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The art of designing a professional development programme for teachers

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ABSTRACT

In this study, we introduce an analytic framework for effective professional development programmes (PDPs) that has been synthesised and derived from the literature. The framework acknowledges that certain design features concerning how to process the content as well as the methods to facilitate teachers' enactment are important but also complementary for effective professional development (PD). The framework is furthermore empirically validated through the analysis of how a group of primary school teachers realise an intended PD module and how its components influence the teachers' competence development. The PD module explored is from the Norwegian PDP Maths and Science Trails (MaST), which aims to enhance teachers' ability to teach in a way that facilitate students' deep learning. The results provide insight to how the different design features and methods in the PD module can influence the teachers' competence development and, hence, how the PD module can be revised and improved. Furthermore, the results demonstrate the framework's utility and validate it as analytic framework that can be used as a tool for designers of PDPs to makes these programmes more effective in improving teachers' competence development.

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Teacher professional development programmes; Analytic PDP framework; Teachers' competence development

Introduction

There seems to be a common agreement in the research on teacher professional development that a number of theoretical principles underlie effective professional development programmes (PDPs) (Osborne *et al.* 2019). PDPs in the sense of programmes which support teachers' professional learning with objective of enhancing their students' learning outcome. These theoretical principles should guide the design of PDPs and are operationalised in features such as content, active learning, collective participation and duration (Desimone and Garet 2015). Additionally, such features as coherence, voluntariness, support and coaching also influence the effect of PDPs (Van Veen *et al.* 2012, Darling-Hammond *et al.* 2017). Findings from several studies and reviews of PDPs support the importance of these features (Garet *et al.* 2001, Penuel *et al.* 2011, Desimone *et al.* 2013), which suggests that including these features when designing PDPs would result in a positive outcome on teachers professional learning. However, findings from several large-scale studies have shown that even though the features are needed in the design of PDPs for teachers to learn, they are not sufficient to result change in their teaching practice (Desimone and Garet 2015, Desimone *et al.* 2002; Garet *et al.* 2011; Osborne *et al.*

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2019) nor sustain their learning over time (Avalos, 2011). The main concern is therefore that ensuring the features in PDPs do not automatically help teachers to enact new ideas and translate them into the context of their own practice (Desimone and Garet 2015, Kennedy 2016).

Based on this concern, Kennedy (2016) moved beyond these features and reviewed PDPs according to their underlying theories of action, including strategies for helping teachers enact within their own ongoing systems of practice. The results showed that different main ideas were not differentially effective; however, different methods of facilitating teachers' enactment in PDPs influenced their practice in diverse ways and were effective to various degrees.

Desimone (2009) previously claimed that sufficient empirical evidence and research consensus may already exist on what features make professional development effective. Yet Kennedy (2016) concluded that we need to replace our current conceptions of 'good' PD as comprising a collection of particular design features with a conception that is based more on a nuanced understanding of what teachers do, what motivates them and how they learn and grow. Desimone and Garet (2015) argued that work needs to be done to take PDP research to the next level. Specifically, a need exists for more insight into aspects of the features in different contexts (Desimone and Garet 2015). We argue that there is also a need to understand how to operationalise the different features in PDPs combined with methods of facilitating teachers' enactment and to validate different analytic frameworks empirically to determine their utility as tool for designers of PDPs.

As a result, this study aims to contribute with insight to aspects of certain features concerning how to process the content combined with methods of facilitating teachers' enactment and fill the gap between theoretical principles and operationalised features in PDPs. In the following section we will introduce an analytic framework for effective PDP showing how it has been synthesised and derived from the literature. By applying the framework to an intended and hence realised module (unit) from a PDP and interviewing teachers who completed the module, the following research questions have been explored:

- *How can a PDP framework be used to identify how teachers realise a PD module?*
- *How can a PDP framework be used to evaluate how components of a PD module influence teachers' competence development?*

Theoretical review

Features for effective PDPs

Such features as content, active learning, collective participation and duration are widely used and implemented in the design of PDPs (Desimone and Garet 2015, Osborne *et al.* 2019). *Content* is one of the most influential features for teachers' learning in PDPs (Capps *et al.* 2012). According to a review study by Darling-Hammond *et al.* (2017), PDPs focusing on the subject content that teachers teach, are those with highest impact on student achievement. In science, *content knowledge* includes scientific knowledge (such as facts, concepts and how scientific knowledge develops through inquiry) and pedagogical strategies that enable teachers to contribute to student learning (Stadler and Jorde 2012). However, PDPs that focus exclusively on subject content tend to have less effect on student learning (Kennedy 2016). Instead, programmes focusing on content in a broader way, such as helping teachers to get insight into student thinking through different strategies, are more successful when it comes to student learning. In other words, the content should be focused on how to support and improve student learning, and it should connect subject and pedagogy into 'subject-didactic' framework (Desimone *et al.* 2011). *Active learning* refers to teachers' opportunities to engage in active learning, and it is a central feature of the effectiveness of a PDP (Loucks-Horsley 1996, Garet *et al.* 2001). Active learning includes, for instance, observing teachers or reviewing student work followed by discussion (Borko 2004, Darling-Hammond and Bransford 2007). Capps *et al.* (2012) pointed out the necessity of encouraging teachers to pursue authentic inquiry experiences when the content of PDPs is about inquiry-based teaching. They also

underlined the importance of modelling inquiry because teachers can often misunderstand inquiry teaching. Kennedy (2016) documented that to be effective, teachers must engage actively in PDPs and not only be presented volumes of body of knowledge and prescriptive details without opportunity to process it.

Collective participation refers to teachers' opportunities to discuss, reflect and interact with one another, and it is a powerful tool for teachers' learning (Desimone *et al.* 2002, 2003, Capps *et al.* 2012). For instance, they can discuss transference of activities from one subject or age group to another or develop their own lessons together. One review indicated that the effectiveness of PDPs depend on the content of the teachers' discussion as well as the nature of intellectual work they are engaged in (Kennedy 2016).

Duration or programme intensity is a feature widely mentioned as important for teachers to practice and to gather experiences from (Garet *et al.* 2001). Teachers who participated in longer PDPs are more likely to change their teaching practice (Supovitz and Turner 2000, Darling-Hammond and Richardson 2009, Luft and Hewson 2014). Still, there are studies that show that duration might not be indispensable for success with PDPs (Desimone *et al.* 2002). Duration and intensity might be of importance but only when relevant content and methods for facilitating enactment are in place (Kennedy 2016).

Other features, such as coherence, voluntariness, support and coaching can also affect teachers' experiences in on PDPs. Coherence means that teachers' learning is consistent with teachers' knowledge and beliefs. Coherence also refers to the consistency of the school curriculum and policies (Firestone *et al.* 2005, Penuel *et al.* 2007). Some studies show significant difference between mandatory and voluntary attendance. Voluntariness increases the positive effects of PDPs (Kennedy 2016). Support and role experts can help to guide and facilitate teachers' learning in the context of their practice. Moreover, the importance of extended support after the PDP has ended, including opportunities to ask questions and receive feedback, seems important for the programme's success (Garet *et al.* 2001).

The last two features (duration and others) described for an effective PDP are of an organisational nature and do not illuminate what the programme's underlying premises are about teaching and teacher learning. Duration, and whether it is voluntary and led by external or internal coaches, is hence excluded, not because we do not recognise this feature but because it depends on how the PDP is organised and how it is implemented.

Methods for facilitating enactment

The features described in the previous sections are important for effective PDPs; however, they do not automatically lead to teachers enacting new ideas; using those ideas in their own practice. Based on this concern, Kennedy (2016) moved beyond mentioned features and sorted 28 PDPs according to their underlying theories of action, including strategies for helping teachers enact that idea within their own ongoing system of practice. The result from Kennedy's study showed that different main ideas were not differentially effective; however, four different methods of facilitating teachers' enactment in PDPs (*prescription, strategies, insights and body of knowledge*) influenced teachers' practice in diverse ways and were effective to various degrees.

Prescription describes or demonstrates what is believed to be the best way for teachers to address a particular teaching problem. It is a method commonly used in PDPs to ensure that teachers do things exactly as intended. Examples of prescriptions include when teachers are introduced to instruction models (Glazerman *et al.* 2008, 2010) and are prescribed methods for implementing a new science curriculum in the school system (Borman *et al.* 2008). Prescriptions are characterised as direct and often detailed but not the best way to facilitate the enactment of new ideas. Since prescriptions are universal, the challenge for teachers is that they are not flexible enough for teachers to enact on in the context of their practice.

Strategies are typically illustrative practices, which can help teachers to achieve a specific goal. These practices can be just as prescriptions, describing or demonstrating a procedure, but they can also differ when they are accompanied by rationale aiming to help teachers understand when and why they should implement these strategies. An example of strategies in PDP is when teachers are given a highly scripted step-by-step lesson-planning strategy that guides them from long-term goals to specific classroom events (Penuel *et al.* 2011). Another example is coaches helping teachers to think more strategically, for example when they design their lessons (Campbell and Malkus 2011) or when they learn an approach to classroom discussion that might improve students' reading comprehension (Matsumura *et al.* 2013). The challenge of strategies is to make sure teachers understand the ultimate goal well enough so that they can decide independently when they will use each strategy and that they can choose the most suitable practice to achieve their goal.

Insights refer to a method that asks provocative questions forcing teachers to re-examine familiar events and come to see them differently. Such insights can alter teachers' behaviour in ways that could not be prescribed by someone else; they can help teachers learn to see situations differently and to make their own decisions about how to respond. The challenge is to predict the teachers' reaction and response outcome because insight is closely connected to teachers' attitudes and beliefs. If successful, this method is a powerful tool to develop teachers' practice. New insights can help teachers to make their own decisions about how to respond to situations in their classrooms, but the challenge is that insight requires more professional judgment. An example of insight (in a PDP) is how a group of teachers who were collectively introduced to research-based reading strategies and hence made their own decisions about how they might design forthcoming lessons in light of these strategies (Gersten *et al.* 2010). Another example is a study in which observation feedback was added to an existing formative assessment feedback system to help teachers to generate more or better ideas about what to do next (Supovitz 2012).

The fourth method of enactment is *body of knowledge*, which is characterised as knowledge organised into a coherent body of interrelated concepts and principles summarised in books, diagrams and lectures. The challenge of this method is that it is inherently passive, leaving the teachers to decide what they do with it. There are therefore large variations and uncertainties in how body of knowledge can stimulate any particular teaching action. An example of body of knowledge is when teachers attend courses covering a single research-based topic (e.g. phonemes or phonemic awareness), accompanied by a textbook on that topic. Moreover, PDPs with lectures and overheads interspersed with opportunities for teachers to solve and explain how they solve them can also be body of knowledge if the teachers are not supported in how to apply their new knowledge to their classroom instruction (Garet *et al.* 2011).

These four methods to facilitate enactment can have many benefits but also challenges. Kennedy (2016) highlighted that the methods differed in their effect on student achievement. PDPs dominated by prescription gave the least effect, followed by body of knowledge. The result of using insight alone had a low effect, but when combined with strategies, the effectiveness increased. In the end, PDPs based on strategies were generally the most effective. In addition, a surprising finding was that the more time the teacher spent with PDPs, the weaker effect it had on student learning. In contrast, studies including a follow-up year increased the effect on student achievement. However, the effect was relatively modest compared to the PDP's method of enactment. This finding suggests that only intensity and duration are of importance when relevant content and methods for facilitating enactment are in place.

A framework for PDPs

Based on the theoretical review of effective PDPs and methods for facilitating enactment, we have designed a matrix, representing a framework for PDPs (Figure 1). The components in the matrix were designed by using Kennedy (2016) descriptions of methods for enactment and Desimone and Garet (2015) descriptions of features, putting them together before discussing and adapting descriptions of each component. The matrix will be described and elaborated in this section.

Methods to facilitate enactment Features of an effective PDP	Body of knowledge	Prescription	Strategies	Insights
Content	Receive body of knowledge summarised in texts, diagrams or lectures.	Receive a description or a demonstration of a learning activity.	Receive a description of teaching strategies.	Receive meta-reflection questions.
Active learning	Explore the body of knowledge.	Explore the learning activity according to the description	Explore the teaching strategies to analyse one's own teaching practice.	Explore own teaching based on the reflection questions.
Collective participation	Discuss the body of knowledge.	Discuss the learning activity.	Discuss the teaching strategies.	Discuss meta-reflections and experiences.

Figure 1. An analytic framework for PDPs, combining design features of effective PDPs (vertical) with the method used to facilitate teachers' enactment (horizontal).

The matrix includes certain features concerning how to process the content of an effective PDP as well as its methods of enactment. Vertically, the matrix includes three of the features for an effective PDP (content, active learning and collective participation) which are important for how teachers process the content in the PDP. The features provide support for teachers to process and internalise the theory. By internalisation, we mean that the participants must have the opportunity to become familiar with the content, get experiences with the content (active learning) and have opportunities to discuss the experiences with other participants (collective participation). It is important is that teachers are given the opportunity to process the content by having it presented and to discuss it with others. In this way, the participants can internalise the content.

Horizontally, the matrix contains methods for enactment, which can help teachers to realise the theory in practice. These include body of knowledge, prescription, strategies and insight. By helping teachers to realise the theory in practice, we mean giving examples or demonstrations in the form of learning activities (prescription) or a set of tools (strategies), which exemplify some general central practices and reflection questions that invite teachers to reflect on the content of the PDP and compare it with their own practice (insight).

The matrix is a result of acknowledging that the design features as well as the methods used to facilitate enactment in the PDP are complementary for an effective PDP. The reason for using a matrix is that it illustrates how to combine opportunities for teachers to receive (content), explore (active learning) and discuss (collective participation) the four different methods of enactment (body of knowledge, prescription, strategies and insight). To embrace both features and methods, we will use the concept of 'components' from now on. Furthermore, in this study, we will apply the matrix in the analysis of the relationship between an intended, and hence realised PDP, which in turn will be seen in context with analysis of the influences on teachers' competence development.

Methodology

Context of the PDP

The PD module explored in this study was from the Norwegian PDP: Maths and Science Trails (MaST). Modules in MaST are independent units on different topics, such as inquiry-based teaching and learning, assessment and deep learning. Each module contains resources and detailed step-by-step instructions supporting school leaders or teachers in facilitating their own local learning community. The modules contain four stages: A: individual preparation; B: collaborative learning I; C: implementing in practice; and D: collaborative learning II. They are free and available from the PDP MaST website (realfagsloyper.no).

Participants and data collection

A total of 18 teachers and two school leaders from a Norwegian primary school were followed as they completed a MaST module on deep learning, titled *Characteristics of Deep Learning*. As a part of the municipality's competence development programme, the school management decided that the entire teaching staff should complete the module. The objective of the module was to enhance teachers' competence to teach in a way that facilitates students' deep learning. The teaching staff consisted of teachers of both genders, with varying ages and lengths of teaching practice, and they worked with students from the first to the seventh grade (six to twelve years old) and taught several subjects. Although MaST is made for mathematics and science, it is only the examples that are subject specific, whereas the principles for facilitating students' deep learning are subject independent. Experiences (observed and reported from teachers) from other schools show that the modules have been found to be suitable as PD resources for teachers teaching all subjects and ages. The teachers and school leaders all participated in stage A, B and D, whereas only the teachers participated in stage C, since the school leaders did not teach. Both of the collaborative learning sessions (stage B and D) were facilitated by two of the teachers who had been introduced to the module beforehand in a network together with teachers from two other schools, facilitated by two science educators. The entire module was completed within five weeks, and in sessions, the school had set aside time for collaboratively PD work for the teachers.

The data included multiple sources in order to analyse and compare how theoretical principles were operationalised, hence realised, and how these influenced the teachers. The data contained descriptions and resources from the PD module, including observations and audio recordings from the PD module; interview were also conducted with the teachers who had completed PD module. The observations and audio recordings were collected from two groups of teachers from the first ($n = 3$) and fifth ($n = 4$) grade during their collaborative talk in stage B (collaborative learning I) and when the same teachers were planning stage C (B – extended). Observations and audio recordings were also collected during stage D (collaborative learning II), which included all teachers ($n = 18$) in plenary discussions and presentations. Additionally, a group interview with two researchers and four of the teachers from, respectively, first, second, third and fifth grade was audio recorded. The group interview was conducted three weeks after the module was completed. The audio recordings from the extended B (teacher planning C) and D (teachers sharing experiences from C) were used as data of how the teachers completed C. An overview of the module stage, participants and data is shown in [Table 1](#).

Analysis

To analyse the data, we employed a deductive approach, in which the matrix ([Figure 1](#)) was applied as an analytic framework. In the first step, the description and resources from each stage B in the PD module were defined as a unit of data and then was analysed and categorised

Table 1. An overview of the module stages, participants and data collection.

Week	Stage	Participants	Data
1	B – Collaborative learning session I	18 teachers (grade 1–5)	Resources from the MaST module on deep learning, Observation
2	B (extended) – Planning teaching	Two groups: 2 × 3 teachers first and fifth grade	Audio recordings 2 x 60 min
2	C – Teaching	18 teachers (grade 1–5)	-
3	Analysing teaching	18 teachers (grade 1–5)	-
5	D – Collaborative learning session II	18 teachers (grade 1–5)	Resources from the MaST module on deep learning, Observation and audio recording 60 min
8	Group interview	Two researchers and four teachers from first, second, third and fifth grade	Audio recording 60 min

according to features and methods described in the matrix. This was initially coded individually by all four authors before comparing our coding. This initial round resulted in a high agreement among all four coders, indicating validation of the framework. In the second round, each unit of data from the entire module was analysed in collaboration and placed in the matrix when agreed upon. When we found one or more instances of a component, it resulted in a cell marked grey in the matrix. Note that this means that the results show if the feature combined with the method is present or not, but does not indicate any frequency or amount. The reason is that the units of data are heterogenous and hence not comparable. In the second step, the teachers' realisation of the module were analysed using the same procedure as in the first step. The completed matrix was hence compared to the completed matrix from the intended module. The two completed matrixes and the descriptions will be used to answer RQ1: *How can a PDP framework be used to identify how teachers realise a PD module?*

In the third step of analysis, the transcriptions from the interview were coded using the matrix to identify if and how the different components in the module contributed to the teachers' competence development. In this coding, two of the authors did the initial coding individually and then in collaboration, before discussing the initial results with the two other authors. In these discussions as well, agreement among all four authors was high, again indicating validation of the framework. After agreement on the results in the matrix, the raw data (transcripts) were used to identify and trace the development of the teachers' competence development and how it is connected to the components in the realised PD module. The results from these analyses contributed to answer RQ2: *How can a PDP framework be used to evaluate how components of a PD module influence teachers' competence development?*

Results

How teachers realised an intended PD Module

In this section we will illustrate how the PDP framework enabled us to identify how teachers realised the PD module and compare this to how the PD module was intended. The results showed that stage A and stage B in the realised PD module were identical to the intended PD module, whereas, the teachers deviated from the intended PD module in stage C and D in several ways. The similarities in the first two stages and the differences in the last two stages will be described and illustrated in the matrix in the following two sections.

The Similarities in stage A and B

Stage A consisted of a reading assignment of an article about teaching principles on deep learning and some reflection questions about the content. The analysis shows that five of the sixteen components of the matrix were present in the intended module (Figure 2). The teachers realised stage A according to the intended PD module; hence, the result from the coding was equal.

Stage B in the intended module consisted of a mix between theory on deep learning, the introduction to two educational tools describing different characteristics of deep learning, reflection questions for group and plenary discussions as well as a learning activity for the teachers to try out in groups in the roles of students. According to the methods used to facilitate enactment, the activity was a prescription. The task was to sort different objects into two categories: living or non-living. At first based on prior knowledge and then on some facts about some the characteristics of living objects. According to the design features, the learning activity was categorised as content of the module, requiring active learning and collaboration. The results of coding all of the components of the intended PD module revealed that all rubrics in the matrix were present (Figure 2).

A

	Body of knowledge	Prescription	Strategies	Insights
Content				
Active learning				
Collective participation				

	Body of knowledge	Prescription	Strategies	Insights
Content				
Active learning				
Collective participation				

B

	Body of knowledge	Prescription	Strategies	Insights
Content				
Active learning				
Collective participation				

	Body of knowledge	Prescription	Strategies	Insights
Content				
Active learning				
Collective participation				

Figure 2. Analysis of the component in the stages A and B in the intended module (left) and the realised PD module (right). A grey cell in the matrix means that we found one or more instances of the combination of the feature and method.

The data from the observations and audio recordings showed that the teachers completed stage B in accordance with intended stage B, except that they extended B – adding time to collaborate in teams to plan a common learning activity for stage C (Figure 2). Both of the teacher teams, for the first grade and fifth grade, decided to design a learning activity, similar to the one from stage B, with only the content changed.

The differences in stage C and D

Stage C of the intended PD module required the participants to use one of the educational tools to analyse their own instructional practice and to reflect on how it facilitated their students' learning. Stage C was therefore coded as active learning, respectively body of knowledge, strategies and insight (Figure 3). The data in this study do not document how the teachers realised stage C in the classroom. Yet the data from the extended stage B, described in the previous section, and the forthcoming results from stage D confirm that the teachers carried out the jointly planned learning activity with their students. Stage C in the realised module was therefore coded as active learning / prescription. However, there was no evidence that the teachers were active learners using body of knowledge, strategies or insight to reflect on their own teaching (Figure 3).

The components of stage D in the intended module involved both group and plenary sharing of emphasis on raising teachers' meta-reflections and were hence entirely coded as insight. When realising the stage D, the teachers once again deviated from the intended module. Instead of using the reflection questions, each team of teachers presented its experiences from stage C. All of the presentations were characterised as being descriptive, and there were only one reflection on the students' in-depth learning or on the teachers' own learning. Thus, the realised module was coded as collective participation / prescription and only vaguely as collective participation / insight instead of as active learning and collective participation, which led to new insight (Figure 4).

C

	Body of knowledge	Prescription	Strategies	Insights
Content				
Active learning				
Collective participation				

	Body of knowledge	Prescription	Strategies	Insights
Content				
Active learning				
Collective participation				

Figure 3. Analysis of the component in stage C in the intended module (left) and the realised PD module (right). A grey cell in the matrix means that we found one or more instances of the combination of the feature and method.

D

	Body of knowledge	Prescription	Strategies	Insights
Content				
Active learning				
Collective participation				

	Body of knowledge	Prescription	Strategies	Insights
Content				
Active learning				
Collective participation				

Figure 4. Analysis of the component in stage D in the intended module (left) and the realised PD module (right). A grey cell in the matrix means that we found one or more instances of the combination of the feature and method.

How components of a PD module influence teachers' competence development

In this section we will illustrate how the PDP framework enabled us to identify and hence evaluate how the components of the PD module influenced the teachers' competence development. During the interviews, the teachers and the researchers had a semi-structured conversation about the teachers' experiences completing the PD module. The results from the analyses revealed two things. First, they highlighted that the outcome for the four teachers was that participation in the PD module had raised their awareness of their teaching practice in general and specifically how different teaching practices can facilitate, or inhibit, their students' deep learning. One teacher expressed it this way:

I realised during the PD module that I already do a lot of teaching that contributes to deep learning. Nevertheless, I think we do it without being so conscious about it. I felt like the PD module raised our awareness of what to emphasise in our teaching.

This result confirms that the PD module provided the intended outcome – that is, to enhance teachers' competence to teach in a way that facilitate students' deep learning. Nevertheless, it also revealed that the outcome for the teachers was more about raising awareness than about acquiring new knowledge. This is an important finding to note, especially because it is significant to acknowledge and build on teachers' prior knowledge to succeed with a PDP. The fact that the teachers became more conscious about their teaching practices is not only a good benefit in relation to deep learning but could also be fundamental to lifelong PD for the teachers.

The second finding from the analysis of the interview concerns how the components of the PD module influenced the teachers’ competence development. These findings revealed not only how the components influenced the teachers’ PD but also in what order, e.g. cause and effect. The results from this analysis are illustrated in Figure 5 and will be described chronologically in the subsequent section. Note that the shaded fields in Figure 5 indicate the not very prominent components of the interview with the teachers. This does not indicate that the feature content and the method body of knowledge did not influence the teachers’ competence development, only that the analysis did not reveal how, since these components probably were embedded in the other components the teachers referred to. This finding also reflects the assets of this component – namely, that it is passive until the teachers choose to use or apply them for something.

(1) Adapt learning activity – notice students’ response

When the teachers described how they implemented their new knowledge in the classroom and their reasons for the choice, they all said that they had adapted the learning activity to the topic they were currently teaching. As for their reasoning, the teachers said they had been inspired by the collaborative stage B. One teacher said: ‘We were very inspired when we learned about the learning activity we tried out together. We discussed how to adapt and use it in our teaching.’

The teachers explained that they found it applicable because it was easy to apply to any subject and the answer was open-ended. As one teacher put it, ‘We were concerned about creating an open task where we don’t take so much control.’

After describing their lessons, the teachers were eager to talk about how the students responded to the planned learning activity: ‘They had very good discussions, and it was very enjoyable and interesting to observe how some students sorted all the pictures in a big bunch, and some sorted a bit randomly.’ As the quote illustrates, the teachers were excited about observing their students working. They also all talked about how their students were engaged and active in discussions about the lesson’s subject content.

(2) Compare Student Response with Strategies and (3) Recognise Student Response as a Sign of Deep Learning

Methods to facilitate enactment	Body of knowledge	Prescription	Strategies	Insights
Design features of effective PD				
Content				
Active learning		(1) Adapt learning activity to students and notice their response	(2) Compare the students’ response with the strategies	(3) Recognise the students’ response as a sign of deep learning
Collective participation		(4) Discuss the students’ response about the activity	(5) Discuss the students’ response using the strategies	(6) Reflect and discuss own teaching practice

Figure 5. An overview of the analysis of the group-interview with four of the teachers who completed the module. The shaded fields indicate not very prominent components in the interview with the teachers.

To describe the response from the students and to determine if the activities contributed to deep learning, the teachers used the descriptions of teaching strategies they were introduced to in the collaborative session B in the module. As one teacher explained:

They [the students] talked together and considered different views, which is one of the characteristics of deep learning [pointing on one of the educational tools]. They were curious and asked each other questions.

The quote reveals that the teachers saw the students consider different views and ask questions, and they recognised this as one of the principles of deep learning described in the teaching strategies.

(4) Discuss Students' Response on Activity, (5) Discuss students' Response using the Strategies and (6) Reflect and Discuss own Teaching Practice

In the intended module, the teachers' task was to use the teaching strategies to analyse and evaluate their own teaching during and after stage C. However, the teachers admitted that they did not use the educational tools to analyse their own teaching. Instead, they used the educational tools to reflect while planning the presentation of their teaching programme for their colleagues. One teacher said the following:

We were given the possibility to reflect on our teaching practice because we were going to present it. This was useful because then we discussed not only what to present but also why things happened. We then had to reflect much more than we do after an ordinary lesson.

Another teacher said: 'We observed the students in their work, and later we discussed what we observed in the team meetings.'

When the teachers shared new insight relating to their students' responses to the learning activity, they used terminology from the educational tools. The observations from stage D did not show signs of this, but the interview showed that a common language containing terms from the content in the PD module had been developed among the teachers. This language enabled them to communicate thoughts about their teaching and is, along with a shared vision, an important factor influencing collaborative professional development. The following statement demonstrates the importance of a common focus:

There are always a lot of choices to make, but it is okay to have a common focus. It makes us make an extra effort, and I think it enhances the chance that we will continue this way of teaching and be even more aware of our teaching strategies when we are planning our teaching.

Figure 5 summarises the results from the analysis of the interview and reveals that the learning activity from the collaborative session B worked as a catalyst for the teachers' competence development. When the teachers implemented the learning activity in practice, it enabled them to elicit and observe the students' responses. The teachers hence also used (to some extent) the strategies from the collaborative session B to interpret and describe their students' deep learning from their lessons.

Summary and discussion

The aim of this study was to contribute to fill the gap between theoretical principles and operationalised features in PDPs. To achieve this we have: 1. presented an analytic framework for effective PDP, describing how it has been synthesised and derived from the literature, 2. illustrated how the framework enabled us to identify how teachers realised components of a PD module and 3. demonstrated how the framework enabled us to evaluate how components of a PD module influenced on teachers' competence development.

One surprising finding when analysing how teachers realised a PD module and how the components influenced on teachers' competence development was the crucial role the learning activity (prescription) played. First, not only did it clearly engage the teachers when they tried it out together, but it also inspired them to make similar learning activities for their students. In contrast, the findings from Kennedy (2016) showed that prescriptions are not effective in

helping teachers portray curricular content; however, our results indicate that the learning activity actually worked as a catalyst for the teachers' competence development. One reason for the positive influence the learning activity had in this study could be that despite being a prescription, it was also adaptable; e.g. the teachers 'adopted and adapted' it to their own subject and level of their own students. This explanation is supported with findings from other studies showing the importance of PD being explicitly linked to classroom lessons (Granger *et al.* 2019, Haug and Mork 2021). Another thing that seemed crucial was that the teachers had the opportunity to collectively try out, discuss and reflect on the learning activity with each other before implementing it to their practice. Many studies show that teachers' opportunities to discuss, reflect and interact with each other are powerful for their learning (Desimone *et al.* 2002, 2003, Capps *et al.* 2012). However, such success depends on the content and the nature of the intellectual work they are engaged in (Kennedy 2016). In this study, the learning activity contributed to the content of the teachers' discussion and seemed to have a unifying role. The activity also resulted in the teachers collaboratively discussing transference and developing their own lessons together – a practice that has been found effective for the teachers' professional development (Desimone *et al.* 2002, 2003, Capps *et al.* 2012). This finding indicates that prescriptions actually can play an important role in operationalising theory for teachers in addition to increasing the chance that they implement it in their teaching practice. The central role of the prescription as a method of enactment is in contrast to what Kennedy (2016) found. Nevertheless, the prescription need to be combined with features, such as active learning and collective participation, which indicates that it is the prescription as a component of the PDP that is the key to success.

Another finding worth discussing is the teachers' deviation in the last stage of the PD module, when they neglected the reflection questions and instead shared descriptions of their experiences. According to previous studies, this would expectedly lead to less insight (Kennedy 2016). Sharing ideas among teachers has not in itself been found to support teachers' PD (Hargreaves and O'Connor 2017). It was therefore unexpected that the findings from the interview verified that the teachers had acquired new insight in terms of how to facilitate for students' deep learning. One explanation is that many of the questions in the interview could be characterised as insight, and in that way, the interview itself could have led to the teachers' reflection on teaching practice. Based on the interview analysis, it is not the teachers' sharing of experiences with their colleagues that positively influences their competence development. Yet it is the preparation for sharing and not sharing in itself that contributed to the positive influence. As shown in the results for research question two, the teachers referred to the terminology from the educational tools when they prepared to share their experiences from the classroom and the students' responses to the learning activity. This finding again highlights the importance of giving teachers the opportunity to reflect and interact with one another during the PDP. Yet a challenge in many PDPs is that teachers might not have common content to share and discuss; hence, they would not benefit from any discussion. In this study, the learning activity functioned as the key content for the discussions, which explains its important role as a catalyst for the teachers' competence development.

These results show us that applying the framework for PDPs has enabled us to get insight to how components in a PD module affects teachers' PD in various ways. The fact that the framework allowed us to identify that the prescription in active learning and collective participation played the role as a catalyst, expanded our understanding to see that it is an essential component and addition should it also occur early in the programme. The framework furthermore made it visible that insight is essential to enhance teachers' PD in the PDP, but we have to ensure that the teachers actually involve in insight tasks by making them more explicit and make teachers aware of how important these tasks are. In summary, the framework expanded our understanding of how all of the components were important in various ways, but combined with other components, to enhance the teachers' PD.

Conclusion and Limitations

Not having any insight into how teachers' learn could be one of the major reasons for PDPs failing to be effective (Guskey 2002, Kennedy 2016). We believe that applying the framework can be of great importance in the work of designing PDPs, to support and ensure teachers' learning and ability to enact new ideas into the context of their own practice. In this way, the framework fills the gap between theoretical principles and operationalised features in PDPs responding the demands from Kennedy (2016) who claimed that we need to replace our current conception of 'good' PD, and Desimone and Garet (2015) who specified that there is a need for more insight to aspects of the features in different contexts.

Despite the theoretical grounding in research literature and empirical validation of the framework in this study, we acknowledge the limitations of the study. Even though the findings give us an indication of how the different components effects the teachers' PD, these findings are derived from empirical research on a small group of teachers. The fact that these teachers possess prior knowledge and other factors affecting their prerequisites for PD makes it hard to generalise. However, the framework is not intended to display what is best PDP design. The PDP framework is meant to make the content (components) of PDPs 'visible' and explicit for PDP designers and as a tool for assessing the effect of certain components on teachers' PD afterwards. The results from the empirical validation in this study, indicated that the way the components were combined and worked together were more important than the components in themselves.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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