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Facilitators' feedback in a mathematics education course for practicing teachers

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In this paper we analyse and discuss mathematics facilitators' feedback to practicing teachers' written assignments, 'missions', where the practicing teachers write about observations from pupils' work with mathematics. We used a framework with four categories; self, task, process and self-regulation levels (Kastberg et al., 2018), to analyse the three facilitators' feedback to a total of 9 mission reports. The findings show that there were differences within the feedback practices of facilitators, especially the amount of feedback given in the categories self and process. We found that the facilitators gave zero feedback categorised as self-regulation in the analysed mission reports. There were variations within feedback coded with process, from one facilitator who used open reflective questions, to another facilitator who gave more suggestions for ways to build on the pupils' work in a classroom setting.

Keywords: Feedback, mathematics teacher educators, practicing teachers.

Introduction

How mathematics teacher educators (MTEs) work, learn and teach is a growing, but still underexplored area of research (Goos & Beswick, 2021). In particular, little is known about their feedback practices. At OsloMet MTEs often have diverse backgrounds, stretching from education in pure mathematics to teacher education with specialisation in mathematics. Most have little formal training as MTEs when they start working in the teacher education. As MTEs are important role models for prospective and practicing teachers, we found it valuable to understand more about their feedback practices. For clarity we use the following vocabulary: facilitators are mathematics teacher educators, who work with practicing teachers, while educators work with prospective teachers, and mathematics teacher educators is the union of the two.

In this paper we analyse feedback practices of facilitators to practicing teachers enrolled in a further education course in primary mathematics (30 ETCS). The content in the course is about teacher knowledge and practices needed for teaching numbers, operations, fractions, algebraic thinking, measurement, and geometry. An important part of the design of the mathematics course offered at our university is the work with missions (Eriksen & Solomon, 2022). Missions are an innovation that is used at OsloMet both for prospective and practicing teacher courses. In the missions prospective or practicing teachers interact with pupils and collect data about pupils' work in mathematics. The teachers write a report on their findings, where they get written feedback from the facilitators on their work. The research question discussed in this paper is: *What characterises different mathematics facilitators' feedback practices on 'missions' in a course for practicing teachers?*

Earlier research and analytic framework

Earlier, our colleagues have analysed how two MTEs in this same course describe their teaching practices with regards to theory of change (Eriksen & Solomon, 2022). They found that in MTE's

descriptions the course for practicing teachers had three important boundary objects; gatherings, research-based course literature, and missions. Regarding missions, the MTEs describe the missions as a way of getting the practicing teachers to listen to the pupils' mathematical ideas and create learning opportunities where there are possibilities for "new discoveries and sheer differences which are not (and cannot be) reconciled with existing practice" (Eriksen & Solomon, 2022, p. 4697), and give the possibility of connecting theory and classroom practice. This is in line with other research in the field of the importance of teachers' professional noticing of children's mathematical thinking (see for instance Jacobs et al., 2010). Earlier, Eriksen et al. (2019) studied prospective teachers' experiences with missions and found that the prospective teachers see the missions as "approximations and decompositions of practice" (p. 3263), and that it complemented their mentored in-school practice placements. The missions gave the prospective teachers the possibility to focus on the mathematics teaching methods, where their ordinary school practice placements focused more on classroom management and teacher training in all subjects.

In 2007, Hattie and Timperley proposed a model for effective feedback in all subjects, not specified to mathematics. The model divide feedback practices into four levels, about self, about the specific task or product, about the process of solving the assignment, or for self-regulation. They argue that "effective feedback must answer three major questions (...): Where am I going? (What are the goals?), How am I going? (What progress is being made toward the goal?) and Where to next? (What activities need to be undertaken to make better progress?)" (Hattie & Timperley, 2007, p. 86). Therefore; feedback should relate to the learning goals of the teacher and the students. Kastberg et al. (2018) used and adapted the levels from Hattie and Timperley's model to analysing feedback given to prospective mathematics teachers on a letter-writing task. In a previous CERME paper (Kjensli et al., 2022), we used Kastberg et al.'s (2018) framework to analyse prospective teachers' responses to feedback given on short exit notes. This made us curious on what kind of feedback practices facilitators used on missions.

In Kastberg et al.'s work they defined the levels "in terms that were appropriate for our task and to mathematics teacher education" (p. 142). In their framework the notion of *self* is about feedback directed at the self of an individual, or the group, with praise "good work" on parts of their work. This can be connected to how they have used theory, or how they have interpreted the pupils' strategies.

The level *task* is about feedback about the work on and writing of the task itself, for instance "you should explain why these tasks are relevant for the pupils' work with two-digit multiplication" or "in an academic text it is important to remember to justify your claims" and similar issues, ranging from issues connected to academic writing to commenting on what is important that a task response contains.

Process is about the processes needed to successfully solve the task (or similar tasks). In our case this could be feedback on the group's discussions in the mission report, use of the pupils' responses and feedback which points towards teacher work in the classroom. For instance, "how can you give the pupils opportunities to discover this strategy" and "how can you use the pupil's response here to

justify your claims?”. An important issue here is feedback which points to where to next with reflections connected to classroom implementation.

Self-regulation is about how the learner can reflect on their own learning, and feedback connected to this is about how the work done could be used in future work on missions or other written tasks. Kastberg et al. (2018) coded self-regulation on feedback when prospective teachers commented on “feeling discouraged” (p. 142) and when the prospective teachers made multiple attempts to understand pupils. One notable finding of Kastberg et al. (2018) is that in their study they found little feedback in the self-regulation level.

Research design and context

We studied feedback given by three different facilitators, who have diverse backgrounds and levels of experiences. Their experience ranges from working with mathematics in teacher education more than 20 years, and 10 years on this course, to a newcomer which had never taught on this course before and had worked less than 5 years in teacher education. We thought that this gave an opportunity to investigate feedback practices of facilitators with different levels of experience. This specific course has been taught at OsloMet for many years, with the same major themes; however, the course is always evolving with the experiences of the facilitators. Usually, the facilitators will work together to make a frame for the lessons across the parallel classes, and then adapt the teaching individually to fit the facilitator’s own teaching style. The facilitators work together to write the instructions for the missions for the course. In these discussions general guidelines are discussed for giving feedback, but there is no formal training or discussions regarding feedback practices, or a common decision to use a specific framework for feedback. We analysed feedback given to 9 mission reports, three commented on by each facilitator. This year two of the facilitators co-teach one class, and the third co-teaches with another facilitator in a different class. The two facilitators who co-taught the first class corrected and gave feedback on half of the mission reports each in their class, while the third facilitator was for this mission the only one who corrected and gave feedback on all mission reports of that class. Both the practicing teachers’ groups, and the facilitators consented to that their work being used for research.

In the course the practicing teachers work with a total of four missions with different themes. When working on the missions they are together in groups of three or four, and this group delivers one common mission report on which they receive feedback. In their oral exams the practicing teachers discuss parts of their missions, to connect pupils’ work with theoretical considerations. The practicing teachers in the course have varied experiences with teaching mathematics, some have previously taught mathematics in primary school, and some have never taught mathematics classes.

In this paper we analyse the facilitators’ feedback given on the mission about multiplication and division. The practicing teachers study pupils’ use of different solution strategies connected to multiplication and division with multi-digit numbers. The groups should make and justify appropriate multiplication and division tasks for pupils, observe, and document the pupils’ work on the tasks, and then write a mission report of about 4000 to 5000 words. All nine reports we analysed at were within this word count. The mission report should describe why their planned tasks are appropriate,

showcase the children's strategies and solving methods and discuss these in relation to the literature in the course.

Data analysis

In our analysis we chose to focus on the actual feedback given and we have not looked into the possibility for different feedback opportunities. We analyse what kind of feedback the groups received, not the content of groups' mission reports. In the analysis we use the categories from Kastberg et al.'s (2020) framework categories; *self*, *task*, *process* and *self-regulation*. To code this we needed to look at the feedback in relation to the written report. For instance, one comment "that's great" could point to *self*, that the practicing teachers had done a good job, or it could point towards *process*, if it was a comment on the pupils' mathematical work. There is therefore needed some interpretation of the intended meaning of the comments. We have used Kastberg et al.'s (2020) adaptations as a starting point. However, we also had to write out what the categories in the framework would mean in our context for the intention of the analysed mission. We have not analysed whether similar issues across the different mission reports are given or not given feedback or given feedback in different or similar ways.

In our analysis of the feedback given on the missions we coded each instance of feedback (ranging from small comments like "good" to several paragraphs) into the categories from the framework. In addition, we tagged comments which we found to not fit into any of the categories with *other*. We did not regard the categories as mutually exclusive, so one feedback statement could get coded with more than one category. For instance, "very good that she is given this task straight after the previous" was coded both self and process. The feedback can be thought of as praise for the work done in the classroom giving this task, and as feedback directed at the process of analysing the pupil's work.

In addition, most of the mission reports got a longer feedback summary statement which was coded with the same categories. Here we divided the longer statement into sections and coded each section. The two authors did the coding independently of each other, after several discussions of using the framework to code one sample from each of the three facilitators before discussing our categorisation to achieve consensus in the interpreting of the categories. The whole set of mission feedback was then coded. After the coding of the feedback, we counted the number of each occurrence of the codes for each facilitator. It is important to recognise the inherent difficulties with using counting the number of feedback comments, because one short feedback comment receives the same weight as a longer statement. Therefore, after we had categorised and counted, we looked qualitatively for patterns within and between the facilitators to characterise the different feedback practices.

Results

The facilitators gave different amounts of feedback on the mission reports. The average number of feedback comments (each note is counted once, regardless of length of the feedback) showed that in average the facilitator 1 (F1) gave 51 comments, facilitator 2 (F2) gave 30 comments, and facilitator 3 (F3) gave 26 comments to the mission reports we analysed. Since we have not analysed the mission reports with regards to quality, we have no indications if this correlates with perceived quality of the reports themselves.

Notable in our data is that we found that the facilitators gave no feedback comments that we coded as self-regulation. In Table 1 we show the number of feedback comments tagged with the different codes (except self-regulation, which as mentioned was zero for all facilitators). As mentioned, one feedback comment could be tagged with several codes, so we therefore show the overview given in percentages of total amount of codes.

As Table 1 shows there are some clear patterns. F1 has about a third of the feedback coded self, while F2 has a bit less than a third of the feedback coded self. F3 has more than half (62 %) of the feedback coded self. When we look at the code task, F1 has least of feedback coded in this way (17 %), with F2 just above (20 %), and F3's feedback is coded around 28 % with task. This is the category where we see the least differences between the facilitators.

Table 1: The number of feedback comments tagged with different codes according to different facilitators

	Self	Task	Process	Other
F1 (feedback to 3 mission reports coded)	33 %	17 %	44 %	6 %
F2 (feedback to 3 mission reports coded)	27 %	20 %	45 %	8 %
F3 (feedback to 3 mission reports coded)	62 %	28 %	1 %	9 %

However, the notable difference is with the feedback coded process. Both F1 and F2 have just under half of their feedback coded in this way, while F3 has almost no comment in this category. This first analysis of the ratios of the comments gave us some further questions. What could be the reasons for these differences? We then went into the mission reports again to look into what the feedback trends between the facilitators could indicated. This is discussed in the following sections.

When we studied the feedback coded with task, we noticed that this was usually coded in the start of the mission. The facilitators would comment on any lack of theoretical justification given for tasks made for pupils and give feedback on issues connected to the groups' academic writing. After the start of the report feedback given on self of the group would occur with uneven intervals during the rest of the mission report. All three facilitators seemed to praise the practicing teachers both within the mission report, and in their final longer comments.

Both F1 and F2 gave about half their feedback on process. When we investigate the feedback coded with this code, we see that most of this kind of feedback is about asking the group of practicing teachers to discuss and reflect on what their observations of pupils could mean for their teaching work in the classroom. For instance, in the following excerpt we have translated a discussion from the mission report and F2's comment. This a about a situation on a pupil's work on solving 15 times 53.

The group describes and shows the pupil's work with drawings and her oral reflections on the task. The group then describes in the mission:

The pupil uses the distributive law by splitting the number 53 into 50 and 3. She shows that she lacks good strategies for multiplication with high numbers. To add 50 15 times is time consuming, and there a high risk of wrong calculations. It seems like it gets easier for her when she groups the 50's. The pupil is in the second level of her development of multiplicative thinking (Solem et al., 2018¹). She is mostly using counting and repeated addition to solve the task.

The following feedback was given to the excerpt by F2:

How could you have proceeded with this pupil? You have noticed that the pupil has used the distributive law. How could you build on this with calculating something like $3 \cdot 15$? What kind of aids could have been used, and what kind of calculation could be useful?

As we can see, this comment is clearly drawing lines towards teacher work in classroom, and how what the teachers observe can be taken into consideration when they plan the pupils' progressions.

Another example is this feedback comment on process from F1 about a pupil:

The dilemma with this pupil is that she knows the area model [for multiplication] so well that you don't get to see any strategies she may have arrived at by herself. Figure out some tasks she could have gotten as "written mental arithmetic" where you could see which strategies she used. Ex: 25×6 is 150 because she knows 25×4 is 100.

F1 is giving suggestions for tasks the group could use later for this specific pupil. A different kind of comment on process is exemplified by this feedback by F2: "What was it that gave this impression? There are instances of pupils who use this method to calculate $612:3$ and give answer 24 – do you see why?". Here F2 is asking a question which the group can reflect upon, without giving a specific solution.

Both feedback comments are categorised by us as process, but they are different in that the first is a comment with specific feedback, while the other is a question intended to foster reflection. Analysing this further, we noticed that it could seem like F2 often gave feedback by asking such questions without specific answers, while F1 was more likely to give concrete suggestions.

Discussion and further work

In this paper we have used Kastberg et al.'s (2018) framework to analyse the feedback practices of three facilitators when they give feedback to a mission about multi-digit multiplication and division. Our research question was: *what characterises different mathematics facilitators' feedback practices on 'missions' in a course for practicing teachers?* When we look at the feedback given, we see that there are, when we use Kastberg et al.'s (2020) framework categories to code, big variations.

The first notable issue is that none of the facilitators gave feedback which we coded as the category self-regulation. This is similar to the result in Kastberg et al.'s (2018) which also found that this was the category that they gave fewest, or none, feedback within. One point that can be made is that some

¹ Solem et al. (2018) is one of the textbooks in the course; Solem, I. H., Norberg, G., Alseth, B. (2018). *Tall og tanke 1 Matematikkundervisning på 1. til 4. trinn. [Number and Thought 1 Mathematics teaching for 1.st to 4.th grade]* Gyldendal Akademisk.

of the comments that are coded process, can be regarded as implicit feedback on future self-regulation of learning. For instance, if we look at the feedback given by F2 shown above, where the practicing teacher was asked how to continue working with this pupil. This feedback can be both a suggestion to make the specific point in the mission report better, and something that the practicing teachers should bear in mind the next time they analyse pupils' work. However, this may not be clear to the practicing teachers, so it can seem that more explicitness is called for. We therefore suggest an increased awareness of this category of feedback within facilitators' feedback practices on missions could be valuable.

We found that all three facilitators gave feedback on the self level. F3 was coded to have over half of the feedback in this category, however F1 and F2 gave around one third of their comments in this category. F1 and F2 shared one class and had given feedback on three mission reports each. They have worked on this course for several years and have the advantage of more experience within teacher education than F3. On this mission F3 gave feedback as the only facilitator in their class, so F3 had less possibility to consult with other facilitators. This could be an indication of the importance of cooperation and facilitators working together so that one can reflect together on feedback practices. Hattie (2007) argues that feedback on self is the least effective feedback of the four levels. However, we argue that there can be great value in good relations between facilitators and the practicing teachers, and that one positive effect of feedback on self can be increased positive relations.

When it comes to feedback on process, we found that even though F1 and F2 both give a great deal of the feedback of this type, the feedback they give varies between them in this category. F3 gave little feedback in this category. As we saw in the examples shown, F1 gave more feedback with concrete suggestions, while F2 more relied on reflective questions to the group. Within this category F1 and F2 varied more in their feedback than the three facilitators did in the self category.

We therefore argue that Kastberg et al.'s (2018) framework is useful and possible to use to find some differences and similarities across the feedback practices on missions of facilitators. We do not think that there exists an optimal ratio of what kind of feedback that should be given; however, that one category from the framework is completely missing in our coding seems like an opportunity to raise the question of whether feedback on this is needed on missions. In addition, we see that the levels are quite broad, and that it could be useful with more specific categorisation to uncover more differences. The level process could possibly be split into reflective comments and comments about concrete suggestions of classroom work.

As for future work, we find several interesting directions to continue the work of looking into feedback given in mathematics education courses for prospective and practicing teachers. We would like to explore if MTEs give feedback in different ways to similar issues, and how we can work to develop the MTEs as a group within our teacher education to give effective feedback on what the MTEs intend to give feedback on. Another perspective is of the practicing teachers: what are their reactions to the different types of feedback which facilitators provided in this study? And is the intended meaning of the feedback the same as the perceived meaning of the practicing teachers. Researching on what the practicing teachers use the feedback for is therefore an important factor for developing our learning as facilitators.

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