FACILITATOR AND PARTICIPANT ROLES IN ONLINE MATHEMATICS TEACHER PROFESSIONAL DEVELOPMENT

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This paper examines how facilitation is enacted and negotiated in interaction during an online mathematics teacher professional development session. Drawing on an enactivist perspective and van Es' framework of facilitation moves, the analysis focuses on transcript excerpts from a synchronous session involving two facilitators and two participants. The findings show that facilitative work is distributed across interaction, with participants frequently taking on facilitation roles such as pressing for clarification and directing attention to mathematical detail. The paper argues that facilitation in online professional development is negotiated rather than fixed.

INTRODUCTION

Online professional development (OPD) has significant potential for allowing more teachers of mathematics to access support in developing their practice, yet sustaining engagement and meaningful interaction in online settings remains challenging. Research on mathematics teacher professional development emphasises the role of facilitation in directing attention to mathematics and supporting engagement that builds on participants' contributions. Facilitation is often considered the responsibility of the teacher educator; however, my recent doctoral study of online mathematics teacher professional development led to the tentative realisation that participants also take on facilitation roles, such as clarifying what others said, or challenging the contributions of others. This paper examines how facilitator and participant roles are negotiated in interaction during an online mathematics teacher professional development session.

RELATED LITERATURE

Professional development for teachers has been conceptualised in a variety of ways, reflecting different assumptions about how teachers learn. Korthagen's (2016) distinction between PD 1.0, 2.0 and 3.0 highlights this diversity, ranging from models that prioritise the transmission of theory, to approaches that emphasise learning in and from practice, and to person-centred professional development that foregrounds teachers' experiences, identities, and reflections. While not all professional development adopts a person-centred orientation, this perspective has been influential in shaping approaches that seek to work with teachers' contributions rather than prescribe particular practices. Such approaches place importance on facilitation that is responsive to what teachers notice, say, and find meaningful in relation to their own practice.

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Alongside debates about the nature of professional development, there has been increasing interest in online formats for teacher learning. Much of the literature on online learning and online teacher professional development positions online settings in relation to face-to-face classrooms. Lee (2014) and Enser (2020), for example, share an assumption that the aim of online learning is to approximate the most effective aspects of in-person teaching. In contrast, Borba et al. (2016) argue that digital environments shape ways of being, interacting, and learning, such that online contexts influence not only how learning happens but also what is learned. From this perspective, online professional development is a qualitatively different interactional space rather than a substitute for face-to-face provision.

Work on online teaching and facilitation has also highlighted attempts to reduce psychological and relational distance, for example through facilitator presence and interactional norms that support dialogue. Eaton (2018) argues that facilitators' presence and embodiment in online professional development influence participant engagement, and that active participation depends on facilitators valuing and working with participants' contributions rather than relying on technological solutions alone. Within mathematics teacher professional development, however, there is relatively little research that examines facilitation in synchronous online settings. Studies of online coaching cycles (Amador et al., 2019) highlight issues of power and responsiveness, but pay limited attention to the moment-by-moment facilitative actions through which group discussions are shaped.

THEORETICAL FRAMEWORK

An Enactivist view of online teacher professional development (OTPD)

Enactivism was initially developed by Varela, Thompson and Rosch (1991) and views cognition not as the transmission or manipulation of internal representations, but as sense-making that emerges through ongoing interaction between individuals and their environments. From this perspective, knowing is doing: meaning is enacted through engagement and action, rather than received as information.

Teachers' sense-making is informed by their histories of experience, and what becomes meaningful in interaction depends on patterns that have been established through prior participation. The observation that "we do not see things as they are, we see them as we are" (Anaïs Nin, in Brown (2020, p. 55)) captures that interpretation is shaped by who the perceiver is and what they bring to the interaction. In online professional development, the literal information transmitted to participants may be limited, yet interactions can nevertheless feel immersive and meaningful. From an enactivist perspective, this is because understanding does not arise from the content of descriptions alone, but from participants' histories of experience, which are brought to bear as they interpret what others say. When a teacher hears another teacher describe a classroom episode, the richness of interpretation emerges not from the words

themselves, but from how those words resonate with the listener's prior experiences of teaching.

An enactivist perspective also suggests that patterns of interaction play an important role in establishing norms for participation. Facilitation plays a key role in this process, as facilitators can enact and reinforce particular patterns of participation, for example by responding selectively to contributions to communicate which forms of contribution are valued.

The role of the facilitator in online teacher professional development

To examine facilitation in this study, I draw on the framework of facilitation moves developed by van Es et al. (2014) shown in Table 1, below. This framework identifies a set of moves through which facilitators support teachers' analysis of practice, organised into four categories.

As well as providing a way of seeing the learning of teachers, enactivism provides a way of seeing learning as researchers. From an enactivist perspective, analysis is not the neutral application of a framework to data, but an activity through which meaning is enacted, with each informing the other through engagement and interaction.

Applying the framework shapes how facilitation becomes perceptible in the transcript, while engagement with the data simultaneously informs and develops my understanding of the framework itself. An important aim of this research is therefore not only to develop a better understanding of the particular online professional development session being studied, but also to contribute to ways of seeing facilitation. The analysis may reveal forms of facilitative work that are not well described by the existing framework, aligning with the focus of this study on the negotiation of facilitator and participant roles.

METHODS

Context

The data for this study comes from a synchronous online professional development session designed for *workgroup leads* within the English mathematics education system. Workgroup leads are teachers of mathematics who lead professional development groups for other teachers within their regional Maths Hubs. Maths Hubs are coordinated nationally by the National Centre for Excellence in the Teaching of Mathematics (NCETM), and aim to support the professional learning of mathematics teachers across England.

The session was designed and facilitated by two facilitators (the author and a colleague) and involved two workgroup leads, resulting in a total of four people in the session. At the time of the session, many Maths Hubs in England were focusing on the development of speaking and listening in mathematics classrooms, reflecting a broader national emphasis on oracy as a means of supporting learning, particularly for

disadvantaged students. The session was therefore designed with a focus on speaking and listening, while remaining grounded in mathematical activity.

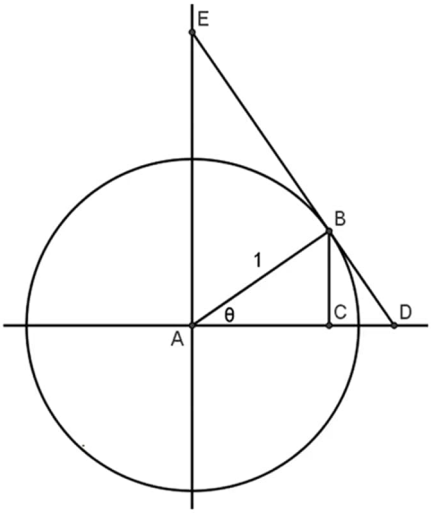
Table 1: Framework for Facilitation of Video-Based Discussion (van Es, Tunney, Goldsmith, & Seago, 2014, p. 347)

	Facilitation move	Definition	Example
Orienting group to the video analysis task	Launching	Pose general prompts to elicit participant ideas	"So, what did you notice? What stood out to you?" "What were interesting mathematical moments or interchanges in the video?"
	Contextualizing	Provide additional information about the classroom context and mathematics lesson	"This was lesson on 2-digit multiplication and you were working the partial products method."
Sustaining an inquiry stance	Highlighting	Direct attention to noteworthy student ideas in the videos	"So it seems like we're all pretty interested in what Tyrone did here. What did he mean by one-fourth equals 25 and one-half is 50?"
	Lifting up	Identify an important idea that a participant raised in the discussion for further discussion	"I think you were bringing up the idea that maybe they understood what met goal exactly meant, but they had this way of thinking that it wasn't each student that got to 50 but rather collectively."
	Pressing	Prompt participants to explain their reasoning and/or elaborate on their ideas	"You said there was a lot she had to do there, can you piece apart for me all the things you think she had to do?"
	Offering an explanation	Provide an interpretation of an event, interaction, or mathematical idea, from a stance of inquiry	"I was thinking that he might have looked at his partner's cards and added the numbers on their two together. That might be why he said 51."
	Countering	Offer an alternative point of view	"You could be right but I was thinking that the sticks and dots weren't really helping Dante. He doesn't arrive at the correct answer . . ."
	Clarifying	Restate and revoice to ensure common understanding of an idea	"So you're saying no, she doesn't really think it's ten?"
Maintaining a focus on the video and the mathematics	Redirecting	Shift the discussion to maintain focus on the task of video analysis	"Can I just bring us back to the video for a second?"
	Pointing to evidence	Contribute substantively to the conversation, using evidence to reason about teaching and learning with video	"Well, what did Jerome say earlier? . . . because I'm wondering if maybe she's using what he said earlier to help her try to figure this out. So, if we look on the page before . . ."
	Connecting ideas	Make connections between ideas raised in the discussion	"So it's similar to what Tom was doing." "Do you have any predictions about what your students would do if they were given this problem?"
Supporting group collaboration	Standing back	Allow the group members time to discuss an issue	Not interjecting when the group is exploring an idea
	Distributing participation	Invite participants to share different ideas based on who is (and is not) participating	"Lisa, it looked like you wanted to say something . . ." "What do others think about that idea?"
	Validating participant ideas	Confirm and support participant contributions	"That's really hard." "That could make sense too. That could be another interpretation."

The session consisted of two mathematics tasks centred on visualisation, chosen to create a mathematical need for speaking and listening. In the first task, participants were asked to visualise a rotating cube and then describe their imagined rotation in a way that allowed others to see what was being described. In the second task, participants were shown an image of a unit circle with additional constructions, shown in Figure 1 below, and asked to describe how the length of line segment AD changed as the angle, θ, increased from 0°. Following the two activities, participants were

invited to reflect on their use of speaking and listening while engaging with the task. The intention of the session was not to provide instruction, but to engage participants in activity and reflection, potentially informing how they might design or facilitate similar experiences within their own workgroups.

Figure 1: What happens to length AD as θ increases from 0°?



Data collection and analysis

The online session was recorded and automatically transcribed. The transcript was used as the primary data source, with all participants anonymised and labelled as facilitators (F1, F2) or participants (P3, P4). The analysis focused on two short excerpts from the transcript: one following the visualisation task and one following the unit circle task. These excerpts were selected because they included moments where facilitative work was visible and where responsibility for directing attention or advancing discussion appeared to be shared between facilitators and participants.

Facilitation was analysed using van Es et al.'s (2014) framework of facilitation moves. Each turn of talk within the selected excerpts was examined and assigned one or more facilitation moves where appropriate, including turns produced by participants. The framework was used as a resource for noticing rather than as a fixed coding scheme, allowing attention to be paid to facilitation as in-the-moment, responsive work. Engagement with the transcript both informed and was informed by the framework, and this reciprocal process supported analysis of how facilitator and participant roles were negotiated in interaction, including moments that were not well captured by existing categories.

RESULTS

In Excerpt 1 in Table 2, below, F1 launches discussion by inviting questions about the cube description, while participants shape the mathematical focus through pressing and clarifying moves. P3's question about direction of rotation exposes an ambiguity in the description, prompting clarification from F1. P4's extended contribution is interesting because it mirrors the offering of an explanation offered by F1, but was not prompted

or invited. They go on to query language about axes and planes of rotation. Although P4 is not a designated facilitator, this contribution performs clear facilitative work by directing attention to mathematically salient features and extending the discussion.

Table 2: Transcript excerpt 1, with facilitation moves identified

Speaker	Min	Sec	Text	Facilitation move
F1	9	50	[…] so the cube is rotating around a vertical edge.	
F1	10	32	Now, I have no sense of whether you have in your minds what I've described, but my hope is that that's less ambiguous. Now I wonder if anybody has any questions about the cube that I've described and how it's rotating?	Launching
P3	10	53	Does it matter whether it's going clockwise or anti clockwise?	Pressing
F1	10	58	I didn't say that, did I. So my cube is rotating anti clockwise.	Clarifying
P3	11	03	So was mine.	
F2	11	04	Yeah, mine was too, but then I didn't know whether it was allowed to.	Pressing
F1	11	11	Right, okay, yeah, yeah	Validating participant ideas
P4	11	15	Yeah, I had the same positioning, so horizontal planes, top and bottom, but mine was rotating around the centre, so I put my axis in the centre, so it was, yeah, okay, yeah. But rotating in a, I don't know what you'd call that, rotating in the vertical plane. This is vertical, isn't it? Your axis of rotation is vertical, isn't it? Yeah, so, but then you're, I suppose you're rotating around the vertical axis, but can you say in what plane you're rotating?	Offering an explanation/ Pressing

In Excerpt 2 in Table 3, below, facilitation involves managing both participation and focus. F2 launches and redirects discussion by inviting contributions while constraining attention to a particular range of values, and brief validating responses support participation without evaluation. Participants also enact facilitation moves: P3 presses for clarification about the scope of the task and later challenges F1's explanation by requesting justification. There is a sense that P3's pressing of F1 is

perhaps encouraged by F1 actively taking on the role of a participant, offering that they are grappling with the visualisation and not resolved.

Table 3: Transcript excerpt 2, with facilitation moves identified

Speaker	Min	Sec	Text	Facilitation move
F2	28	55	P3, anything to add to P4's description? So if we stick with the description, rather than where, where it might go to	Distributing participation/redirecting
P3	29	03	Yeah, so it's starting at one	
F2	29	06	Okay	Validating participant ideas
P3	29	09	Eventually becoming infinite.	
P3	29	19	When theta is 45 it would be root two.	
F2	29	26	Okay	Validating participant ideas
P3	29	29	Are we taking it past the horizontal then?	Pressing
F2	29	31	What do you mean, sorry?	Pressing
P3	29	37	I mean, are we going beyond B being directly below E?	Clarifying
F2	29	43	Oh, right, so theta being greater than 90 degrees. Okay, we, we might do that in a minute, if you'd like to. But yeah, for now, let's just stick with zero through 90.	Clarifying
F2	29	59	Go on F1. Yeah,	Distributing participation
F1	30	01	I'm grappling with the start. So when theta is zero, B, C and D are all in the same place. When B starts moving, it feels like D doesn't move.	Offering an explanation
P3	30	25	Why not?	Pressing

DISCUSSION

Across both excerpts, facilitation emerges as negotiated and distributed work rather than a fixed role attached to designated facilitators. While facilitators frequently manage participation, participants also enact facilitative moves such as pressing for clarification, challenging interpretations, and directing attention to mathematically

salient features. These shifts occur moment by moment in response to the unfolding interaction, suggesting that facilitation in synchronous online professional development is not simply enacted *by* facilitators, but *with* participants.

Using van Es et al.'s (2014) framework as a resource for noticing makes this distributed facilitative work visible, while also revealing its limits. Several participant contributions combine multiple facilitative functions and facilitators taking on roles as participants extends beyond the framework's existing categories. This supports the view that the framework does not simply describe facilitation, but participates in shaping how facilitation is perceived and understood through its use. In this sense, the analysis contributes not only to understanding the specific online professional development session studied, but also to developing ways of seeing facilitation in synchronous online settings. Attending to moments where facilitative work is taken up by participants, and vice-versa, highlights possibilities for online professional development that move beyond facilitator-led interaction, and invites further research into how facilitation roles are enacted, negotiated, and redistributed in online mathematics teacher professional development.

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