

## Learning Writing By Reviewing In Science

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**Abstract.** We examined a theoretical perspective on reciprocal peer reviewing of writing. As an alternative to the traditional approach, *Learning Writing by Writing*, focusing on increasing writing opportunities, we proposed and tested a new hypothesis, *Learning Writing by Reviewing*. Reviewing is defined as a problem solving activity of practicing problem detection, diagnosis, and solution generation in peer writing. The results supported the hypothesis in that peer reviewers improve their own writing by reviewing peer writing.

In spite of extensive efforts for the past three decades under the Writing-Across-Curriculum (WAC) and the Writing-in-the-Disciplines (WID) movements, being able to write well is a fundamental skill that most students in the U.S. lack across all ages. The National Assessment of Educational Progress in 2002 found that 69% of 8<sup>th</sup> grade students and 77% of 12<sup>th</sup> grade students were found to have only basic or lower levels of writing skills (Persky, Daane, & Jin, 2003). Other age group students also performed poorly. Not surprisingly, a great number of high school graduates in the U.S. remain at a lower level of writing skill (Kamil, 2003) than is expected by colleges and employers. Accordingly, the U.S. National Commission on Writing (2003) argues that improving writing across the board should be a national goal of the U.S. They argue that a fundamental reason for this unfortunate situation is that students do not have opportunity of writing practices because instructors are simply overwhelmed by the workload related to reading, grading, and commenting on student writing assignments. Therefore they tend to avoid instructing writing assignments in their courses (National Commission on Writing, 2003).

On the basis of findings that writing improves across multiple drafts as a function of feedback (Hayes, Flower, Schriver, Stratman, & Carey, 1987), a natural, dominant response is to endow students with more chances of practicing writing with feedback. We term this general approach as *Learning Writing by Writing*. This approach tries to make feedback available for students to help guide the writing practice. For example, as part of the WAC and WID movements, considerable resources have been devoted to having a few writing-intensive experiences where instructors or TAs give students opportunities of writing practice with feedback. Another variation of the approach is to outsource feedback beyond instructors. An interesting example is that at Texas Tech, freshmen submit their writing to a system, and then this writing is graded by a graduate student from a pool of such graders (Wasley, 2006).

By contrast to the traditional approach that is dominant, we propose a different perspective, called *Learning Writing by Reviewing*, analogous to the reciprocal teaching approaches to early reading instruction. This perspective emphasizes that learners may improve their own writing skills by engaging in peer review of writing (e.g., Rushton, Ramsey, & Rada, 1993). We define reviewing as a process of problem solving in which reviewers are engaged in exercising important skills for writing (Bereiter & Scardamalia, 1987; Fitzgerald, 1987; Flower, Hayes, Carey, Schriver, & Stratman, 1986) such as problem detection, diagnosis, and solution generation along with reading and commenting on peer writing. These activities may improve reviewers' own writing and revising skills by reinforcing successful strategies and by calling attention to unsuccessful strategies that the reviewers have already used in their own writing. Thus, the goal of this study is to extend the value of peer reviewing beyond its practical advantage by examining how doing peer reviews helps reviewer's own writing skill development.

It is important to note that there are currently barriers restricting practical use and adoption of peer reviewing. Due to the demanding nature of reading and commenting on papers, students as well as instructors are leery of using peer commenting. From the instructors, peer reviewing activities can be perceived as having an opportunity cost—what other instructional activities could students be engaged in? From the students' point of view, commenting is the job of the instructor, not the students. A fundamental reason is that students are not only novices in their disciplines, but also are inexperienced in writing and reviewing. If the reviewing activity had its own pedagogical merit, these concerns might be allayed.

## Method

Initially 145 college students in three intro Physics courses participated in this study as a part of their course requirements. Each student was asked to write first draft and revised draft of two technical research papers. In addition, each student reviewer was randomly assigned four peer papers. Thus, each student submitted first drafts, reviewed four peer drafts, received comments on their writing from peer reviewers, and then revised their first drafts. The reviews were double-blind: authors had pseudonyms and reviewers merely were numbers to the authors. It was important to controlling for floor and ceiling effect on the writing quality evaluation scale because very low writing scores often reflect complete lack of effort on the writer's part, and very strong first drafts have little incentive to revise the paper further. Therefore, participants whose first writing scores placed in the middle 60 % ( $n=87$ ) were selected for further data analyses. Individual students played two roles, one of writer and one of reviewer. These selected students were then categorized into a HIGH helpful review group ( $n = 44$ ) and a LOW helpful review group ( $n = 43$ ) based on reviewing quality, defined in the next section. Although the participants wrote two drafts of two papers, we only used the two drafts of the first paper.

Reviewing quality was defined using helpfulness ratings provided by writers on the peer comments they received. After submitting their final/revised drafts, the writers who received peer reviews evaluated the quality of the reviews on a 7-point rating scale from *Not helpful at all* (1) to *Very helpful* (7) with space provided for optional short responses.

## Results

Before analyzing the main hypothesis, we examined the first draft writing scores and the 1<sup>st</sup> draft reviewing helpfulness ratings between the High helpful review group and the LOW helpful review group to verify that the groups differed only on review helpfulness and not on initial writing ability. As desired, the first draft writing scores between the HIGH helpful review group ( $M = 5.48$ ,  $SD = .38$ ,  $SEM = .06$ ) and LOW helpful review group ( $M = 5.52$ ,  $SD = .37$ ,  $SEM = .06$ ) were not significantly different, suggesting that both groups entered this study with similar writing skills. As manipulated, the review qualities between the HIGH helpful review group ( $M = 6.20$ ,  $SD = .28$ ,  $SEM = .04$ ) and the LOW helpful review group ( $M = 5.29$ ,  $SD = .30$ ,  $SEM = .05$ ) were significantly different,  $F(1, 85) = 211.13$ ,  $MSe = 0.09$ ,  $p < .001$ .

The number of words used in comments was analyzed to estimate how much effort each group made. As shown in Figure 2, the HIGH helpful review group ( $M=151.3$ ,  $SD= 48.8$ ) put significantly longer comments than the LOW helpful group ( $M=94.7$ ,  $SD=43.2$ ). Also the number of words has a significant correlation with the Helpfulness ratings,  $r(87) = .63$ ,  $p < .05$  and with the writing quality improvement,  $r(87) = .24$ ,  $p < .05$ .

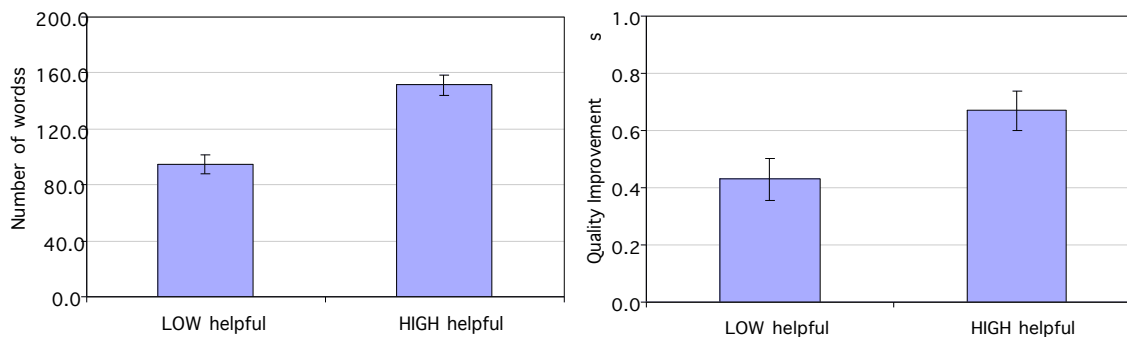


Figure 1. comment length and writing improvement between the LOW and HIGH helpful review groups

To test the *Learning-By-Reviewing* hypothesis, a one-way analysis of covariance (ANCOVA) was carried out with the first draft writing quality (mean peer evaluation) as a covariate, and the reviewing performance as an independent variable on the final/revised writing quality. The first draft writing quality was used as a covariate because it is very likely to a significant predictor of the quality of revised drafts (Cho & Schunn, 2007), and this approach to assessing predictors of improvement is preferred to using gain scores because gain scores have regression-to-the-mean issues. As shown Figure 1, the final/revised draft writing quality of the HIGH helpful review group ( $M = 6.15$ ,  $SD = .46$ ) significantly outperformed the LOW helpful review group ( $M = 5.95$ ,  $SD = .48$ ),  $F(1, 84) = 5.68$ ,  $MSe = .18$ ,  $p < .05$ . The effect size of the improvement of writing quality from the first draft to final

draft was medium (*Cohen's d* = .56). In addition, the Pearson correlation analysis revealed that there is a significant relationship between reviewing helpfulness ratings and writing improvement,  $r(85) = .51, p < .05$ . Thus, these results clearly supported the *Learning-Writing-By-Reviewing* hypothesis.

## Discussion

In this paper, we examined the gains for reviewers-as-writers rather than the more traditional empirical focus of reviewers-as-surrogate-feedback for instructor feedback. A moderate effect size was found from the single round of reviewing. Practically, the findings encourage the use and adoption of peer reviewing in addition to its practical advantage of making rich feedback available more often to students. Thus, this research suggests that peer reviewing can empower learning to write from many angles.

One possible alternative explanation involves a third-variable explanation: stronger revisers giving better feedback and also being better able to revise their own papers. However, revision is an element of first draft writing, and the groups were well-matched on first draft scores. If the HIGH helpful group had been better revisers all along, then they would have had higher first draft scores. Note that we did not force the first draft writing scores to be identical—we merely restricted the range to be the middle two-thirds of first draft scores. Therefore, it would have been possible to find first draft score differences.

Although this research supports the proposed Learning-Writing-by-Reviewing hypothesis, several limitations require cautious interpretation of the findings. The reviewing quality measure we used in this study may be limited in that student writers are very likely to prefer praise comments as well as specific comments (Cho, Schunn, & Charney, 2006). While developing praise comments may be useful for authors and may involve practicing some evaluation skills, it seems likely that learning from making specific revision suggestions will have greater transfer to one's own writing than making praise comments. Therefore, it is strongly recommended that further data analysis focus on the content of reviews to examine if comments related to problem detection, diagnosis, and solution are especially associated with gains in one's own writing.

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