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Reasons for teachers' successful development of a formative assessment practice through professional development – a motivation perspective

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ABSTRACT

Formative assessment has been shown to have the potential to significantly enhance student achievement, but a strong research base about how to support teachers to implement such a practice is lacking. This is particularly so for a conceptualisation of formative assessment as a unity of integrated formative assessment strategies. The aim of this study is to investigate why the mathematics teachers who participated in a successful professional development programme in formative assessment developed their formative classroom practice to such an extent that it had a significant impact on student achievement. An analysis of data from teacher questionnaires and interviews shows that the teachers' actions can be explained by expectancy-value theory of achievement motivation. Characteristics of the professional development programme that the teachers experienced as important for their development of a formative classroom practice are identified, and the characteristics' affordances for the development of the teachers' expectancy and value beliefs are discussed.

Introduction

Background

The seminal research review by Black and Wiliam (1998) showed that several strategies of formative assessment have the potential to significantly enhance student achievement. Some scholars use the terms *formative assessment* and *assessment for learning* with somewhat different connotations (e.g. Swaffield, 2011), while others use these terms synonymously (e.g. Baird, Hopfenbeck, Newton, Stobart, & Steen-Utheim, 2014; Bennett, 2011; Black & Wiliam, 2009). We use the terms synonymously and throughout this article we will most often use the term formative assessment, or formative classroom practice, conceptualised in accordance with the definition provided by Black and Wiliam (2009) (this conception will be further elaborated in the section named 'Formative assessment'):

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> Practice in a classroom is formative to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited. (p. 9)

This definition affords several different foci in carrying out formative assessment, and Black and Wiliam's review included studies examining the impact of different strategies to formative assessment. Some of these strategies had been studied using the term formative assessment, while some carried denotations such as feedback, self-assessment or peer-assessment. Research reviews focusing on each of these strategies have confirmed their potential for enhancing student achievement. Such research includes reviews on teachers' adjustment of instruction based on collected evidence of student learning (National Mathematics Advisory Panel, 2008; Yeh, 2009), feedback (Hattie & Timperley, 2007; Shute, 2008), self-regulated learning, which includes self-assessment and subsequent actions to attain the learning goals (Dignath & Büttner, 2008; Ross, 2006), and peer-assisted learning including peer-assessment and subsequent feedback (Rohrbeck, Ginsburg-Block, Fantuzzo, & Miller, 2003; Van Zundert, Sluijsmans, & Van Merriënboer, 2010).

Since these strategies are complementary components of a classroom practice, it is possible that integrating them into a unity would further improve student achievement. There are several suggestions of how such practice may be conceptualised and operationalised (Arter, 2009; Wiliam & Thompson, 2008). However, studies on random samples of teachers have found limited extent and fidelity in teachers' implementation of professional development programmes focusing this approach to formative assessment, and consequently no impact from the programme on student achievement (Bell, Steinberg, Wiliam, & Wylie, 2008; Randel et al., 2011). In general, attempts to promote formative assessment have frequently been unsuccessful in accomplishing a substantially developed formative assessment practice (Carless, 2005; De Lisle, 2015; Hume & Coll, 2009; James & McCormick, 2009; Marshall & Drummond, 2006; Schneider & Randel, 2010; Wylie & Lyon, 2015), to the extent that increased student achievement was obtained (Bell et al., 2008; Carless, 2005; Jönsson, Lundahl, & Holmgren, 2015; Randel et al., 2011; Schneider & Randel, 2010).

There are several issues that make it difficult for teachers to develop formative assessment practices. Firstly, formative assessment practice is complex (Vingsle, 2014), and using assessment information to plan subsequent instruction is especially difficult (Heritage, Kim, Vendlinski, & Herman, 2009; Schneider & Meyer, 2012). Secondly, external factors, such as accountability (Darling-Hammond & McCloskey, 2008; Klenowski, 2011; OECD, 2005) and the focus on examination and summative assessment (Bennett, 2011; Brown, Kennedy, Fok, Chan, & Yu, 2009; Wiliam, 2006) can impede implementation of formative assessment. Misconceptions of the meaning of formative assessment, conceptions of its value and time to carry it out, as well as beliefs about teaching and learning can also hinder integration of formative assessment into classroom practice (DeLuca, Luu, Sun, & Klinger, 2012). To exemplify, teachers who do not see any connections between summative and formative assessment cannot use information about student learning for more than one of these two assessment purposes. For reasons of perceived accountability and limited classroom time to cover the curriculum, they may choose to focus on summative assessment. Teachers who have practised impoverished forms of formative assessment and found no value from such practices may be less likely to embrace the idea of formative assessment. Marshall and Drummond (2006) also found that teachers who do not value important characteristics of

formative assessment and hold circumstances or students (rather than themselves) responsible for impediments to students' learning, are less likely to embed these characteristics in their practices.

Reviews on professional development across content (Desimone, 2009; Timperley, Wilson, Barrar, & Fung, 2007), and specifically in formative assessment (Heitink, Van der Kleij, Veldkamp, Schildkamp, & Kippers, 2016; Schneider & Randel, 2010), have identified a number of general programme features that are important for attaining teacher and student outcomes. They include a focus on teaching and learning subject matter; inclusion of instructional resources, materials and examples; active teacher learning including e.g. hands-on practice, interactive feedback and discussions focused on the impact of teaching on student learning; coherence between e.g. what is being taught in the programme and teachers' beliefs, wider policy trends and research; time for teachers in the programme; collaboration among participants; individualisation of teachers' learning goals, personalised by the teachers themselves; and engagement of school leaders and external expertise.

However, the more specific requirements on important programme features are not yet established. For example, it is not clear how much time and expertise that is required for different samples of teachers to implement a formative assessment practice that have an impact on the achievement of various student samples. Furthermore, there is a lack of empirical studies examining the characteristics of professional development programmes in formative assessment and their impact on both teacher practice and student achievement (Schneider & Randel, 2010). Heitink et al. (2016) only identified two studies showing a direct impact of teacher professional development in formative assessment on student achievement, and Schneider and Randel (2010) conclude 'rigorous causal evidence linking improved student achievement to professional development in formative classroom practice is not available' (p. 262). Thus, a strong research base supporting how to effectively help teachers to implement a high-quality formative assessment practice is lacking (Schneider & Randel, 2010; Wiliam, 2010).

The present study is part of a larger research project investigating a teacher professional development programme (PDP) in formative assessment and its effects on teaching and student achievement in mathematics. In the project a random sample of school-year-4 teachers participated in this PDP, which was built on the idea of formative assessment as a unity of integrated strategies. A study presented in Andersson and Palm (2017a) shows that the teachers made significant changes towards a more formative classroom practice in the school year following the PDP (see the section on 'the effects of the professional development on the teachers' classroom practice', below) to the extent that their students significantly outperformed the students of the teachers in a control group after one school year of implementation of formative assessment, controlling for the performance on a pretest at the beginning of the year (Andersson & Palm, 2017b).

The aim of this study is to investigate why these teachers were able to use the PDP to make these changes to their teaching practice. The study focuses on the following four research questions:

RQ 1: Why did the teachers use the PDP to significantly change their overall teaching practice towards a more formative classroom practice?

RQ 2: Why did they make the specific changes they made, and why not others?

RQ 3: Which characteristics of the PDP did the teachers experience as the most important for them in order to implement this new formative classroom practice?

RQ 4: Which aggravating conditions to change did the teachers experience?

The expectancy-value theory of achievement motivation

In the investigation we will take a motivation perspective. The expectancy-value theory of achievement motivation (Wigfield & Eccles, 2000) will be used as an interpretive lens in the analysis of the teachers' reasons to fully engage in the professional development and in the implementation of a new formative classroom practice. Motivation is the driving force of human behaviour, and the failures of ambitious professional development programmes often seem to be related to teachers not sufficiently directing and sustaining their efforts towards programme implementation (Bell et al., 2008; Randel et al., 2011; Schneider & Randel, 2010).

According to expectancy-value theory expectancies of success and achievement values are the two major determinants of individuals' motivation to carry out an activity. Expectancy of success can be defined as individuals' 'beliefs about how well they will do on upcoming tasks, either in the immediate or longer-term future' (Wigfield & Eccles, 2000, p. 70). Such beliefs may include expected success in learning and implementing new formative assessment practices. Different components of achievement values are defined: attainment value (importance), intrinsic value (interest), utility value (usefulness), and cost (Wigfield & Eccles, 2000). Attainment value refers to the perceived importance of doing well on an activity. It is also linked to the relevance of engaging in an activity to confirm or disconfirm salient aspects of one's actual or ideal self-schema such as competence in a domain (Wigfield & Eccles, 1992). Thus, such self-schema may involve ideas about what a good teacher is. Intrinsic value refers to the enjoyment of conducting an activity in itself, and utility value refers to a perceived useful outcome of the activity. Enjoyment may arise from the satisfaction of learning to use new teaching methods, and enhanced student learning would be considered a utility value. Cost pertains to a negative value, which may arise from the current activity limiting the engagement in other valued activities. For example, teachers who devote more time for lesson planning will have less time to spend on other activities such as family life. Expectancy-value theory posits that a number of social, cultural and cognitive factors interact in the development of expectancy and value beliefs. In this study we focus on the teachers' expectancy and value beliefs, but also reflect on the characteristics of the PDP, and how these factors may have influenced the teachers' expectancy and value beliefs.

Formative assessment

The core of most definitions of formative assessment includes using assessment evidence for adapting teaching and learning activities to the students' learning needs, but there is no agreed-upon definition of formative assessment in the research community (Baird et al., 2014; Bennett, 2011; Dunn & Mulvenon, 2009; Filsecker & Kerres, 2012; Good, 2011; Wiliam, 2011a). Some see formative assessment as an instrument (e.g. a test), others see it as a process and still others as a combination of instrument and process (Bennett, 2011). Another example of a differentiating factor is the relative role of the teacher and the learner. Some scholars put the teacher in the foreground, while others emphasise the importance of

the learners being the main agents developing into autonomous self-regulated learners (for an overview of different definitions of formative assessment, and assessment for learning, and their theoretical underpinnings, see Baird et al., 2014).

In the present study, we conceptualise formative assessment in accordance with the definition by Black and Wiliam (2009) above. In this conceptualisation, formative assessment is seen as a practice where the participants may use both formal and informal methods of gathering information about student learning, and both the teacher and the students are seen as important agents in the practice that also includes adapting teaching and/or learning to the identified learning needs. The definition by Black and Wiliam (2009) was operationalised by Wiliam and Thompson (2008) in a form that facilitates the learning, and practical use, of formative assessment in the classroom, and this framework was used in the professional development programme carried out in the present study. The framework consists of the 'big idea' of using evidence of student learning to adjust instruction to better meet the identified student learning needs, and the following five key strategies (KS):

KS 1. Clarifying, sharing and understanding learning intentions and criteria for success

KS 2. Engineering effective classroom discussions, questions, and tasks that elicit evidence of learning

KS 3. Providing feedback that moves learners forward

KS 4. Activating students as instructional resources for one another

KS 5. Activating students as the owners of their own learning

The key strategies come from considering three instructional processes (establishing where the learners are going in their learning, establishing where the learners are right now in their learning, and establishing what needs to be done to get where they are going), and three agents in the classroom (teachers, the individual student and peers). Key strategy 1 focuses on the importance of the teacher and the students coming to a mutual understanding of the learning goals. Key strategy 2 deals with the gathering of evidence of students' current skills and understanding, and Key strategy 3 is about how to act on this information to better meet the students' identified learning needs. Such actions comprise feedback and/ or instructional activities that are adapted to the identified needs. Key strategy 4 includes peer-assessment and peer-feedback, and Key strategy 5 is about students as autonomous self-regulated learners in the formative assessment processes. The five key strategies represent different aspects of formative assessment that is integrated into one unity by the 'big idea' (see next paragraph).

The strategies of formative assessment are neither stand-alone entities nor sequential steps (Hawe & Parr, 2014). The different key strategies are connected, and the strengthening of each of the strategies enhances the benefit of the other strategies. For example, from the perspective of the teacher as an agent in the teaching and learning processes, clarification of the goals for the students also forces the teachers to raise their own awareness of their personal interpretation of the goals. Clearer goals facilitate the assessment of the most relevant knowledge and skills, which in turn provides more valid and reliable data about students' learning needs and thus the possibility to make more valid and reliable decisions about feedback and instructional activities that are adapted to the students' learning needs. From the perspective of the students as agents in the teaching and learning processes, a

clear and mutual understanding of the learning goals is important since these goals guide the students, as well as provide standards for self-assessment, in self-regulated learning processes (Zimmerman, 2002). In addition, a mutual understanding of the learning goals facilitates the provision and interpretation of useful peer-feedback. Hence, activities in which the teacher and the students work together to come to a mutual understanding of these goals increase the empowerment of higher quality peer-assisted and self-regulated learning. There is ample empirical evidence that practices based on individual formative assessment strategies have the power to enhance student achievement (see references in the Background section above), but the full potential of formative assessment 'can only be realised when all strategies are present, to a greater or lesser extent, within a learning–teaching episode and when students are afforded opportunities to take responsibility for their learning' (Hawe & Parr, 2014, p. 212).

The five key strategies are operationalised in the classroom by *formative assessment activities* that are carried out by the teacher and the students. We define such activities as concrete activities used in classroom practice that contribute to the attainment of the purpose of at least one of the key strategies, and the 'big idea'. The requirement of contributing to the purpose of the big idea means that, for example, a specific activity by which information about student learning is gathered is only regarded as a formative assessment activity (pertaining to Key Strategy 2, 4 or 5 depending on who is making the assessment) if the information is used to adapt teaching and/or learning to the identified student learning needs. An example of a formative assessment activity pertaining to Key strategy 2, would be when a teacher asks the students questions in a whole-class session, and the students answer on mini-whiteboards that they hold up at the same time for the teacher to see. This use of mini-whiteboards as an all-response system provides the teacher with information about all students' learning at the same time. Based on an interpretation of the thinking and skills underlying the students' responses, the teacher can adjust the instructional activities during the same lesson taking all students' learning needs into consideration. However, an individual formative assessment activity may be a manifestation of more than one key strategy. For example, an activity in which the students assess their own work in relation to success criteria may be a part of a strategy aiming at coming to a mutual understanding of the learning goals and criteria for success (Key strategy 1), but also a part of a strategy supporting students to becoming self-regulated learners (Key strategy 5).

Method

Study design

In the spring of 2011 a randomised selection of teachers participated in a professional development programme in formative assessment, and in the school year 2011–2012 the teachers were back in full-time teaching again. Data collection was made using teacher questionnaires and teacher interviews. The first questionnaire was administered directly after the professional development programme, and included questions about the teachers' experiences of the professional development, and their plans and expectations about their possible implementation of a formative classroom practice the coming school year. The second questionnaire was administered in the end of the school year 2011–2012, and comprised questions about changes in practice they had made, reasons for these changes,

and plans and expectations for future practice. The interviews with each teacher were also carried out in the end of this school year. The interview focused on the changes the teachers made in their practice and the reasons for these changes, as well as reasons for not implementing other activities that were included in the programme.

Participants

Twenty-nine teachers were randomly selected from all teachers who were going to teach mathematics in year 4 (10-year old students) in a middle-sized Swedish city in the school year 2011–2012. These teachers were invited to participate in the professional development programme and the research study. Seven of them declined. The reasons for not wanting to participate differed but included soon retirement, already feeling proficient in formative assessment, and other school priorities. The remaining 22 teachers (14 females and 8 males) participated both in the professional development and in the study. Most of the participating teachers had only year-4 students in their class, but four of them had a mixed-age class. The socio-economic and cultural backgrounds of their students were diverse. As in all schools in Sweden, these teachers and students work in a context where there are national tests in year 6, but not in year 4 and 5.

The professional development programme

The teachers participated in a professional development programme (PDP) in formative assessment led by the second author. The content of the PDP was formative assessment conceived of as a unity of integrated strategies, which was operationalised through the framework by Wiliam and Thompson (2008) described above. The programme was designed to possess many characteristics that in research reviews, of professional development in a variety of content areas, have been identified as associated with successful professional development (Desimone, 2009; Schneider & Randel, 2010; Timperley et al., 2007). Such characteristics include content that is consistent with wider trends and research, and the inclusion of teachers in the decisions about the goals and design of the programme. They include external expertise, and learning opportunities over an extended period of time with frequent contact hours. The learning opportunities involve participation in teacher learning communities where the teachers process new understandings or challenge problematic beliefs, with a focus on the impact of teaching on student learning. The PDP is intended to support a culture of openness, trust and cooperation in the communities, and the teachers are provided with recurrent possibilities of seeing the effects of their efforts, and feel responsible for their own development.

    The teachers and the programme leader met at the university for six hours once a week over one term (144 h in total). In addition, the teachers had another 72 h available for reading literature, planning and reflecting over new formative assessment activities. The main literature was Wiliam (2011b), and many of the activities exemplified in this book were tried out by the teachers (for examples of such activities, see the next section on 'The effect of the professional development on the teachers' classroom practice'). Between the meetings the teachers were supposed to put theory into practice by trying out formative assessment activities, which had been introduced and discussed at a meeting. A typical university meeting comprised lectures presenting the theory of formative assessment, its

research base and examples of concrete activities for its implementation in the classroom, group discussions about formative assessment and its implementation, and discussions about experiences from last week's implementation. It was a deliberate decision to provide time at the meetings for group planning of new formative assessment activities to try out in the classrooms. When teachers are supposed to carry out such planning at other times, it may easily be down-prioritised by other teaching duties. In addition, in group planning teachers can support each other. Furthermore, the teachers may be propelled to actually do try out the activities when they both plan and evaluate these try-outs together. In the discussions at the next meeting, the teachers evaluated the try-outs, shared experiences of success and discussed how they could help each other overcome obstacles and develop the use of any particular activity. They first discussed their experiences in small groups. To support these discussions and keep them focused on how to successfully implement a formative assessment practice, the discussions were organised to include what had worked well and not well, what had been difficult, which barriers the teachers had experienced, how these difficulties and barriers had been handled in order to overcome them and which other strategies that may exist to overcome these or other potential difficulties. Then all groups gathered and discussed each group's most important experiences and conclusions (not what they had been talking about in general), so everyone could learn from these. The tutor supported these discussions and intervened with suggestions when deemed useful. Such support could include clarifications of the theory, and suggestions for modifications of activities that had not worked well in the classroom. But support could also come in the form of arguments for the advantages of formative assessment to motivate the teachers, and in the form of help to focus group discussions that had come off track, which happened every now and then. As part of the support for the teachers' self-regulated learning, the teachers could take an active role in the decision-making about the goals and design of the meetings. This includes decisions about the focus of individual meetings, and which activities to try out in the classrooms before the next meeting. For example, after requests from the teachers it was decided that, even though every week's meeting included planning for trying new activities in the classrooms, the follow-up on these try-outs would be after two weeks to increase teachers' flexibility regarding when to carry out the try-outs. Thus, generally the programme had a formative and process-oriented character where decisions about learning activities were based on information about the teachers' learning needs that were continuously identified in discussions and practical activities. At the last meeting, time was put aside for planning, individually or in small groups, for their use of formative assessment in their teaching in the next term.

The effect of the professional development on the teachers' classroom practice

The differences in practice, with respect to formative assessment, before and after the professional development input were identified in another study through classroom observations, interviews and questionnaires. They are described in detail in Andersson and Palm (2017a) and summarised here. All teachers changed the foundation of their teaching towards a practice based on the 'big idea' that teaching and learning practices must be adapted to the students' learning needs. These needs were recurrently identified by (formal and informal) assessments. The teachers considered themselves as both active agents in carrying out these formative assessment processes, and as important for helping their students to take part in

these processes as autonomous learners. The differences in the teachers' implementation of formative assessment practices can be described in both quantitative and qualitative terms. The differences span from, at the one end, a teacher who recurrently carried out eight new activities of which most (but not all) involved the teacher as the main responsible agent, and, at the other end, the teacher who implemented 34 new activities, and whose every lesson was permeated by formative assessment processes. The latter practice included many activities in which the teacher assessed her students and provided feedback or instructional activities adapted to the information she received from the assessments. The practice also included many activities that involved the students as main responsible agents. The teacher and her students discussed the learning goals, and she purposefully trained her students in peer-assessment and peer-feedback as well as trained her students to developing their self-regulated learning competence by both describing how such regulation can be carried out and by letting them practise these skills.

In relation to Key Strategy 1, most teachers began breaking down learning goals into subgoals, and set up criteria for achieving these goals at different levels. These subgoals and criteria were clarified in discussions with the students. In their communication with their students, half of the teachers also replaced their previous focus on the number of tasks to be solved by a focus on emphasising and clarifying the learning intended.

The most evident change the teachers made was to implement new ways of assessing student learning (activities pertaining to Key Strategy 2), and then used the information to adjust instruction to better respond to identified learning needs (the big idea). The most common new activities were the frequent use of student mini-whiteboards (mentioned in the section on formative assessment above) and 'exit passes' (see below). The use of mini-whiteboards as an all-response system provides the teacher with information about every student's learning within seconds during a lesson, and thus solves the problem of acquiring information about every individual student in large classes. Based on an interpretation of the students' responses on the mini-whiteboards, the teachers are able to adjust their instructional activities in the same lesson. The use of exit passes means that students write their responses to teacher questions, for example on a piece of paper, at the end of the lesson and give it to the teacher when leaving the classroom. Based on these responses, instruction in the next lesson is adjusted to fit the students' understanding. The use of mini-whiteboards and exit passes are techniques described in Wiliam (2011b). Other new and commonly used assessment activities were using tests for formative purposes, encouraging students to reveal insecurity in their understanding and replacing students putting their hands up as a system for choice of respondent to teacher questions with a random choice system.

Common instructional adjustments were to modify instruction for the whole class based on learning needs identified in assessments of all students, provide extra or adjusted instructional activities for smaller groups of students, modify the time spent on a mathematical unit or to (in dialogue with individual students) make sure each student worked with tasks appropriate for their current mathematical understanding. All of these adjustments are now better grounded because of their new activities aimed at gathering information on each individual student's learning. Common changes in the teachers' feedback (Key Strategy 3) were to only give feedback in the form of comments, and not as marks or grades, and to provide feedback that both communicates what the students have done well and a specific suggestion about how to improve.

In addition, the teachers tried to activate the students as agents in the formative classroom practice. The teachers' most common changes in relation to Key strategy 4 were to increase their encouragement of their students to help each other, and together with the students identify how to act as resources for one another. The most common changes to operationalise Key strategy 5 were to support their students in becoming more autonomous learners by coming to grips with ways of regulating their own learning such as how to monitor and evaluate their use of time and how to handle situations in which they do not know how to solve the learning tasks.

The teachers' developed formative assessment practices can be seen as a unified and connected set of activities guided by the 'big idea' of adapting teaching and learning to students' learning needs. Teachers and students interpreted learning goals, used these interpretations to assess learning needs, and adapted feedback, instructional activities and learning to fit these identified needs. The practices provide extended learning opportunities for the students. For example, the feedback and learning activities that were adapted to the students' learning needs, identified through the frequent assessment of all students' learning (e.g. through the use of mini-whiteboards and exit passes), makes the classroom time more efficiently used for more students than before. The feedback (from the teacher and the students) that after the PDP to a larger extent communicated specifics of what the students had done well provides a sense of competence and therefore promotes student motivation (Ryan & Deci, 2000), and the specific suggestion about how to improve increases the students' possibilities to actually learn from the feedback. In addition, the students spent less time waiting for help from the teacher, and more time on active learning, because they were less dependent on the teacher when they sought and provided high-quality support from each other and activated themselves in self-regulated learning processes, which were processes that were supported by the teachers in the study. The increased focus on the learning goals (Key strategy 1), makes it easier for both teachers and students to ask relevant questions, to give appropriate feedback and to guide learning.

Questionnaires

Almost all of the teachers (21 out of 22) answered the two administered questionnaires. The teacher missing for each time was not the same. Both questionnaires included questions to be answered on a five-point scale, as well as open-ended questions. Questionnaire 1 included thirteen questions, and Questionnaire 2 included five questions, pertaining to the first and second research question about why the teachers made changes in their teaching practice. The questions refer to the changes the teachers made, as well as to their degree of motivation and expectancy and value beliefs for making the changes. Four questions in Questionnaire 1 were used to identify the opportunities the teacher had experienced as important for the implementation of formative assessment (Research question 3), and four questions were aimed at conditions the teachers experienced as aggravating for the implementation (Research question 4). All of these questions are displayed in the Results section in connection to the presentation of the teachers' responses to them.

Interviews

The interviews were semi-structured with duration of approximately 1½ hour, and directed by an interview guide. The interview guide was structured by conversational logic, rather than strictly following the research questions. The interview guide had three parts. In the first part the teachers were asked to describe their teaching after the PDP, without having to go into detail. In the second part the teachers were asked to provide more details about their changes in practice, but also reasons for the specific changes they made. Questions probing the reasons for implemented activities were for example: 'What did you think would be the value of that activity'? and 'How did it work'?. In the third part of the interview the teachers were asked to more generally talk about the reasons for their choice of practice after the professional development. Three kinds of questions were used: (1) questions about why certain changes were made and not others ('Why did you make these particular changes'?, 'Why did you do all this, and not less'?, 'Why did you not do more'?) (2) questions about support at their school that affected the implementation ('Are there any conditions or support that you have experienced at your school that have affected the implementation positively or negatively'?), and (3) questions about the teacher's general experiences from the implementation of formative assessment (e.g. 'What are your experiences of this year's teaching that included the new formative assessment elements'? 'Which advantages and disadvantages have you experienced with this kind of teaching'?).

No question explicitly asked for the significance of the PDP or what in the PDP that had been most important for changes in classroom practice (Research question 3). However, if teachers brought up the PDP as important for their implementation, follow-up questions would address why they thought so and which characteristics they thought were most important.

Procedures for data analysis

Answers to the research questions are based on an analysis of data from both questionnaires and the interview. The first two research questions refer to why the teachers implemented a more formative classroom practice in general (Research question 1) and why specific activities were implemented (Research question 2). The answers to these research questions are based on analyses of the teachers' responses about their degree of motivation, as well as expectancy and value beliefs, for implementing formative assessment into their classroom practice. According to expectancy-value theory, these beliefs are the two main determinants of motivational behaviour (Wigfield & Eccles, 2000). The mean values of the teachers' responses to each questionnaire question that was answered on a five-point scale were calculated as estimates of the teachers' degree of motivation and degree of expectancy and value beliefs. In addition, reasons, for implementation and non-implementation, pertaining to motivation and expectancy and different value beliefs that were given to open-ended questions in the questionnaires and in the interview were categorised. For example, the following teacher utterance was categorised as the teacher experiencing a utility value in formative assessment: 'I see it in their [the students] performances … the whole attitude to both the learning and the subject is a positive change, which of course is stimulating in itself'. The number of teachers with responses classified in each category was calculated, and used as an additional measure of the group of teachers' motivation and expectancy and

value beliefs. This second measure was used as triangulation for possible enhancement of confidence in the findings based on the teachers' responses to the questionnaire items with a five-point scale response format. Based on these analyses the expectancy-value theory was used to draw conclusions about why the teachers implemented a more formative classroom practice in general, and why they implemented certain activities and not others.

Data for answering which characteristics of the PDP the teachers experienced as most important for them to be able to implement their new formative classroom practice (Research question 3), and which aggravating conditions for change they experienced (Research question 4) came from the responses to the open-ended questions in Questionnaire 1 and the interview. These responses were classified in categories not specified beforehand. Descriptions of the identified categories, and examples of classifications of teacher utterances, are provided in the Results section.

Results

RQ 1: Why did the teachers use the PDP to significantly change their overall teaching towards a more formative classroom practice?

Teachers' motivation

A starting point for the analysis was the teachers' motivation to developing their teaching. The results from analysing the teachers' answers to both Questionnaire 1, given directly after the PDP, and the interview carried out after one year of teaching after the PDP, showed that after the PDP the teachers were highly motivated to make significant changes in their teaching towards a more formative classroom practice (see Table 1).

The teachers' statements in the interviews were consistent with their responses to the questionnaire items. When they were asked about the changes they had made during this year, all but one of the teachers spontaneously expressed how inspired they were after the PDP to implement a more formative classroom practice. The following is an example of such a comment: 'When we started here this autumn it felt like we really had the training fresh in our minds. We felt that we now had the chance because now it's a new student group, so now you want to start up a new type of practice'.

Expectancy and value beliefs for implementing formative assessment

The data analysis shows that expectancy-value theory can explain the teachers' high motivation for implementing a developed formative classroom practice. The analysis of both questionnaires and interviews after the PDP shows that the teachers had high expectations

Table 1. Teachers' degree of motivation for implementing formative assessment.

Items in Questionnaire 1	Mean
1. How much of a change would you like to make in your teaching towards a more formative classroom practice (compared to your teaching before the PDP) for your year 4 mathematics class during this school year?	4.1
2. How motivated are you to make these changes?	4.7
3. During the coming school year at times you will have several important things that you need to do at work. To what extent do you plan to prioritise your implementation of a more formative classroom practice during these periods?	4.1

Note: The first column displays the questions in Questionnaire 1 that measure teachers' motivation. The second column displays the average value of the teachers' responses to each question on a 5-point scale (1 referring to little extent or small changes, and 5 to large extent or big changes).

of succeeding with the implementation of formative assessment and also experienced high values and relatively low cost of doing so (see Table 2). Although the teachers' value beliefs were high directly after the PDP (Questionnaire 1), their answers to the question about the importance of carrying out their formative classroom practice rose from 4.2 to 4.8 at the end of the school year (Questionnaire 2). This increase in importance came despite a small decrease in utility value beliefs (which remained quite high) and a small increase in the beliefs about cost.

The teachers' value beliefs, reflected in their answers to the above questionnaire items, were consistent with their responses to the open-ended questions in Questionnaire 1 ('Why do you want to make small or big changes?' and 'Why do you want to make those particular changes?'), Questionnaire 2 ('Why would it be important for you to continue with a formative assessment practice?'), and the interview questions that targeted these beliefs. The teachers did not bring up expectancy of success beliefs into those open-ended questions. In both questionnaires, 11 teachers referred to a reason for making changes that was categorised as reflecting an attainment value. In the interview, all teachers provided answers indicating that their ideal regarding teaching was captured by the principles of formative assessment, e.g. 'once I had tried and tested I felt that it was obvious that I had wanted to teach like this the whole time'. They expressed that adapting classroom practice to the students' learning needs (the 'big idea') was something they had always wanted, and they also considered it important to help the students becoming more responsible for their learning. They felt that the PDP provided the support and tools they needed to carry out such a practice. Teaching in this way allowed them to conceive themselves as competent teachers. All teachers brought up reasons representing utility values in both the questionnaires and in the interview. The

Table 2. Teachers' expectancy and value beliefs about implementing formative assessment.

Items in Questionnaire 1	Belief	Mean
1. To what extent do you think that you have acquired the knowledge of formative assessment you need to feel ready to undertake such teaching in an effective way?	Expectancy of success	4.1
2. To what extent do you feel it is important for you to make changes in your teaching towards a more formative classroom practice?	Attainment value	4.2
3. How much of a positive outcome for yourself do you think the changes you plan on making will lead to?	Utility value	4.2
4. How much of a positive outcome in terms of student learning do you think the changes you plan on making will lead to?	Utility value	4.0
5. How much other positive outcomes for students (e.g. interest or welfare) do you think that the changes you plan on making will lead to?	Utility value	4.1
6. How large costs for you (time, effort, scepticism, other) do you think the changes you plan on making will lead to?	Cost	2.8
Items in Questionnaire 2		
I. To what extent does it feel important for you to continue with a formative classroom practice? (Why?)	Attainment value	4.8
II. How much of a positive outcome for yourself have you experienced due to the changes in teaching you have made?	Utility value	4.1
III. How much of a positive outcome in terms of your students' learning have you experienced due to the changes in teaching you have made?	Utility value	3.6
IV. How much of other positive outcomes for students (e.g. interest or welfare) have you experienced due to the changes in teaching you have made?	Utility value	3.7
V. How large do you experience the costs have been for you (time, effort, scepticism, other) due to the changes in teaching you have made?	Cost	2.9

Note: The first column displays the questions in Questionnaire 1 and 2 that measure the expectancy and value beliefs specified in Column 2. The third column displays the average value of the teachers' responses to each question on a 5-point scale (1 referring to little extent, and 5 to large extent).

following utterance describes these utility values: 'I see it in their performances … their whole attitude to both the learning and the subject matter has changed positively, which of course is stimulating in itself'. The teacher exemplifies that the students have become much better at describing exactly what they understand and what they need help with, and that they seem to enjoy being the most active part in the process of identifying their understanding. In the interview, 12 teachers referred to reasons conveying intrinsic values for pursuing a formative classroom practice. They said that it had been more enjoyable to teach during this school year, e.g. 'I've always thought it was enjoyable … to go to work … I think that it's even more fun now, because I think I am a bit more competent'. Sixteen teachers brought up the costs in the interview, and two did so in the questionnaires. They did not see formative assessment as a quick fix, but no one emphasised that this was a big problem and the following quote is representative of their responses: 'I will encounter challenges and obstacles, but it makes total sense to continue with my started rethinking'.

RQ 2: Why did the teachers make the specific formative assessment changes they made, and not others?

The analysis of the teachers' responses to questions in the questionnaires and interview shows that also the teachers' choice of specific activities to implement is consistent with expectancy-value theory. Teachers' beliefs about their expectancy of succeeding in carrying out specific activities were not measured in this study. However, the teachers' value beliefs were important. All three new activities that were most commonly implemented (based on an analysis of the teachers' classroom practice presented in Andersson and Palm (2017a) were appraised with high value and relatively low cost (see Table 3). These appraisals were based on theory and research insights presented during the PDP, but mostly on experiences from the new activities the teachers were trying out.

This is consistent with the interviews in which 15 of the teachers expressed that they chose to implement activities they found provided high value at little cost, e.g. 'I think I've chosen the ones that have provided the most value, both for myself and the students, and that also have been viable'. Examples of such values are experiences of increased student engagement during lessons and enhanced learning. The students' appreciation of the activities was also decisive for implementing them. For example, teachers stated that their students liked using mini-whiteboards, which encouraged the teachers to use them even more than they had

Table 3. Expected positive effect and cost for the three most used activities presented in the PDP.

Activity	Number of teachers	Expected positive effect (value)	Expected cost
Use of mini-whiteboards for student answers	21	4.9 (14)	1.6 (13)
Use of exit passes for evidence of learning	17	3.8 (15)	2.2 (13)
Feedback providing identification of two accomplishments and one suggestion for improvement	17	4.1 (12)	2.9 (9)

Note: The second column displays the number of teachers that regularly used each activity during the school year following the PDP (based on an analysis of the teachers' classroom practice presented in Andersson and Palm (2017a). The third and fourth columns display the average value that the teachers assigned, on a 5-point scale in Questionnaire 1, to the positive effect and cost they expected from each activity. The numbers within the parenthesis display the number of teachers these results are based on (only teachers who, in the questionnaire, had submitted the activity as one of the five they had tested the most during the PDP could assign levels of expected value and cost to the activity).

planned. In contrast, few teachers developed or used rubrics, describing various levels of attainment of learning objectives, other than those developed during the PDP. The teachers experienced this type of work to be difficult and time-consuming, and did not affect the students' learning since it was difficult to achieve student understanding of the rubrics.

RQ 3: Which characteristics of the PDP did the teachers experience as the most important for them in order to implement their new formative classroom practice?

The identification of the most important characteristics of the PDP was based on the statements made in the interview and teachers' responses to the questions in Questionnaire 1 asking:

A. which opportunities they had had to acquire the knowledge of formative assessment they needed to feel ready to undertake such practice in an effective manner,
B. which opportunities they did not have that would have facilitated the acquisition of these skills,
C. which factors in the PDP they thought were crucial to whether it would lead to the teaching changes they wanted to make,
D. and finally the teachers were asked to provide feedback regarding the PDP in the form of 'two positive characteristics and an unlimited number of suggestions for improvement'.

No suggestions were made in response to Question B. In the interview the teachers' statements mostly came from responses to questions about the reasons behind the changes they made, why they made all of these changes rather than fewer, and why they hadn't made more changes. Teacher responses relevant to Research question 3 also came to follow-up questions that involved asking which characteristics of the PDP had been important for bringing about their changes in teaching.

Six characteristics of the PDP have been identified as the most important for bringing about the changes made in teachers' classroom practice. These characteristics, as well as representative exemplars of the classification of teacher responses, can be found in Table 4. In addition, the large majority of the teachers highlight the PDP as a whole, including most of the six characteristics identified. The following teacher quote summarises the experience of the value of the PDP as depending on all six characteristics working together:

> The time, that we had in our training … we have all said that, in that way, it has been the best training we have ever had, because we have had the opportunity to talk, we have received lectures, thought through ideas and tested them in our classrooms, and been given feedback. Really this learning spiral we've had, I've never experienced such training.

RQ 4: Which aggravating conditions to change did the teachers experience?

Generally, the teachers were satisfied with their learning conditions during the PDP. The mean value of the responses to the following item in Questionnaire 1 was 2.35: 'To what extent do you think you would need different conditions in order to implement the changes in the teaching you want?' When asked about opportunities and conditions they missed during the PDP hardly any were mentioned.

Table 4. The most important characteristics of the PDP for teacher change, and teacher utterances that exemplify the categorisation.

PDP characteristics	Number of teachers
Availability of activities directly useable in classrooms	
During the PDP the teachers were presented with concrete teaching activities that were directly useable in the classroom. They were also supported to develop new activities	11 (50%)
'It's fun to get new techniques for ideas that I already had, so to speak. That's why it's so easy to sell this, really, for all teachers agree with these ideas. It is obvious that one should not assume what the students know, but to keep track of their understanding. There is no one who would argue with this, but we have not really had the tools to do this.'	
Experience the value of formative assessment activities	
The teachers could test the concrete classroom activities presented or developed in the PDP so they could experience the value of this way of teaching and feel comfortable with implementing these activities	20 (91%)
'… possibility to put theory into practice immediately'	
Connection between theory and practice	
This characteristic refers to the content of the PDP (formative assessment), as well as the PDP including lectures and relevant literature that, in addition to concrete activities, also focused on the theory of formative assessment that underlies the presented activities. The PDP connected theory and practice, and provided a theoretical structure for the activities	19 (86%)
'[It was] very good that the course structure had a mixture of theory and practice', 'it's a great acknowledgment of some of the thoughts I've had in the past, or it is a confirmation of that, and at the same time it has provided a structure of how to handle it'	
Knowledgeable support	
Knowledgeable support was expressed by the teachers as the PDP leader being knowledgeable and inspiring, presenting content and learning intentions clearly, and providing useful feedback	15 (68%)
'The way [the PDP leader] explained using examples if we didn't understand', '[The PDP leader] knows the topic and has been good at inspiring us'	
Formative and process-oriented PDP	
The PDP was carried out as a formative practice	21 (95%)
'The form of the training was very well adapted for the purpose. That is, one day a week for one term when we learned about techniques for formative assessment, discussed them, implemented them, and then shared our experiences'	17 (77%)
Time	
This characteristic refers to two types of time available for the PDP: (1) time for learning and practising new knowledge and skills, and (2) the duration of time, meaning regular meetings spread over an (for them) unusually long period of time	
'It was also great that we were given time to plan, implement, and then discuss the different strategies', ''Because training was over a long time, it made it possible to introduce strategies and use techniques gradually. We are grateful for the continuity of the training that made it possible to follow each other's experiences on the way to a formative classroom practice on a deeper level'	

However, the teachers mentioned two main conditions pertaining to their schools they perceived made it harder for them to implement a more formative classroom practice. These conditions constituted a threat to the expectancy of succeeding with the implementation and therefore their motivation of doing so. The first condition is about how the students are grouped in classes, which includes mixed age classes or large class size (mentioned by 7 teachers), and classes with a large spread in achievement or including students that are disruptive in the classroom (mentioned by 5 teachers). Such classes were seen to put further demands on using formative assessment because the students will work with different content areas. Disruptive students demand the teacher's attention to such an extent that the teachers find it difficult to make time for formative assessment activities with the other students. Four teachers also said that the young age of the students (10 years) affected their expectations about the difficulties for them to successfully carry out some of the activities. For example, the development of rubrics in collaboration with the students was expected to be especially difficult with this age group. The experience that some conditions made it more difficult to achieve positive outcomes, at low cost, from the activities does not mean that the teachers put the blame for these difficulties on the students (as some teachers in the study by Marshall & Drummond, 2006, did). All teachers in the present study spoke of their own responsibility for being able to carry out the activities they value. They did so regardless of whether they had made the activities a part of their regular practice despite the difficulties, whether they did not expect to be able to carry them out at all or whether they planned to try them again after first having consolidated other activities as part of their habits of practice.

Eighteen teachers referred to time as an aggravating condition. Implementation of formative assessment was described as a new and difficult process and until new habits of teaching have been established it needs special attention, and time for this is hard to find. All teachers found themselves capable of doing the implementation on their own, but a majority would have preferred collaborating with other teachers in order to make planning and preparation more effective. Thirteen teachers said that continued networking with the other teachers who participated in the PDP, or collaboration with colleagues at their own school, would have been desirable for continuing the use of formative assessment. One of the teachers expressed this as 'I wish that we could continue to meet up […] and that more colleagues will get the chance to make the same trip we made'.

Discussion

A contribution of this study is the finding that expectancy-value theory of achievement motivation can help explaining the teachers' successful development of a formative assessment practice, and thus may be a useful tool for understanding teachers' functioning in professional development contexts. To be able to implement a new formative classroom practice teachers need the motivation to prioritise the commitment to learn how to carry out such practice, as well as the commitment to implementing it in the classroom. The expectancy-value theory clarifies that such motivation is dependent on the teachers having the beliefs that learning and implementing formative assessment is both valuable and possible for them to achieve. The study shows that the teachers were able to acquire both of these types of beliefs.

The study also revealed the characteristics of the PDP the teachers viewed as most important for their learning and implementation of formative assessment. These characteristics are in alignment with the findings from the professional development literature (see references in the Introduction), although not all of them can be found in the same publications and are rarely empirically connected to student achievement outcomes.

We will now discuss how these characteristics may be connected to the teachers' development of the expectancy and value beliefs that provided the motivation for learning and implementing a formative assessment practice. The activities made available to the teachers during the PDP, and the possibilities for the teachers to test these activities in their classrooms with subsequent reflections, made it possible to experience the positive effects that these activities may have on students' attitudes and learning. These experiences may have positively affected the teachers' expectancy of succeeding in this implementation, as well as increasing their perceived utility value of the activities. The support of colleagues and external expertise may have contributed to these beliefs by providing help to find solutions to problems in the implementations, and to boost feelings of success after successful implementations. The connection between suggested activities, theory and research evidence, which was made available in lectures and in literature, may have provided a ground for the strengthening of the teachers' attainment value beliefs. Teachers' utterances in the interview (exemplified in the Results section) indicate that they found support for perceiving this practice as being at the heart of their professional identity. The knowledgeable support may also have been important for the acquisition of these attainment values by facilitating the understanding of theory and practice through explanations of content not well understood by the teachers. This knowledgeable support that also was important in helping teachers to overcome problems in their implementation, may also have strengthened expectancy beliefs as well as reducing beliefs about costs by showing new possibilities for implementing activities that did not come out well in a teacher's try-out in the classroom. In addition, this act of reducing perceived costs may have been facilitated by the teachers' limited need of summative tests due to the absence of grades and national tests in school year 4. Having a process-oriented PDP, and ample time available for the teachers during the PDP, provided possibilities for the teachers to actively engage in the activities above as self-regulated learners in a collaborative and supportive environment.

The results of this study and the reasoning connecting the characteristics of the PDP to the teachers' expectancy and value beliefs may also be indicative of why professional development programmes in formative assessment that lack some of these characteristics may not be successful. For example, the PDP investigated in the present study included 24 days of allotted time for the teachers, as well as external expertise that was continuously available and led the PDP. Such support may be decisive when the content of a PDP is as complex as formative assessment conceptualised as a unity of integrated strategies has been shown to be (Andersson & Palm, 2017a; Vingsle, 2014). In the studies by Bell et al. (2008) and Randel et al. (2011) the much less allotted time, and support mostly in the form of books, DVDs and instructions of how to work in teacher groups, were not sufficient for the teachers to implementing a formative assessment practice having a significant impact on student achievement. Indeed, the teachers in the study by Randel et al. (2011) mentioned the lack of time and external facilitator as main barriers for their implementation of formative assessment. The availability of extended time and external expertise may be important for several reasons. The motivational aspect of the functioning of the characteristics may be

understood by way of expectancy-value theory. In the beginning of a professional development all teachers may not have the expectancy and value beliefs required for sufficient engagement in the programme. Many will be pressured for time, and may not see their teaching as being of low quality. Therefore, they may not anticipate more than a little value coming from engaging in professional development, and if ample time is not provided they may anticipate the cost for engagement, in terms of time that could have been used for other important and pressing activities, being high. In accordance with expectancy-value theory they may therefore decide not to fully engage in all of the activities described above by which they may develop the necessary expectancy and value beliefs. An expert may support the teachers when they have doubts about the value of the new practice, when their expectancy of success in implementing formative assessment is low because they feel they do not have sufficient understanding of formative assessment, when they experience difficulties in implementation, or when they feel pressured by other responsibilities. Such support may have to take into consideration content issues, as well as social and emotional issues. Consistent with formative assessment practice, the support may be most useful when it is based on knowledge about individual's needs. Therefore, information about these needs must be recurrently gathered to facilitate the development of the teachers' expectancy and value beliefs required to make the commitment needed to learn and implement a formative classroom practice.

Disclosure statement

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