

Self-Awareness in a Computer Supported Collaborative Learning Environment

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Abstract. The purpose of this study was to examine the role of self-awareness (SA) interfaces implemented for writing skill improvement in a computer supported collaborative writing environment called SWORD [7]. Visualization interfaces to improve SA were developed for SWORD. Students were provided with opportunities to self-monitor and self-evaluate their writing with the use of multiple peer feedback. The study results show that although all the students did not develop their SA with the interfaces, the students who developed SA drastically improved their writing skills compared to those who did not enhance SA. Finally, the results are discussed and future research topics are suggested.

Keywords: Self-awareness, Peer feedback, Peer review, Writing, CSCL, SWORD, Self-monitoring.

1 Introduction

While writing is considered as one of the most important skills that learners are expected to master for professional as well as academic success, being able to write well is a fundamental skill that most students lack across any ages in the U.S. and also very likely in other countries [21]. Although the U.S. National Commission on Writing consisting of more than 4,300 schools and colleges in the U.S. declares of great urgency the increased emphasis on writing at all levels of education, instructors avoid writing instructions [21]. Instructors are simply overwhelmed by a daunting challenge of reviewing and giving grades on student papers. Therefore, students have few opportunities to practice writing.

Our purpose is to examine the role of self-awareness (SA) interfaces implemented for writing skill improvement in a computer supported collaborative writing environment. The SA interfaces are theoretically based on self-regulated learning and collaborative learning that were found to be robust in improving writing skills. In specific, we address two major questions as follows: 1) Does the computer supported self-monitoring system influence SA? and 2) Are the SA changes related to writing quality improvement?

1.1 Self-Awareness

SA is defined as students' consciousness about their writing processes and their use of writing strategies [22]. It seems that SA may be activated by self-evaluation via

self-monitoring (SM) on the use of learning strategies and processes [4], [27], [29]. SA manages students' self-regulated writing activities [4], [19], [27]. For example, SA contributes to students' metacognitive assessment of the validity and usefulness of their learning strategies.

Existing research seems to agree upon the positive role of SA in learning and also in writing improvement [5], [15], [29]. It was found that SA is one of the most important characteristics of the successful writers. They are aware of their own limitations, necessary processes, and ways to improve their writing. In addition, SA is found to make writers strategically function when working on their writing [14], [16], [24], [27], [29], [31].

Writers' SA is activated through self-regulated learning processes such as goal setting or planning, monitoring, and evaluation and reflection [27], [29]. More specifically, successful writers set goals or plans for writing. Once they set goals, they regularly monitor their writing processes. Based on their monitoring results, self-regulated writers self-evaluate and self-reflect and produce SA about what they are doing and what they need to improve their writing quality. The activation process of SA implies that providing students opportunities to self-monitor and self-evaluate is important.

1.2 Peer Feedback as a Way to Activate SA

While SA is critical in learning to write, inaccurate SA may undermine its positive role in writing improvement [18]. When student writers overestimate or underestimate their writing quality, their inaccurate SA may hinder the students from setting realistic goals and using appropriate learning strategies. Thus, inaccurate SA may have students deviate from an established route to writing improvement.

Providing students with opportunities having feedback is one of the most commonly used methods to improve SA [15], [25]. Feedback enables student writers to view their own writing from various reader perspectives. By checking feedback, student writers may improve self-monitoring on their own writing, generating reliable SA. Therefore, it can be inferred that providing feedback to students is an effective way to be used to promote students' SA.

Despite the effectiveness of feedback as a way to promote students' SA, instructors avoid providing students with feedback on student writing. This is simply because reading and giving feedback on student writing is time and effort demanding especially in a large class setting [7], [9]. As an alternative to this unfortunate situation, multiple peer feedback has been implemented in writing education. Cho and his colleagues found that multiple peer feedback is more effective in improving writing than expert feedback in education settings as well as in organizational settings [6], [7]. Also, Fallahi, Wood, Austad, and Fallahi found students experiencing peer reviews significantly improved their writing skills in terms of grammar, writing style, mechanics, and referencing [11]. Furthermore, Cho, Schunn, and Wilson found multiple peer evaluations are highly reliable and also valid as instructor evaluations [9].

In addition to peer feedback, revision opportunities may help students improve their SA. Successful writers use self-monitoring and self-evaluation process while they are engaged in revision processes. Based on feedback from others, writers may successfully self-monitor how their own writing evaluation is different from others as well as self-reflect how they improve their writing after comparing their own

evaluations with those from others. This comparison may enable writers to revise their plans or goals to activate proper cognitive and metacognitive writing strategies.

1.3 SA Interface Design

Based on the literature review, Cho and Schunn developed visualization interfaces to improve SA in SWoRD (Scaffolded Writing and Rewriting in the Discipline), a web-based hybrid intelligent system supporting reciprocal peer reviewing of writing where each student plays two roles, one of writer and one of reviewer [7].

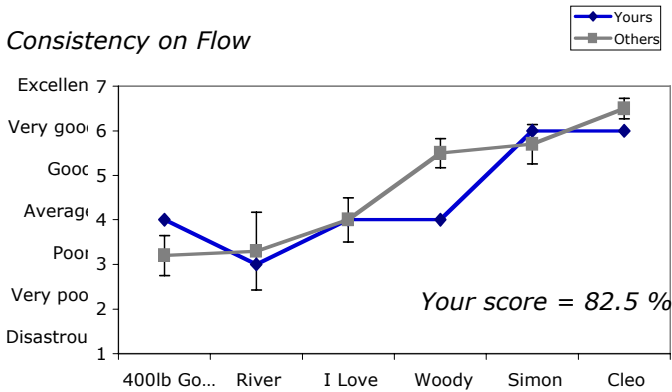


Fig. 1. An example SA interface in SWoRD

Two types of interfaces were designed to promote SA; one is for SA on their own writing and the other is for SA on their reviewing. First, SA interfaces on their writing were designed to use self-monitoring by comparing self-evaluations with peer evaluations on their own writing [2], [24], [26], [30]. The other type of the SA interfaces on reviewing was designed to allow each reviewer to compare their evaluations with other evaluations on the same papers. Figure 1 shows an example of the reviewer support interface activating SA for a reviewer. The interface visualizes the extent to which a reviewer’s evaluation is consistent with that of others who reviewed the same papers. The pattern in Figure 1 shows that the reviewer’s grades are consistent with those of others, while there is a visually significant difference with 400lb Gorilla. Pseudo names such as 4001b Gorilla or River are used to keep students from identifying reviewers. Also, if a reviewer clicks on the author name, then the reviewer can read both her own review and others’ reviews on the same writing.

In sum, this study is to investigate the role of the SA interfaces in improving writing skills. We examine this question with a large number of participants in universities in the U.S., unlike the past SA research conducted with a small number of elementary or adolescent students [14], [20], [28]. This endows the study with strong generalizability. In addition, this study may be characterized with subject matter courses unlike most of the previous studies using writing courses.

2 Method

2.1 Participants

Data were collected from three research universities in the U.S. across 16 courses including various genres of writing tasks (i.e., cognitive psychology, cognitive science, physics, and healthy psychology). 603 students participated in the research for course credits and used the SWoRD system for their course activities. Typically writing and reviewing together accounted for approximately 40% of the final course grade in each course.

2.2 Writing Task

The exact writing task assigned to students varied across the courses, as one would expect across courses from many different disciplines. The required length of the assigned papers varied from shorter (5-to-8 pages) to longer papers (10-to-15 pages). Paper genres included 1) the introduction section to a research paper; 2) a proposal for an application to real life of a research findings; 3) a critique of a research paper read for class; and 4) a proposal for a new research study.

2.3 Self-Monitoring (SM)

SM is defined as an absolute difference between self-evaluation (SE) and other evaluation (OE) and on their writing. If the difference is closer to zero, a learner is assumed to have better self-monitoring. OE stands for an average of other evaluations and SE stands for an average self-evaluation. Students had SE and OE on the first writing and also on their revised writing.

$$\underline{SM} = |SE - OE|. \quad (1)$$

2.4 Self-Awareness (SA)

SA is defined as a difference between the first self-monitoring (SM_{11}) and the second self-monitoring (SM_{12}). If the SA value is positive, it is assumed that SA occurs. Positive values means students self-monitoring gap between others and self are reduced the second time. SM_{11} stands for the total differences between the first other evaluation and the first self-evaluation. SM_{12} is the total difference between the second other evaluation and the second self-evaluation.

$$\underline{SA} = \underline{SM_{11}} - \underline{SM_{12}}. \quad (2)$$

2.5 Procedure

The experiment followed the built-in processes in SWoRD. After each instructor set their writing and reviewing assignments, due dates, and assignment policies, all of the remaining procedures were managed online by SWoRD. First, student writers turned in their first drafts and did self-evaluations on the seven-point rating scale (1: Disastrous to

7: Excellent). Then individual student reviewers reviewed a set of peer drafts randomly assigned by the system. The reviewers used the same rating scale. Then, the writers received peer evaluations and revised their writing. After the writers submitted the revised writing and did their self-evaluations, the system asked the same reviewers who evaluated the first drafts to review the revised/final drafts. Finally, the writers received peer reviews from their reviewers.

3 Results

First, we examined if SA would develop over time with the SA interface. The mean of SA1 was 3.04 ($SD = 2.6$), and that of SA2 was 3.32 ($SD = 3.1$), respectively. In fact SA was decreased from SA1 to SA2, $t(602) = -2.23$, $p < .05$. Further research is necessary to explain the decrease of SA. Thus, overall the participants' SA was not found to be improved.

To address the second question, the role of individual difference with SA was investigated. As shown in Figure 2, the writing quality was enhanced with students whose SA was improved over time, $M = 2.2$, $SD = 2.09$, while the writing quality was not improved with students whose SA was not improved for non-SA, $M = -.18$, $SD = 3.10$. The mean difference between the SA and non-SA group was statistically significant, $F(1, 601) = 119.92$, $MSE = 7.11$, $p < .001$. A large effect size was estimated, $d = .93$. This result shows that SA positively influences writing quality improvement.

In addition, the Pearson Correlation was computed to analyze the association between, SA change and the writing quality improvement. The correlation was statistically significant, $r(602) = .66$, $p < .001$, showing SA change and writing quality improvement are highly associated.

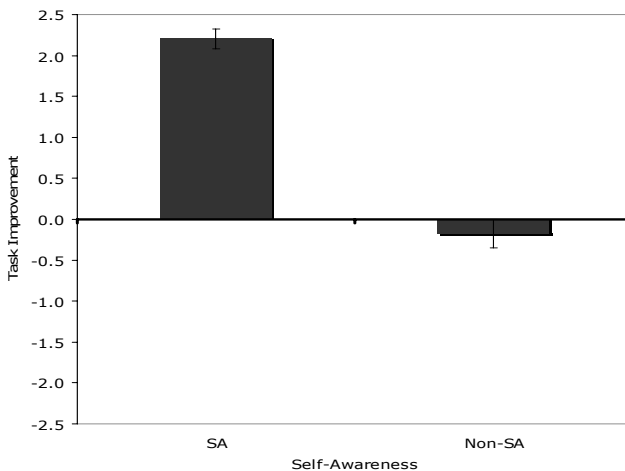


Fig. 2. Individual difference of SA and writing quality improvement

4 Discussion

The results show that although all the students did not develop their SA with the interfaces, learners who enhanced SA drastically improved their writing compared to those who did not develop SA. The results are consistent with Graham and Harris's self-regulated strategy development (SRSD) model that self-regulated writing positively influences writing performance [12]. For example, Graham, Harris, and Mason found that students who received SRSD training significantly improved their writing in their post-test as well as outperformed those who did not receive SRSD training in terms of number of writing length, story element, persuasive elements, and quality [13].

Although this study found the impact of SA on writing improvement, the role of the SA interfaces seems less stable than hypothesized because some students greatly benefited from the SA interfaces while others did not. One of the possible explanations is that students' unfamiliarity of the SA interface may be attributed to the non-improvement of SA. For example, Azevedo using the think-aloud method compared students' self-regulated learning experiences between a computer supported scaffolding environment and a human-agent supported scaffolding environment [1]. It was found that students in the computer environment are less likely to activate self-regulated learning strategies than those in the human-agent environment. The study implied that if students are not familiar with new interfaces, they are less likely to activate self-regulated learning strategies even if the system provides them with effective self-regulation scaffolding. Therefore, it can be inferred that students who were not familiar with the SA interfaces in this study might not know how to use peer feedback to monitor their own writing. Future research is necessary to test this assumption.

In addition, in this study we did not provide explicit instructions on SM and SA. This approach is somewhat different from the previous research on self-regulated learning that emphasizes explicit training of self-regulated learning strategies [14], [17], [32]. Therefore, explicit instructions on SM and SA strategies might result in more positive findings with the SA interfaces.

The research findings have several implications. First, the results empirically verified that SA is important for students' writing improvement in that students whose SA was effectively activated outperformed those whose SA was not activated. According to self-regulated learning theories, skillful self-regulated writers tend to be correctly aware of their own learning [18], [27], [29].

Second, the research findings might be attributed to students' developmental differences of epistemological beliefs. Research on epistemological belief argues that students' beliefs about knowledge sources are related to learning strategy use [3], [10], [23]. If students are leery of peer evaluations because the most typical evaluation source is experts and instructors, the students may not value peer feedback, which in turn may lead to inaccurate self-awareness for their self-regulated writing [7]. By contrast, if they value peer evaluations, the students may take advantage of using peer evaluations to enhance their SA for self-regulated writing. Consistently past research supports this reasoning. For example, Schommer found that students who have naïve epistemological beliefs knowledge tended to avoid effective learning strategies [23]. Also Bråten and Strømsø found a negative relationship between certain types of knowledge beliefs and the use of metacognitive self-regulated learning strategies [3].

They commonly found sophisticated epistemological beliefs are associated with deep level self-regulated learning strategies such as self-monitoring and self-evaluation.

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References

1. Azevedo, R.: Using Hypermedia as a Metacognitive Tool for Enhancing Student Learning? The Role of Self-Regulated Learning. *Educational Psychologist* 40(4), 199–209 (2005)
2. Bandura, A.: *Social Foundations of Thought and Action: A Social Cognitive Theory*. Prentice Hall, Englewood Cliffs, New Jersey (1986)
3. Bråten, I., Strømsø, H.I.: The Relationship between Epistemological Beliefs, Implicit Theories of Intelligence, and Self-Regulated Learning among Norwegian Postsecondary Students. *British Journal of Educational Psychology* 75, 539–565 (2005)
4. Butler, D.L., Winne, P.H.: Feedback and Self-Regulated Learning: A Theoretical Synthesis. *Review of Educational Research* 65(3), 245–281 (1995)
5. Cho, K., Chang, K., Kye, B. A.: Next-Generation E-Learning Model Based on Learners' Interest, Motivation, and Flow. *Korean Education Research and Information Services* (2005)
6. Cho, K., Chung, T. R., King, W. R., Schunn, C. D.: Peer-Based Computer-Supported Knowledge Refinement: An Empirical Investigation. *Communications of the ACM* (in press)
7. Cho, K., Schunn, C.D.: Scaffolded Writing and Rewriting in the Discipline: A Web-Based Reciprocal Peer Review System. *Computers & Education* 48(3), 409–426 (2007)
8. Cho, K., Schunn, C.D., Lesgold, A.: Comprehension Monitoring and Repairing in Distance Collaboration. In the Proceedings of the 24th Annual Conference of the Cognitive Science Society. Erlbaum, Mahwah New Jersey (2002)
9. Cho, K., Schunn, C., Wilson, R.: Validity and Reliability of Scaffolded Peer Assessment of Writing from Instructor and Student Perspectives. *Journal of Educational Psychology* 98(4), 891–901 (2006)
10. Dahl, T. I., Bals, M., Turi, A. L.: Are student's beliefs about knowledge and learning associated with their reported use of learning strategies? *British Journal of Educational Psychology*, 257–273 (2005)
11. Fallahi, C.R., Wood, R.M., Austad, C.S., Fallahi, H.A: A Program for Improving Undergraduate Psychology Students' Basic Writing Skills. *Teaching of Psychology* 33(3), 171–175 (2006)
12. Graham, S., Harris, K.R.: Self-Regulated Strategy Development: Helping Students with Learning Problems Develop as Writers. *Elementary School Journal* 94, 169–182 (1993)
13. Graham, S., Harris, K.R., Mason, L.: Improving the Writing Performance, Knowledge, and Self-Efficacy of Struggling Young Writers: The Effects of Self-Regulated Strategy Development. *Contemporary Educational Psychology* 30, 207–241 (2005)
14. Graham, S., Harris, K. R., Troia, G. A. Writing and Self-regulation: Cases from the Self-Regulated Strategy Development model. In: Schunk, D. Zimmerman, B. (eds.): *Self-Regulated Learning: From Teaching to Self-Reflective Practice*. Guilford New York, pp. 20–41 (1998)

15. Hacker, D., Cho, K.: Other-Regulated to Self-Regulated Writing: A Web-Based Approach to Peer Revision. (Unpublished manuscript) (2006)
16. Hayes, J.R., Flower, L.S.: Identifying the Organization of Writing Processes. In: Gregg, L.W., Steinberg, R. (eds.) *Cognitive Processes in Writing*, pp. 3–30. Erlbaum, Hillsdale New Jersey (1980)
17. Ley, K., Young, D.B.: Instructional Principles for Self-Regulation. *ETR&D* 49(2), 93–103 (2001)
18. McCaslin, M., Hickey, D.T.: Self-Regulated Learning and Academic Achievement: A Vygotskian View. In: Zimmerman, B.J., Schunk, D.H. (eds.) *Self-Regulated Learning and Academic Achievement*, pp. 153–189. Lawrence Erlbaum Associates, Hillsdale New Jersey (2001)
19. McComb, B.: Self-Regulated Learning and Academic Achievement: A Phenomenological View. In: Zimmerman, B.J., Schunk, D.H. (eds.) *Self-Regulated Learning and Academic Achievement*, pp. 67–124. Lawrence Erlbaum Associates, Hillsdale New Jersey (2001)
20. Mooney, P., Ryan, J.B., Uhing, B.M., Reid, R., Epstein, M.H.A: A Review of Self-Management Interventions Targeting Academic Outcomes for Students with Emotional and Behavioral Disorders. *Journal of Behavioral Education* 14(3), 203–221 (2005)
21. National Commission on Writing in American School and Colleges. The Neglected ‘R’: The Need for a Writing Revolution. Retrieved November 12, 2006 from (2003) <http://www.writingcommission.org/report.html>
22. Schraw, G.: Promoting General Metacognitive Awareness. *Instructional Science* 26, 113–125 (1998)
23. Schommer, M.: Effects of Belief about the Nature of Knowledge on Comprehension. *Journal of Educational Psychology* 82(3), 498–504 (1990)
24. Schunk, D. H., Zimmerman, B. J. Developing Self-efficacious Readers and Writers: The Role of Social and Self-regulatory Processes. In: Guthrie, J. T., Wigfield, A. (eds.): *Reading for Engagement: Motivating Readers through Integrated Instruction*. International Reading Association New York, pp.34–50 (1997)
25. Sitko, B. M. Knowing How to Write: Metacognition and Writing Instruction. In: Hacker, D. J., Dunlosky, J., Graesser, A. C. (eds.): *Metacognition in Educational Theory and Practice*, pp. 93–115, LEA New Jersey (1998)
26. Vygotsky, L.S.: *Mind and Society: The Development of Higher Mental Processes*. Harvard University Press, Cambridge MA (1978)
27. Winne, P. H., Hadwin, A. F. Studying as Self-Regulated Learning. In: Hacker, D. J., Dunlosky, J., Graesser, A. C. (eds.): *Metacognition in Educational Theory and Practice*. LEA New Jersey, pp. 277–304 (1998)
28. Wong, B.Y.L.: Writing Strategies Instruction for Expository Essays for Adolescents with and without Learning Disabilities. *Topics In Language Disorders*. pp. 29–44 (August 2000)
29. Zimmerman, B.J.: Becoming a Self-Regulated Learner: An Overview. *Theory Into Practice* 41(2), 64–70 (2002)
30. Zimmerman, B., Kitsantas, A.: Acquiring Writing Revision and Self-Regulatory Skill through Observation and Emulation. *Journal of Educational Psychology* 94(4), 660–668 (2002)
31. Zimmerman, B., Risemberg, R.: Becoming a Self-Regulated Writer: A Social Cognitive Perspective. *Contemporary Educational Psychology* 22, 73–101 (1997)
32. Zimmerman, B. J., Bonner, S., Kovach, R.: Developing Self-Regulated Learners: Beyond Achievement to Self-Efficacy. American Psychological Association Washington DC (1996)