Assessing the Validity of Peer Feedback in a Sixth Grade Mathematics Class

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Abstract: To better understand the possible benefits of using peer assessment in middle school mathematics classes, we examined how the quantity and quality of peer feedback compares to teacher feedback. In general, students not only received more feedback from peers, but the amount of feedback was also more consistent. Moreover, the sixth-grade students focused on similar issues and provided just as many solutions. Detected differences in focus and type of solution could inform instructional design.

Introduction

In the US, emphasis in mathematics is moving away from computational fluency and focusing on student's construction of mathematical arguments or explanations and analyzing the reasoning of others. While policy makers recognize the importance of mathematical communication, students are rarely asked to write in mathematics classes (Mastroianni, 2013). Writing is important because it can help students organize and refine their ideas, think deeper about concepts as they explain their ideas, and connect new concepts to existing knowledge (Flores & Brittain, 2003). However, teachers are concerned that grading writing tasks will take more time than traditional mathematics work, and they lack the knowledge how to incorporate writing tasks (Teuscher, Kulinna, & Crooker, 2015).

One way to address these issues is through the use of peer assessment. Peer assessment (often also called peer review) is the quantitative evaluation or qualitative feedback of a learner's performance by another learner among students. Peer feedback is particularly beneficial because students can receive more total feedback from multiple peers that is articulated using more understandable terms and represents diverse audience perspectives from peers than when receiving feedback from an over-taxed instructor (Patchan, Charney, & Schunn, 2009). Moreover, peer feedback can be just as effective as an instructor's feedback in helping students improve their drafts (e.g., Gielen, Tops, Dochy, Onghena, & Smeets, 2010) and sometimes more effective (e.g., Cho & MacArthur, 2011).

To examine quality in the current study, we focus on two feedback features that had large, positive effects on revision: the focus of the comment and providing a solution (Nelson & Schunn, 2009; Patchan, Schunn, & Correnti, 2016). The use of these features appears to depend on the reviewer's prior knowledge. For example, a content instructor focused more on substance issues than a writing instructor, whereas the writing instructor focused more on writing issues; college students (having less substance and writing knowledge than both instructors) fell between the two instructors (Patchan, et al., 2009). Similarly, a writing instructor provided double the amount of solutions as a content instructor, and college students again fell between the two instructors. Similar differences were observed among secondary students—they focused less on skills and more on content, and they provided fewer solutions (Hovardas, Tsivitanidou, & Zacharia, 2014). To extend this work, the goal of the current study is to examine how the quantity and quality of feedback provided by middle school students compares to teacher feedback.

Method

Participants and context

This study was conducted in a sixth-grade mathematics class in a small rural town located in West Virginia. Thirty-one students (24 females) from two sections participated in this study.

Design and procedure

Participants created study guides with worked examples of word problems posed by the student. Then, students evaluated and commented on four peers' drafts, and the teacher reviewed all students' drafts. Finally, the students were randomly assigned to receive feedback from only their peers or only their teacher, and they revised their study guide using this feedback.

All of the participants' feedback was segmented by idea units, and a total of 1,660 comments were coded. Using a bottom-up approach, 38 issues were identified and coded, including seven general issues (e.g., difficult to read or follow), 12 issues with the word problem (e.g., problem not solvable), and 19 issues with the solution (e.g., incorrect formula). In addition, each comment was coded for the presence of three independent features: problems, general solutions, and specific solutions.

Results

Although students received more feedback from four peers, the comments from the teacher were longer. More importantly, students received a consistent amount of feedback from peers, whereas the amount of feedback provided by the teacher decreased over time (see Figure 1). Quality of drafts did not vary across time.

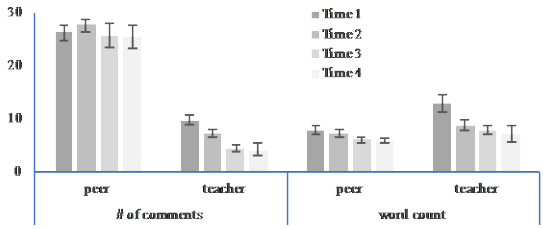

Figure 1. Amount of feedback (i.e., number of comments and word count) across time by reviewer type.

Peer feedback was much more likely to provide praise (16%) than teacher feedback (3%). When peers criticized students' work, they focused on similar issues as the teacher (i.e., missing question and incorrect formula). However, they were also more likely to complain that the work was difficult to read or follow (8% vs. 4%); whereas the teacher was more likely to notice missing measurements (8% vs. 1%).

Finally, both peers and teachers included solutions. However, the peer was more likely to provide a general solution (49% vs. 20%; e.g., "Make sure you use the correct formula"), and the teacher was more likely to provide a specific solution (32% vs. 10%; e.g., "Use: $SA=2\pi rh+\pi r^2$ to exclude top.").

Discussion

This study demonstrated that students could benefit from more consistent feedback from peers that focuses on similar issues and includes a similar amount of solutions as teachers. Future analyses will also examine the impact of these differences on implementation and revision quality. Findings could inform future work on what additional support students may need to provide helpful feedback.

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