Norwegian primary teacher education: Prospective teachers' responses to short written feedback

Grethe Kjensli, Siri Krogh Nordby and Trude Sundtjønn

OsloMet – Oslo Metropolitan University, Norway
grethe.kjensli@oslomet.no, siri-krogh.nordby@oslomet.no, trude.sundtjonn@oslomet.no

This paper reports on a project in a mathematics course for prospective teachers, where the teacher educator modelled feedback based on formative assessment principles. We analyse and discuss the prospective teachers' responses when they are challenged to reflect from a teacher's perspective on how to use different models to compare fractions in a primary classroom setting. We find that the prospective teachers tended to use the feedback to move forwards in their teacher perspective, while some of them reflected on their uncertainty of how to use the models in a classroom. We argue that the prospective teachers got the opportunity to reflect on their own learning process.

Keywords: Formative assessment, teacher education, prospective teachers, feedback.

Introduction

Research on written feedback as formative assessment for mathematics teachers' education is sparse, however there is some work emerging. For example, Buchholtz et al. (2018) examined what learning opportunities could be identified when combining formative and summative assessment of prospective teachers' professional competence. Their findings showed that a significantly higher number of learning opportunities were perceived when these two forms of assessment were combined. In another study, Kastberg et al. (2020) found that mathematics teacher educators' written feedback could be described as effective when it gave prospective teachers the opportunity to build on their own answers; however, Kastberg et al. saw little evidence of feedback intended to help prospective teachers self-regulate their own learning.

Mathematics courses in teacher education aim to prepare prospective teachers to teach mathematics and provide experiences on which they can base their later pedagogical practices. Research suggests that prospective teachers benefit from experiencing for themselves the didactics the teacher educator intends for them to learn, especially if they receive an explanation of why certain practices are of value in classrooms (Rojas et al. 2021). Summative assessment is still the prevalent assessment method for teacher education courses (Mumm et al. 2015), which means that prospective teachers receive little prompt individual feedback during their day-to-day teaching and learning. This is also the case at our university, where, in our mathematics courses, students have one exam at the end of each semester (for a total of three exams over 1.5 years) and two or three longer written assignments (mostly in groups) each semester, for which they receive feedback. One way of giving students more continuous feedback is through formative assessment, which combines participants' awareness of learning goals, academic and process-oriented guidance such that it contributes to a community of learning (Black et al., 2003). Written feedback gives teacher educators and prospective teachers the opportunity to revisit the comments over time to reflect and discuss important points in their work (Kastberg et al., 2020). In this project we wanted to explore how short written feedback could be used in a mathematics education course. The research question discussed in this paper is: what

characterises prospective teachers' answers to short written feedback intended to raise awareness of use of different fraction models for primary school teaching?

Theory

The concept of formative assessment is used in the literature with different interpretations (Mumm et al. 2015). In this study we use Black and Wiliam's (2009) framework which emphasise five aspects of formative assessment: clarifying and understanding learning goals, effective classroom learning activities, giving feedback that points forwards, using students in peer learning and getting students to own their own learning process. An assessment is formative if used as a guide to what the participants should learn, what they already know and where to go next (Wiliam, 2007). Short-written feedback can contribute to this process of learning, and Swaffield (2011) highlights for assessment to be fruitful, it is important that it is directed towards learning that occurs in activities that are taking place there and then. Furthermore, feedback has greatest effect when aimed at a particular task and have concrete suggestions for improvements (Hattie & Timperley, 2007). In a classroom, formative assessment can occur in two different ways: spontaneously or planned (Dixson & Worrell, 2016). Spontaneous formative assessment is characterised, for example, by the teacher taking hold of academic moments that appear in the teaching and allowing the participants to contribute with academic justifications and examples on the spur of the moment. Planned formative assessments allow teachers to become aware of participants' current competences, and such information can help facilitate and adapt further learning and teaching (Wylie et al., 2009).

Lunenberg et al. (2007) argue that teacher educators can model teaching in four different ways: implicit modelling, explicit modelling, explicit modelling by facilitating to classroom practice and connecting their own teaching with theory on how to teach. Implicit modelling is when the teacher educator uses themselves as good examples of how to teach. However, without an explicit discussion of why their teaching is a model for good teaching practices, there is a risk of prospective teachers not recognising the transfer value because they do not recognise the connection to practice and theory. Prospective mathematics teachers need to know not only the right answers to questions but also how to teach mathematics in appropriate ways to pupils. This can be achieved by teacher educators modelling, for example, how to use different models for teaching fractions. Olanoff et al.'s (2014) research summary showed that while student teachers often knew how to procedurally calculate with fractions, they struggled with knowing why the procedures worked and how to use number sense to understand fractions. The work developed in this study draws from the outlined theory, emphasising how formative assessment, using short written feedback contribute to guiding prospective teachers in their learning of teaching mathematics. Based on Hattie and Timperley's (2007) framework of effective feedback, which includes questions such as "where am I going", "how am I going" and "where to next", we see the goal of this study as an opportunity to identify prospective teachers use of such feedback.

Research design and context

Prospective teachers intending to teach in grades 1-7 (ages 6-12) in Norway have a mandatory mathematics course (equivalent to 30 ETCS), which is a blend of learning mathematics and learning how to teach mathematics. Pupils in Norwegian primary schools do not receive grades, so their own

future assessments will be mostly formative. In this semester they studied 10 ECTS in mathematics (in addition to 10 ECTS in Norwegian and 10 ECTS in pedagogy). The course theme in this period was fractions; with the use of different fraction models (i.e., area model, set model, and place on a number line) and how to use visualisations and representations for pupils' understanding of fractions.

Each lesson started with an introduction to the intended goal, and at the end of the lesson, the prospective teachers were asked planned question(s) based on the lesson's teaching goal, in line with Swaffield's (2011) point that the assessment should be directed towards the activities at that point in time. The prospective teachers got about 10 minutes to independently answer these questions in a notebook and handed it in before leaving. The teacher educator would afterwards write short written feedback to their answers, in the form of questions and reflection notes. The notebooks were given back at the start of the next lesson. The prospective teachers got the opportunity to reflect and make written changes according to the feedback. The idea was to encourage them to evaluate their own work, challenge and explore their choices and teacher knowledge so that the gap between what the prospective teachers understood and what the teacher educator wanted them to understand decreased.

The teacher educator (one of the authors) was a teacher with more than 10 years teaching experience from both lower secondary school and teacher education. She was experienced in using formative feedback, primarily in lower secondary school, and familiar with Black and Wiliam's (2009) framework. During the project the authors of the paper discussed how to give feedback to the answers. All the prospective teachers in the class agreed to participate in this study; however, not everybody was present for each lesson. Data were collected during a five-week period, within a weekly session of three hours. However, in this paper we only analyse one cycle of feedback and answers after one lesson, in which the teaching had focused on how to visualise and compare fractions using different models. The stated learning goal of this was: ''you should be able to use different models for fractions and assess when the different models are suitable.'' The questions the prospective teachers answered at the end of the lesson was ''which of these fractions is larger, $\frac{9}{4}$ or $\frac{7}{6}$? Answer with as many visualisations as you know'' and the same question, with comparing the fractions $\frac{3}{7}$ and $\frac{4}{9}$.

Data analysis

The data analysed in this paper come from 30 prospective teachers who had answered the questions after the lesson and responded to written feedback. The feedback from the teacher educator was in the form of short questions and comments and varied from short encouraging answers, such as ''good'' to questions, such as, ''could you show this with more visual models?'' and ''could you show this more accurately?'' This included responses intended to encourage the prospective teachers to think about how to use their knowledge in a classroom setting, such as ''how could you show this for a 5th grade?'' and ''how could you do this if the pupil did not know how to find a common denominator?''

The coding and thematic analysis were done by all three authors. We read all feedback and answers individually. We discussed what we had seen and decided to code the feedback given by the teacher educator as ''mathematical feedback'', ''reflective teacher questions'', ''encouraging comments'' and ''other''. These categories were not mutually exclusive, some of the comments and questions

were shared between content knowledge of fractions and how to teach fractions, while other questions and comments were focused on either content knowledge or teaching knowledge. The coding of the teacher feedback was afterwards done individually by the first and third author, and then compared and discussed until we reached consensus. In this paper we report on the analyses of the prospective teachers' responses to the questions and comments that gave them the opportunity to reflect and comment on the use of their knowledge in a mathematics classroom. We focused our analysis on the notebooks of prospective teachers who had been given what we coded as a reflective teacher question (22) and had in some way answered this question (16). These answers were then individually divided by the authors according to the prospective teachers' revisions and comments 1) with a focus on the mathematics content, 2) with a focus on how to teach, and 3) those that were either wrong or not in accordance with the feedback. Here we again compared and discussed for consensus in the grouping. These three categories enabled us to compare the prospective teachers' responses. Here, we report on three characteristic examples of the prospective teachers' answers.

Results

The analysis of the prospective teachers' answers to questions about how the knowledge could be implemented in a classroom showed that they answered quite differently to similar questions. The answers showed that the prospective teachers were unsure of how to use their knowledge in a teacher context, and some, in their reflections, also showed this uncertainty.

The first example is from a prospective teacher who answered the feedback ''which model do you think is best suited for explaining to a 5th grade'' which they had gotten in response to their answer to original question, ''which of these fractions is larger $\frac{3}{7}$ and $\frac{4}{9}$? Answer with as many visualisations as you know.'' There was also a comment on a more mathematical issue, where the teacher educator had drawn an arrow between the number lines and asked, ''what was important here?''

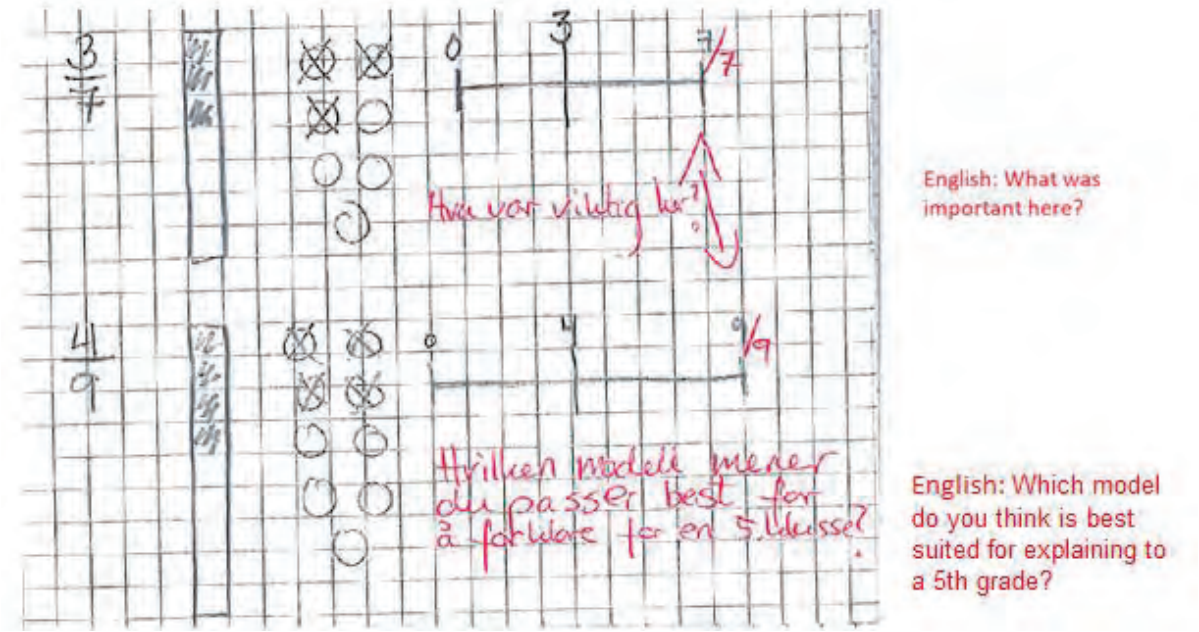

Figure 1: Prospective teacher's original answer, with feedback from teacher educator in red

In the prospective teacher's original answer, they used an area model, a set model, and a number line to visually represent the fractions $\frac{3}{7}$ and $\frac{4}{9}$. There was no written answer to which fraction is larger, and it was not clear from the answer how the prospective teacher's intended to use these to figure out which fraction is larger. They answered the feedback from the teacher educator and wrote

> To be best for a 5th grade it is important that the distance on the number line is the same for each value, and maybe it should have been marked [with] the numbers across…? Or maybe the most important [is] to show that 1 is $\frac{7}{7}$ so that it does not get confusing that $\frac{7}{7}$ is the value of one whole and not the value 7.

In their answer, the prospective teacher incorporated both the mathematical issue about a number line with 7 or $\frac{7}{7}$ and discussed what could be done when teaching pupils. They used the feedback to reflect on what could be important in a classroom, but they signalled uncertainty with their use of ''…? Or''.

Similarly, another prospective teacher had written in their original answer that their own drawing was inaccurate. The teacher educator challenged the prospective teacher to again think about how to compare $\frac{3}{7}$ and $\frac{4}{9}$ for pupils.

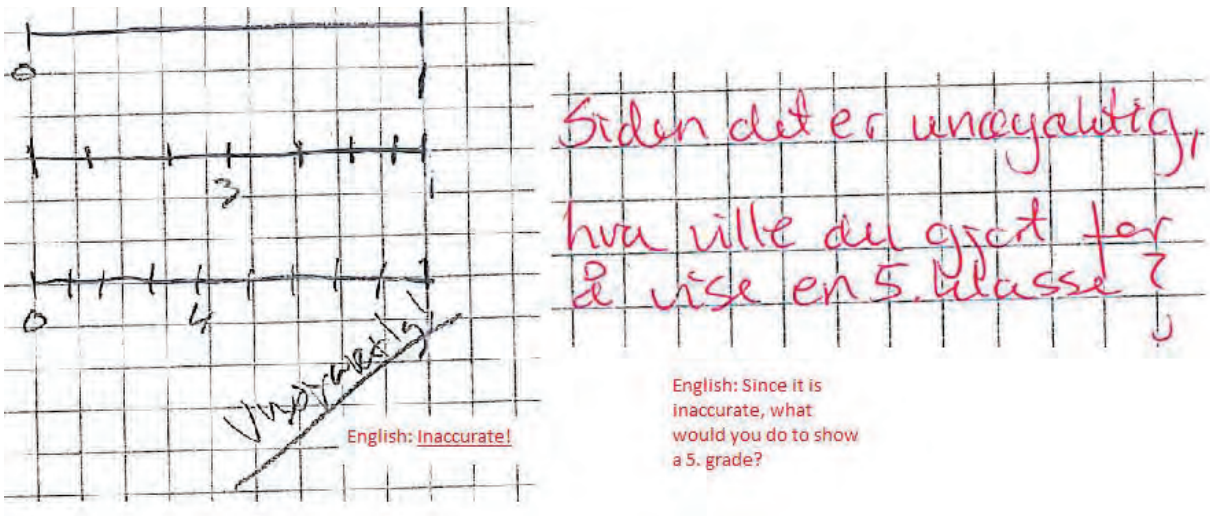

Figure 2: Prospective teacher's original answer (left) and teacher educator's comment (right)

This example shows how the prospective teacher used the feedback (see Figure 2), ''since it is inaccurate, what would you do to show a 5th grade?'', to answer, ''for explaining for a fifth grade I would focus on the explanation of parts and whole, and from there discuss these two magnitudes. I think. Difficult to answer this now.'' The answer shows that the prospective teacher's awareness that they could not fully answer the feedback and that they were still in a learning process.

The third example is from a prospective teacher who had gotten feedback on their answer to the question, ''which of these fractions is larger, $\frac{9}{4}$ or $\frac{7}{6}$? Answer with as many visualisations as you know.'' As seen in Figure 3 (left-hand side), in their original answer that they show knowledge about the different representations (i.e., circular and rectangular area models and number lines), but they did not show how these models could be used to compare fractions. Here, the teacher educator gave the feedback. ''Ok! How can you show this clearly for a 5th Grade which is larger?''

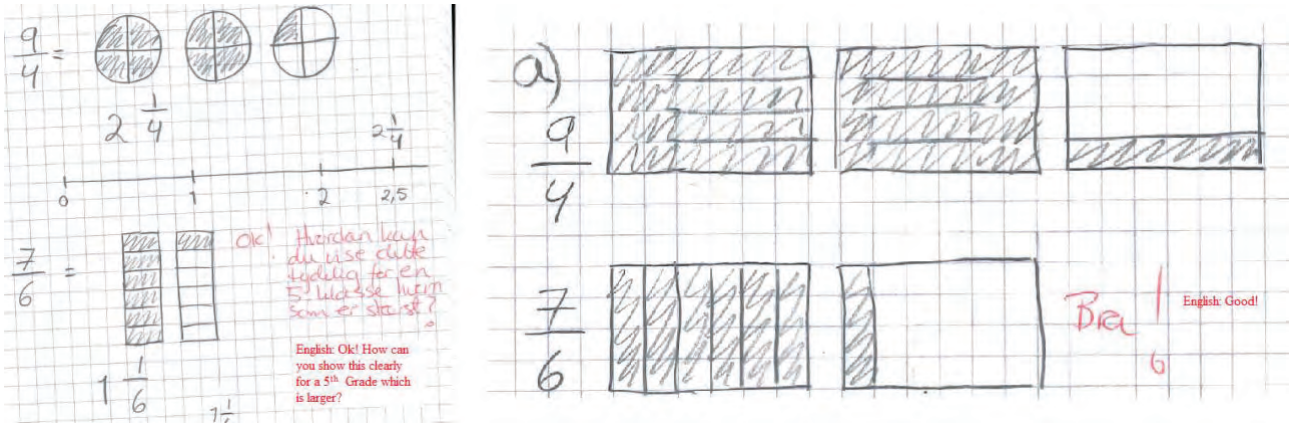

Figure 3: Prospective teacher's original area models (left) and revised area models (right)

The prospective teacher's revised answer (Figure 3, right-hand side) shows the fractions sketched using a rectangular area model, but here, they chooses the same shape and size for a unit fraction. Although there are no notes to accompany the drawing, the drawing is precise. It shows $\frac{1}{4}$ and $\frac{1}{6}$, and the rectangles are drawn above each other, which makes a comparison easy. However, in this question, it may have been obvious to the prospective teacher that $\frac{9}{4}$ was bigger than $\frac{7}{6}$, since $\frac{9}{4}$ is more than two wholes, and $\frac{7}{6}$ is just above one whole. Therefore, the shape of the area models may not have mattered to the prospective teacher in this case.

Discussion and concluding remarks

In this project, the teacher educator used implicit modelling for an assessment practice that the prospective teachers could use in their own classrooms. We saw that the teacher educator used different kinds of comments in the feedback, which ranged from encouraging remarks to mathematical comments, and comments directed at giving the prospective teachers a nudge towards thinking of their future classroom teaching. The three answers shown in this paper are examples of the prospective teachers' reflections after they had revived short written feedback intended to point forwards and help them take a teacher perspective. The prospective teachers, by answering the questions and receiving tailored comments, got the opportunity to reflect on how the fraction models could be used in teaching mathematics and experienced an assessment practice, which they also could use in their own teaching. This is in line with Rojas et al.'s. (2021) suggestion on how to improve learning processes in mathematics teacher education.

It seemed like that when first asked about comparing fractions in different ways, the prospective teachers answered with a focus on showing that they could draw different models. This may be a consequence of the question they were asked, which consist of two parts, both comparing the fractions and showing different visualisations. It may be that the prospective teachers focused on showing their knowledge of different fraction models and disregarded the point that they should compare the fractions. In the lesson the teacher educator had both showed how to visualise different fraction models and showed how to use them for comparison. With the original questions, the teacher educator's intention was that the prospective teachers should model ways that could be used in a classroom, so the questions in this case had two functions. The teacher educator could use the questions and answers with feedback to help the prospective teachers turn their attention towards 1)

using the fraction models as teaching tools and 2) realise that there was a gap between the prospective teachers' answers and the teacher educator's intentions. For formative assessment it is important that learning goals are understood, and here the formative assessment gave both the teacher educator and prospective teachers the opportunity to adjust their understanding of the goal of the lesson. Such common understanding can contribute to a community of learning (Black et al., 2003).

The feedback they received gave the prospective teachers opportunities to assess and reflect on their previous answers. They showed that they were aware they were still in a learning process, and some of their answers communicated to the teacher educator their own uncertainty about how to respond to the feedback. We argue that the prospective teachers were in a process towards owning their own learning, which is an important aspect of a formative assessment (Black & Wiliam, 2009). The prospective teachers get little individual feedback during their mathematics courses in our institution. With such short-written feedback, they got the opportunity to reflect on if they could answer the questions related to the lesson. The feedback can use in their learning both immediately when they received the feedback and later while revising the course content on their own. We also found that the prospective teachers used this feedback loop to establish a rapport with their teacher educator and indicate where they were unsure about something, which was useful for both.

From a teacher educator's perspective, the formative assessment gives the teacher educator an opportunity to identify where the prospective teachers are struggling and provide feedback to help promote learning. This can be done for individuals as comments and by lifting problematic areas into the teaching of the whole class. In retrospect, we recognise that more thorough feedback could have been given in the answers. For example, this could be to point out more misunderstandings and give more specific positive remarks. However, because the project was intended to be carried out with teacher educators' busy schedule, it is important to reflect on which and how many comments are given.

Acknowledgment

A big thank you to the prospective teachers who worked diligently on their assignments and let us look into their answers, questions and reflections.

References

Black, P., Harrison, C., & Lee, C. (2003). *Assessment for learning: Putting it into practice*. McGraw-Hill Education.

Black, P., & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability, 21*(5). https://doi.org/10.1007/s11092-008-9068-5

Buchholtz, N. F., Krosanke, N., Orschulik, A. B., & Vorhölter, K. (2018). Combining and integrating formative and summative assessment in mathematics teacher education. *ZDM, 50*(4), 715–728. https://doi.org/10.1007/s11858-018-0948-y

Dixson, D. D., & Worrell, F. C. (2016). Formative and summative assessment in the classroom. *Theory Into Practice*, *55*(2), 153–159. https://doi.org/10.1080/00405841.2016.1148989

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(1), 81–112. https://doi.org/10.3102/003465430298487

Kastberg, S. E., Lischka, A. E., & Hillman, S. L. (2020). Characterizing mathematics teacher educators' written feedback to prospective teachers. *Journal of Mathematics Teacher Education*, *23*(2), 131–152. https://doi.org/10.1007/s10857-018-9414-6

Lunenberg, M., Korthagen, F., & Swennen, A. (2007). The teacher educator as a role model. *Teaching and Teacher Education*, *23*(5), 586–601. https://doi.org/10.1016/j.tate.2006.11.001

Mumm, K., Karm, M., & Remmik, M. (2015). Assessment for learning: Why assessment does not always support student teachers' learning. *Journal of Further and Higher Education*, *40*(6), 780–803. https://doi.org/10.1080/0309877X.2015.1062847

Olanoff, D., Lo, J., & Tobias, J. (2014). Mathematical content knowledge for teaching elementary mathematics: A focus on fractions. *The Mathematics Enthusiast*, *11*(2). https://doi.org/10.54870/1551-3440.1304

Rojas, F., Montenegro, H., Goizueta, M., & Martínez, S. (2021). Researching modelling by mathematics teacher educators: Shifting the focus onto teaching practices. In M. Goos & K. Beswick, K. (Eds.), *The Learning and Development of Mathematics Teacher Educators*, pp. 367–382. Springer Cham.

Swaffield, S. (2011). Getting to the heart of authentic assessment for learning. *Assessment in Education: Principles, Policy & Practice*, *18*(4), 433–449. https://doi.org/10.1080/0969594X.2011.582838

Wiliam, D. (2007). Keeping learning on track: Classroom assessment and the regulation of learning In F.K. Lester Jr. (Ed.), *Second handbook of mathematics teaching and learning* (pp. 1053–1098). Information Age Publishing.

Wylie, E. C., Lyon, C. J., & Goe, L. (2009). Teacher professional development focused on formative assessment: Changing teachers, changing schools. *ETS Research Report Series*, *1*, i–32.