Learning Writing By Reviewing

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Abstract. We examine a theoretical perspective on reciprocal peer reviewing of writing that could be a more common form of peer collaboration for writing. The traditional approach, called Learning Writing by Writing, focuses on opportunities for practicing writing with feedback. The alternative approach, called *Learning Writing by Reviewing*, considers reviewing as an important method for learning writing skills, because reviewing is a problem solving activity that engages problem detection, diagnosis, and solution generation. We empirically evaluated the Learning Writing by Reviewing hypothesis with 87 students in three physics courses that were using SWoRD (Cho & Schunn, 2003, 2005, 2007), a reciprocal peer review system. In support of the hypothesis, the reviewers' own writing skills improved according to the helpfulness of their review comment-giving work.

The Context: A Writing Crisis in the U.S.

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 8th grade students and 77% of 12th 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 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. Instructors are simply overwhelmed by the workload related to giving feedback on writing assignments, and therefore tend to avoid administrating writing assignments in their courses (National Commission on Writing, 2003).

A Traditional Approach: Learning Writing By Writing

On the basis of findings that writing improves across multiple drafts as a function of feedback (e.g., 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. One of such effort focuses on feedback from instructors. 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).

A very different approach is to use peer collaboration in the form of peer reviewing such as collaborative writing, peer conference, peer revision, and peer editing. Haswell (2005) noted that peer review of undergraduate writing is ubiquitous although poorly studied. Peer reviewing is a practically valuable solution that can be easily integrated into current classrooms. Consistent with general peer collaboration research, these peer comments on writing can be reliable for evaluation and effective for improving the given draft (Cho, Chung, King, & Schunn, in press; Cho, Schunn, & Charney, 2006; Cho, Schunn, & Wilson, in press; Schunn & Cho, 2005). Thus, this strategy can be extremely valuable to producing more writing opportunities in the class because in can reduce the workload of instructors.

It is important to note that there are currently expectation barriers restricting its practical use and adoption. 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 at 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. If the reviewing activity had its own pedagogical merit, these concerns might be allayed.

Another problem of perception concerns validity and reliability of peer-generated comments and grades (Cho et al., in press; Cho & Schunn, 2007; Rushton, Ramsey, & Rada, 1993; Stefani, 1994; Swanson, Case, & van der Vlueten, 1991). These worries have considerable face validity: 1) student peer reviewers are novices in their disciplines with respect to both content knowledge and writing genre of the discipline; 2) students are inexperienced in assessing disciplinary writing quality; 3) students are prone to bias due to uniformity, race, and friendship (Dancer & Dancer, 1992); and 4) subgroups of students may form pacts to inflate their grades (Mathews, 1994). Despite the face validity of these concerns, the peer-generated grades (when averaged across several peer evaluators) have been found to have good validity and reliability (Cho et al., in press; Topping, 1998).

A New Approach: Learning Writing By Reviewing

By contrast to the traditional approach that is dominant, we examine 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). Instead of examining the practical issues of reciprocal peer reviewing of writing that are part of the Learning Writing by Writing approach, namely instructor workload reduction and validity/reliability issues, in this paper we seek to examine the benefit of reviewing for learning to write using new empirical evidence. In other words, 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.

The cognitive process model of revision proposed by Hayes et al. (1987) provides insight on the reviewing process. According to the model, shown in Figure 1, writers first represent texts by identifying various components of a given text, such as the text's goals, the goals for its potential audience, the writer's goals, the goals of others that have influence over the text, the constraints under which the revision is taking place, and the criteria being invoked for judging success. Then, while building a representation of the text, writers monitor problems such as spelling or grammatical errors, inconsistent information, or ambiguous meaning. Following the detection process, they diagnose the problem, characterizing or describing the text's problems. To solve the problems, they choose strategies among available methods such as rewriting or editing. Finally, they take actions to fix the problems.

Although various forms of peer reviews exist, typically a student reviewer receives multiple peer papers and is expected to find problems and give them some comments for improvement. Thus we should take into account at least two major variations from Hayes et al's original model to explain peer reviewing. One is that the reviewer is engaged in examining peer writing, texts written by others. This places the first step of the model. The other is that the reviewer is asked to provide suggestions or explanation for peer writers instead of directly repairing the problems.

In terms of the Hayes et al.'s model, reviewers initiate the review process by representing peer writing. They read peer writing to understand it. They try to integrate successively encountered information from the texts into a coherent and well-integrated (mental) representation (Kintsch, 1998). When comprehension failures occur while or after representing texts, reviewers use meta-cognitive monitoring to detect the failures or problems in texts (Chi, 2000).

In their own texts, students often find few problems in texts because they automatically refer to relevant long-term

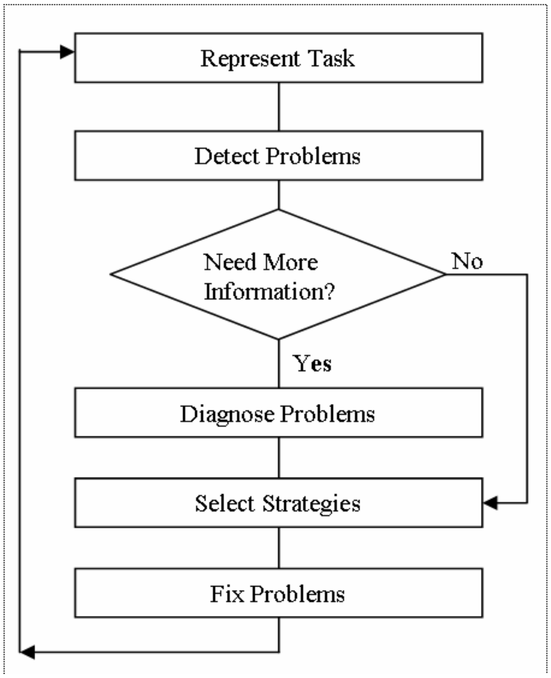

Figure 1. Hayes et al. (1987)'s cognitive model of revision

memory that fills the gap between what they actually wrote and what they wanted to write. It was well known that writers frequently fail to detect their own misunderstandings (Markman, 1979), ignore incorrect information (Otero & Kintsch, 1992), and overestimate their own understandings (Glenberg, Wilkinson, & Epstein, 1982) and capabilities (Presseley & Ghatala, 1990). People are too often satisfied with their faulty understanding to challenge given tasks and hence fail to trigger repairing processes.

Research in collaborative learning has shown that learners working alone are often subject to self-confirmation bias and non-detection error (Cho, Schunn, & Lesgold, 2002), while those working with others can benefit from ‘checking mechanism’ in collaboration (Miyake, 1986) that advances comprehension monitoring. Many more errors made are detected and corrected by partners (Miyake, 1986; Resnick & Salmon, 1993).

Therefore inexperienced writers may benefit from reviewing peer drafts because it provides rich opportunities for practicing problem detection. This detection practice may be particularly helpful, as Hayes et al. (1987) found that inexperienced writers detected significantly fewer problems that did expert writers.

After detecting problems in texts, reviewers are automatically engaged in diagnosing the problems. Reviewers may retrieve their prior knowledge or analogy to infer about the cause of the problem. This problem diagnosis experience may help reviewers understand the sources of the problem and inform them how to repair the problem. Research shows that novice writers tend to have more difficulties in diagnosing problems in their texts. For example, novice writers might have a vague diagnosis, “it seems something is wrong”, whereas expert writers might more specifically note, “contradictory information against the previous theme.” Hayes et al. (1987) found that expert writers diagnosed 74% of the problems they detected, while inexperienced writers did only 41%.

After problem diagnosis, peer reviewers are usually asked to generate solutions for the problems. The Hayes model assumes an automatic connection between detecting problems and repairing problems. However, sometimes even obvious problems are not fixed. For example, Cho, Schunn, and Legold (2002) found that in the face of obvious text problems, some collaborators tried to fix them by elaborating on what could be correct while others just ignored them. Swaney, Janik, Bond, and Hayes (1981) also observed that revision actually can make writing worse instead of better. In addition, Bracewell, Scardamalia and Bereiter (1978) found that even if novice and expert writers identify the same problems, novice writers often have serious difficulty in revising texts. Their revisions often introduced new problems and made the texts worse. Therefore, it is highly possible that novice writers may benefit from practicing solution generation. Solution generation may provide the reviewer of concrete and solid experiences of how to improve writing, connecting diagnosed problems with solution types (Coleman, Brown, & Rivkin, 1997).

Finally, reviewers must communicate these comments the writers. Like peer tutoring, reviewers are expected to provide peer writers with coherent explanations or suggestions for improvement. Therefore, reviewers may be more engaged in constructing coherent understanding of peer writing to develop more coherent explanations (Bargh & Schul, 1980).

In sum, reviewing is a process of problem solving in which reviewers are engaged in exercising important skills for writing (Bereiter & Scardamalia, 1987; Fitzgerald, 1987; Flower et al., 1986) such as detection, diagnosis, and solution generation along with reading and commenting. 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.

Despite all these theoretical possibilities for practicing various elements of writing and revision through peer commenting, the oversight of the peer commenting is not strong, and there is the problem of how peers come to generate diagnosis and solution categories in the absence of strong expert input. The goal of this research is to examine whether reviewers actually benefit from reviewing peer writing in a reciprocal peer collaboration situation.

Method

Participants

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. 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 Measure

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. Perceived helpfulness reflects the revisions made in later writing (Rucker & Thompson, 2003). These helpfulness ratings contributed to student class grades and were a normal part of the classroom peer-reviewing task to encourage students to take the peer commenting task seriously. Here we use these ratings as a proxy for the extent to which peers engaged in the peer review task. Our past research has shown that student authors prefer comments that include specific suggestions on why and how to fix the problems (Cho, Schunn, & Charney, 2006). The kind of preference suggests that these helpfulness ratings will specifically reflect the extent to which students engaged in practicing revision activities.

Procedure & Peer Review System: SWoRD

The courses used SWoRD (Scaffolded Writing and Rewriting in the Discipline, Cho & Schunn, 2007), a system for implementing reciprocal peer review of writing. SWoRD is a web-based application (http://sword.lrdc.pitt.edu) that 1) helps manage the distribution of papers to reviewers and reviews back to authors (similar to current online conference, journal, and grant reviewing systems), and 2) includes evaluation mechanisms that force students to take their reviewing task seriously. Revision is a core feature of SWoRD that distinguishes it from other web-based peer review systems: students must submit two drafts, and peers evaluate both drafts. Here we provide a detailed overview of the SWoRD (version 3) process, focusing on the aspects of scaffolding that pertain to review consistency.

The instructor can adjust several parameters of the process, including the number of papers each student must write, the number of peer reviews each paper will receive (and thus how many reviews each student must complete), and the amount of time given to students for writing a first draft, evaluating first drafts, rewriting a first draft, and for evaluating final drafts. Typically, students write one paper or two (via two drafts), each draft paper receives 4 to 6 peer reviews, and students are given one week for each phase although this research focuses on the first paper. Reviewers were required to evaluate each draft both qualitatively and quantitatively along three dimensions, (1) Introduction, theory and experimental setup, (2) Data analysis and result, and (3) Abstract and conclusion. For each dimension, they wrote comments and then provided a rating along a seven-point rating scale from *disastrous (1)* to *excellent (7)*. A rubric guided the rating task, and guidelines structured the commenting-giving task.

SWoRD processing consists of the following eight steps, although the current research focuses specifically on steps 2 through 6. In step one, students create an account in the system and specify a pseudonym. Papers are later distributed to authors under this pseudonym in order to reduce any status biases that may occur in peer review. Reviewers are only identified to authors by number (e.g., reviewer #1, reviewer #2, etc) to ensure there is no retribution between particular authors and reviewers.

In step two, authors upload their draft paper sometime before the 1st draft deadline. Any file type is allowed, but usually MS Word, Rich Text Format, or PDF are uploaded. Once the submission deadline has passed, each author's draft is assigned to n peers, where n is pre-specified by the instructor. A moving-window algorithm is used to insure that no two drafts are assigned to the same set of n peers (for reasons relating to more reliable assessment of accuracy of peer-generated ratings).

In step three, reviewers login sometime during the review period and download the *n* papers assigned to them. They also download a MS Word version of the reviewing rubric to guide their evaluation. Sometime before the end of the review period, reviewers again log into the system and paste their written comments into html forms associated with the evaluation rubric. In addition, they rate each draft on three 7-point evaluation dimensions with a grading rubric for each scale point (described below). Ratings are used to determine the grade for the draft, and the comments are meant to serve as helpful feedback to guide authors in their revisions. SWoRD requires written comments to be entered for each evaluation dimension before the evaluation rating is made: this order encourages reviewers to base ratings on substance rather than intuition. When the review deadline has passed, these evaluations and comments are made available to authors.

In step four, when the review deadline has passed, SWoRD automatically determines grades for authors and numerical evaluations for reviewers; grades for the quality of written comments are determined later. Reviewer evaluation grades are based on three automatically determined measures of review consistency. The grade assigned to a paper is a weighted average of the peer ratings of that paper, with the weighting factor being the overall consistency grade assigned to each reviewer. In this way, authors are shielded from atypically incompetent or unmotivated reviewers.

In step five, students log into the system to view the evaluations of their first draft and begin the draft revision process. At this point, each student sees the full set of comments on their draft paper, the ratings assigned to that paper by each reviewer, the system's assessment of each reviewer's consistency, their overall writing grade so far in relation to the class mean, the system's assessment of their own reviewing consistency, and their overall reviewing grade so far relative to the class mean.

In step six, prior to the final draft deadline, each student logs in to the system and uploads their final draft. That draft is distributed to the same peer reviewers as used in the first round of reviewing. Once the draft has been submitted, each author is asked to rate the helpfulness of each review they received, using a 7-point helpfulness scale, from *not helpful at all* (1) to *very helpful* (7).

In step seven, each reviewer logs in, downloads the final drafts assigned to them, and begins the final draft review process. The same rating rubric is used as for the first draft, but the comment-giving task focuses on evaluating the changes made rather than providing suggestions for further improvements. Reviews of final drafts must be turned in by a specified deadline, at which point reviewing consistency grades for the final draft round and final draft writing grades are computed using the same approach described in Step 4.

In the final step, authors see the grade assigned to their final draft and comments. They are asked to grade the helpfulness of the final draft comments using the seven-point scale noted earlier. These helpfulness ratings constitute the final element in a student grade. The instructor assigns the relative (typically equal) weight given to writing and reviewing grades. SWoRD automatically places equal weight on first and final draft activities, and equally weights reviewing rating consistency and comment helpfulness.

Results

Before analyzing the main hypothesis, we examined the first draft writing scores and the 1st 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.

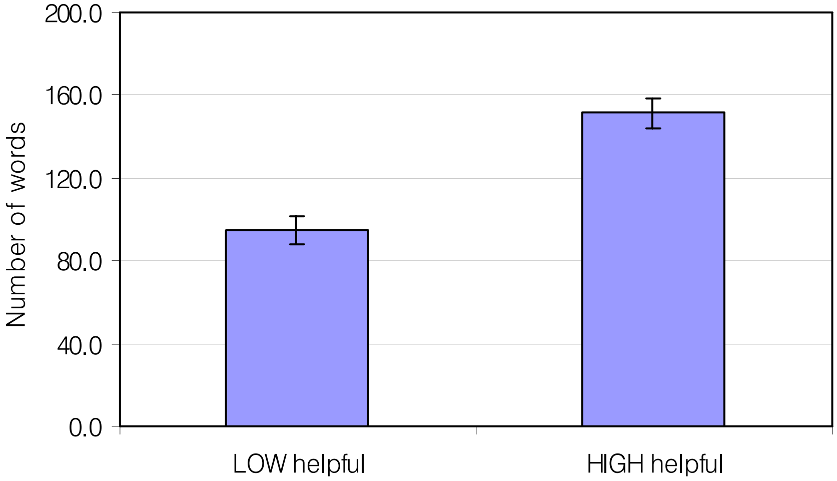

Figure 2. Length of comments between the LOW and HIGH helpful review groups

To test the *Learning-Writing-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 3, 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.

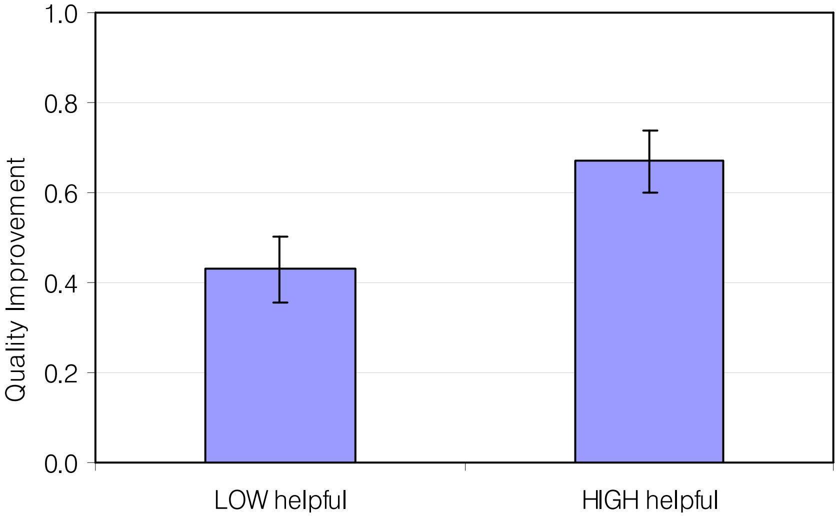

Figure 3. Writing quality improvement between the LOW and HIGH helpful review groups

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.

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.

Other research strands also support the Learning-Writing-By-Reviewing hypothesis. For example, self-explanation (Chi, 2000) that improves problem solving (e.g. Chi et al., 1989; Chi et al., 1994) may be a major component of reviewing. Self-explanation is a strategy in which a learner monitors his or her own understanding texts and infers missing knowledge to fill gaps. Reviewers may be likely to self-explain peer writing which triggers comprehension successes or failures, which in turn may lead to further processes of diagnosis and solution generation. In addition, peer tutoring (Roscoe & Chi, 2004) shares some features with peer reviewing.

Although this research supports the proposed Learning-Writing-by-Reviewing hypothesis, several limitations require cautious interpretation of the findings. First, 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 ones 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.

Second, the current study focused on current draft revision. The gains derived from reviewing activities could be at the level of writing skill, but they could also be at the level of assignment understanding or setting higher writing standards (i.e., via social comparison processes). Further research will need to specifically examine the nature of what was learned and how it transfers across assignments, writing genres, and class contexts.

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