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Peer Feedback in the Mathematics Classroom

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ABSTRACT This study explores peer feedback in a combined fifth and sixth-grade classroom. Drawing on Hattie and Timperley's (2007) model for feedback, we analyzed 334 peer feedback comments gathered during six mathematics lessons. Our analysis revealed evidence of peer feedback being beneficial to the students who provide it as well as those who receive it. Specifically, we share examples of how peer feedback can support opportunities for providers of feedback to 1) self-regulate by choosing mathematics strategies, 2) make connections between their own mathematical ideas and those of their peers, and 3) engage in ongoing back-and-forth conversations. Findings from our study point to recommendations for teachers to be more purposeful in their prompts to students about the types of feedback they might provide one another.

KEYWORDS *feedback, peer feedback, classroom practices, elementary mathematics*

Introduction

Peer feedback is a specialized form of feedback that is “provided by equal status learners” (Gielen et al., 2010, p. 305). In the classroom, this translates into students providing each other with feedback, rather than the teacher. Peer feedback is an important feature of peer learning (Falchikov, 2001; Topping, 2005, 2009) as well as formative assessment processes (Black & Wiliam, 1998). Researchers suggest that peer feedback can be comparable to teacher feedback when the goals are clear and the criteria are set (Falchikov & Goldfinch, 2000; Hamer et al., 2015). As mathematics educators, we are interested in exploring peer feedback in an elementary mathematics classroom—what it looks like, sounds like, and feels like for teachers and students. Despite extensive literature on feedback in general, research on peer feedback is still in its youth (Kollar & Fisher, 2010). Of the limited research that has investigated the topic of peer feedback, studies have examined how peer feedback relates to teacher feedback (Falchikov & Goldfinch, 2000), effectiveness of peer feedback for learning (Gielen et al., 2010), and how peers perceive the feedback provided by their peers (Strijbos et al., 2010). Much of

the literature about feedback has focused on potential benefits to the receiver. In contrast, this paper analyzes feedback for traces of there being mutually reciprocal benefits to the provider of feedback. In this pursuit, we will share examples of peer feedback that unfolded during mathematics lessons in a combined fifth and sixth-grade classroom. Our examples show how peer feedback can benefit the student who provides the feedback by 1) supporting their self-regulation in choosing mathematics strategies, 2) facilitating making connections between their own mathematical ideas and those of their peers, and 3) offering the opportunity to engage in ongoing back-and-forth conversations. Finally, we will discuss how teachers can be purposeful and more explicit when guiding students to provide peer feedback.

Description of the Project

This study was part of a larger collaborative research project between researchers at a large urban university and an inservice teacher at an elementary school. Taking place over the course of four months, the larger study gathered data from six lessons, each lesson focusing on

one mathematics task. The tasks ranged across a variety of topics, including geometric growing patterns, proportional reasoning, and tasks that involve using data to investigate mean, median, and mode. The study reported here uses data from all six lessons.

Within this study, we report on the feedback the students in a combined fifth and sixth grade mathematics classroom provided to one another. The teacher structured the observed lessons so that first, students worked in pairs on a mathematics task to co-create posters that displayed their thought process. Then, following the completion of the posters, students were directed to review one to two other posters and provide written feedback on sticky notes (see Figure 1).

Writing phrases such as “good work” or “I like your poster” was discouraged because the teacher wanted

her students to focus feedback on the mathematics. This was evidenced by the teacher’s prompt for her students to “comment on the mathematics.”

A Model for Peer Feedback

To analyze our data, we first needed a model or framework that would help us categorize and describe different types of peer feedback provided by the students. A review of the literature revealed that there was not a well-developed and generally agreed-upon model for categorizing and describing peer feedback. In the absence of such a model, we decided to apply Hattie and Timperley’s (2007) model of feedback. The use of this model seemed appropriate as their definition of feedback acknowledges peers as potential generators of feedback. Furthermore, other researchers (e.g., Harris et al., 2014) have also used Hattie and Timperley’s (2007) model to study peer feedback. Hattie and Timperley’s (2007) model for feedback consists of four non-hierarchical levels, in which each level describes the focus of the feedback (see Table 1).

Our coding process involved identifying statements and/or elements in each of the feedback comments that related to the descriptions for the four levels of feedback. This was an iterative process where the two researchers individually coded the data and then compared findings with the purpose of seeking agreement. There were instances where we did not agree on the coding of a particular feedback comment. To resolve these discrepancies we continually referred back to Hattie and Timperley’s (2007) model and examined the criteria and description for each level and discussed the comments in relation to the mathematics on the poster.

Figure 1
Example of a Poster Given a Mathematics Task

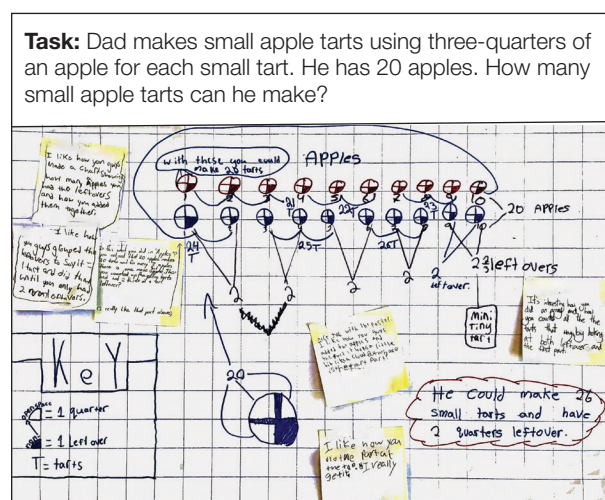


Table 1
Hattie and Timperley’s (2007) Levels of Feedback

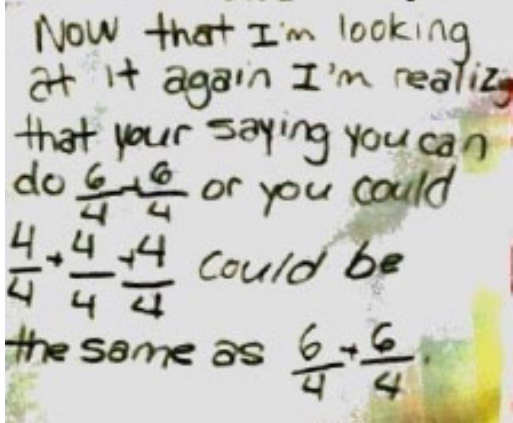
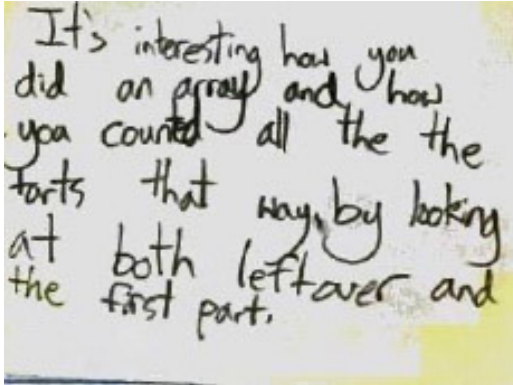
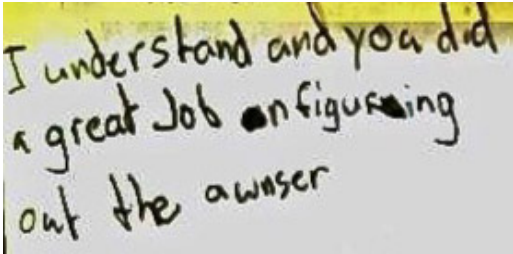
Feedback Level	Description
Feedback on Task (FT)	Feedback about the learner’s presentation, organization, and correctness of the task.
Feedback on Process (FP)	Feedback about the learner’s thinking and strategies.
Feedback on Self (FS)	Feedback that is about the learner and not the task.
Feedback on Self-regulation (FR)	Feedback that engages the learner in self-regulation.

Analysis and Findings

At the end of each lesson, we took photos of all the posters that were created by the students. Each poster contained between four and six sticky notes that were used to provide peer feedback (see Figure 1). Based on the descriptions for each level of feedback, we then coded

the students' peer feedback comments using the four levels of FT, FP, FR, FS. We found that out of 334 peer feedback comments, 282 (84%) were feedback on task (FT), 26 (8%) were feedback on process (FP), 26 (8%) were feedback on self (FS), and 0 (0%) were feedback on self-regulation (FR). Table 2 provides examples for each of the four levels of peer feedback.

Table 2
Examples of Peer Feedback Categories

Feedback Level	Example
Feedback on Task (FT)	
Feedback on Process (FP)	
Feedback on Self (FS)	
Feedback on Self-regulation (FR)	We found no examples of feedback that engages the receiver in self-regulation.

Our initial analysis of the data revealed that some peer feedback comments had elements that could arguably place them in more than one of the four levels described in Hattie and Timperley's (2007) model. Being provided with more than one level of feedback is beneficial to learners because it allows more opportunities for taking up feedback. Our analysis of the comments also revealed that the benefits of the feedback were not exclusive to the students receiving them. In fact, some of these comments had the potential to benefit the person providing the feedback.

Peer Feedback that Benefits the Provider

As a peer-to-peer form of communication, peer feedback has the potential to support both the providers and the receivers. Below, we share examples of comments that offered the feedback provider opportunities to 1) self-regulate, 2) make connections between mathematical ideas, and 3) elicit further conversations with peers.

Self-Regulation: "I'll use your strategy next time!"

Self-regulation involves self-assessment, self-appraisal, and self-management (Hattie & Timperley, 2007). Self-regulation includes thoughts, feelings, and actions that support the attainment of personal goals (Zimmerman, 2000). For example, students engaged in self-regulation might consider accepting feedback provided to them or seek further information in order to better understand and apply the feedback. In this study, we did not find samples of peer feedback that would engage the student receiving the feedback in self-regulation. However, we noticed peer feedback comments that illustrated self-regulation on behalf of the student who provided the feedback, which we have coded as *Feedback on Self-regulation on behalf of the Provider* (FR-P).

Example 1: "You [have a] unique way of doing this poster! Me and my partner never did that kind of work! Maybe I'll use your strategy next time!"

The student begins by complimenting the uniqueness of the poster (FS), goes on to self-assess by sharing that they had never used that strategy (FR-P), and concludes by considering using that strategy next time. The comment, "I'll use your strategy next time" demonstrates how the student providing the feedback may be reconsidering their own problem solving strategies and,

therefore, engaging in self-regulation. We think this is important because it exemplifies how peer feedback can serve the student who is providing it, not just the one receiving it.

Connection-Making Feedback: "Me and my partner did ..."

To grow mathematical understanding, the National Council of Teachers of Mathematics (NCTM) recommends that teachers provide opportunities for students to analyze and compare one another's mathematical approaches and arguments (2014). There is a personal quality to peer-to-peer feedback that helps students connect their ideas with those of their peers. While analyzing our data, we noticed that almost all of the peer feedback comments started with "I" statements such as "I like...", "I understand...", "I don't see how...", etc. In the following two examples of peer feedback comments, students made connections between their strategies and what they saw on the poster. We coded these comments as *Feedback on Connection-Making* (FCM).

Example 2: "I liked how you showed the bottom that one block + 1 block + 1 block = figure 2. I also like how you showed that on figure 2 there is 2 on the side and it keeps going, figure 3 has 3 on the side. Me and my partner did the same thing."

Example 3: "I like how you did the odd and even pattern and how 1 and 3 are odd and 6 and 10 are even. I also like how you did the old blocks and the new blocks. Me and my partner did something like the odd and even except we used the figure number as the odd and even instead of the full figure."

In both examples, the students describe what they see on the poster and compare it to their own solution strategy. In Example 2, the student providing the feedback appears to be making a connection (FCM) by noticing the same solution strategy: "me and my partner did the same thing." In Example 3, the student providing the feedback also appears to be making a connection (FCM) to their work by noticing a similar, yet slightly different, way of seeing the pattern by noting that they "used the figure number as the odd and even instead of the full figure."

The examples outlined here demonstrate how peer feedback facilitates the students providing peer feedback to make connections and, potentially, deepen their understanding of the mathematical concept.

Elicit Further Conversation: “Talk to me after.”

NCTM (2014) *Principles to Action* recommends that teachers facilitate meaningful mathematical discourse. Such discourse supports students to a) clarify understandings, b) construct convincing arguments, c) develop language to communicate mathematical ideas, and d) learn to see things from different perspectives. In this study, of the 334 comments, 47 were either in the form of asking questions or eliciting a conversation between peers. We coded these comments as *Feedback as Conversation* (FC). The following examples show how peer feedback can support the beginnings of a mathematical conversation:

Example 4: “Me and my partner noticed the same thing that the 3 apples makes 4 tarts. Is this what you mean 26 ½ apples of ½ tarts (talk to me after)”

Example 5: “... I don’t really understand the top left. Can you explain?”

In Example 4, the student shared a connection between their solution strategy and what their peers did (FCM). Then, they posed a question and invited their peers to talk afterward (FC). In Example 5, the student communicated their lack of understanding of a part of the strategy on the poster and asked for more explanation (FC). The comments, “talk to me after,” and “can you explain” invite both students, the provider and the receiver of peer feedback, to have a future conversation, creating the conditions for further action. This is significant because it highlights how peer feedback can evolve from one-directional communication to an exchange of ideas, thus supporting student achievement (Lau et al., 2009).

Discussion

Our use of Hattie and Timperley’s (2007) model to analyze peer feedback comments revealed an uneven distribution of data among the four levels. Specifically, 84% of the comments belonged to the FT level. We think one possible reason for the large number of FTs could be attributed to the teacher’s “focus on the mathematics” prompt at the launch of the feedback activity. Similarly, the teacher’s decision to discourage students to use phrases such as “good work” or “I like your poster,” could explain the comparably fewer number of comments that belong to the FS level. These results inspired us to consider how teachers can be more purposeful in instructing their students about the types of feedback

they might provide one another. For instance, instead of simply telling students not to say, “I like your poster” or “good work,” teachers can prompt students by asking questions such as the following:

- What can you learn from your peers’ work? Are there ideas in the work that inspire you to do something different next time?
- How is the mathematics communicated on the poster similar to or different from your work? Specifically, how do your peers’ strategies compare with the strategies you used?
- Is there something in the poster that you want to know more about or talk further about?

Prompting students with questions like these may elicit a range of feedback comments from students, thus promoting a more even distribution among the four levels. This is important because each level of feedback focuses on a different aspect for growth. Having a more even distribution of feedback levels offers learners more opportunities to use the feedback and improve their work.

Conclusion

Hattie and Timperley’s (2007) model is designed for studying and categorizing feedback provided by teachers. Consequently, when describing the levels of feedback, they only consider the benefits to the student who receives the feedback. However, as this study examines feedback provided by and for peers, it is only natural that both the provider and the receiver of feedback are impacted by the process. Our analysis of the examples indicate that peer feedback has the potential to benefit the students who provide feedback and those who receive it. Specifically, peer feedback may support the provider’s ability to self-regulate, make connections, as well as present opportunities for mathematical discourse among peers.

We recognize that our study was limited by its scope and duration—six lessons in one classroom. However, thinking deeply about what students are saying and doing while providing peer feedback has expanded our perceptions of the potential for using peer feedback routinely in mathematics lessons. We hope this study inspires further inquiries into peer feedback and the ways that teachers can support students to engage in reciprocal feedback processes. Specifically, future studies might investigate how teachers and students can co-create criteria for peer feedback.

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