Assessing the effectiveness of technology integration: message boards for strengthening literacy

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Abstract

This paper reports current findings from a multi-phased research project that is an offshoot of a 3-year, $155,000 “Best Practices in the Use of Technology” grant awarded to one of the co-authors, 1998–2001. The expanded Phase 1 portion of the study has a general focus on the cognitive complexity of student written responses over time in Virtual Literature Circles or electronic message boards utilized according to the structure of more traditional classroom literature circles. The Phase 1 ex-post-facto research question examined was: Did the cognitive complexity of student responses increase with continued use of Virtual Literature Circles? The findings suggest that this research question is best answered in the negative. The Phase 2 portion of the study focuses more specifically on the effects of different types of question prompts used in Virtual Literature Circles. The Phase 2 ex-post-facto research question was: Did the cognitive complexity of student responses differ according to prompt types? The findings suggest that this research question is best answered in the affirmative. Together, these findings shed light on existing higher-order literacy theory and on the effectiveness of Virtual Literature Circles in their current pilot state. Additionally, knowledge was gained in this study regarding new instrumentation being developed to help with the unique challenges of assessing student message board responses. © 2002 Elsevier Science Ltd. All rights reserved.

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1. Introduction

This paper reports current findings from a multi-phased research project that is an offshoot of a 3-year, $155,000 “Best Practices in the Use of Technology” grant awarded to one of the co-authors, 1998–2001. An earlier version of the Phase 1 portion of this research was presented and published by the authors in the spring of 2001 (Hofmeister & Thomas, 2001). The findings of this
earlier research were the impetus behind furthering the research into Phase 2. Both Phase 1 and Phase 2 of this on-going research project are reported here.

2. Background

2.1. Constructivist theory

Learning by doing underscores a central focus in constructivist thought as students actively apply skills and knowledge so new information can be assimilated or rejected. This is often interpreted to mean that a process is used to learn new ideas and skills. As students are confronted with a new idea or needed skill, their frame of reference to address this confrontation is influenced by innate abilities, aptitudes, prior knowledge, and environmental factors which all place limitations on student learning capacity. If the students are isolated in their work, this impacts on how learning occurs. If the students work together with others, the collective frames of reference brought by each participant allow for scaffolding of individual and group thought processes so that learning is increased. These beliefs about student learning give emphasis to the use of cooperative learning and constructivism in US schools. In light of the current emphasis on technology integration into instructional practice, it is also sensible to wonder how online learning environments may facilitate this sort of cooperative/constructive learning. That is what this paper investigates. This study examines the cognitive complexity of student responses when they have an online mechanism for engaging other students to discuss literature, presumably gaining the opportunity to build upon one another’s thoughts.

2.2. Literature Circles

The instructional process named “Literature Circles” by Harvey Daniels has produced significant improvements in various literacy outcomes (Daniels, 1994). Literature Circles are a combination of reading for interest, cooperative learning, and independent study. Teachers introduce Literature Circles by providing various literature sets of up to five books each. From this range of books, students personally select the book of greatest interest. Based on the book selected, students form study groups to read and discuss various aspects of the literature. Once each student in the group reads a preset number of pages, the group members come together for discussion. Within the group, cooperative learning roles are assigned to each student. Within these roles, students engage each other in discussion, with the goal being to understand the literature as deeply and meaningfully as possible. During student discussions, the teacher remains engaged by facilitating the conversation. The teacher’s role is to intervene only when students get off the subject, cannot settle a dispute, or seem stymied by the task.

2.3. Message boards

Anecdotal observation suggest that elementary students find message boards to be unique web-based forums to engage in asynchronous discussions with other students. While current communication tools emphasize chat, instant messaging, and desktop video conferencing for real-time
communication, message boards allow individual teachers to engage students from different schools on the same topic while maintaining autonomy in how each teacher schedules the day in individual classrooms. This connectivity along with individual flexibility provides teachers with the opportunity to integrate computer technology and the Internet within the reading program. Combining message boards with the basic principles associated with Literature Circles created the phrase “Virtual Literature Circles,” coined by one of the co-authors.

2.4. Needed: research on efficacy of technology integration

To date, much of the discussion of educational technology has focused on simple use and integration of advancing technologies into school classrooms and educational practices. While this has been needed and helpful, a key component that has been missing is scholarly discussion and quantitative research on the efficacy of such technology integration upon student learning. As Linda Harasim, keynote speaker at the Elsevier Science Computers and Learning 2001 Conference writes: “Online education is becoming ubiquitous, not replacing traditional education, but enhancing and transforming it, thereby contributing to a paradigmatic shift in educational theory and practice. Within this context, critical and urgent issues emerge regarding the need for evidence-driven design in both the pedagogy and the technology of online education. Which learning models and approaches work best, under what circumstances, and for whom? What technological designs are needed to support best practice?” (Harasim, 2001). The research findings presented in the study help to address the need of identifying the efficacy of technology integration upon student learning. The findings shed light on not just using the technology, but how to perhaps use it more effectively to impact student learning.

2.5. Challenges in assessment

Assessment of cognitive complexity of student message board responses is important in determining the effectiveness of Virtual Literature Circles. However, this sort of assessment is difficult. There are few measures of cognitive complexity available for rating written responses in traditional writing environments, especially for the shorter responses common to many elementary-aged students. This challenge is magnified in Virtual Literature Circles where student written responses are rather like unique hybrids between short contributions to group conversations and traditional written responses, as will be illustrated ahead. In order to help address this challenge in their on-going Virtual Literature Circles grant and research projects, the authors are developing a simple cognitive complexity rating scale that it is hoped will continue to be refined, especially for use in the message-board environment. It is the earliest version of this rating scale that was used for the data analysis in this report, and will be explained in more detail ahead.

3. Purpose of the study

This study was conducted to examine the depth of student reading and writing experiences in Virtual Literature Circles. An overall goal for the grant involved in this study was that students who participated in Virtual Literature Circles would be able to interact with other students at
advanced (or at least advancing) levels of cognition and that message board response threads would maintain the intellectual continuity of the discussions, similar to a regular classroom discussion (or maybe even be enhanced by the asynchronous environment). This paper has been undertaken in order to partially examine these issues and to shed refining light on the efficacy of technology integration (or perhaps synthesis) with more traditional instructional practices.

4. Research questions

The Phase 1 research question was crafted ex-post-facto, but prior to formal data analysis and is as follows: “Did the cognitive complexity of the student responses increase with continued use of Virtual Literature Circles?” The Phase 2 research question was crafted ex-post-facto, motivated by the findings of the Phase 1 research, and is as follows: “Did the cognitive complexity of student responses differ according to prompt types?”

5. Design

The Phase 1 research question was examined by first dividing in half the multiple written responses chronologically posted by each student. Then the mean cognitive complexity of the first half of each student’s responses was compared with the second half, looking for mean score gains from the first half to the second half, in order to examine whether or not the cognitive complexity of student responses increased with continued use of the Virtual Literature Circles. The Phase 2 research question was examined by comparing the mean cognitive complexity of student responses on three different types of prompts: reconstructive, constructive, and non-directive (explained in more detail ahead).

6. Method

6.1. Subjects

During a 2-week study in the spring of 2000, 125 third and fourth grade students from five rural schools in central Missouri, USA, participated in reading and discussing Fig Pudding by R. Fletcher. All students listened to the reading of the story or personally read it. The text was discussed on a chapter-by-chapter basis in Virtual Literature Circles formed through message boards maintained by one of the authors. The discussions from a random sampling of 25 participants make up the population for this study. Students made different numbers of responses. In Phase 1 of this study, all responses were collected and analyzed per student in chronological order in order to evaluate possible gains due to continued use of the Virtual Literature Circles. In Phase 2 of this study, the cognitive complexity of each student’s responses were analyzed according to prompt type (reconstructive, constructive, or non-directive, as explained ahead).
6.2. Data analysis

The message board discussions were quantitatively examined for levels of cognitive complexity with a simple four-point scale developed by one of the authors (Table 1).

This Cognitive Complexity Rating Scale was an attempt by the authors to create an instrument useful to the particular needs of assessing message board responses (as discussed earlier). They attempted to create an elementary message board rating scale somewhat akin to aspects of the McDaniel’s Cognitive Complexity Scale (McDaniel & Foss, 1992, unpublished, as reported and published in Foss & Stensvold, 1994) by creating a scale from the core dichotomy of the hierarchy of annotation types presented in the Read-Encode-Annotate-Ponder reading, writing, and thinking strategy (Eanet & Manzo, 1976). For Phase 1 of this study, the two authors independently rated the student responses according to this new rating scale, and the means from these two sets of ratings were used for the student cognitive complexity scores. The traditional psychometric interrater reliability in this pilot study was only 0.37, considerably lower than would be desired or perhaps even considered acceptable. However, according to Sax (1997), in some situations, especially where limited testing options are available, or the costs required to increase reliability may be prohibitive, even tests yielding low reliabilities may be useful, especially when they are used in exploratory or probative research with groups, rather than individuals. Additionally,

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<th>Table 1</th>
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<td>Cognitive complexity rating scale with sample responses</td>
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<tr>
<td>Reconstructive responses</td>
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<tr>
<td>1</td>
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<tr>
<td>Very simplistic text-dependent response</td>
</tr>
<tr>
<td>“I thot the book was good and fanny” [sic]</td>
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when analyzing how often the rater mean scores for individual students were within one point (on the four-point scale) of each other, there was an interrater agreement of 88%. For these reasons, it seemed reasonable to the authors to continue to report these findings, as probative as they may be.

For Phase 1 of the research, each student received two cognitive complexity scores: a mean of the first half of their message board responses and a mean of the second half of their message board responses. The scores were calculated according to the four-point scale described previously. Each student’s score was the average of the two raters’ assessments. The Phase 1 research question was analyzed by comparing the group means between the first and second half of the individual student responses, in order to see if cognitive complexity increased with continued use of Virtual Literature Circles.

For Phase 2 of the research, each response made by each student was categorized according to one of three response types: reconstructive, constructive, or non-directive. See Table 2 for sample descriptions of these different prompt types. The two authors worked together to come to rating agreement for the cognitive complexity of each response (which also helped as continual development of the rater training on the instrument). The mean cognitive complexity scores for each of the three response types were then compared.

7. Results

7.1. Phase 1

The absolute differences between the group means of the first and second half of the student responses were quite small (Half 1 = 2.23 and Half 2 = 2.38). A paired-samples \( T \)-test was calculated between the group means of the first half and the second half of the student responses and did not show statistical significance at the 0.05 level. Additionally, using the effect size measure of Cohen’s \( d \) (Cohen, 1977), the difference between the means was relatively small (Cohen’s \( d = 0.27 \)). These results suggest that the Phase 1 research question should be answered in the negative. It seems reasonable to claim that the cognitive complexity of the student responses did not meaningfully increase with continued use of Virtual Literature Circles.

7.2. Phase 2

The absolute differences between the means of the three different types of prompts seemed notable. (Reconstructive = 1.88; Constructive = 2.93; Non-directive = 2.45). Paired samples \( T \)-tests were calculated between each pair of means and showed statistical significance, at the 0.05 level, Table 2

<table>
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<tr>
<th>Prompt category</th>
<th>Sample prompt</th>
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<td>Reconstructive (text-dependent)</td>
<td>“What was your favorite part of the chapter?”</td>
</tr>
<tr>
<td>Constructive (text-independent)</td>
<td>“This chapter reminds me of…”</td>
</tr>
<tr>
<td>Non-directive (neutral)</td>
<td>“What did you think about while reading?” or No prompt</td>
</tr>
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between constructive and reconstructive \((n=10)\) and between constructive and non-directive \((n=17)\). The \(P\)-value was very close to statistical significance \((0.06)\) for the means between reconstructive and non-directive \((n=10)\). Additionally, using the effect size measure of Cohen’s \(d\) (Cohen, 1977), the difference between these two means was high \((0.82)\). It seems that the Phase 2 research question should be answered in the affirmative: it seems reasonable to claim that the cognitive complexity of the student responses did meaningfully vary according to prompt type.

8. Discussion

Although these findings are small, they are not without importance. This study bears upon existing theory about cognitive complexity and higher-order literacy, and it sheds light on what we may hope to find as valuable in using electronic message boards. Additionally, knowledge has been gained regarding the rating instrument used in this study, allowing for future refinements.

The results of this study support the descriptive theories of higher-order literacy of Manzo and Manzo (1995) and Thomas (2001), most notably the argument that higher-order responses to text are often dispositional, or driven by orientation and will. It is embedded in this theory that higher-order responses to text, or responses of higher cognitive complexity, seem to be highly related to one’s desire, tendency, or will to respond in such a way. Some have a tendency to respond in higher-order ways, and others do not. In Phase 1 of this study it is apparent that the cognitive complexity of student responses was predictable between halves; the response tendencies of the students at the beginning of their involvement in the Virtual Literature Circles was very similar to their response tendencies throughout their continued involvement in the project. Therefore, Phase 1 this study suggests that at least a portion of the students’ tendency toward cognitive complexity seems embedded in the students themselves, more than in the general stimulus that is provided by simply using the message board environment.

This then, sheds important light on some of the educational dynamics that may be (or may not be) inherent in Virtual Literature Circles and other similar uses of electronic message boards. Since observation reveals that elementary students find message boards to be stimulating forums to engage in asynchronous discussions with other students, it is reasonable to hope that this would have an impact on helping to increase the cognitive complexity of written responses. It would be hoped that the more engaging and interactive the learning activity, the greater the increase in cognitive complexity. This, however, in the Phase 1 findings, does not seem to be the case for Virtual Literature Circles, at least not in their present pilot-study form. This prompted the researchers to consider what other possible, more finely tuned aspects of stimulating Virtual Literature Circle discussions might be needed. It seemed possible, for instance, that focusing specifically on the types of question prompts used by the discussion board moderators may be the key to eliciting higher-levels of cognitive complexity, as may be suggested by the “Just-Ask-For-It” hypothesis of Manzo, Manzo and Estes (2001). This served as the impetus for Phase 2 of this study.

The Phase 2 findings suggest that the careful choice of specific question prompts by discussion board moderators may hold the key to more effective implementation of Virtual Literature Circles. It is clear that reconstructive prompts yield text-dependent, lower-complexity responses and that constructive prompts are more likely to lead to text-independent, increasingly complex responses. If increases in cognitive complexity in student writing is an educational goal, then the
findings of this study suggest that simply using Virtual Literature Circles, or other such message board environments, might not be sufficient. However, using Virtual Literature Circles with carefully chosen question prompts may be just the sort of fine-tuning pedagogical step that is needed. Future studies of Virtual Literature Circles should focus on intervention strategies using carefully chosen question prompts in order utilize this emerging message board technology to increase student cognitive complexity.

Finally, this study has led to the initial stages of developing a much-needed instrument for assessing student responses in message board environments. Although the interrater reliability of the author-created rating instrument was low in Phase 1, it at least provided a starting point for attempting to meaningfully assess and analyze the hybrid response forms unique to message board environments. Phase 2 allowed the researchers to progress toward a better understanding of the rater training needed to raise the interrater reliability of this instrument. Future studies using this instrument in Virtual Literature Circles should help refine the instrument, potentially providing an important tool for use in the inevitable merger of the Internet message board environment with traditional literacy practices.

9. Summary

This study is small in scope, but still may be seen as important because the findings provide educators with more information to help with understanding the potential efficacy in the fusion of two seemingly complimentary and potent educational tools: Literature Circles and Internet message boards. This is an important step in continuing to delineate the results of combining traditional literacy instruction with the technological tools of twenty-first Century.

References