing as a loss of a useful tool for assessment. She comments that of course there will be expressions of disapproval when you add to teachers’ workloads, but she reasoned that national testing was abandoned too rapidly:

But everything you do becomes a habit. So, I think if you had waited out the first irritation wave, I think this could have continued to be a very good tool for assessment. (Gisela, I4)

Even though the teachers in our sample had begun to coordinate the reforms into their work concerning both teaching and assessment practices, the short period of implementation lessened the need for teachers to form sustainable habits in their teaching practices in relation to national testing. However, in relation to grading, transparency was still considered to be an affordance.

Working with the experiences of increased levels of stress

The teachers in our sample assert that the increasing demands from assessments, due to the introduction of national tests and grading, provide an additional pressure that both students and teachers feel.

Although almost all teachers found at least some affordances in working with the national tests, all the teachers mention that they were time-consuming and that they created a lot of stress for both teachers and students (see also Skolverket, 2015b). Many teachers in the study reflected that grading put unnecessary and heavy pressure on the students, and some teachers also expressed that grading in Y6 is too early. Celina expresses consistently throughout the interviews that she is not a proponent of grades and would prefer to postpone grading until the students are a bit older. She also expresses that the new grading system is hard on the students since they need to show competency in subcategories of the subject, such as communicating and being able to argue, to get a certain grade. This may be especially hard for those who, for example, are good at practical parts of science and not as good at the communicative parts. She mentions the risk that students may never be able to earn high grades and thereby risk being excluded as applicants for technical programs in higher education, which could fit them perfectly. These students could mature as they get older. Nevertheless, despite her habit of downplaying assessment in her practice, she is working to find functional ways of grading the students. In the last interview she says, “Well, I’m going to give grades, then I have to make sure that I have a basis that works” (Celina, I4). This teacher describes a tension between working with something that she feels is not entirely helpful but still required. The motive for her concern is students’ wellbeing. The need to be fair and be able to justify a grade, which is a way of caring, brings about an increased focus on testing students. In a study exploring the implementation of the last Swedish curriculum reform, Wahlström (2018) found general patterns in classroom discourse concerning the increased focus on assessment. These patterns showed that teachers’ talk had changed from being dialogical in a broader sense to represent a more narrowed focus on certain facts and concepts to ensure that the students had acquired important knowledge elements according to the standards. The increased focus on assessment in everyday teaching practice is a common finding in the studies.

Andrew states that students, especially in Y6, feel a lot of pressure from the idea of grades in Y6. He says that he has had students that get stressed and that even have started crying because they got a lower grade than they had expected or wished for. The teacher describes mostly negative stress for students, but Andrew’s comments show a tension in that grades can be seen as both an affordance and a challenge. He expresses that there are some students that actually were positively inspired by the idea of grades, and these students made more effort to succeed. The consequences of grading are different for different students. Andrew continues:

Yes, there was a period when I thought the grading should be removed, but ... It is difficult. We have these children who fail and fail and fail, it feels like we pull them down. But they already know, really. And there were actually those [students] you graded who did not believe they would get that grade as well. (Andrew, I1)

Andrew goes on to say that national tests and grades can work as both carrot and stick in the feedback they give, which, in his view, works foremost as a positive driver for students’ learning.

Jonathan points out that students' wellbeing is at risk when they get overloaded with tests during the spring term, but he also gives a potential solution for handling this challenge:

The downside is, of course, that the spring semester is tough. And I don't know what to do about it, if you can spread [the testing] out even more, if you could remove certain parts, for example, the Swedish, the math (Jonathan, I1)

In the teachers' comments about assessment, both in terms of preparing for and administering the national tests and when grading students, the concern about the students' wellbeing can be viewed as an expression of care for the students. Teachers are worried about the risk of discouraging students, which may have negative consequences for the students as individuals. In line with Guskey's (2002) findings about practices that are found to work well are practices that help students attain desired learning outcomes, our results suggest that the teachers' actions of course have an important role in this relation. As Guskey states; learning outcomes relate both to cognitive achievement as well as to the students' motivation for learning and attitudes towards schools and towards themselves. In our data, teachers' care for students' well-being is prominent. Previous research shows that depending on the teachers' habits of teaching, caring for students' wellbeing can be expressed in different ways, such as taking science education even more seriously, preparing the students for the test or helping the students develop as individuals and letting their teaching be guided by interest and curiosity (Lidar et al., 2020).

Working to develop professionally in collective practices

There are many examples in the interviews where teachers talk about how they have developed professionally while working with the reforms. Teachers have, for example, gotten inspiration from the tests on how to teach and assess certain competences. The teachers also talk about how dialogues with colleagues have been rewarding when discussing how to interpret the content in the syllabus and in the tests.

In the response below, Dagmar notes a tension between teaching habits and her understanding of what is assessed in the tests. In this case, the tests are described as functioning as a guide, and in similar ways the tests are discussed as providing tools for learning as they provide concrete examples of how to interpret the syllabus.

Each school was responsible for marking its own students' tests and this teacher discussed about how these conditions made her work with the content in the tests and how to interpret the questions and the assessment template. In this way the marking of the tests gave opportunities for cooperation and discussions between teachers:

I think it will be very good, it will be a very good opportunity for discussion. There are very good pedagogical discussions when we mark [tests] together. [...] It feels good with the national tests in that way. But perhaps it is not really the main purpose of the tests, I don't know, but it is certainly a result of them which I think is good. (Dagmar, I1)

Some schools, including Dagmar's school, exchanged tests with a few other schools when marking them, which led to increased collaboration with other teachers, both at their own schools and with other schools. This goes to show that collaborating have the

potential to be functional in teachers' work, and that teachers' social networks can support efforts to sustain reform-related instruction (see also Coburn et al., 2012).

Even though Helena sees both affordances and challenges concerning the efforts and the outcome from the tests, in the last interview she explicitly talks about the tests as an opportunity for professional development:

Well, yes [...] when it comes to national tests, so that's a lot [of work] and it's tough for the students, it is really. No matter what age you're talking about. But they are fantastic as continued professional development, especially when assessing the national tests together. [...] you learn a lot about the assessment that way, how to think. (Helena, I4)

Throughout these four years, most of the teachers have found that working with the reforms provided opportunities for learning new things that have helped them develop their teaching practices. Farida is a teacher that clearly changed her ways of expressing affordances and challenges from the reform. In the first interview she expressed ambivalence regarding the reforms:

I don't think my teaching will be better because of the national tests or grades. However, I think it will be better because of the planning and that I control of the content. It is inherently a result of having to give a grade (Farida, I1)

In the second interview, Farida expresses that she has learnt a lot and changed her teaching to a great extent; however, she still thinks that a lot of the content that is included in the Y6 national tests is introduced too early.

I will be teaching completely differently. It is obvious that I have to adjust to what is new [...] I am still totally convinced that it would be better in primary school just to feel that science class is great fun and then, when they enter secondary school, they can start with this. (Farida, I2)

Also, in Interview 3, Farida continues to talk about how she in principle has changed everything in her teaching. In the last interview, when looking back, she expresses the following:

From the beginning I thought it was really a shame and very sad, but now I think perhaps that it has raised the level (Farida, I4)

Her teaching habits have been challenged through enacting the reform, which from the interviews seem to have resulted in adjusted teaching habits.

When we met this teacher in interview three, a colleague passed by. This colleague had not been responsible for any of the tests since she had taught Y4 and Y5 when the tests were given. This teacher expressed that not having to deal with all the details and the stress of giving national tests with her students was a relief. But she also expressed that she had been worried that the textbook they used did not follow the new curriculum to the letter and that her students would not have been taught what they were to be tested on. This teacher's reaction can be seen as an expression of anxiety about not preparing the students sufficiently. The disparity between the approaches these two teachers expressed highlights the importance of the experiences of a teacher and the coordination that takes place as teachers are putting into practice educational policy reforms.

During four years of this study, Farida struggled with coordinating what she experienced in the reforms as new with her existing habits of teaching, and she found new functional ways of teaching. This work meant a careful selection process to include and exclude content and methods in relation to her existing habits. During the same period of time, Farida's colleague never encountered the content of the national tests in a way that made her start a coordination process.

Reconsidering the teaching content and methods

During most of the interviews we found that the teachers easily talked about their work situation in relation to the introduction of the reforms. However, when we talked about issues that concerned questions related to selection of content and methods and how the teachers motivated these choices, they answered sparser. Nevertheless, in a general manner, a common theme was that the tests clarified expectations in the reforms which made them feel they needed to introduce new content in their teaching practices. The clarity is thus also discussed as positive encouragement for change, where the tests provided examples of how to teach specific content or interpret the subject plans and knowledge requirements. Lidar et al. (2020) and Jonsson and Leden (2019) also find that another reason for teachers to implement new content introduced by the tests, is that it will assure that their students do not fail the tests. Teachers talk about content and methods that are discerned as new as areas where they made changes, or think about making changes. These areas include the use of terminology and concepts, the work with argumentation or taking a stand in different questions, and the ways of doing laboratory work, such as practicing being systematic when working with investigations (e.g. Lundqvist & Lidar, 2013). In adapting content and methods, the tests can work as a tool for development:

And the sixth grade now, it was a lot [for students] to look for facts in different places, and they would use different contexts and be able to justify why, and it was awkward, it felt hard, aha, maybe we need to practice [...] and the tests are designed to guide us. (Andrew, I1)

The teachers paid attention to the focus on scientific language in terms of being more precise in the use of terminology and concepts from the first time they gave the national tests. For some teachers this required a coordination of past and present experiences in order to work more purposely:

One thing I have learned from the national tests is that I have become careful with concepts. Or with words. If [the students] have described too much pressure. If they have described what happens when they feel too much pressure but not used the word pressure, I have not bothered so much about it [before]. Now I understand that I have to be careful with the words. I have learned that. (Celina, I1)

This teacher's habit can be described as illustrating science without being specific about the terminology when teaching. In her experiences with the national tests, she found that she needed to coordinate her teaching to be more careful about introducing scientific terminology to describe the phenomenon.

The teachers also recognised a focus on the tests on learning to work systematically, reflecting the increased emphasis on scientific investigation. For Andrew, laboratory

work previously included a teacher demonstration or student investigation work, with the primary aim of creating interest in science and showing that laboratory work is an important part in science practices. The national test made this teacher notice that he had to introduce other ideas in his practice:

I have to train them in such things as risk analysis. I have not worked with that before. Making a hypothesis correctly, before I just said I think it will be like this, okay, that is a hypothesis, but it's not good enough. To understand these things, you must work systematically, to have a control, not to run four different variables at the same time, what does it say then? That you take one at a time [...] It's not "learning to take the test"; instead it's training them in what the curriculum requires, what you should work with. (Andrew, I1)

Lunde, Rundgren, and Chang Rundgren (2015) discuss inquiry-based science teaching in relation to what is prescribed in Lgr 11. They conclude that teachers use and imitate laboratory activities from the national tests to meet the requirement for such activities in the curricula. This suggests that teachers do not have a knowledge base in purposeful laboratory activities and find it hard to find good examples. As a consequence, the laboratory activities tend to become hybridisations, where the teachers use existing activities and adapt them to new conditions. It may cause tensions that the existing activities are often part of a long tradition of how to perform laboratory exercises that might have other aims than those intended in inquiry-based science teaching.

In the fourth interview, teachers discussed many similar elements as important in their teaching (selection of content and methods) and in what they say has changed in their teaching after the Lgr11 curriculum was introduced, along with the introduction of national testing and grading. Teachers still mention a greater focus on terminology and investigations, where the students not only perform the investigation but plan and evaluate what they have done to a larger extent. However, we did detect a shift in reasoning. In earlier interviews, these changes were made in reference to what was tested on the national exams. In Interview Four there is little mention of the explicit use of the national tests, when for example, performing tasks from the tests or when designing tests. Instead many of the teachers refer to the syllabus, the knowledge requirements and the core content in the curriculum as their point of departure and as having the greatest impact on their teaching. Gisela states the following:

I think the biggest change has probably been the new syllabus and the requirement for grading in intermediate school. (Gisela, I4)

As Celina (I4) expresses it, when the test ended there was a tendency for teachers to fall back into old habits, and teachers needed to exert a little more effort to assess all the competences in the curriculum. In the last interview Celina refers to a group of colleagues instead of the national test, when developing science teaching in the local community, and for where to find inspiration for how to work with the competences.

Conclusion

In this study we set out to explore the consequences of educational policy reform through analyses of how teachers reason as they are doing their work in everyday practice. This is done by applying Dewey's concept of habits to analyse how and what

aspects teachers coordinate in their work that may result in modifications of habits. In Sweden, the mandatory national tests in science in Y6 were introduced and then ended after two years. Everyday teaching activities needed to proceed regardless of the quick changes and the uncertainty these changes might generate. Even though none of the teachers questioned the actual implementation of the national tests, the work these teachers performed to integrate the changes into the classroom practice was very different. One explanation to this can be that the teachers made sense of the reform by coordinating their actions to align to the purpose of the reform, in relation to what was motivating and functional for them in their practice (e.g. Fullan, 2010).

In many cases in this study, there are tensions in teachers' ways of reasoning about decisions made in teaching. As there are tensions in teachers' talk about affordances and challenges when working with the reforms, some parts in the empirical material inevitably overlap. Although we found a variety, some issues emerged as central in all of the teachers' responses. What unites teachers' views on the reforms is that they accept them and that the content of the reforms is a confirmation of their teaching. All of the teachers talk about the national tests as being a confirmation of either the level of their teaching, the grading of students or the selection of content (see also Arensmeier & Lennqvist Lindén, 2017; Wahlström & Sundberg, 2015). As new norms were introduced, teachers' professional identities, connected to their habits, were challenged. For example, Farida is a teacher expanding her ways of teaching, changing some of the teaching content and changing ways of assessing. Inger, on the other hand, is resisting in altering her teaching as a result of the reforms. She instead trusted that her teaching was already well suited to what is required from the new policies. In this matter, the teachers' coordination work could be compared to Buchanan's two forms of agency, pushing back and stepping up, which are apparent in this group of teachers as well, as described by Buchanan (2015).

Concerning habits of teaching, we noticed in the interviews that the teachers tended to talk easily about their work situations but did not seem to be used to talking about the scientific content to the same extent. It was hard to get them to elaborate on what is most important to learn and how new conditions possibly affect their perceptions of what should be taught and assessed. A similar phenomenon was observed in a survey questionnaire performed by Lidar, Karlberg, Almquist, Östman, and Lundqvist (2017). In the survey, teachers were given questions on if and how they changed their teaching in relation to a given reform. The results indicated that they were not used to evaluate knowledge, and many teachers answered that all content is equally important. In Lidar, Engström, Lundqvist, and Almquist (2019), the survey was constructed to avoid valuing all content as equally important, but there were still comments about how this felt unsatisfactory. The national tests seem to potentially facilitate this kind of evaluation by offering opportunities for teachers to elaborate on the subject content and could as such have a role in teacher professional development.

In line with what Au (2007) found as a consequence of standardised testing, it seems that teaching content has expanded for many of the teachers in the study. However, analyses from the last interview round show that teachers who had stated that the tests inspired them to work in new ways no longer implemented the content from the tests in their evaluations about important science content. An

important implication drawn from this research is that to successfully implement new reforms presupposes that teachers get time to integrate the reform into their teaching habits, as also highlighted by Lidar et al. (2020) and Ryder et al. (2018). This suggests that if reforms, in this case, national tests, are not fully integrated with existing habits, it will not be regarded as a problem if they end. The national tests were mandatory for two years, which is a short time to revise habits for a professional. It takes time to learn how to teach and assess according to new requirements and integrate this with current professional habits.

Though the national tests were described as time-consuming, in the first years it was striking that almost all the teachers responded to the reforms primarily as a positive element in terms of learning in their professional work. Datnow (2012) and Coburn et al. (2012) highlight the need for teachers to engage in learning communities as well as professional development when there is a policy change. As the national tests and the assessment instructions were introduced by the government, teachers found them reliable (Arensmeier & Lennqvist Lindén, 2017). The tests could thus work as a common starting point for discussions about science content and ways of marking the students' answers. Initiating professional discussions where no one presents their own tests means teachers risk less when engaging and have more room to express different views. The results from Hirsh's (2016) report also show that the teachers find that marking the tests contributed to their professional development. In fact, that it facilitated discussions and cooperation between teachers was mentioned as one of the greatest benefits of these reforms.

However, the current overarching policy from the government concerning the management of national tests in other subjects now includes a strategy to digitalise all of the tests and mark them centrally (Skolverket, 2019). Starting in 2022, that strategy will be in place. This strategy will probably save time, and it might ease some stress for the teachers. However, the overall number of tests will not change, which is problematic considering the stress, some students can experience from the amounts of assessments. Moreover, the introduction of digitalised tests risks losing the benefit of teachers' collaboration and processing of teaching content and methods.

Notes

1. At the beginning of the project, 16 teachers were interviewed, but, unfortunately, some of the teachers dropped out in the third or fourth interview round due to retirement and sick leave.

Acknowledgments

This work was supported by the Swedish Research Council under Grant UVK 2012-5769.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Swedish Research Council [2012-5769].

Notes on contributors

Eva Lundqvist is associate professor of Curriculum Studies at the Department of Education, Uppsala University, Sweden. She has conducted research mainly on learning and socialization in Science Education. Besides the research interest in sociocultural studies of classroom interaction, her research has been focusing on educational reforms and the potential impact on teachers' practices. In her current research she is focusing on research based development of teaching, a work that is done in close collaboration with teachers.

Malena Lidar is associate professor of Curriculum Studies at the Department of Education, Uppsala University, Sweden. Her field of research is teaching and learning, mainly within Science Education. Recent studies deal with how knowledge, values and power relations are linked in the classroom and teaching-developing research.

ORCID

Eva Lundqvist  <http://orcid.org/0000-0001-8036-6245>

Malena Lidar  <http://orcid.org/0000-0001-6764-954X>

References

- Anderson, K. J. B. (2011). Science education and test-based accountability: Reviewing their relationship and exploring implications for future policy. *Science Education*, 96(1), 104–129.
- Arensmeier, C., & Lennqvist Lindén, A.-S. (2017). Bemyndigande eller granskning – Nationella prov som styrinstrument. *Utbildning & Demokrati*, 26(2), 49–74.
- Au, W. (2007). High-stakes testing and curricular control: A qualitative metasynthesis. *Educational Researcher*, 36(5), 258–267.
- Barnes, M., Clarke, D., & Stephens, M. (2000). Assessment: The engine of systematic curricular reform? *Journal of Curriculum Studies*, 32(5), 623–650.
- Bergh, A., & Wahlström, N. (2018). Conflicting goals of educational action: A study of teacher agency from transactional realism perspective. *The Curriculum Journal*, 29(1), 134–149.
- Black, P., Harrison, C., Hodgen, J., Marshall, B., & Serret, N. (2010). Validity in teachers' summative assessments. *Assessment in Education: Principles, Policy & Practice*, 17(2), 215–232.
- Bryman, A. (2016). *Social research methods*. Oxford: Oxford University Press.
- Buchanan, R. (2015). Teacher identity and agency in an era of accountability. *Teachers and Teaching*, 21(6), 700–719.
- Coburn, C. E. (2004). Beyond decoupling: Rethinking the relationship between the institutional environment and the classroom. *Sociology of Education*, 77(3), 211–244.
- Coburn, C. E., Russel, J. L., Kaufman, J. H., & Stein, M. K. (2012). Supporting sustainability: Teachers' advice networks and ambitious instructional reform. *American Journal of Education*, 119(1), 137–182.
- Collins, S., Reiss, M., & Stobart, G. (2010). What happens when high-stake testing stops? Teachers' perceptions of the impact of compulsory national testing in science of 11-year-olds in England and its abolition in Wales. *Assessment in Education: Principles, Policy and Practice*, 17(3), 273–286.
- Cotton, D. R. E. (2006). Implementing curriculum guidance on environmental education: The importance of teachers' beliefs. *Journal of Curriculum Studies*, 38(1), 67–83.

- Datnow, A. (2012). Teacher agency in educational reform: Lessons from social networks research. *American Journal of Education*, 119(1), 193–201.
- Dewey, J. (1922/1983). Human nature and conduct. In J. A. Boydston (Ed.), *John Dewey: The middle works* (Vol. 14). Carbondale: Southern Illinois University Press.
- Dewey, J. (1934/2005). *Art as experience*. New York, NY: Penguin.
- Fullan, M. (1993). *Change forces: Probing the depth of educational reform*. London: Falmer Press.
- Fullan, M. (2010). The big ideas behind whole system reform. *Education Canada*, 50(3), 24–27.
- Garrison, J. (2001). An introduction to Dewey's theory of functional "transaction": An alternative paradigm for activity theory. *Mind, Culture, and Activity*, 8(4), 275–296.
- Garrison, J. (2002). Habits as social tools in context. *The Occupational Therapy Journal of Research*, 22(1_suppl), 11S–17S.
- Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice*, 8(3), 3/4.
- Hirsh, Å. (2016). *Nationella prov i grundskolan. En studie av hur lärare och rektorer uppfattar och hanterar prov och provresultat*. Stockholm: Skolverket.
- Jonsson, A., & Leden, L. (2019). The ambiguous influence of high-stake testing on science teaching in Sweden. *International Journal of Science Education*, 41(14), 1926–1943.
- Kvale, S., & Brinkmann, S. (2015). *InterViews: Learning the craft of qualitative research interviewing*. London: Sage Publications.
- Lidar, M., Engström, S., Lundqvist, E., & Almqvist, J. (2019). Undervisningstraditioner i naturvetenskaplig undervisning i relation till utbildningsreformer i NO i årskurs 6. *NorDiNa: Nordic Studies in Science Education*, 15(2), 174–192.
- Lidar, M., Karlberg, M., Almqvist, J., Östman, L., & Lundqvist, E. (2017). Teaching traditions in science teachers' practices and the introduction of national testing. *Scandinavian Journal of Educational Research*, 62(5), 754–768.
- Lidar, M., Lundqvist, E., Ryder, J., & Östman, L. (2020). The transformation of teaching habits in relation to the introduction of grading and national testing in Sweden. *Research in Science Education*, 50, 151–173.
- Lunde, T., Rundgren, C. J., & Chang Rundgren, S.-N. (2015). När läroplan och tradition möts – Hur högstadielärare bemöter yttre förväntningar på undersökande arbete i naturämnesundervisningen. *Nordina*, 11(1), 88–101.
- Lundqvist, E., & Lidar, M. (2013). Nationella prov i NO och lärares val av undervisningsinnehåll. *Utbildning & Demokrati*, 22(3), 85–106.
- Nelsen, P. J. (2014). Intelligent dispositions: Dewey, habits and inquiry in teacher education. *Journal of Teacher Education*, 6(1), 86–97.
- Priestly, M., Edwards, R., Priestly, A., & Miller, K. (2012). Teacher agency in curriculum making: Agents of change and spaces for manoeuvre. *Curriculum Inquiry*, 42(2), 191–214.
- Ryder, J., Lidar, M., Lundqvist, E., & Östman, L. (2018). Expressions of agency within complex policy structures: Science teachers' experiences of education policy reforms in Sweden. *International Journal of Science Education*, 40(5), 538–563.
- Skolverket. (2011). *Curriculum for the upper secondary school 2011. (Lgr11)*. Stockholm: Swedish National Agency of Education.
- Skolverket. (2015a). *Lärlarinformation, Ämnesprov, läsår 2014/2015, Fysik årskurs 6*. Stockholm: Author.
- Skolverket. (2015b). *Skolreformer i praktiken. Hur reformerna landade i grundskolans vardag 2011-2014* (Rapport 418:2015). Author: Stockholm.
- Skolverket. (2017). *Utvärdering av betyg från årskurs 6* (Rapport 451: 2017). Author: Stockholm.
- Skolverket. (2019). Digitalisering av de nationella proven. Retrieved June 2019, 20, from <https://www.skolverket.se/om-oss/organisation-och-verksamhet/skolverkets-prioriterade-omraden/digitalisering/digitala-nationella-prov/digitalisering-av-de-nationella-proven>
- Sundberg, D., & Wahlström, N. (2012). Standards-based curricula in a denationalised conception of education: The case of Sweden. *European Educational Research Journal*, 11(3), 342–356.

- Swedish Research Council for the Humanities and Social Sciences. (2017). *God forskningssed. Vetenskapsrådets rapportserie. VR 1708*. Stockholm: Vetenskapsrådet. ISBN: 978-91-7307-352-3
- Tierney, R. D., Simon, M., & Charland, J. (2011). Being fair: Teachers' interpretations of principles for standards-based grading. *The Educational Forum*, 75(3), 210–227.
- Tracy, S. J. (2010). Qualitative quality: Eight "big-tent". Criteria for excellent qualitative research. *Qualitative Inquiry*, 16(10), 837–851.
- van der Heijden, H. R. M. A., Beijaard, D., Geldens, J. J. M., & Popeijus, H. L. (2018). Understanding teachers as change agents: An investigation of primary school teachers' self-perception. *Journal of Educational Change*, 19(3), 347–373.
- Wahlström, N. (2018). When transnational curriculum policy reaches classrooms – Teaching as directed exploration. *Journal of Curriculum Studies*, 50(5), 654–668.
- Wahlström, N., & Sundberg, D. (2015). Theory-based evaluation of the curriculum Lgr11 *Working paper 2015: 11*. Uppsala: IFAU.
- Wallace, C., & Priestley, M. (2011). Teacher beliefs and the mediation of curriculum innovation in Scotland: A socio-cultural perspective on professional development and change. *Journal of Curriculum Studies*, 43(3), 357–381.
- Wieringa, N., Janssen, F. J. J. M., & van Driel, J. H. (2017). Using goal systems to understand and support biology teachers' implementation of context-based reform. *Paper presented at the ESERA conference in Dublin, Ireland*.