FACILITATORS' JUSTIFICATIONS FOR WHETHER OR NOT DISCUSSIONS ARE PRODUCTIVE FOR TEACHER LEARNING

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Studies on professional development (PD) emphasize the important role of facilitators in supporting teacher learning. Since moderating discussions is an essential part of PD, this study examines how facilitators justify the productivity of PD discussions for teacher learning. Two fictional PD discussions were designed to show a fictional facilitator enhancing teacher learning in a more or less productive way. Fifty-one facilitators were asked to select one of the discussions and explain their choice. A content analysis yielded four categories of justifications. The most important aspect of moderating a productive discussion, according to facilitators, was cognitive activation of teachers. The most important aspect of moderating an unproductive discussion was lack of appreciative feedback.

INTRODUCTION

Professional development (PD) provides teachers with opportunities to learn about the theoretical and practical aspects of students' mathematical understanding and learning (Zaslavsky & Leikin, 2004). Facilitators play a crucial role in supporting teachers' learning and are a key focus of research (Prediger et al., 2022). Due to the communicative nature of PD, wherein facilitators share their knowledge with groups of teachers (Schifter & Lester, 2005), research on leading mathematical discussions in PD settings is of growing interest (Elliott et al., 2009). Regarding the role of mathematical discussions in supporting teacher learning (Borko et al., 2014), studying moderation strategies and the elements that contribute to productive discussions between facilitators and teachers could provide valuable insights into improving PD mathematical discussions. This study focuses on how facilitators determine the productivity of mathematical discussions. Information about facilitators' focus when examining mathematical discussions in a PD setting could highlight relevant aspects for improving qualifications programs for facilitators.

THEORETICAL BACKGROUND

Facilitators' role in supporting teacher learning

As PD is important in supporting teachers to understand how students learn mathematics, studies have identified aspects that influence the quality of PD. Koellner et al. (2011) emphasized the importance of fostering professional learning communities, developing teachers' mathematical knowledge, and adapting PD to local needs. Synthetizing research on the effectiveness of PD, Desimone (2009) highlighted content focus, active learning, coherence, duration, and collective participation as

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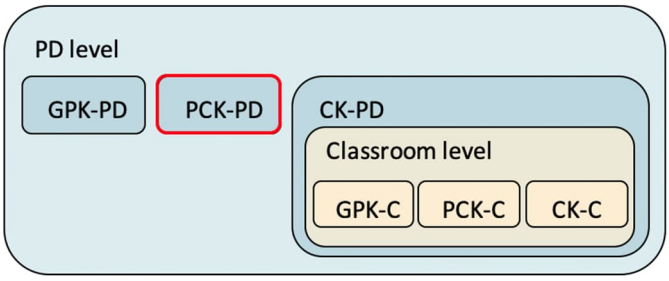
essential features. Based on this research, (Prediger & Selter, 2024) identified seven principles for high-quality teacher PD: coherence, competence orientation, case focus, participant orientation, reflection stimulation, experimental model, and collaboration stimulation. Taken together, these studies demonstrate that facilitators play a crucial role in implementing PD principles. This is particularly relevant with respect to the content-related realizations, and monitoring teachers' learning of mathematical concepts and instructional aspects (Roesken-Winter et al., 2021). Facilitators play a significant role in supporting teachers' learning by structuring and supporting mathematical discussions during PD (Schifter & Lester, 2005). To accomplish this objective, therefore, facilitators must have knowledge at two distinct but connected levels: classroom-level knowledge, which refers to the knowledge necessary for instructing students, and PD-level knowledge, which refers to the knowledge necessary for supporting teacher learning (Figure 1).

Figure 1: Facilitators' knowledge at the PD-level (adapted from Prediger et al., 2022)



When facilitating the exchange and application of mathematical knowledge, one essential knowledge category is pedagogical content knowledge at the PD-level (PCK-PD). In addition, facilitators need general pedagogical knowledge for PD (GPK-PD), and content knowledge at the PD-level (CK-PD), which includes the three classroom-level facets (GPK-C, PCK-C, and CK-C) (Prediger et al., 2022). PCK-PD particularly involves engaging teachers in mathematical discussions and supporting their learning (Jacobs et al., 2017), which is in the focus of our study.

Adaptation of frameworks for productive mathematical discussions

Extensive research has been conducted on productive mathematical discussions in the classroom (e. g., Cobb et al., 1992). However, research on the PD-level concerning mathematical discussions with teachers is more limited. In light of the connection between the two levels outlined above, it may be useful to examine the similarities in processes between the classroom- and PD-levels and adapt existing frameworks for the PD-level, in line with Prediger et al.'s (2019) idea of "lifting strategy". For instance, Elliott et al. (2009) adapted Stein et al.'s (2008) framework to encourage productive mathematical discussions at the PD-level. This approach involves anticipating teacher responses to rich tasks, monitoring during exploration, selecting and sequencing work for group sharing, and connecting different contributions to develop key mathematical ideas. More specifically, regarding the aspect of monitoring discussions, Shaughnessy et al. (2021) proposed a framework for leading mathematical discussions at the

classroom-level. This framework is divided into three areas: framing, orchestrating, and recording/representing content. The central focus of our study is orchestration, given its pivotal role in facilitating mathematical discussions. This includes eliciting contributions, probing thinking, encouraging engagement with peers' ideas, and making contributions to maintain focus. However, this is adapted to the PD-level.

Current study and research question

Against this theoretical background, we investigated how facilitators envision supporting teacher learning through productive mathematical discussions in PD situations. Particularly, to access the PCK-PD of facilitators, we presented them with two PD discussions on the same content, one productive and the other more directive, to enhance teacher learning. We designed the two discussions, led by a fictional PD facilitator, with a strong focus on teachers' handling of their students' learning. Particularly, we adapted the orchestration aspects from Shaughnessy et al. (2021) and implemented different moderation strategies in the two discussions. Our research question is as follows: What justifications do facilitators provide for choosing between the two discussions led by a fictional PD facilitator (one productive and the other directive of teacher learning) to promote teacher leaning?

METHOD

Participants and context of the study

The research was conducted as part of a program for 51 facilitators on the topic of "Quantities and measurements, chance and probability 1–4". The average age of the facilitators is 44.4 years (SD = 9.6), and they have an average of 16.4 years of teaching experience (SD = 9.2). Additionally, the average facilitating experience is 4.1 years (SD = 5.0), though 26 out of 47 facilitators indicated that they have led ten or more PD sessions. Prior to the activity analyzed in the study, moderation strategies were defined and introduced with examples.

Activity for facilitators and data collection

Data were collected via an activity for facilitators that was built on an PD activity for teachers (Figure 2).

Figure 2: PD activity for the teachers on the right and task for the students on the left

Task for the students and result of the data collection:
Which flavor of ice cream do you like best? Choose between vanilla, chocolate, strawberry and cookie.

Activity for teachers:
Based on the task and the unsorted picture cards, consider what a learning path oriented towards comprehension might look like for students to arrive at a bar chart. Your approach could comprise five steps. Also note how these steps can be linked together.

Then, the facilitators were presented with two different discussions between a facilitator and three teachers after the PD activity. In discussion 1, the fictional facilitator was productive (Figure 3), and in discussion 2 the fictional facilitator was directive in terms of teacher learning. The facilitators were then asked to choose the discussion that, in their view, best supported teacher learning and to provide examples to justify their choice.

Figure 3: Fictional PD discussion 1 held after the PD activity for teachers, displaying different moderation strategies in response to three teachers' contributions

Sonia: We discussed it together and came up with some ideas. **Katja:** Exactly. We thought we would first collect the cards, sort them by color, then place them in columns and line them up neatly. That way, the children can easily compare the different ice cream flavors and discuss them. ***Facilitator: What do the others think about this?*** **Anja:** I would let the children do it themselves and not show them how.	**orienting teachers toward the thinking of others**
Katja: But how are they supposed to come up with the idea of arranging the cards in columns? ***Facilitator: What suggestions could you give to encourage the children to arrange the cards more clearly?***	**probing teachers' thinking**
Katja: I could ask them how they can quickly see which ice cream flavor most children like best. Then they might realize that it's not practical to sort the cards by color alone. **Anja:** Okay, but you also need to explain why they should arrange the cards in a line. ***Facilitator: How could you make the children aware of this? What kind of stimulus could you give them?***	**eliciting teachers' thinking**
Anja: I would ask two children to compare their heights. Then I would ask one child to stand on a raised platform. And I would ask if they can still compare themselves. ***Facilitator: Okay, you are deliberately drawing on the children's prior knowledge and then transferring it to the bar chart, right?*** **Anja:** Exactly, yes, that's how I would do it.	**making contributions to maintain focus**

Discussion 1 was designed to demonstrate how the four moderation strategies can be used at the PD-level. First, the facilitator *orients teachers towards Katja's thinking,* inviting them to consider about her ideas and comment on them. Second, the facilitator *probes the teachers' thinking* regarding on one specific idea. Based on Katja's and Anja's responses, the facilitator then *elicits teachers' thinking* to share their ideas on how to proceed. Finally, the facilitator *contributes to maintain the focus*. The teachers' responses also demonstrate how the facilitator successfully supported their learning. In contrast, discussion 2 showed the facilitator using only two moderation strategies. First, he or she posed the following question to the three teachers: "Okay, so how would you instruct the children to proceed?" While doing so, the facilitator applied the strategy of *probing teachers' thinking* by rephrasing their ideas and asking for confirmation to ensure understanding. Second, the facilitator asked for clarification of the initial idea directly, again drawing on this strategy: "Why did you decide to do that? Could you explain briefly?" Then, the facilitator provided examples of how the teachers could respond, and explained why the teachers' examples were or were not

appropriate. In other words, the discussion was moderated to *maintain focus*. Consequently, in discussion 2, the facilitator adopted a more directive approach to teacher learning, focusing more on pressing than supporting teachers. An expert rating showed that the fictional facilitator's contributions to the discussions reflected the moderation strategies as intended.

Data analysis

The data were collected in the form of short written responses and analyzed using inductive content analysis. Four categories emerged from the facilitators' justifications for choosing which of the two discussions would best support teacher learning: *activating cognitive processes*, *providing appreciative feedback*, *promoting the exchange of ideas*, and *focusing on teacher learning gains* (see Table 1).

Table 1: Categories for facilitators' justifications and their definitions

Category	**Definitions** The facilitators state that the fictional facilitator …
Activating cognitive processes	encourages teachers to think independently and/or motivates them to participate actively.
Providing appreciative feedback	gives appreciative, objective, and/or neutral feedback to the teachers.
Promoting the exchange of ideas	motivates the teachers, provide supportive guidance, and/or creates space for discussions between the teachers to exchange their own ideas and opinions with each other.
Focusing on teacher learning gains	promotes teachers' skills by communicating learning objectives and/or independently developing new insights.

Depending on how the facilitators perceived the moderation strategies being employed in the two discussions, they used these categories in either a positive or negative manner. This is reflected by the positive and negative use of the definitions in the results section. Two researchers coded the data independently of each other. The interrater agreement for the coding was 83.3%.

RESULTS

In response to our research question, 40 out of 44 facilitators' justifications were positive about discussion 1, in which the fictional facilitator supported teacher learning productively. In contrast, 46 out of 52 of the responses to discussion 2 were negative, as the fictional facilitator adopted a more directive approach to teacher learning. Table 2 provides an overview on the use of the four categories that emerged used by the facilitators, either positively or negatively, to justify their choices.

Table 2: Categories for facilitator justifications for choosing discussion 1 or 2, along with their frequency.

	Discussion 1: "productive of teacher learning"		**Discussion 2: "directive of teacher learning"**	
	Positive	Negative	Positive	Negative
Activating cognitive processes	21	0	0	12
Providing appreciative feedback	8	1	1	21
Promoting the exchange of ideas	6	0	0	8
Focusing on teacher learning gains	5	3	5	5
Total positive/negative	40	4	6	46

Most of the negative justifications (21) related to the lack of *appreciative feedback* from the fictional facilitator in discussion 2 with comments such as, "[the question] sounds almost reproachful". Another important factor contributing to the negative perception of discussion 2 was the failure of the discussion moderation to *activate cognitive processes* for teachers: "In discussion 2, there is no support, only instructions." The failure of the fictional facilitator to *promote exchange of ideas* was also viewed negatively: "In discussion 2, the facilitator's overall share of the conversation is too high." Conversely, the most frequently mentioned positive aspect of discussion 1 was the activating of teachers' cognitive processes (21): "Thinking for yourself is essential." Additionally, *appreciative feedback* was perceived positively: "She maintains an appreciative attitude." Encouragement to share ideas with others was also viewed positively in discussion 1: "The facilitator contributes significantly less to the discussion, [...] the participants have more of a say[...]".

However, the category of *appreciative feedback* showed one positive justification regarding discussion 2 ("However, I think it's good that she also voices criticism directly") and one negative justification regarding discussion 1 ("I find it difficult in discussion 1 that the other participants are supposed to discuss a statement made by their colleague").

The most ambiguous aspect was the *focus on teacher learning gains*. In discussion 1, the teachers' active participation in their own learning was viewed positively: "The impulses and classifications should not come from the facilitator, as this contradicts an understanding-oriented approach at the teacher level." Nevertheless, the fact that the moderation strategies in discussion 2 directed the teachers towards the content aspects of the PD was also viewed positively: "In general, I find the moderation style in discussion 1 more successful, but I would like to see a little more depth in terms of content (as in discussion 2)".

DISCUSSION AND CONCLUSIONS

The facilitators used the same four categories to justify their selection of one of the two discussions. In Discussion 1, a fictional facilitator initiated productive discussions to support teacher learning. In Discussion 2, however, a more directive approach was employed. Most of the positive justifications for Discussion 1 were related to *activating cognitive processes*, which aligns with one of Prediger and Selter's (2024) principles of high-quality professional development (PD). The facilitators did not draw on this category negatively, however, but rather focused on the lack of *appreciative feedback*, as described by Borko et al. (2014).

In other words, the facilitators used different criteria to evaluate the two discussions. Discussion 2 was viewed negatively and was mainly justified by atmospheric aspects; it did not address the lack of active learning opportunities for teachers. These findings suggest a potential avenue for future research: examining the relationship between facilitators' justifications and their experience with facilitation.

The category of *promoting the exchange of ideas* was in line with the discussions' intended focus and showed a similar frequency of positive and negative justifications. Most surprisingly, the category of *focusing on teacher learning gains*—the intended focus of any professional development endeavor—was used positively or negatively in both discussions. This finding aligns with other studies (e.g., Shure et al., 2025) that have identified challenges for facilitators in consistently supporting teacher learning and monitoring mathematical learning goals. Therefore, using fictional facilitators to moderate mathematical discussions in PD situations could be key to supporting facilitators in leading discussions and consequently improving the quality of teacher PD.

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