Relationship Between Sense of Community and Learning in Online Learning Environments

Peggy A. Ertmer
Department of Curriculum and Instruction
Purdue University
United States
pertmer@purdue.edu

Donald A. Stepich
College of Engineering
Boise State University
United States
dstepich@boisestate.edu

Abstract: Eleven students, enrolled in advanced instructional design courses at two universities, engaged in collaborative online discussions and video-conferences for the purposes of extending and enriching course activities and assignments. To determine the impact of our approach, we examined students’ perceptions of learning, measures of higher-order learning, as well as perceptions of community. Similar to previous studies, results support the hypothesis that perceptions of community and perceived learning are related. However, evidence of a relationship between perceptions of community and higher-order learning was not found, suggesting that these relationships may be more complex and difficult to discern.

Theoretical Framework

Over the last few years, the number of postsecondary institutions offering distance education courses has grown tremendously. For example, in 2003, 81% of all institutions of higher education offered at least one fully online or hybrid course (Allen & Seaman, 2003), up 25% from the 2000-2001 figures (National Center for Education Statistics, 2003). Along with this growth in available courses have come dramatic increases in enrollment. In 2000-2001, total enrollments surpassed the 3 million mark, up nearly 200% from the 1997-98 figures.

As the number of online learners has grown, so has the amount of attention given to the importance of establishing a sense of community among students in order to maintain motivation and increase learning (Palloff & Pratt, 1999). According to Rovai (2002b), a classroom community is defined as a “social community of learners who share knowledge, values, and goals” (p. 322) and is comprised of two main components: 1) connectedness—students’ feelings of “cohesion, spirit, trust, and interdependence” (p. 325), and 2) learning—students’ feelings “regarding the extent to which their learning goals and expectations are satisfied” (p. 325).

Garrison, Anderson, and Archer (2001) observed that the community is “extremely valuable, if not essential” (p. 7) to the development of higher-order learning because it provides the social context in which learning occurs. Bielaczyc and Collins (1999) concurred, noting that community creates a culture of learning that can promote the kinds of higher-order learning currently being advocated in the literature (Bransford, 1993; Bransford, Brown, & Cockling, 1999; Newmann, Bryk, & Nagaoka, 2001; Resnick, 1987). According to Pea (1993), the mind rarely works alone. Although the importance of cognition “in solo” is often emphasized in schools, common events in everyday and professional communities highlight the importance of socially-constructed meaning (Dornisch & Land, 2002). According to situated cognition theorists, knowledge isn’t located in an individual’s mind, but is “embedded” within the specialized relationships that exist among people working together (Badarraco, 1991). According to this theory, learning is seen as a “dialectical process of interaction” among people, the environment, and the cognitive tools people create (such as language) to guide their thinking and action (Wilson & Myers, 1999).

Recent research has established a clear link between a sense of classroom community and perceived learning in online learning environments (Picciano, 1998; Rovai, 2002b). For example, Arbaugh (2000) investigated five Internet-based MBA courses and found that students’ perceptions of learning were most closely associated with the instructor’s emphasis on interaction within the course, ease of interaction, and classroom dynamics.
Haythornthwaite, Kazmer, Robins, and Shoemaker (2000) suggested three basic strategies for building this kind of community within online learning environments: (1) promote initial bonding, (2) monitor and support continual participation, and (3) provide multiple means of communication. Over the past several years we have applied these community-building strategies within our online educational courses. While the research described here was conducted within a graduate-level instructional design (ID) course, our findings have implications for other disciplines as well.

The purpose of this study, then, was to extend the results of previous research by clarifying the relationships among sense of community, perceived learning, and learning outcomes for students enrolled in a case-based hybrid course. Using “the development of students’ higher-order thinking” as the intended learning outcome, we examined changes in students’ thinking and problem solving skills during the semester and investigated how these developing skills related to their judgments of perceived learning, as well as their perceptions of community.

**Methods and Procedures**

We gathered both quantitative and qualitative data to examine relationships among students’ perceived sense of community, perceived learning, and higher-order learning. Students’ perceptions of learning and sense of community were measured with self-report survey instruments. Indicators of higher-order learning included changes in the quality of students’ bulletin board postings from the beginning to the end of the semester and comparisons between students’ pre- and post-case analyses. Both quantitative (paired t-tests, correlations) and qualitative (constant comparative coding) analysis methods were used to describe and interpret our findings. Course assignments (including students’ additional case analyses), discussion board postings, and mid- and end of course evaluations served as secondary data sources and were used to triangulate survey findings.

Participants included 11 graduate students (3 PhD; 8 MS) enrolled in an advanced ID course at a midwestern (n=5) or northwestern (n=6) university during fall 2003. Students ranged in age from 27-52 years (x = 38) and had a broad range of backgrounds, knowledge, and experiences. Throughout the course, students from the 2 universities collaborated in 12 online case discussions via an electronic bulletin board, and in 7 face-to-face discussions via Internet-based videoconferencing.

**Data Collection and Analysis**

*Perceived Learning*

At the beginning and end of the course, students completed a self-assessment questionnaire in which they rated themselves on 16 ID competencies (IPSTPI, 1984), from 1 (weak) to 5 (strong). Sample competencies included: “Determine projects that are appropriate for instructional design,” “Conduct a needs assessment,” “Design instructional materials,” and so on. A gain score was calculated to determine changes in students’ judgments of competency, thus serving as a measure of perceived learning.

*Sense of Community*

At the end of the semester, students completed the Classroom Community Scale (Rovai, 2002a), in which they rated levels of agreement from 1 (strongly disagree) to 5 (strongly agree) on items related to feelings of connectedness (e.g., “I trust others in this course.”) and learning (e.g., “I feel that I am given ample opportunity to learn.”). Ratings for each item were totaled to obtain a scale score ranging from 20 to 100, with scores for each of the two subscales (connectedness, learning) ranging from 10 to 50. Higher scores reflect a stronger sense of classroom community.

*Learning Outcomes*

Two data sources provided measures of higher-order learning: students’ weekly bulletin board postings and their pre- and post-case analyses of published instructional design case studies. An independent rater scored each
posting on the bulletin board (n = 631), based on the level of cognitive skill demonstrated, using Bloom’s taxonomy. Postings at the knowledge, comprehension, and application levels received 1 point; postings demonstrating analysis, synthesis, or evaluation received 2 points; non-substantive postings received 0 points. The rater was a graduate assistant for the course whose main responsibility was to read and score students’ messages on the bulletin board using a rubric, including sample postings and scores, developed by one of the authors.

Throughout the course, students analyzed a series of case studies involving two basic tasks: 1) analyzing problems and issues in the case and 2) making recommendations for identified issues. Case responses were typically posted online as part of the weekly discussions, however, initial and final case analyses were submitted as written assignments. These analyses related to the same case study and, thus, served as pre- and post-learning measures.

After the graduate assistant removed all identifying information (including whether the response was a pre- or post-course assignment), the authors scored each response using a rubric based on six primary characteristics of expert-novice problem solvers described in the literature (e.g., conceptualization of the issues, impact and implications of recommendations; see Table 1) and outlined previously (Stepich et al., 2001). An independent score, from 0-3, was assigned to students’ responses based on each of the six characteristics, using the following criteria: If a response exhibited no expert-like elements related to a specific characteristic, the response was given a score of 0 (no evidence of expertise) for that characteristic. If the response included at least one expert-like element, but there were more novice than expert-like elements, it was given a score of 1 (some evidence of expertise; mostly novice approach); if a response included some expert-like elements but there were more expert than novice-like elements, it earned a score of 2 (some evidence of expertise, mostly expert approach); finally, if a response exhibited a substantial number of expert-like elements, and the prominent approach taken by the student was expert-like, it was given 3 points (a lot of evidence of expertise; primary approach). To increase the consistency of our ratings, we identified examples from students’ responses that seemed to clearly illustrate the different ratings for each characteristic. These examples, then, were used as templates to guide our continued analysis efforts. After consensus was reached on all ratings, scores were totaled for each analysis. With a maximum score of 3 on 6 primary characteristics, possible scores ranged from 0 (no expert qualities) to 18 (mostly expert-like). Following this, responses were identified as belonging to specific individuals, sorted into pre- and post-course responses, and used for further analyses (e.g., correlations, t-tests).

**Results and Discussion**

**Perceived Learning**

Results of the self-assessment questionnaire showed a significant increase ($t = 4.16; p = .001$) in students’ perceptions of their ID skills from pre- to post course. On average, students’ ratings changed .51 points from 3.38 (neither weak nor strong) to 3.85 (somewhat strong).

**Sense of Community**

Students’ scores on the Community Scale averaged 83/100 points suggesting that, in general, students “agreed” that they felt connected to each other ($x = 39/50$) and “strongly agreed” that the community enabled them to reach their learning goals ($x = 44/50$). Students’ comments at the end of the course supported this: “I found it very valuable to collaborate with a diverse group I gained a much better understanding of ID in the field.”

**Learning Outcomes: Bulletin Board Postings**

Scores reflecting the quality of students’ postings also showed steady increase over the semester, ranging from a total of five 2-point responses (13%) during the first discussion to 19 (53%) during the last week. Similarly, 0-point responses decreased from 11 during the first week (29%) to 0 during the last week. Two-point responses accounted for 38% of the total postings; 0-point responses equaled 7.5%. On average, students made 1.8 two-point postings during the first three weeks of the semester, while they made an average of 6 two-point postings during the latter weeks of the semester. To determine if the change in the number of 2-point postings from early in the course to late in the course was significant, a t-test was performed using the number of 2-point posts, for each student, from weeks
perceived learning and the connectedness subscale (gain scores). The point value assigned to the completion of this final case analysis was weighted relatively low in relationship to the total number of possible points in the course (7/150 points) and students may have given it low priority compared to other tasks needing to be completed. Future work includes plans to change the structure

Learning Outcomes: Students’ Case Analyses

Analyses of students’ case responses showed no significant difference from pre to post course. Students’ scores on the pre-case analysis ranged from 1 – 15 points (x = 6.1); scores on the post-case analysis ranged from 3 – 16 (x = 6.3). Whereas some students increased their ratings from pre- to post-course by 2 or 3 points, others decreased their ratings by a similar amount, thus, canceling out any noticeable gain, overall, in expert-like thinking. It is important to point out, however, that these averages do not include the scores from one student who obtained a post-course score that was 11 points lower than her pre-course score. Despite being one of the strongest contributors in the class and having the strongest rating on her pre-course analysis, she submitted a very short and fairly superficial response for the post-case analysis. This was possibly due to the fact that she was simultaneously involved in studying for and taking the comprehensive exit exam for her master’s degree. Given these circumstances, we decided to exclude her scores from further analysis, as it appeared that her lower score on the post-case analysis was most likely due, not to a lack of expertise (she obtained 15/18 points on the pre-case analysis), but to her lack of attention to this particular task at this point in her program. Furthermore, because this score represented such a drastic departure from the results obtained from the other 10 students, it would have skewed the outcomes to such an extent that it would have been difficult, if not impossible, to interpret our findings.

Comparisons between students’ pre- and post-case analyses, then, suggest that students’ ability to solve case problems did not improve, to any measurable extent, during the course. Students who started the course with fairly expert-like approaches, ended the course with fairly expert-like approaches; similarly, students who started with fairly novice-like approaches, ended with fairly novice-like approaches. While it is certainly possible that students’ higher-order thinking skills did not improve during the course, the significant increase noted in the quality of students’ online postings suggests otherwise. A number of other possible interpretations bear further consideration. First, our qualitative analysis techniques may not have been sophisticated enough to detect the changes that occurred in students’ case analysis approaches. While our analysis categories were based on expert characteristics described in the literature, application of these categories to widely divergent case write-ups is a challenging process, and one that we continue to refine. Second, it is possible that while students’ ability to analyze case problems improved, they did not demonstrate this to the extent to which they were capable. In other words, the assignments might not have been structured well enough to allow students to demonstrate the skills they had. Third, other variables may have negatively impacted students’ post–case analyses, particularly other commitments or pressures that occurred at the end of the semester. The point-value assigned to the completion of this final case analysis was weighted relatively low in relationship to the total number of possible points in the course (7/150 points) and students may have given it low priority compared to other tasks needing to be completed. Future work includes plans to change the structure and the value of the pre- and post-case assignments.

In addition, we have begun the process of validating our analysis framework using a peer review process. This involves two major steps: 1) establishing construct validity for components of our expert-novice rubric and 2) achieving acceptable levels of inter-rater reliability among independent raters using the rubric. Efforts are currently focused on clarifying our definition and description of the manner in which both experts and novices conceptualize issues in a case study (the first expert-novice characteristic on the rubric). After identifying key examples of each of the major components of this characteristic, we will gather input from a panel of experts who will help us further refine our understanding. Then, after describing this characteristic as succinctly and clearly as possible, we will apply it in our analysis of students’ case responses and then calculate a measure of inter-rater reliability. This will enable us to determine the extent to which we are consistently able to apply this framework in our analysis efforts. The peer review process will continue until an inter-rater reliability coefficient of .70 or higher is achieved.

Relationships among Variables

Pearson product correlations (see Table 2) showed a significant relationship between perceived learning (i.e., gain scores on the ID self-assessment) and the community learning subscale (r = .64; p < .05), but not between perceived learning and the connectedness subscale (r = .39) or the total scale (r = .52). While students with greater
gains in perceived learning were more likely to feel that the community contributed to their learning, students who felt more connected didn’t necessarily feel that they learned more. These results suggest that perhaps what is most important to students is the perception that they can learn from the community, whether they feel a strong sense of cohesion with the group or not. Alternatively, the sense of connectedness may have a less direct effect on perceived learning. This alternative view is supported by student comments: “We certainly benefited from the range of experience and numbers of the other class. The community-spirit/connection was less apparent than in the face to face situation.” Future work might try to tease apart which of these community perceptions are most critical to the learning experience.

While previous researchers have suggested that measures of perceived learning are an adequate substitute for measures of actual learning outcomes (Rovai, 2001a, 2001b), the results of this study suggest the need to examine this practice more closely. That is, despite finding a significant relationship between perceived learning and the community learning subscale, we found no systematic relationships between the measures of community and our measures of learning (see Table 2). Neither did we find significant relationships between our measure of perceived learning and our two measures of learning. At least in this study, it appears that these instruments were measuring different things. Perhaps this should be not too surprising given that our measure of perceived learning focused, primarily, on students’ perceptions of their ability to complete specific ID tasks (e.g., conduct a needs assessment; design instructional materials) while our measures of learning focused, primarily, on the development of problem-solving skills. Future work suggests the importance of refining and validating current measures and/or locating other validated measures of higher-order learning.

While we did not find a significant relationship between measures of perceived learning and measures of learning, we did find positive and, in some cases, significant relationships between the various measures of students’ higher-order thinking used in this study (see Table 3). That is, students’ pre- and post-case analyses scores were significantly correlated to the number of 2-point posts \( r = .62 \) and \( .67, \) respectively; \( p < .01 \), suggesting that these two measures may have been assessing similar cognitive abilities.

**Implications and Conclusions**

Taken together these results suggest that while students’ perceptions of community appear to relate to their perceptions of learning, actual learning outcomes may not be influenced by these perceptions, contrary to what has been suggested in the literature (Picciano, 1998; Rovai, 2002b). Although the small number of participants in this study warrants caution in interpretation and in generalizing to other contexts, it does suggest that more research needs to be conducted in which measures of students’ learning and/or achievement are obtained.

Even though students in this study demonstrated increases in higher order thinking skills, as well as increases in their judgments of ID competencies, it does not appear, at least from the results obtained here, that these changes were systematically related to their perceived connectedness to others in the class. This suggests the need for additional work in this area. As Bonk (2003-2004) cautions, “Although this quest for community may be considered the penultimate goal of online discussion, we must ask research questions about the learning benefits of such communities. … Is there always a satisfactory marriage” (p. 100)?

Many online programs provide specific activities to develop feelings of community among participants (Swan, 2002) based on the assumption that this will increase both student motivation and learning. While the results of this study lend some support to this assumption, additional work is needed. As suggested by Swan, “Researchers should explore those unique characteristics of asynchronous online environments that matter, or can be made to matter, in learning and instruction” (p. 26). Furthermore, this implies the need to continue to look beyond perceived learning to determine whether a similar relationship exists with actual learning outcomes (i.e., change in knowledge or skill), as determined by measures other than self-report. Research in this area is still incredibly young; however, given the large number of students enrolled in online courses (and the speed with which this number is growing), this is an important area for our continued efforts.

**References**


### Problem-Solving Characteristic

<table>
<thead>
<tr>
<th>Expert</th>
<th>Novice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Analysis Categories</strong></td>
<td></td>
</tr>
<tr>
<td>Conceptualization of the issues</td>
<td>Interprets issues in light or previous experience</td>
</tr>
<tr>
<td>Search for information</td>
<td>Focuses on building from what is known</td>
</tr>
<tr>
<td>Attention to relationships among issues</td>
<td>Makes explicit links among multiple issues</td>
</tr>
<tr>
<td><strong>Solution Categories</strong></td>
<td></td>
</tr>
<tr>
<td>Attention to relationships among solutions</td>
<td>Makes explicit links among multiple solutions</td>
</tr>
<tr>
<td>Level of commitment to solutions</td>
<td>Describes recommendations in tentative terms and allows them to change as additional information</td>
</tr>
</tbody>
</table>
Consideration of implications of recommendations

<table>
<thead>
<tr>
<th>Recommendation Category</th>
<th>Includes explicit consideration of implementation and/or effects of recommendations</th>
<th>Little apparent consideration of implementation and/or effects of recommendations</th>
</tr>
</thead>
</table>

Table 1: Six expert-novice categories used to rate student case responses

| Sense of Community - Connectedness Subscale | .39 | .45 | .05 |
| Sense of Community Learning Subscale | .64* | .16 | .03 |
| Sense of Community Total Scale | .52 | .34 | .04 |

Table 2: Correlations among sense of community, perceived learning, and learning outcomes

<table>
<thead>
<tr>
<th>Pre-case Analysis</th>
<th>Post-case Analysis</th>
<th>Gain Score - Case Analysis</th>
<th>Number of 1-point posts</th>
<th>Number of 2-point posts</th>
<th>Gain Score – Bulletin Board Postings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-case Analysis</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Post-case Analysis</td>
<td>.89**</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Gain Score-Case Analysis</td>
<td>-.35</td>
<td>.129</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Number of 1-pt messages</td>
<td>.459</td>
<td>.569</td>
<td>.17</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Number of 2-point messages</td>
<td>.629*</td>
<td>.679*</td>
<td>.03</td>
<td>.56</td>
<td>--</td>
</tr>
<tr>
<td>Gain Score – BB</td>
<td>.22</td>
<td>.35</td>
<td>.23</td>
<td>.66*</td>
<td>.74**</td>
</tr>
</tbody>
</table>

* Significant at the .05 level; ** Significant at the .01 level

Table 3: Correlations among measures of higher-order thinking