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ABSTRACT

Research has identified characteristics of professional development programmes (PDPs) that are important for accomplishing change in teachers' practice and student achievement. However, these characteristics do not predict and guarantee the outcomes of a specific PDP. In the present study the authors investigated whether the expectancy-value theory of achievement motivation can be used to explain teachers' change of practice. Through teacher interviews and questionnaires the authors investigated why randomly selected year-7 teachers, after participating in a PDP on formative assessment, changed their practice in ways identified in an earlier study, and why these changes differed from those of year-4 teachers participating in a similar PDP. The results show that expectancy-value theory can be used to explain both the schoolyear-7 teachers' changes in practice, and why the PDP for the year-7 teachers produced different outcomes in teacher practice than the parallel PDP, with the same general design features, did for the year-4 teachers.

Introduction

Research reviews have shown that the use of formative assessment in classroom practice may be one of the most effective ways of increasing student achievement (Black and Wiliam 1998; Hattie 2009, 297). However, despite efforts to spread its use, high-quality formative assessment is seldom observed in practice (e.g., Flórez and Sammons 2013; Ofsted 2008; Smith 2011; Stiggins 2002). Initiatives to promote formative assessment have frequently been unsuccessful in accomplishing a substantially improved formative assessment practice (e.g., Hume and Coll 2009; James and McCormick 2009; Schneider and Randel 2010; Wylie and Lyon 2015), to the extent that increased student achievement was obtained (Bell et al. 2008; Randel et al. 2016; Schneider and Randel 2010).

Reviews of professional development have identified several programme features important for attaining desired teacher and student outcomes across content areas (Desimone 2009; Timperley et al. 2007). These features can be summarized as: (1)

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a focus on teaching and learning subject matter, (2) active learning, including for example hands-on practice, (3) teacher collaboration and discussions about the impact of activities tested in the classrooms, (4) coherence between what is being taught in the programme and wider policy trends and research, and (5) the duration of and time spent on the programme. In addition, Timperley et al. (2007) also found engagement of school leaders and external expertise to be necessary for a professional development programme (PDP) to affect student achievement. A recent review, focused specifically on formative assessment, identified similar features as important (Heitink et al. 2016).

Despite an apparent consensus on the characteristics of PDPs that lead to teacher learning and change (Desimone 2009), we are still unable to predict teacher learning based on these characteristics (Kennedy 2016; Opfer and Pedder 2011). Design features of PDPs may differ in important ways, in intensity and in different contexts, and these differences may affect teacher learning (Kennedy 2016; Opfer and Pedder 2011). Opfer and Pedder (2011) argue that a focus on the presence or absence of each characteristic limits our possibilities to understand and predict various outcomes of PDPs. They also argue that professional learning for teachers is a complex system where variables interact and combine in many ways and intensities. For example, the time needed for teachers to learn new ideas and transfer them into practice will vary depending on their prior knowledge and beliefs and on available support from external expertise. They suggest a shift in 'the conceptual framing of teacher learning and professional development research from a cause-and-effect approach to a focus on causal explanation so that we understand under what conditions, why, and how teachers learn' (Opfer and Pedder 2011, 378). Kennedy (2016) concurs and recommends research designs and professional development models be more closely tied to underlying theories of teacher motivation and learning. Indeed, since motivation is the driving force of human behaviour (Ryan and Deci 2000), this would be a useful perspective in trying to understand teachers' choices in PDPs to learn new ideas and implement them in their classrooms. The failures of many professional development initiatives (e.g., in formative assessment) seem to be related to teachers not directing and sustaining their efforts towards programme implementation (see Bell et al. 2008; Randel et al. 2016; Schneider and Randel 2010).

There are several theories of motivation that may be used in trying to understand teacher change. One such widely used theory is the expectancy-value theory of achievement motivation developed by Eccles, Wigfield and colleagues (Eccles et al. 1983; Wigfield and Cambria 2010), which posits two motivational beliefs: expectancy of success and expectancy of value, as the main determinants of motivated behaviour (for a description of the theory, see the section 'Expectancy-value theory of achievement motivation' below). As one of the most prominent theories of motivation, it has been used to understand motivated behaviour in education as well as in other domains, and there are several studies using the theory to understand teachers' choices. For example, Abrami, Poulsen, and Chambers (2004) used the theory to explain the extent to which teachers employ collaborative learning as an instructional strategy, and Xie et al. (2017) investigated the effects of professional development on teachers' expectancy of succeeding in implementing digital learning contents and the level of their values of doing so. However, despite the many uses of the theory, it has rarely been used to explain the effects of professional development on teacher practice. In fact, although a database search in ERIC, Psychinfo and Academic Search Elite (using the Boolean search command 'Expectancy-value theory'

AND 'teacher*' AND 'professional development' OR 'in-service training' OR 'teacher change' OR 'teacher learning' OR 'teacher growth' anywhere in the text), and the same search in SCOPUS (searching in the title, abstract and keywords), returned 60 journal articles, only one of them used the theory to explain the effects of professional development on teacher practice (regardless of the content of the PDP).

Aims and research questions

One aim of the present study is to investigate whether expectancy-value theory can be used to explain the change in practice of a sample of secondary school teachers. A second aim is to investigate whether the theory can explain the differences in professional development programmes' effects on the practice of two different groups of teachers. In the study, we investigated why year-7 mathematics teachers made some changes but not others in their classroom practice after participating in a PDP in formative assessment. We present this analysis and also compare the results with those of year-4 teachers (Andersson and Palm 2018) in the only study in the literature search above that used expectancy-value theory to explain effects of a PDP on changes in teacher practice. The PDPs were both led by the second author, and the design of both programmes included many of the characteristics identified in reviews (e.g., Desimone 2009; Timperley et al. 2007) as important for bringing about teacher change. Despite the similarity of the programmes, the outcomes in teachers' practices and students' achievements differed between the two groups of teachers. After the PDPs, the year-4 teachers implemented far more formative assessment activities than the year-7 teachers (see the section 'The effect of the PDP on the teachers' classroom practices' below, and for more detailed descriptions of the practices of each teacher group see Andersson and Palm 2017a; Boström and Palm 2019). After one school year of implementation the students of the year-4 teachers in the PDP outperformed the students of teachers in a control group (Andersson and Palm 2017b). No such effect was found for year-7 (Boström 2017).

The study focuses on the following two research questions:

RQ1. How can the year-7 teachers' change towards a more formative assessment practice be explained by the expectancy-value theory of achievement motivation?

RQ2. How can differences in the number of implemented activities between the year-7 and the year-4 teachers be explained by expectancy-value theory?

The expectancy-value theory of achievement motivation

Motivation is the driving force of human behaviour and instigates, directs and sustains goal-directed human behaviour. We used the expectancy-value theory of achievement motivation (Eccles et al. 1983; Wigfield and Cambria 2010) in the data analysis to understand the choices the teachers made when participating in the PDP. According to this theory, expectancies of success and achievement values are the main determinants of motivation, and are assumed to directly influence motivation and its manifestations in terms of achievement choices, effort and persistence. *Expectancy of success* can be defined

as individuals' beliefs about how well they will do on an upcoming task. In the context of this study, teachers' expectations of succeeding in learning and implementing a new formative assessment practice would constitute such beliefs. Expectations of succeeding in implementing new formative assessment practices do not refer to the teachers' beliefs about their general ability to implement new practices, but to their beliefs about how well they will do on the specific task of learning and implementing new formative assessment practices in the situation they are currently in. Achievement values do, in contrast to expectancy of success beliefs, involve appraisals about the extent to which implementing a new formative classroom practice would render value. Different components of achievement values are attainment value, intrinsic value, utility value and cost. *Attainment value* refers to the importance of doing well in 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, which in this case may involve ideas about what a good teacher is. If a teacher believes that formative assessment constitutes good teaching, and that an important aspect of her teacher identity is that she is a good teacher, then she would find it important to implement such a practice to confirm important aspects of herself. That is, she would experience an attainment value from implementing formative assessment. *Intrinsic value* refers to the enjoyment gained from conducting an activity, which, for example, may be evoked by the satisfaction of learning and using new ways of teaching such as formative assessment. In contrast, a *utility value* does not come from the activity itself but from the consequences of doing the activity. Utility value refers to the usefulness of the activity. In the context of this study, enhanced student engagement in the classroom or higher salary may be considered utility values because they are values that may come as a consequence of the teacher developing the classroom practice. *Cost* refers to what an individual has to give up to do a task, or the anticipated effort that needs to be exerted to complete the task. For example, the decision to engage in the learning and implementation of formative assessment may limit the possibilities for teachers to do other activities (e.g., planning ordinary classroom activities), and may require much effort.

High expectancies of success, high attainment, intrinsic and utility value beliefs, and low beliefs about costs enhance motivation. In the present study, expectations of succeeding in learning and implementing a formative assessment practice would contribute to their motivation of doing so. Teachers who think it is important to succeed in such an implementation, and think that this would enhance their sense of being a good teacher, would have high attainment values, which also would support motivation. Those who think it is fun or interesting to implement formative assessment would have intrinsic values, and those who for example see its usefulness for students' learning would have a utility value. Both these types of values would also strengthen the teachers' motivation. Teachers who anticipate that engaging in formative assessment would render too much more work would have a belief of high costs, which would decrease their motivation.

In this study, we primarily focus on the teachers' expectancies of success and value beliefs for learning and implementing formative assessment, but we will also discuss how these expectancy and value beliefs may have developed. The theory posits that expectancies and values are influenced by individuals' goals and self-schemata (e.g., ability beliefs and perceptions of task demands), as well as their affective memories for different achievement-related events (see Figure 1). These variables are influenced by individuals'
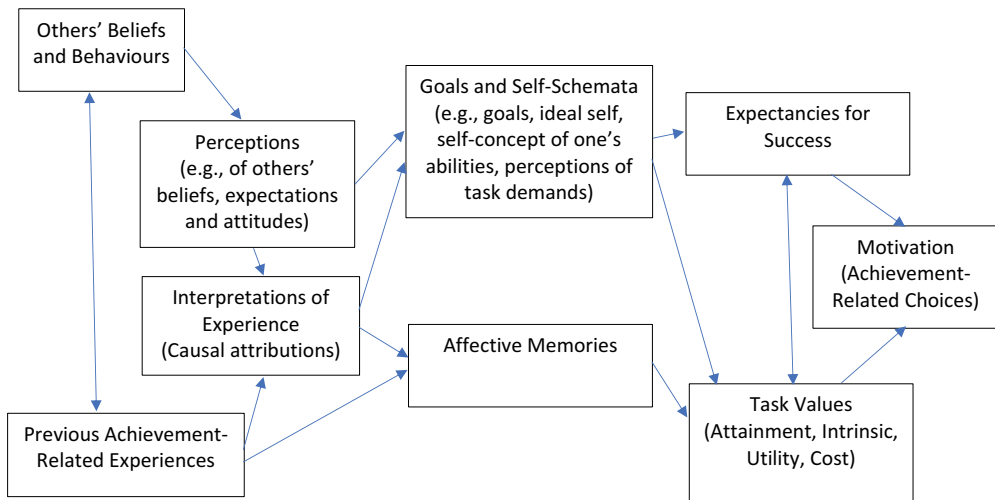
Figure 1. Simplified model of expectancy-value theory (based on Figure 1 in Wigfield and Cambria 2010, 37).

perceptions of other peoples' beliefs, attitudes and expectations, and the individuals' interpretations of their own previous achievement outcomes (how they attribute these experiences). These perceptions and interpretations are in turn influenced by other peoples' actual beliefs and behaviours, and their own previous achievement-related experiences (and their aptitude and cultural milieu in which they live, but these variables are not discussed in this study and are therefore not included in Figure 1).

The content of the professional development programme

The content of the PDP was formative assessment defined as:

> 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. (Black and Wiliam 2009, 9)

The term 'instruction' used in the definition includes both teaching and learning and refers to 'any activity that is intended to create learning' (10). In the PDP and the analysis of the teachers' changes in classroom practice (Andersson and Palm 2017a; Boström 2017), we used a framework by Wiliam and Thompson's (2008) that operationalizes the above definition. The framework consists of the 'big idea' of using evidence of student learning to adjust instruction to better meet 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 'big idea' is intended to permeate all the strategies. KS 1 emphasizes the importance of the teacher and students attaining a shared understanding of the learning goals. KS 2 focuses the gathering of evidence about student learning in order to provide feedback that meets students' learning needs (KS 3) and to make better-informed decisions about how to proceed with instruction. KS 4 and KS 5 clarify that, in addition to the teacher, the students may also be active agents in these processes, for example through peer assessment accompanied by peer feedback, and self-assessment with subsequent learning activities that are based on the identified learning needs. The framework does not specify particular activities, so different class-room activities may be used to achieve the purposes of the 'big idea' and each key strategy.

The design of the PDP

The PDP was designed according to many of the characteristics identified in research reviews (Desimone 2009; Timperley et al. 2007) as important for attaining desired PDP outcomes. The year-7 teachers attended four-hour meetings at the university once a week for one term (96 hours). The schools also freed five hours a week (120 hours for the whole term) for the teachers, individually or in collaboration, to read, plan how to implement new formative assessment activities in their classrooms and reflect on the outcomes of the trials. A regular course meeting presented lectures on the theory of formative assessment and its research base. In line with the conclusions of Kennedy's (2016) review of PDP research, the teachers were not told exactly how to implement formative assessment in their classroom and which activities to implement, but were presented with Wiliam and Thompson (2008) framework of formative assessment, including the 'big idea' and five key strategies. They were also presented with research evidence backing the value of formative assessment, and examples of how concrete activities could manifest the 'big idea' and key strategies in practice. The meetings also included group discussions in which the teachers could discuss the meaning and significance of formative assessment, help each other to plan for new activities to test in their classrooms between meetings, evaluate the trials from the last week's teaching, share their successes and failures, and help each other overcome obstacles and modify and develop their use of the activities. The programme leader supported these discussions by, for example, suggesting modifications to activities that had not worked well in practice or by clarifying aspects of the theory. Since these teachers follow their classes from schoolyear 7 to schoolyear 9, and they all were going to get a new year-7 class the next term, they tried out the new formative assessment activities in their year-9 classes. To support the teachers' self-regulated learning, they were asked to take an active part in designing the meetings and making decisions, for example, about the foci and time frames of individual meetings and which activities to try in practice before the next meeting.

The parallel study with year-4 teachers in a corresponding PDP differed only in allotting two of the five additional hours to prolonging the university meetings to six hours; this was not possible for year-7 teachers because principals found it difficult to arrange for them to be absent for a whole day from their schools.

The teachers' view of the PDP

All teachers were pleased with both the content and the design of the programme (Boström and Palm 2019), although the year-7 teachers would have preferred the PDP to take place during an autumn term (the PDP was conducted during a spring term, see the Methods section). They felt they needed some of the lessons for preparing their year-9 classes for national tests, which are administered in the spring, and thus had fewer opportunities to try out activities in class during the spring term. In addition, they would have liked the available time for PDP-related work outside the university meetings to be more continuous (e.g., two to three hours in a row), which also would have facilitated their possibilities to collaborate with their colleagues, but their schedules made that difficult to achieve. The year-4 teachers suggested no improvements to the PDP (Andersson and Palm 2018). After the year of implementation, both year-4 and year-7 teachers mentioned some main conditions that made the development of a more formative assessment practice more difficult. These included a heavy workload when teaching full-time after the PDP and problematic class situations such as large class sizes, spread in student achievement, and working in a 'messy class'. The difficult class situations were especially evident among the year-7 teachers who implemented fewer activities. Some year-7 teachers also perceived little support from their principals. The school year after the PDP, the teachers were also required to implement a new national curriculum, which the year-7 teachers found competed for time with their implementation of a more formative assessment practice (Boström and Palm 2019) more than the year-4 teachers did (Andersson and Palm 2018). In this context it may be noted that one of the most critical parts in the implementation of a new curriculum may be the part connected to the grading of students, and grading in Swedish schools does not occur until schoolyear-6.

The effect of the PDP on the teachers' classroom practices

The year-4 and year-7 teachers' use of activities that may be characterized as formative was similar before the PDP (Andersson, Boström, and Palm 2017). The changes in the year-7 teachers' formative assessment practice after the PDP have previously been identified and described in detail (Boström and Palm 2019). The analysis showed that all teachers implemented new formative assessment activities that they used regularly in their classrooms (range 3 to 19 new activities; median 11.5). The new activities strengthened classroom practice in line with the 'big idea' of collecting evidence about student learning to adjust instruction to better meet students' learning needs. In relation to KS 1, about half of the teachers broke down the learning goals into sub-goals presented in every lesson (lesson goals). About half of the teachers also, in communicating with students, shifted their focus from solving individual tasks to emphasizing and clarifying the intended learning in those tasks. However, the teachers did not go into detail with examples or more thorough descriptions of the learning goals, or the criteria for attaining them at various levels. Neither did they involve the students in active discussions and negotiations about the meaning of the goals. The most common and frequent change was that teachers more often, and for more students, elicited evidence of student learning (KS 2) in order to adjust their instruction accordingly. The teachers implemented new ways of quickly and regularly assessing their students' learning.

Almost all teachers started to use 'exit-passes' (questions that all students answered in writing in the end of the lesson), and about half of the teachers also started to let their students answer teacher questions during the lessons on mini-whiteboards. These all-response systems provided the teachers with frequent information about *all* their students' learning, and not only those who put their hands up. When asking questions in class, half of the teachers also started to randomly distribute questions as a complementary system to receive information about student learning from more students than those who choose to engage in class discussions. The teachers then made more frequent well-founded instructional adjustments to fit their students' learning needs. The teachers' feedback became more thought-out, and half of the teachers started to provide feedback that communicated both what the students had done well and a specific suggestion about how to improve. Only minor changes were made concerning KS 4 and KS 5.

The year-4 teachers' changes in their classroom practice have been presented in detail in Andersson and Palm (2017a). These teachers made similar changes to their classroom practices as the year-7 teachers, but they implemented many more new formative assessment activities (between 8 and 34 new activities with a median of 20 per teacher). For example, while nearly all of the year-4 teachers began to often let all students respond to their daily whole-class questions on mini-whiteboards followed by immediate modifications to instructional activities and feedback, only half of the year-7 teachers did so. The feedback of the year-4 teachers more often included detailed comments about both what the students had done well and suggestions for improvement. In addition, it seems the year-7 teachers may more often have used questions targeted only towards 'basic knowledge' rather than aiming at conceptual understanding at various levels. Since many students' understanding lies above 'the basics', this means that the year-4 teachers could adapt instruction for the benefit of a larger proportion of their students. Also, more year-4 teachers than year-7 teachers began to teach their students how to regulate their own learning and how to assess and give feedback to their peers.

Method

Study design

A randomized selection of year-4 and year-7 mathematics teachers participated in two comprehensive professional development programmes (PDPs) in formative assessment in the spring of 2011. The next term the teachers were back to full-time teaching. Data collection for the present study consisted of two teacher questionnaires and teacher interviews targeting the teachers' motivation to implement formative assessment practices as well as their expectancy of success and value beliefs, which according to expectancy-value theory are the main determinants of motivation. The first questionnaire was administered directly after the PDP, and the second one year later (late spring 2012). The individual teacher interviews were also conducted at the end of the year in which the teachers had the opportunities to use experiences from the PDP to implement new formative assessment practices (late spring 2012).

Participants

The study involved 14 year-7 teachers (8 men, 6 women) and 22 year-4 teachers (14 men, 8 women). The students in year-7 are 13 years old, and the students in year-4 are 10 years old. The teachers were randomly selected from all mathematics teachers in a middle-sized municipality in Sweden who were to teach mathematics for each school year during 2011–12. In the selection procedure, schools were first stratified based on the number of classes in grades four and seven respectively, and then one to three teachers were randomly selected from each school depending on the number of classes in these school years. Participation was voluntary, and 2 of the 20 selected year-7 teachers and 7 of the 29 selected year-4 teachers declined to participate in the PDP. The reasons for not wanting to participate included imminent retirement, feeling adequately proficient in formative assessment and having other school priorities. Four other year-7 teachers began the PDP but needed to withdraw from the study for reasons such as moving to another city or not being assigned a year-7 class for the year of implementation. The teachers' students came from various socio-economic and cultural backgrounds.

Questionnaires

The questionnaires comprised items for several connected studies, and we have here described the questions used in this study. Before the inclusion in the questionnaires, the questions were tested on teachers that did not participate in the study. Interviews with those teachers about their understanding of the tasks, and our interpretation of their responses, indicated that the teachers understood the questions and provided interpretable responses. The questionnaires included items to be answered on a 5-point scale. Questionnaire 1 included questions about the teachers' motivation for implementing a formative classroom practice (see Table 1 in the Results section). One of these questions directly asked about their motivation, using the term *motivation*, and the other two were directed at the manifestation of their motivation in terms of their choice to implement formative assessment. Items in Questionnaire 1 also targeted the teachers' expectancy of success and different value beliefs (attainment value, utility value and cost) for implementing a formative classroom practice (Table 2). The teachers' responses to these questions were used to analyse whether expectancy-value theory could explain the teachers' changes in practice, regarding both RQ1 and RQ2, (see 'Procedures for data analysis' below). Since the questionnaires were used for several interconnected studies, some prioritizations had to be made when it comes to the number of items and the constructs to be targeted in the questionnaires. For that reason, intrinsic value was not measured through items to be answered on a 5-point scale, but could still be identified in the open-ended questionnaire items and in the interviews. Expectancy of success, attainment value and cost were measured with one item each. The item pertaining to expectancy of success focused on the extent to which the teachers believed they had acquired sufficient knowledge to implement formative assessment in an effective way, the item about attainment value asked about the importance of making changes (using the notion of 'importance' is the most common way of targeting attainment value in questionnaires) and the item on cost included all types of costs. Three items were directed at utility value due to earlier experience with three salient types of utility value. These types were

positive outcomes for the teacher, positive outcomes in terms of student learning and other positive outcomes for the students. To collect information about whether the teachers' beliefs about attainment value, utility value and cost remained the same during the school year, similar items as in Questionnaire 1 were included in Questionnaire 2. All of these questions that are relevant for this article are displayed in the Results section together with the teachers' responses to them. A similar item to that targeting expectancy of success in Questionnaire 1 was mistakenly not included in Questionnaire 2. However, both open-ended questionnaire items and the interviews were used to collect complementary information about the influence of both expectancy of success and value beliefs on the teachers' motivation to implement formative assessment practices (see below).

Questionnaire 1 also included two questions aimed at collecting data about whether expectancy-value theory can explain teachers' choice of *specific* formative assessment activities to implement (RQ1). These questions were: 'For each of those formative assessment activities from the PDP that you have tried out in your classroom, how much of a positive outcome for your students have you experienced?' and 'How high do you feel the costs are for carrying out each of these activities?' Thus, for these questions only utility value and cost are targeted. For each activity the teachers had tried out in the classroom they answered the questions on a 5-point scale. Since all teachers did not mention the same activities and their answers were not compared with the year-4 teachers, these results are not given in Table 2 but formulated in the text of the Results section.

Finally, the questionnaires included three open-ended questions. In Questionnaire 1, the open-ended questions were 'Why do you want to make large or small changes?' and 'Why do you want to make those particular changes?' In Questionnaire 2 the question was 'Why would it be important for you to continue with a formative assessment practice?' The aims of these open-ended questions were to see if the teachers would bring up expectancy and value beliefs as reasons for their willingness to implement formative assessment, obtain examples of the teachers' expectancy and value beliefs, and see if these examples would enhance the confidence of those findings in relation to RQ1 that are based on the teachers' responses to the questionnaire items with a 5-point scale response format.

Interviews

The aims of the interview questions were the same as the aims of the open-ended questions in the questionnaires. The semi-structured teacher interviews (about one hour each) employed an interview guide consisting of three parts. To be able to discuss reasons for the teachers' choices, they were first asked to briefly describe the changes they had made in their classroom practice after the PDP, with a focus on formative assessment. The second part followed the structure of the five key strategies and teachers were asked to elaborate on the changes they made for each key strategy and the reasons for each of their changes. The aim was to see if the teachers would bring up expectancy and value beliefs as reasons for their change (or lack of change) in practice even if they were not prompted to do so. Follow-up questions, which then led them into elaborating on expectancy and value beliefs, included 'What did you think would be the value of that activity?', 'How did it work?' and 'Was that difficult or easy?' In the third part, the teachers were asked to more generally talk about the reasons for their choice of

practice after the PDP, and their responses were analysed to detect expectancy and value beliefs (see 'Procedures for data analysis' below). Three kinds of questions were used: (1) why some changes were made and not others (e.g., 'Why did you do all of this, and not less?', 'Why did you not do more?' and 'Why did you make these particular changes?'), (2) how school support (or lack of support) affected their implementation of changes, and (3) their general experiences of the implementation of formative assessment (e.g., 'What were your experiences of this year's teaching that included the new formative assessment elements?' and 'What advantages and disadvantages did you experience with this kind of teaching?').

Procedures for data analysis

To answer RQ1 (how can the year-7 teachers' change towards a more formative assessment practice be explained by expectancy-value theory?), we calculated mean values of the teachers' responses to the questions answered on a 5-point scale to obtain estimates of their motivation as well as their expectancy of success and value beliefs (see Tables 1 and 2 in the Results section). We also categorized the reasons, pertaining to motivation and expectancy and value beliefs, given in response to the open-ended questions in the questionnaires and the interview for implementing (or not) formative assessment activities. The number of teachers providing reasons referring to expectancy of success and each type of value was calculated, and this additional measure was used to triangulate data and possibly enhance confidence in the findings based on the 5-point scale responses. Responses to the open-ended questions also provided further understanding of the more quantitative data. Based on these analyses expectancy-value theory was used to draw conclusions about why the teachers implemented formative assessment activities. To answer RQ2, the Mann–Whitney U test was conducted to test for significant differences between the year-4 and year-7 teachers' responses to the 5-point scale items targeting their motivation and expectancy and value beliefs in the two questionnaires (see Tables 1 and 2). A non-parametric test was chosen since the data was not normally distributed, and therefore did not meet the requirements of a parametric test.

Results

RQ1 How can the year-7 teachers' change towards a more formative assessment practice be explained by the expectancy-value theory of achievement motivation?

Table 1 shows that directly after the PDP, the year-7 teachers were motivated to make changes in their classroom practice. Also, after one year of teaching most teachers expressed in the interviews how inspired they had been after the PDP to implement more formative assessment in their classroom practice. The following quote exemplifies such an utterance: 'It was a super course that has given me a lot . . . I felt really excited and, yeah, now I'm going to do this!' However, Table 1 also shows that the teachers' willingness to prioritize these changes during periods of a high workload was much lower than their general motivation to make these changes.

Table 1. Teachers' motivation for implementing formative assessment.

Items in Questionnaire 1	Mean value for year-7 teachers	Mean value for year-4 teachers[a]
1. How much of a change would you like to make in your teaching towards a more formative assessment practice (compared to your teaching before the PDP) for your mathematics class during this school year?	3.6 (0.7)	4.1 (0.6)
2. How motivated are you to make these changes?	4.2 (0.7)	4.7 (0.5)
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 prioritize your implementation of a more formative classroom practice during these periods?	3.1* (0.7)	4.1 (0.8)

The first column displays the item in Questionnaire 1. The second and third columns show the average values for the year-7 and year-4 teachers' responses to each question on a 5-point scale (1 = *few or minor changes/to a little extent*; 5 = *several or major changes/to a large extent*). Standard deviations are provided in the parentheses
*Significant difference ($p \leq 0.05$) between the two groups of teachers.
[a]These values come from Andersson and Palm (2018).

Table 2 shows that after the PDP the teachers also had relatively high measures on their expectancy of success and value beliefs posited by expectancy-value theory as the main determinants of motivation. Data from Questionnaire 1 show that directly after the PDP the year-7 teachers had relatively high expectations of succeeding with implementing formative assessment. They also anticipated relatively high values of doing so. Data from Questionnaire 2 show that after one year of implementation their attainment value remained high, while their utility values and estimated costs had decreased. (Questionnaire 2 did not include questions about expectancy of success).

The teachers' value beliefs reflected in their answers to the questionnaire items in Table 2 were consistent with their responses to the open-ended questions in the questionnaires and the interview (the teachers did not bring up beliefs about their expectancy of success in response to the open-ended questions).

All teachers gave reasons for making changes that represented utility values. The teachers expressed having experienced various positive effects when testing and using activities in their classrooms. For example, they experienced that they obtained more and better information about their students' learning (since they more often elicited evidence of all their students' learning), which enabled them to quickly adapt their teaching. One teacher exemplified this experience as 'I think I now have a better understanding of the students' understanding, both on [the] group and individual level, and that has made it easier for me to help the students.' They also felt their new practice had had a positive impact on students' engagement in learning, on their attitudes and on their achievement. As an example, in Questionnaire 1 one teacher answered that 'I want to do this change because I have seen that when I tried different activities for formative assessment the students became more active and understood the importance of following the teaching.' Most teachers also gave reasons for changes that we categorized as reflecting an attainment value. Their answers reflected an ideal of teaching captured by the principles of formative assessment, and since they believed in the idea of formative assessment and had learned ways to implement it in the classroom, it became important for them to change their practice towards a more formative one. Teacher comments from Questionnaire 2 that reflect this value include 'I experience it is obvious that I should work with this formative approach to students and their learning' and 'One cannot disregard this now that one is initiated.' About half the teachers brought up reasons

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

Items in Questionnaire 1 (administered directly after the PDP)	Belief	Mean year-7 teachers	Mean year-4 teachers[a]
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	3.6 (0.5)	4.1 (0.6)
2. To what extent do you feel it is important for you to make changes in your teaching towards a more formative assessment practice?	Attainment value	3.7 (0.9)	4.2 (0.8)
3. How much of a positive outcome for yourself do you think the changes you plan on making will lead to?	Utility value	3.6* (0.6)	4.2 (0.7)
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	3.3* (0.9)	4.0 (0.8)
5. How much of 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	3.2* (0.9)	4.1 (0.7)
6. How much (time, effort, scepticism, other) do you think the changes you plan on making will cost you?	Cost	3.3 (1.1)	2.8 (1.0)
Items in Questionnaire 2 (administered one year after the PDP)			
1. To what extent does it feel important for you to continue with a formative assessment practice?	Attainment value	3.9* (0.9)	4.8 (0.4)
2. How much of a positive outcome for yourself have you experienced due to the changes in teaching you have made?	Utility value	3.2* (0.8)	4.1 (0.9)
3. How much of a positive outcome in terms of your students' learning have you experienced due to the changes in teaching you made?	Utility value	2.9* (0.5)	3.7 (0.7)
4. 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	2.8* (0.8)	3.7 (0.8)
5. How high do you feel the costs (time, effort, scepticism, other) have been for you due to the changes in teaching you have made?	Cost	2.9 (0.9)	3.0 (1.0)

The first column displays the questions in Questionnaire 1 and 2 that measure the expectancy and value beliefs specified in Column 2. The third and fourth columns display the average value of the teachers' responses to each question on a 5-point scale (1 = *little or none*; 5 = *high/very much*). Standard deviations are provided in the parentheses.
*Significant difference ($p \leq 0.05$) between the two groups of teachers.
[a]These values come from Andersson and Palm (2018).

conveying intrinsic values for incorporating and pursuing a more formative assessment practice. The following quote is an example of such an utterance: 'I have felt that I have developed as a teacher, and I think this is an incredibly pleasant feeling.' Most teachers also brought up costs, mainly the lack of time.

Also teachers' choices of specific formative assessment activities to implement may be explained by the expectancy-value theory. For example, the teachers' responses to Questionnaire 1 show that during the PDP almost all chose to test the two activities of giving their students 'exit passes' at the end of a lesson and using mini-whiteboards during the lesson to collect evidence of student learning for use in adjusting their instruction. Ratings of the positive effects of these activities on the students (utility value) were 4.1 and 4.2 respectively. Their experience of the cost of carrying out the activities was estimated at 2.2 for both activities (these measures are not included in Table 2). After the PDP, almost all teachers chose to implement exit passes as a regular activity, and half did the same for the mini-whiteboards (Boström and Palm 2019). In contrast, after the PDP no teachers chose to implement rubrics to clarify learning goals and criteria for success to reach a common understanding of the learning goals (related to KS 1). In Questionnaire 1, the teachers judged the use of rubrics to have a low value (2.5) and high cost (4.6). Many thought both the construction of rubrics and their use in the classroom were difficult and time-

consuming. The teachers' appraisals of using activities rated high value and low cost are also consistent with their responses in the interviews, in which most said that they implemented high-value, low-cost activities. In the interviews, most teachers also gave reasons for implementing specific activities that reflected an expectancy of success (they chose to implement activities that they during the PDP had mastered and felt secure with).

RQ2 How can differences in the number of implemented activities between the year-7 and the year-4 teachers be explained by expectancy-value theory?

Table 1 shows that the year-4 teachers' implementation of more formative assessment activities is consistent with their higher motivation to do so after the PDP. They expressed a significantly higher willingness than year-7 teachers to prioritize a more formative classroom practice during times of extra heavy workload. Table 2 shows that the differences between the year-4 and year-7 teachers' motivation to implement new formative assessment activities can be explained by the expectancy of success and value beliefs they held after participating in the PDP. Directly after the PDP, the year-4 teachers displayed higher measures on expectancies of success and values, and a lower measure on the cost of making the changes (although only the differences in the measures of utility values reached statistical significance). After one year of implementation, the differences between the expressed values of the implementation had grown even larger. After only small and similar decreases for the two groups of teachers, the utility values were still significantly higher for the year-4 teachers, and now also the difference in attainment value was statistically significant due to a larger increase in this value for the year-4 teachers. Indeed, the average value of 4.8 that the year-4 teachers assigned to attainment value is extremely high. After a decrease for the year-7 teachers, and a small increase for the year-4 teachers, in the expressed costs, they were after one year similar for the two groups of teachers.

Discussion

Despite consensus on the importance of certain PDP characteristics (Desimone 2009), the outcome of PDPs does not seem to be predictable based on the presence of these design features (Kennedy 2016; Opfer and Pedder 2011). Therefore, a call has been made for studies to focus on causal explanations, instead of cause-and-effect (Opfer and Pedder 2011), and to tie these explanations to models of teacher motivation and teacher learning (Kennedy 2016). However, using theories of motivation to explain effects of PDPs on teachers' practice is rare, which particularly holds for the elsewhere widely used expectancy-value theory of achievement motivation. In the study reported here, we have used expectancy-value theory to explain the changes in practice a group of randomly selected year-7 teachers made after participating in a PDP in formative assessment. The study extends the results of Andersson and Palm (2018) showing that the theory can be used to explain the effects of a PDP on teachers' changes in practice for a different sample of teachers that teaches older students. Furthermore, in addition to explaining the outcomes of one PDP on one sample of teachers, the results also show that the theory can be used to explain why the PDP for the year-7 teachers produced different outcomes in teacher practice than a parallel PDP, with the same general design features, did for year-4 teachers.

Expectancy-value theory can explain both the number and the kinds of activities implemented. The year-7 teachers had relatively high expectancy and value beliefs and anticipated moderate costs, although their utility value beliefs decreased during the year of implementation. In accordance with expectancy-value theory, the year-7 teachers expressed motivation to develop their formative classroom practice and did so. They also chose to implement the kind of formative assessment activities they expected to be able to carry out with moderate costs and believed would produce valuable outcomes. Furthermore, the greater number of activities implemented by the year-4 teachers is consistent with these teachers having higher expectancy and value beliefs than the year-7 teachers, without beliefs about higher costs.

In the following, we will use expectancy-value theory to discuss how these beliefs may have developed differently in the two groups of teachers. One possible reason that the groups held different beliefs after the PDP is that their motivations for changing their formative assessment practice were already different before the PDP. This seems unlikely though, since their classroom practices were similar before the PDP (Andersson, Boström, and Palm 2017). Another possibility is that these expectancy and value beliefs were affected by specific differences in the PDPs (despite the similarities of the design features) in combination with the school context. For example, both teacher groups were provided with several contact hours over a long time to participate in the learning activities in the PDP. However, a slight difference in the organization of this time (the year-4 teachers had more time scheduled at the university) provided the year-4 teachers with more suggestions of how to overcome obstacles and more narratives of successful trials of activities from their colleagues and the PDP leader. These practical suggestions and the exposure to colleagues' perceptions of success in their behaviours may have provided the year-4 teachers with a clearer perception that the demands on implementation of a formative assessment practice are manageable, and that implementation success therefore can be expected if effort is exerted. Such expectancies would increase the motivation to try out more formative assessment activities themselves, and with the help of the PDP leader and colleagues succeed in doing so. This, in turn, would increase the possibility of the teachers attributing failure and success to causes to which they have control over, which according to the theory would positively affect the perception of their ability and the perception of manageable implementation demands. Such perceptions would further increase their expectancies for success. More narratives from their colleagues about positive experiences may also have affected their emotional experiences, and these affective memories would, in line with the theory, influence the teachers' beliefs about the value of the activities. These perceptions of value would, in turn, increase the motivation to try out new activities, which could lead to them experiencing implementation success and perceptions of value. Such influences from sharing narratives would be consistent with the influences of sharing anecdotes on teachers' beliefs about implementing formative assessment practices found by Harrison (2005). Indeed, access to external expertise and collaboration with colleagues were identified by both groups of teachers as important characteristics of the PDP in successfully implementing formative assessment in the classroom (Andersson and Palm 2018; Boström and Palm 2019). About half of the year-7 teachers also called for more continuous time (e.g., 2–3 consecutive hours at a time) for PDP-related work, which also would facilitate collaboration with their colleagues.

The differences in expectancy and value beliefs between the two groups of teachers may also be connected to the school context. During the PDP, the year-7 teachers perceived that preparing the year-9 classes they were teaching at that time for national tests decreased their opportunities to try new activities in their classrooms. During the school year after the PDP, the year-7 teachers also felt more time-challenged by the need to implement a new national curriculum (Boström and Palm 2019) than the year-4 teachers were (Andersson and Palm 2018). This perception of constraints on their opportunities to try new activities in the classroom may have resulted in year-7 teachers attributing failures of trying out new formative assessment activities to causes out of their control. Such attributions would lead to perceptions of high task demands and less ambitious goals, which in turn would lead to lower expectancies for success in implementing formative assessment.

Another factor, linked to the school context, which may have differently influenced the two teacher groups' expectancy and value beliefs is support from principals. Although all principals were positive and arranged time for their teachers' participation in the PDP, year-7 teachers were less likely than year-4 teachers to perceive support from their principal (Boström and Palm 2019). Furthermore, five of the six year-7 teachers who reported less support from their principal belonged to the group who implemented fewer formative assessment activities. When teachers reflect on ideas presented in the PDP, and on the outcomes of their enactment of these ideas in practice, the support from principals may affect how important they perceive making changes to be. Thus, such support may affect their affective memories and in turn the attainment value teachers put on developing their formative assessment practice. However, the teachers expressed different opinions of the importance of support from their principals, and the influence of low principal support on teachers' attainment values would depend on the value teachers put on their principal's support. This value of principal support may have been affected by the teachers' affective memories from previous achievement-related experiences involving the principals. Yet another factor that may have differentially influenced the teachers' expectancy and value beliefs is their working conditions. All but one of the year-7 teachers who implemented fewer formative assessment activities experienced comparatively difficult working conditions, such as not being the sole teacher responsible for teaching mathematics in the class (while being the only one who had participated in the PDP) or having a problematic class situation. Such circumstances affected those teachers' beliefs about the demands required for the implementation and in turn their expectancies of success in doing so.

The results of this study show that a focus on motivation, and specifically expectancy-value theory, may be valuable both when designing teacher PDPs and when studying why and under what conditions teachers learn and use insights from PDPs. Teachers can be mandated to participate in professional development, but they cannot be forced to learn and develop their practice. As Kennedy (2016) noted, since professional development programmes are aimed at already practicing teachers, they have often already found ways to deal with problems in their endeavours to helping their students learn. Thus, it is not only about offering them new ideas about teaching but offering them different ideas from those that have guided them so far. Dedicating time and effort to replacing and complementing existing ideas and practices that may be perceived as

satisfactory with something else requires a strong motivation. As shown in this study, motivation is important both for learning during the PDP and for the teachers' continuing practice in the years that follow.

The results also indicate that when designing PDPs in future studies it may be worthwhile to provide the teachers with a support system that is directed at their needs of expecting success in implementing new practices, at an acceptable cost, and anticipating high value of doing so. Such a support system could include providing teachers with suggestions of easy and concrete learning activities and ways of meeting students' learning needs that most teachers can implement at low cost and experience high value from (e.g., the use of mini-whiteboards in this study). It may also include providing practical and intellectual support for developing more advanced teaching practices, and in such cases the support will need to be more comprehensive. It is sometimes argued that teacher change needs to be carried out slowly and in small steps. Based on expectancy-value theory and the present study we can qualify this idea. We can describe it in terms of adapting the professional development, and the steps the teacher need to take, to the teachers' need for expecting and experiencing success at an acceptable cost while also experiencing the value of such success. In addition, expectancy-value theory provides a description of types of values to focus on, and the present study exemplifies these values in the context of teacher development. However, providing the comprehensive support argued for here is not trivial since it requires identifying what the specific teachers at hand need to be able to expect success, what might be acceptable costs, which values would be most important for them, and then adapting the PDP accordingly. Thus, the PDP would need to be based on formative assessment practices.

In the study we have focused on the teachers' expectancy and value beliefs, which are posited by the theory to directly affect achievement-related choices and performance. A strength of the study is the use of multiple methods of collecting and analysing data. The conclusions are consistent throughout the analysis of the answers to the questionnaire items answered on a 5-point scale, the open-ended questionnaire items and the interview questions, which enhance confidence in the findings. A limitation of the study is the restricted set of items in the questionnaires. More items targeting the teachers' motivation, expectancy of success and value beliefs on the 5-point scale would have enhanced the validity of the measurement of the constructs. In addition, inclusion of measurements of both expectancy of success and all of the different types of values on the 5-point scale in both questionnaires would have increased the confidence in the conclusions about the teachers' expectancy and value beliefs over time. Together, such alterations in the questionnaires would have further strengthened the validity of the conclusions. In the study we have also discussed how expectancy-value theory may be used to explain how specific nuances of the variables known to facilitate or enhance teacher learning (e.g., Desimone 2009; Timperley et al. 2007) may have affected these beliefs and change in practice. Future studies that put a stronger focus on how other variables in the theory influence these expectancy and value beliefs in a PDP context may further improve our understanding of how to support teachers in the difficult endeavour of learning and developing formative assessment practices and other complex educational developments.

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Disclosure statement

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