**Online learner self regulation: Learning presence, viewed through quantitative content- and social network analysis**

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**Abstract:** This paper presents an extension of an ongoing study of online learning framed within the Community of Inquiry model (Garrison, Anderson & Archer, 2001) in which we further examine a new construct meant to reflect online learner self- and co-regulation. We suggest that the roles of online students differ from online instructors, even within collaborative and inquiry based models and that it is important to articulate the roles of successful online learners engaged in these pedagogical approaches. To gain insight, we present results of a study using quantitative content analysis and social network analysis (SNA) in a complementary fashion. SNA has been applied to online learning, but lacks a theoretical foundation for understanding how and why networks of interaction might promote better learning. However, a great deal of educational research indicates that successful learners self regulate in ways that lead to success and emerging research indicates self-regulation is especially important in interactive online learning environments. Such regulation includes an iterative cycle of forethought and planning; monitoring and adapting strategies for learning, reflecting on results. We therefore used quantitative content analysis to identify metrics of self and co-regulation of learning, a construct we label “learning presence” that might be applied in SNA. We suggest that learning presence reflects theory-based indicators of quality that can be applied within social network analysis to better understand the relationship between self regulation, interaction, and learning while providing insight into the application of social network analysis in online education research. We conclude that significant benefits accrue to online students who demonstrated better self- and co-regulation and that these benefits are manifest in metrics associated with social network analysis. These results extend and confirm both the CoI Framework and extend previous research using SNA in investigation of online learning.

**1. Objectives/purposes**

As online learning continues to grow in higher education it is critical that we gain insights into the mechanisms by which we can promote quality. The longstanding Community of Inquiry (CoI) framework (Garrison, Anderson, & Archer, 2000) represents one such mechanism. More than ten years of research and a recent two part edited journal (Internet and Higher Education, 2010) dedicated to CoI and the advances in our understanding of online learning gained through this theory are testament to its usefulness. With more than 6.1 million college students enrolled in at least one online course during 2010 and an accompanying growth rate of more than 10% (Allen & Seaman, 2011) it is clear that we will continue need a comprehensive model that helps describe, explain, and predict how people learn online. Almost a third of college students are now studying in environments that lack conventions of face-to-face interaction that have characterized most higher education classrooms for centuries. It’s clear that theoretical understanding of these rapidly expanding environments can be beneficial. This paper seeks to add to that understanding through an analysis of the self-regulatory performance of online learners, viewing these behaviors as a form of “learning presence”, a construct meant to compliment and expand upon teaching, social, and cognitive presence contained in the CoI model.

Specifically this paper seeks to explore relationships between online learner self and co-regulation (learning presence) evident in quantitative content analysis and advantageous location within networks of online interaction reflected in social network analysis. In part we seek to examine the effects of assigning and assisting doctoral level students to facilitate discussion and other activities on the expression of learning presence and student location within the resulting network of interaction in online discussion. We conjecture that, as in previous research, transferring some of the instructional responsibility to learners increases self and co-regulatory performance (Shea, Hayes, Uzuner, Vickers, Wilde, Gozza-Cohen, & Jian, 2011), and will result in advantageous location within associated learner interactions as measured by social network analytics.

**2. Theoretical framework**

Three frameworks inform our analysis in this paper, the Community of Inquiry Framework, Self Regulated Learning, and Social Network Analysis. The CoI Framework describes the deliberate development of online learning community stressing the processes of instructional dialogue likely to lead to collaborative knowledge building. The model explains formal online knowledge construction through the cultivation of various forms of “presence”, among which are teaching-, social-, and cognitive presence (Garrison, Anderson, & Archer, 2001). The framework theorizes online learning in higher education as a result of collaborative work among active participants in learning communities characterized by instructional orchestration appropriate to the online environments (teaching presence) and a supportive collegial online setting (social presence). The teaching presence construct outlines participant instructional responsibilities such as organization, design, discourse facilitation, and direct instruction (Anderson, Rourke, Garrison, & Archer, 2001) and articulates the specific behaviors likely to result in a productive community of inquiry (e.g. Shea, Li, Swan & Pickett, 2005). Social presence emphasizes online discourse that promotes positive affect, interaction, and cohesion (Rourke, Anderson, Garrison, & Archer, 1999) that support a functional collaborative learning environment. The model also refers to cognitive presence, a cyclical process of interaction intended to lead to significant learning within a community of learners.

Recently another dimension of presence has been suggested in CoI research. In analyzing student contributions to online courses using the CoI model researchers were unable to reliably code instances of student generated discourse found in collaborative learning activities using indicators of teaching, social, and cognitive presence (Shea, Hayes & Vickers, 2010). The researchers investigating this discourse considered these student contributions to be examples of online learner self- and co-regulation and applied the term *learning presence* (LP) to describe this interaction (Shea, et. al, 2010, Shea & Bidjerano, 2010). Self regulated learning is a well researched theoretical construct and previous researchers have concluded that self regulation is predictive of better learning outcomes in classroom-based education (e.g. Zimmerman, 2001). It is recognized that successful online learners also require significant self direction, motivation, time management etc and previous investigators have argued that self-regulated learning may be the most inclusive conceptualization for these online learner attributes, strategies and performance (Shea et. al, 2009). Beyond classroom based analysis, research has begun to emerge conceptualizing differences in and analyzing effects of self regulation in online environments. For example, reviewing studies that investigated elements of online learner self- regulation (e.g., Bixler 2008; Chang 2007; Chung, Chung & Severance 1999; Cook, Dupras, Thompson &. Pankratz, 2005; Crippen & Earl, 2007; Nelson, 2007; Saito & Miwa 2007; Shen, Lee & Tsai 2007; Wang, Wang, Wang, & Huang, 2006) Means and her colleagues, (2009) concluded that all the studies converged on advantageous learning outcomes for providing support for self-regulatory strategies including self-reflection, self-explanation, and self-monitoring. As Means et al. concluded that support for enhancing self regulation has a positive impact on online learning we sought in this study to examine the effects of employing learner-centered approaches to online doctoral education, specifically the impact of a scaffolded transfer of some instructional roles from the instructor to the learners.

This paper represents an extension of previous research examining online learner self and co-regulatory processes and employs a coding scheme reflecting the conceptual framing of learning presence. This coding scheme aligns with socially grounded conceptions of self regulated learning (e.g. Zimmerman, 2000) and includes categories for forethought and planning, performance, and reflection.

Social network analysis seeks to understand the nature of relationships and flows of information and influence among participants located in networks of interaction. Perspectives informed by social network analysis span a wide range of disciplines including studies of kinship structure, social mobility, science citations, corporate power, and class structure (Scott, 1988) as well as analyses of interaction in online education (e.g. Aviv, Erlich, Ravid, & Geva, 2004). While previous researchers have employed other constructs from the CoI model with social network analysis (see e.g., de Laat, Lally, Lipponen & Simons, 2007 and teaching presence) most previous social network analysis research in online learning has lacked a comprehensive conceptual framing for knowledge construction that reflects the CoI model and each of the associated indicators meant to predict quality in online learning. Here we are especially interested to understand the nature of the relationship between online self regulatory performance (learning presence) and location within social networks that may be seen as advantageous for networked learning.

For the purpose of this paper we assume that both learning presence and the sharing of the instructional role can serve as independent variables. For example, we hypothesize that for students who are asked to design and facilitate a module this added responsibility will heighten their self- and co-regulatory behaviors resulting in higher levels of learning presence for student facilitators versus non-facilitating students. We also hypothesize that the role of facilitation will place students in more advantageous positions reflected in social network analysis. We further conjecture that higher levels of learning presence will be found to correspond with more advantageous position in reflected in social network analysis. This analysis is an extension of previous research (e.g., Shea & Bidjerano, 2010) suggesting that teaching presence should be re-conceived to include an instructor level responsibility to foster online learner self- and co-regulation (learning presence).

*Research Questions*

The specific research questions addressed here are:

1. When part of the instructional role is shared with students (elements of design and facilitation of discourse) is there an impact on the expression of self- and co-regulation as measured through quantitative content analysis of student discussion postings and learning journals (learning presence)?
2. What impact does the shared instructional role (learner design and facilitation of an online learning module) have on metrics reflected in social network analysis? Do facilitators occupy more advantageous locations in the social network?
3. How does student learning presence manifest when we compare more public, interactive forms of online learner self and co-regulation as documented in student discussions versus more private venues such as individual learning journals? How are the three categories of learning presence and their constructs distributed across these two learning activities?
4. **What network positions do students, with high levels of combined learning presence in discussions and journals, occupy relative to their peers?**

5**) How do prestige and influence correlate with combined learning presence, in discussions and learning journals, and in each of these activities when considered separately?**

**3. Methods and Data**

The data for this study, student learning journals and the transcripts of online discussions, was collected from a doctoral level research methods course that used blended instruction, offered during the 2010 fall term at a large state university in the northeast. There were 18 students enrolled in this required course, which met face-to-face for three weeks at the start of term, switching to fully online for the remainder of the semester. The online components of the course consisted of eight modules. We purposively selected one module for coding and analysis and another for comparison. In this proposal, we report on the results from two sets of three concurrent discussions in module six , and the associated module learning journal. Overall, the six discussions had an aggregated count of 105 student postings which serve as one unit of analysis in this study. One discussion was required and there were two others from which students could select to participate. Student postings by discussion were as follows for weeks 1 and 2: Week 1 mandatory discussion, 72; option 1, 30; option 2, 28; Week 2, mandatory discussion, 43; option 1, 18: option 2, 32. For the module 6 learning journal there were a total of 16 journal entries and 19 comments.

The learning journals were a course requirement. Throughout the semester, the students completed a total of seven, and they were asked to post their journal entries to a blog forum which was read by members of the whole class. Some of the journal assignments were prompted with specific questions and topics, while in others, students were simply asked to include their comments, questions, insights, concerns, and other reactions to the content of the assigned readings. Although the journal entries were posted to the blog forum, they did not require continuous student interaction. Instead, each student was expected to respond to one or two other students’ journal posts.

*Scaffolding Support for Shared Instructional Roles*

Online discussions were a requirement in the course, and were scheduled in each of the eight modules. At the beginning of the semester small teams of students chose one or more research methods from a list compiled by the instructor. The teams agreed to be the facilitators for a module of instruction covering these methods. Working with the instructor each team selected key readings and devised leading questions and activities to facilitate discussion around these readings. Following instructor guidelines, modeling, and suggestions students were expected to ask questions, raise issues, and state their agreements and disagreements with appropriate support and evidence from the literature. Some discussions were carried out by small groups, while others involved the whole class.

*Analysis*

To analyze the journals and discussion postings, we employed two methods of inquiry, quantitative content analysis (QCA) and social network analysis (SNA).

We conducted QCA using a revised version of the original Learning Presence coding scheme, which was developed for a prior study (Shea, Hayes, Uzuner, Vickers, Wilde, Gozza-Cohen, & Jian, 2011). At the start of this project, the two researchers who developed this coding scheme refined it further to align it more closely with Zimmerman’s (1998, 2000) three phases of self-regulation, by adding several new indicators and a new reflection category, and re-categorizing the existing monitoring and strategy-use sections to sub categories under a more inclusive organizing principle for self-regulation, performance(See Appendix A).The unit of analysis was the discussion post in both discussions and individual student learning journals with associated student comments. The two independent coders were instructed to count and mark every occurrence of a code when it appeared in the discussion transcripts or learning journals. When tallying these codes, we only reported on the presence or absence of the primary learning presence categories: forethought /planning, performance, and its sub-categories monitoring and strategy use, and reflection. Lastly, no instructor posts were coded, because the learning presence construct is specific to students.

To establish a baseline for inter-rater reliability, two experienced researchers first coded and discussed a test sample of the Module 1 learning journals looking for evidence of LP indicators. Then they independently coded Module 2 learning journals. Upon completion, they then submitted their results to the researcher responsible for calculating an initial interater reliability metric (IRR). Next, these researchers negotiated their coding differences and identified transcription errors, and a final IRR measure was calculated and recorded. For the coding of the course discussions, these researchers trained two new coders who repeated the test coding process, and the coding/negotiation process using two practice discussions from another course to establish an adequate level of agreement (See Appendix A).

This second group of coders reached a satisfactory IRR with ongoing negotiation allowing for continued improvement over the course of the coding, a process further discussed in the results section. After the training sessions were completed successfully, all four researchers applied the revised coding scheme across all data sets in a consistent manner.

Inter-rater reliability was calculated using Holsti’s Coefficient of Reliability (CR). This method looks at percent agreement using the following formula: 2*M*/(*N*1+*N*2) where M represents the total agreed-upon observations, *N*1 represents the number of total observations for coder 1, and *N*2 represents the total number of observations for coder 2 (Holsti, 1969; Krippendorf, 2004, Neurendorf, 2002). For exploratory research of this nature, an acceptable IRR of 0.70 is considered acceptable (Lombard, Snyder-Duch, & Bracken, 2002; Neurendorf, 2002).Although Lombard et al. (2002) recommend multiple matrices for establishing IRR, we chose to utilize the single measure of IRR due to the exploratory nature of our research. To ensure rigor and consistency we avoided sampling and instead used one-hundred percent of the data in calculating IRR, and coders used ongoing negotiation to improve both the IRRs and coding scheme.

We employed social network analysis (SNA) as our second inquiry method because it provides both visual and statistical analyses of interaction in networked learning environments. Given the importance of interaction in the CoI framework, SNA has been adopted by a growing number of researchers as a method to better understand both individual and group dimensions of online learning (Aviv, Erlich, Ravid & Geva, 2003 ; Cho, Gay, Davidson, & Ingraeffea, 2007; Dawson, 2008; Dawson, 2010; Dennen, 2008; Haythornthwaite, 2005; Lowes, Lin & Wang, 2007; MacFayden & Dawson, 2010; Russo, & Koesten, 2005; Wang & Tang, 2003; Zhu, 2006).  For the purpose of this study, we examined student network centrality, a measure of prominence associated with an actor’s position in a network, based on the number of mutual and unreciprocated ties or relations with others. We used two SNA centrality measures, prestige (in-degree centrality) and influence (out-degree centrality) to quantify students’ interactions in three aggregated online discussions (Wasserman & Faust, 2007, p. 170-180). We also developed network graphs to illustrate these relationships and to explore the relative measures of student learning presence found in the module discussions and learning journals.

In the case of online discussions, prestige measures the number of incoming responses directed to a student’s discussion post and represents the degree to which other students seek out that student for interaction (De Laat, et al., 2007). Students with high prestige are notable because their thoughts and opinions may be considered more important than others in the class. In contrast, students with high influence are in contact with many other students, as evidenced by the large number of discussion posts that they initiate to others. Students with low influence post few messages and are not as actively engaged with building or sustaining relationships with other students.

To extract the network data from this course, we used a new software tool called SNAPP (Social Networks Adapting Pedagogical Practice) (Dawson, Bakharia & Heathcote, 2010; Backharia, Heathcote & Dawson, 2009). SNAPP was used to capture student discussion posts from the six forums in module 6. A researcher next aggregated these data into adjacency matrices that represented all student interactions across all module discussions. She then created a separate attribute file that contained data on each student’s frequency counts of LP in each module’s learning journals and discussion posts, as well as individual measures of prestige and influence that had been calculated using UCINet software. The researcher imported these files into the NetDraw software package to generate a series of network graphs which are analyzed in the results section.

**4. Results**

*IRR:* For journals, the average initial CR was 0.773 and negotiated CR of 1.0000. For discussion, coders reached an average initial CR of 0.7748 and negotiated CR of .9914. See Appendix A for itemized journal and discussion IRR CRs. All of these are acceptable measures of inter-rater reliability for the purposes of this research.

*Research Question 1*. When part of the online instructional role is shared with students (elements of design and facilitation of discourse) is there an impact on the expression of self- and co-regulation as measured through quantitative content analysis of discussion postings and learning journals (learning presence)?

When comparing mean learning presence in the combined averaged discussion and learning journal of the module 6 student facilitators (02, 09, 13 and 19) and the rest of the class, we found that the facilitator group exceeded their peers, with an average of 11.25 versus 8.79 LP occurrences across the two learning activities; thus facilitators exhibited 31% more learning presence indicators then their non-facilitating peers (See Table 1).

Table 1. Comparison of average combined LP of student facilitators and rest of class

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| StudentFacilitators | Combined M6 LP Occurrences |  | Rest of Class | Combined M6 LP Occurrences |
| S02 | 13.0 |  | S01 | 4.0 |
| S09 | 12.0 |  | S03 | 9.0 |
| S13 | 16.0 |  | S04 | 6.0 |
| S19 | 4.0 |  | S05 | 19.0 |
| Total | 45.0 |  | S06 | 17.0 |
| Mean | 11.3 |  | S08 | 3.0 |
| Median | 12.5 |  | S10 | 3.0 |
|  |  |  | S11 | 9.0 |
|  |  |  | S12 | 3.0 |
|  |  |  | S15 | 8.0 |
|  |  |  | S16 | 8.0 |
|  |  |  | S17 | 10.0 |
|  |  |  | S18 | 13.0 |
|  |  |  | S20 | 11.0 |
|  |  |  | Total | 123.0 |
|  |  |  | Mean | 8.8  |
|  |  |  | Median | 8.5 |

Mann-Whitney U was performed to determine whether student facilitators and non-facilitators differed with respect to levels of learning presence beyond statistical chance. Median combined occurrences of learning presence were 12.50 and 8.5, respectively. Although the student facilitators as a group had a higher average rank (Mrank=7.0) than the student non-facilitators (Mrank=10.21), the differences in the distribution of learning presence within the two groups were not statistically significant (Mann–Whitney U = 18.00, n1 = 4, n2 = 14, p =.286 two-tailed).

*Research Question 2*. What impact does the shared instructional role (learner facilitation of online module) have on metrics reflected in social network analysis? Do facilitators occupy more advantageous locations in the social network?

When we examined student interactions using a network graph (see figure 1) to visualize the ties that emerged between students as result of their postings in all six module 6 threaded discussions, we found the following students were most centrally positioned in the network: 17, 13, and 09. Two members of this group were student facilitators, 13 and 09. These three students were most active in initiating posts and responding to other students, as evidenced by the number of ties that connected them to their peers. In contrast, student facilitator 19 was somewhat more central, and student 02 was located on the edge of the network, because he had fewer peer relationships.

Overall, the student facilitators also demonstrated more prominent network positions for prestige (in-degree centrality) and influence (out-degree centrality) than the rest of the class, when these two measures were aggregated and averaged across the group (See Table 2). In terms of prestige, the facilitators had a median of 12.0 incoming ties versus 8.0 for the rest of the class. The median of outbound ties (influence) for the facilitator group was 12.0 versus 9.0 for their peers. In both cases facilitators had higher measures than non-facilitators.

Results from Mann-Whitney U, testing differences in prestige and influence between student facilitators and non-facilitators, indicated that although the student facilitators had higher medians of in-bound and out-bound messages than their counterparts, statistically significant differences in the metrics for influence (Mann–Whitney *U* = 17.00, n1 = 4, n2 = 14, *p* =.24 two-tailed) and prestige (Mann–Whitney *U* = 19.00, n1 = 4, n2 = 14, *p* =.337 two-tailed) were not found.

Table 2. Comparison of centrality, prestige and influence for student facilitators and non-facilitators

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| StudentFacilitators | Freeman Degree Centrality  All M6 Discussions(In + Outbound Ties) | Prestige (In-Degree Centrality) in All M6 Discussions | Influence(Out-Degree Centrality) in All M6 Discussion |  | Rest of Class | Freeman Degree Centrality  All M6 Discussions(In + Outbound Ties) | Prestige(In-Degree Centrality) in All M6 Discussions | Influence(Out-Degree Centrality) in All M6 Discussions |
| S02 | 13.0 | 4.00 | 9.00 |  | S01 | 8.0 | 4.00 | 4.00 |
| S09 | 30.0 | 18.00 | 12.00 |  | S03 | 18.0 | 11.00 | 7.00 |
| S13 | 67.0 | 47.00 | 20.00 |  | S04 | 16.0  | 7.00 | 9.00 |
| S19 | 18.0 | 6.00 | 12.00 |  | S05 | 32.0 | 9.00 | 23.00 |
| Total | 128.0 | 75.00 | 53.00 |  | S06 | 20.0 | 3.00 | 17.00 |
| Mean | 32.0 | 18.75 | 13.25 |  | S08 | 5.0 | 3.00 | 2.00 |
| Median | 18.5 | 12.0 | 12.0 |  | S10 | 7.0 | 5.00 | 2.00 |
|  |  |  |  |  | S11 | 19.0 | 10.00 | 9.00 |
|  |  |  |  |  | S12 | 10.0 | 3.00 | 7.00 |
|  |  |  |  |  | S15 | 15.0 | 4.00 | 11.00 |
|  |  |  |  |  | S16 | 20.0 | 10.00 | 10.00 |
|  |  |  |  |  | S17 | 45.0 | 24.00 | 21.00 |
|  |  |  |  |  | S18 | 24.0 | 11.00 | 13.00 |
|  |  |  |  |  | S20 | 22.0 | 15.00 | 7.00 |
|  |  |  |  |  | Total | 261.0 | 119.00 | 142.00 |
|  |  |  |  |  | Mean | 18.6 | 8.5 | 10.14 |
|  |  |  |  |  | Median | 19.0 | 8.0 | 9.0 |

Note: S07 = Instructor; S14 = Guest speaker in later module

Figure 1. Network graph for combined module 6 discussions
Network positions of student facilitators 

= Student Facilitator

Table 3. Rankings of student measures of centrality, prestige and influence for all module 6 discussions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Student Rankings | Centrality Freeman Degree)  All M6 Discussions(In + Outbound Ties) |  | Student Rankings | Prestige (In-Degree Centrality) All M6 Discussions(In-bound Ties) |  | Student Rankings | Influence (Out-Degree Centrality) All M6 Discussions(Out-Bound Ties) |
| S13 | 67.0 |  | S13 | 47.0 |  | S05 | 23.0 |
| S17 | 45.0 |  | S17 | 24.0 |  | S17 | 21.0 |
| S05 | 32.0 |  | S09 | 18.0 |  | S13 | 20.0 |
| S09 | 30.0 |  | S20 | 15.0 |  | S06 | 17.0 |
| S18 | 24.0 |  | S03 | 11.0 |  | S18 | 13.0 |
| S20 | 22.0 |  | S18 | 11.0 |  | S09 | 12.0 |
| S06 | 20.0 |  | S11 | 10.0 |  | S19 | 12.0 |
| S16 | 20.0 |  | S16 | 10.0 |  | S15 | 11.0 |
| S11 | 19.0 |  | S05 | 9.0 |  | S16 | 10.0 |
| S03 | 18.0 |  | S04 | 7.0 |  | S02 | 9.0 |
| S19 | 18.0 |  | S19 | 6.0 |  | S04 | 9.0 |
| S04 | 16.0 |  | S10 | 5.0 |  | S11 | 9.0 |
| S15 | 15.0 |  | S02 | 4.0 |  | S03 | 7.0 |
| S02 | 13.0 |  | S15 | 4.0 |  | S12 | 7.0 |
| S12 | 10.0 |  | S06 | 3.0 |  | S20 | 7.0 |
| S01 | 8.0 |  | S08 | 3.0 |  | S01 | 4.0 |
| S10 | 7.0 |  | S12 | 3.0 |  | S08 | 2.0 |
| S08 | 5.0 |  | S01 | 4.0 |  | S10 | 2.0 |
| Total | 389.0 |  | Total | 194.0 |  | Total | 195.0 |
| Mean | 21.6 |  | Mean | 10.7 |  | Mean | 10.8 |
| Median | 19.0 |  | Median | 9.0 |  | Median | 10.0 |

Note: S07 = Instructor; S14 = Guest speaker in later module

Table 4. Comparison of LP in discussions and learning journals by student

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Student  | All M6 Discussions Total LP Occurrences | As Percent | M6 Learning JournalTotal LP Occurrences | As Percent | Combined M6 Learning LP Occurrences | As Percent  |
| S01 | 4.0 | 2.9 | 0.0 | 0.0 | 4.0 | 2.4 |
| S02 | 8.0 | 5.8 | 5.0 | 16.1 | 13.0 | 7.7 |
| S03 | 7.0 | 5.1 | 2.0 | 6.5 | 9.0 | 5.4 |
| S04 | 6.0 | 4.4 | 0.0 | 0.0 | 6.0 | 3.6 |
| S05 | 16.0 | 11.7 | 3.0 | 9.7 | 19.0 | 11.3 |
| S06 | 13.0 | 9.5 | 3.0 | 9.7 | 16.0 | 9.5 |
| S08 | 1.0 | 0.7 | 2.0 | 6.5 | 3.0 | 1.8 |
| S09 | 11.0 | 8.0 | 1.0 | 3.2 | 12.0 | 7.1 |
| S10 | 0.0 | 0.0 | 3.0 | 9.7 | 3.0 | 1.8 |
| S11 | 9.0 | 6.6 | 0.0 | 0.0 | 9.0 | 5.4 |
| S12 | 2.0 | 1.5 | 1.0 | 3.2 | 3.0 | 1.8 |
| S13 | 15.0 | 10.9 | 1.0 | 3.2 | 16.0 | 9.5 |
| S15 | 6.0 | 4.4 | 2.0 | 6.5 | 8.0 | 4.8 |
| S16 | 7.0 | 5.1 | 1.0 | 3.2 | 8.0 | 4.8 |
| S17 | 9.0 | 6.6 | 1.0 | 3.2 | 10.0 | 6.0 |
| S18 | 10.0 | 7.3 | 3.0 | 9.7 | 13.0 | 7.7 |
| S19 | 4.0 | 2.9 | 1.0 | 3.2 | 5.0 | 3.0 |
| S20 | 9.0 | 6.6 | 2.0 | 6.5 | 11.0 | 6.5 |
|  |  |  |  |  |  |  |
| Total | 137.0 | 100.0 | 31.0 | 100.0 | 168.0 | 100.0 |
| Mean | 7.61 | 5.6 | 1.7 | 5.6 | 9.3 | 5.6 |
| Median | 7.5 | 5.5 | 1.5 | 4.9 | 9.0 | 5.4 |

Note: S07 = Instructor; S14 = Guest speaker in later module

*Research Question 3.* How does student learning presence manifest when we compare more public and interactive forms of online learner self and co-regulation as documented in student discussions versus more private venues such as individual learning journals? What does student LP look like when we compare student discussions and learning journals? How are the three categories of learning presence and their constructs distributed across these different learning activities?

In comparing the distribution of the three LP categories in figure 2, forethought and planning, performance, and reflection, in the two sets of learning activities in Module 6, the monitoring construct was most frequently reported in both discussions (58.4%) and learning journals (51.6%). From here patterns diverged. The six discussions accounted for 32.1% of strategy use, with no evidence of forethought and planning, and low levels of reflection (9.5%). In contrast, student learning journals demonstrated more evidence of reflection (22.6%) which occurred more frequently than strategy use (19.4%) and forethought and planning (6.5%). This provides evidence that the categories reflect the intended constructs; one would expect to see more reflection in activities such as learning journals in which students are asked to think about their learning.

Figure 2. Comparison of LP in all module 6 learning activities

\*The performance LP category is comprised of monitoring and strategy use.

Wilcoxon Signed Ranks Test was used to examine if an overall difference in occurrences of learning presence in discussion posts and learning journal entries exists. The results indicated that 14 participants had higher learning presence occurrences in the discussion posts and 4 participants had higher occurrences of learning presence in the learning journals. The median occurrence of learning presence in discussion (Mdn=7.50) was significantly higher than was evident in learning journals (Mdn=1.50), z = -3.51, *p<*.001.

*Research Question 4.*

What network positions do students, with high levels of combined learning presence in discussions and journals, occupy relative to their peers?

The network graphs in Figures 3 and 4 use scaling to change the node size to correspond to the relative percentages of each student’s combined LP occurrences based on all six module 6 discussions and their learning journals. With but one exception, all of the students who were ranked with highest LP were near the center of the network, indicating they had the greatest interaction with their peers. All of the students with the lowest LP were found at the periphery of the network.

To further illustrate the effect of learning presence on online activity, a medium split was used to identify students with high and low levels of combined learning presence from both discussions and journals using data from Table 4. The newly created variable served as grouping to examine differences in centrality, prestige, and influence.

With students’ ranks as a dependent measure, learning presence levels (high vs. low) had an effect on the overall centrality of student positions on the network, [Mann–Whitney U = 6.50, n1 = 8, n2 = 10, p =.003 two-tailed]. See Figure 3.

Figure 3. Network graph: Module 6 discussions node size by combined discussion and journal LP and rankings for high vs. low centrality



With students’ ranks in terms of influence as a dependent measure, the results indicated that students with high learning presence rank higher on influence [Mann–Whitney U = 10.50, n1 = 8, n2 = 10, p =.008 two-tailed]. See Figure 4. The same pattern of network positions found in Figure 3 are repeated in Figure 4.

The results from independent samples test with prestige ranks as a criterion showed no differences in students’ ranks of prestige depending upon high and low levels of LP [Mann–Whitney U = 19.50, n1 = 10, n2 = 8, *p* =.068 two-tailed].

Figure 4. Network graph: Module 6 discussions node size by combined discussion and journal LP and rankings for high vs. low Influence (in-degree centrality)



*Research Question 5.*

How do prestige and influence correlate with combined learning presence (in discussions and learning journals) and in each of the activities when considered separately?

Prestige and influence as they relate to combined learning presence

When we examined combined LP found in discussions and learning journals, results from correlation analysis indicated that, as a whole, this measure is has a positive and moderate correlation with prestige [Spearman rho (18)=.451, *p=*.06] and a positive and large correlation with influence [Spearman rho (18)=.737, p<.001].

Prestige and influence as they relate to discussion LP

*Prestige.* The relationship between LP in discussion posts and prestige was moderate, Spearman rho (18)=.569, p=.014. Even though the results from direct group comparisons were not statistically significant, the students with prominent positions on the variable prestige tended to have also higher ranks on LP in discussion, Mann–Whitney *U* = 7.00, n1 = 3, n2 = 15, *p* =.065 two-tailed. .

*Influence.* The relationship between influence and LP in discussion posts was large and statistically significant, Spearman rho (18)=.781, *p*<001. Furthermore, when grouped based on influence, students with higher positions tend to have also higher ranks on the variable LP in discussion, Mann–Whitney *U* = 3.00, n1 = 4, n2 = 14, *p* =.008 two-tailed.

*Prestige.*

Non-significant correlations between journal LP and prestige (Spearman rho (18)=-.211, p=.40), and journal LP and influence (Spearman rho (18)=.081, p=.75), confirmed that journal LP and prestige and influence are unrelated. Moreover, results from Mann-Whitney, showed that high and low prestige within the network cannot be reliably linked to levels of journal LP, Mann–Whitney *U* = 15.00, n1 = 3, n2 = 15, *p* =.363 two-tailed. Also, journal LP did not differ between students with high and low influence in the network, Mann–Whitney *U* = 20.00, n1 = 4, n2 = 14, *p* =.385, two-tailed. Again, this suggest that certain students, perhaps those who are less active in public forums do, nonetheless, exhibit elements of learning presence in more private forums, and that asking them to facilitate a module may result in higher expressions of learning presence. (See Tables 2 and 3.)

**6. Scholarly significance of the study**

As noted by previous researchers (e.g. de Laat, Lally, Lipponen & Simons 2007) the combination of quantitative content analysis (QCA) and social network analysis (SNA) may allow for a compatible research approach illuminating some of the qualities of both form and content of interactions in online learning environments. Through the combination of these kinds of analysis we are able to uncover important patterns bearing on the effects of approaches to new online pedagogy generated from emerging theory. We have also extended the use of SNA in analyzing a new construct within the CoI framework.

Enhancing learner self regulation has proven to have advantageous outcomes in much research in classrooms (e.g. Zimmerman, 2000) and in emergent research in online environments (e.g. Means et al, 2009). In past research it has been suggested that providing students with more complex collaborative tasks results in higher levels of self and co-regulatory performance (Shea, et al, 2011). This study sought to extend previous findings by implementing learner centered forms of instruction in which we analyzed levels of learning presence of student facilitators and non-facilitators in online discussions and journals through QCA and SNA.

Specifically, in this paper we analyzed teaching presence as well as a new element in the Community of Inquiry Framework reflecting online learner co- and self regulatory processes – *learning presence* We examined the impact of providing a scaffolded shift in instructional roles in which learners were supported to take on more of the responsibility for design and facilitation of discourse (elements of teaching presence) and resulting variation in associated indicators of self- and co-regulatory performance (learning presence) reflected through quantitative content analysis of different learning activities. Through research questions 1, 2 and 4 we discovered that lead student facilitators exhibit higher levels of learning presence *and* occupy more advantageous location reflected in social network analytics.

Through results reflected in research question 3 we disclosed significant and illuminating patterns in categories of learning presence in different learning activities. Perhaps not surprisingly forethought and planning are not very evident in either online discussions or learning journals where strategy use and reflection are more common. That learners are exhibiting forms of strategy use more during performance (online discussion) and greater monitoring and reflection in learning post performance journal activities validates the intended categories within the learning presence construct. We would expect to see these patterns, i.e. more reflection and monitoring in journals and greater strategy use during performance and we find them.

Research question five is significant in that results suggest that students with high discussion LP also have high in-degree centrality indicating that other students sense that they are valuable partners for interaction and knowledge building meant to result from it. Also of note is the finding that learning presence dimensions that are evident in certain activities (learning journals) are not automatically associated with metrics important in social network analysis and that insights found in reflection after online discussion does not necessarily help students with more interactive forms of learning. These results also suggest that higher levels of learning presence in online discussions are reflected in important metrics associated with social network analytics.

Overall these finding are significant in that they support and extend previous research seeking to enhance one of the dominant theories that describes, explains, and predicts learning in online environments, the Community of Inquiry framework. Results here represent important support for the validity of learning presence as a complimentary construct to the CoI framework. Findings indicating that learning presence can be fostered through shared instructional roles and that this form of self- and co-regulatory performance is associated with advantageous location in social networks suggest that the construct is useful. We conclude that the long standing belief that online learners require greater self direction, time management and the like is supported and better explained through the more inclusive theoretical construct of self-regulated learning and the related construct of online learning presence. We further conclude that the online environment creates demands for new forms of self regulation that are under articulated in the current CoI model. We believe that the model can be enhanced through additional research into the specific roles of learners qua learners in collaborative online education.

This paper contributes to the literatures on both constructivist online learning and social network analysis by adding analysis of a theoretical construct, learning presence, to SNA. A weakness of social network analysis in educational research has been its lack of relevant a theoretical framing for metrics of centrality. We don’t know, for example, based on the numbers of ties between actors in online learning contexts, whether such connections reflect the quality of the discourse or other processes important to learning. We assume that through interaction learners increase their opportunity to activate processes known to support knowledge construction. For example Chi (2009) explains that interaction involves co-construction of knowledge and enhances understanding by allowing learners to do things like build upon each other’s contributions, defend and argue positions, challenge and criticize each other on the same concepts or points, and ask and answer each other’s questions. Chi argues that such interaction is constructive in nature because learners are generating knowledge that goes beyond the information that would typically be provided in learning materials. The cognitive benefits of such interaction include that a partner’s contributions can provide additional information, new perspectives, corrective feedback, reminders, or a new line of reasoning which can enhance learning through added guidance, hints, and or scaffolds that either enrich knowledge or support additional inferencing.

Through the analysis of learning presence within social network analysis we sought to understand whether learners who evince higher levels of online self regulated learning (learning presence) in their discourse also occupy more central locations within the interaction networks reflected through social network analysis. In other words, do indicators of learning presence correlate with indicators of prestige and influence measured through social network analysis meant to indicate richer interactive opportunities of the type that support knowledge creation? Is SNA a promising research method for examining theoretically grounded explanations of online learning? Results reported here suggest that SNA does reflect constructs that are grounded in theories of how people learn as adapted for online environments. Specifically these results indicate that students with higher levels of learner presence occupy more advantageous positions indicating that they are more active and more sought after in networks of interaction. This represents a promising conclusion and additional research into the relationship between learning presence and interaction is warranted.

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Appendix A. Learning Presence Coding Scheme [need to add this]

|  |
| --- |
| **Revised Coding Scheme for Learning Presence (LP)** |
| **5/29/11** |  |  |  |
|  |  |  |  |  |  |  |
| **Cate-gories** | **Code** | **Indicator** | **Description** | **Example** | **Comments** | **Source** |
| **Forethought/Planning** | **FP1** | **Goal setting**  | Deciding upon specific actions and outcomes | At the end of next week, as a team, we have to submit a summary of our discussion points. |  | Zimmerman (2000) |
|   |  |   | Our goal is to submit a two page position paper defending the position against outsourcing. |   |   |
| **FP2** | **Planning** | Deciding on methods/strategies appropriate for the task | Why don't we list (all of us) what we perceive to be the cons of outsourcing. | Methods and strategies are used to meet goals | Zimmerman (2000) |
|   |  |   |  I was thinking we should decide what arguments we want to use in this paper. |   |   |
| **FP3** | **Coordinating, delegating or assigning tasks to self and others** | Distributing, sequencing tasks and sub-tasks to others/self for future completion | Are you picking this [task] up next? | Methods and strategies are accomplished through tasks | Emergent |
|   |  |   | I will take care of the intro and the summary. I have to work all night tonight. I will submit it for the group tomorrow evening sometime |   |   |
| **Performance**  | **M1** | **Checking for understanding** | Seeking verification of understanding of tasks, events or process | …Are we sure that everything has been cited correctly? |   | Zimmerman (1989) |
|   |  |   | I submitted my proposal a couple of different ways but don't know if it is viewable to the class. I don't see anybody else's either. Is there something I am missing?  |   |   |
|   |  |   | If we paraphrase…I am pretty sure the in-text citations is not required. You can check: https://esc.angellearning.com/section/resources/default.asp |   |   |
| **M2** | **Identifying problems or issues** | Identifying difficulties related to materials, technologies, understanding (e.g. confusion) etc. that interfere with completion of tasks, performance, products or other outcomes. | I believe the assignment is 500 words or less so we may need to skimp down a bit. |   | Emergent |
|   |  |   | ...then I realize that it has scrambled my idea of what I thought I knew. |   |   |
| **M3** | **Noting completion of tasks** | Comments that indicate that certain tasks or activities have been finished to support attaining a goal. | I did some research and then typed up the employer section. | Look for statements expressed as past tense. These are easy to overlook. | Emergent |
| **M4** | **Evaluating quality**  | Evaluating the quality of a product, its content or its constituent parts as students work toward completion |   | Must be substantive and provide some evidence or explanation "why." "Great job" or "nice work" are insufficient. Formative or summative evaluation | Azevedo et al. (2004) |
| **M5** | **Observing or monitoring during performance and taking corrective action** | Statements that monitor individual or group performance that result in corrective action based on feedback or reflection | I think we need a solid intro and conclusion. As the paper stands now, we have none.  | What I am hearing is that I need to think more abstractly about structuralism.  | Zimmerman (2000)  |
| **M6** | **Appraising personal interest, engagement or reaction.** | Comments about self or others' engagement, interest, comittment or participation. Also includes personal "reactions" to tasks, materials and activities. |  As I travel extensively for my job, by interaction is a bit sporadic | In this statement, student is monitoring their level of participation | Azevedo et al. (2004) |
|  |  |   | I found that information [in the chapter] all new and a little scary. | Statement must be related to the completion of the task, not the content of the discussion. |   |
| **M7** | **Recognizing learning behaviors of self or group (i.e., metacognitive knowledge)** | Statements about individual or group's preferences, strengths or weaknesses as learners. | I am more of a hands on learner.  | Statement must be related to the completion of the task or process. Avoid coding content of the discussion. | Emergent |
|   |   | I am one….who likes to explore new programs and put totether an object without reading directions. |   |   |
| **M8**  | **Advocating effort or focus** | Encouraging others to contribute or focus on tasks, materials and activities. | Has everyone contributed their pieces? |   | Curtis & Lawson (2001) & Zimmerman (2000) |
|   |  |   | I'd encourage my classmates not be intimidated by the boring title of "ethics." |   |   |
| **M9** | **Noting use of strategies** | Statements that illustrate that students are mindful and aware of the strategies that they are using | I was almost hyperventilating, so I decided to stop and think what I would do next in order to make my endeavor to read more productive. |   |   |
|  |  |   | I decided to extract concepts from the graphic organizer on page 26 and Google each word to try and make sense how the concepts tie together.  |   |   |
| **S1** | **Seeking, offering or providing help**  | Requesting, offering, or providing assistance related to learning materials, tasks, processes or products. | If you need any assistance, please let me know what I can do to help you out. | M1 should only be applied after all other more specific codes have been ruled out. | Curtis & Lawson (2001) |
| **S2** | **Recognizing a gap in knowledge** | Statements indicating that students are aware of a gap in knowledge and its connection to the current task, process or product. |   |  |   |
|  |  |   |   |  |  |
| **S3** | **Reviewing** | Comments noting the need to review or the completion of reviewing content related to the course. | I would need to refer to this chapter in otder to review the principles of this philosophy |   |   |
| **S4** | **Noting outcome expectations** | Statements in which students acknowledge the relevance of current tasks or processes to a future outcome | At present, all I know is that grasping the epistemology of inquiry will help me read research in a more informed and holistic way.  |   |   |
|  |  |   | As I grow in the doctoral program I fully expect to read…with more foresight |   | Zimmerman (2000) |
| **S5** | **Seeking / offering additional information**  | Looking beyond course content and materials to locate additional information to deepen understanding | The answer to my question was provided by The “Research Methods Knowledge Base .Trochim (2005). |   |   |
|  |  |   | I went to AERA's web site and it looks like the Foreword has been updated since the book was published. |   |   |
| **Reflection** | **R1** | **Change in thinking** | Statements that indicate a change in thinking as a result of process, product or outcome | I can now understand some of their points and I feel the biggest misconception I had was that outsourcing does not necessarily entail taking jobs out of the country |   | Emergent |
|   |  |   | This issue is not as simplistic as I once thought… |   |   |
|   |  |   | It was a huge eye-opener for me when I viewed interactions through this new lens. |   |   |
| **R2** | **Causal attribution of results to personal or group performance** | Statements in which students credit their results to their performance (i.e., use of forethought/planning, monitoring, strategies) | I think this was because I was now able to make associations with time periods. |   | Zimmerman 2000 |
|   |  |   |   |   |   |

Appendix B. Inter-rater Reliability

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| --- |
| *Table 1.* Inter-rater Reliability for Journals |
|  | Journal M2 | Journal M3 | Journal M5 | Journal M6 | Journal M8 |
|  | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| CR | 0.8367 | 1.0000 | 0.7544 | 1.0000 | 0.6829 | 1.0000 | 0.6923 | 1.0000 | 0.7500 | 1.0000 |

|  |
| --- |
| *Table 2.* Inter-rater Reliability for Module 6 Discussions |
|  | Discussion 1 | Discussion 2 | Discussion 3 |
|  | Pre | Post | Pre | Post | Pre | Post |
| Week 1 | 0.8219 | 1.0000 | 0.7576 | 0. 9706 | 0.7119 | 1.0000 |
| Week 2 | 0.7179 | 1.0000 | 0.8052 | 1.0000 | 0.8571 | 0.9778 |

Appendix B. LP Counts for Journals and Discussions

|  |
| --- |
| *Table 3*. LP Counts – Journals |
|  | Journal 2 | Journal 3 | Journal 5 | Journal 6 | Journal 7 | Total  |
| FP | 1(3.13%) | 4(8.16%) | 2(6.45%) | 0(0.00%) | 1(4.00%) | 8(4.85%) |
| M | 17(53.13%) | 24(48.98%) | 16(51.61%) | 15(53.57%) | 13(52.00%) | 85(51.52%) |
| S | 11(34.38%) | 11(22.45%) | 6(19.35%) | 8(28.57%) | 4(16.00%) | 40(24.24%) |
| R | 3(9.38%) | 10(20.41%) | 7(22.58%) | 5(17.86%) | 7(28.00%) | 32(19.39%) |
| Total | 32 | 49 | 31 | 28 | 25 | 165 |

|  |
| --- |
| *Table 4*. LP Counts –Module 6 Week 1 Discussions  |
|  | Discussion 1 | Discussion 2 | Discussion 3 | Total |
| FP | 0(0.00%) | 0(0.00%) | 0(0.00%) | 0(0.00%) |
| M | 22(75.86%) | 14(70.00%) | 12(70.59%) | 48(72.73%) |
| S | 3(10.34%) | 3(15.00%) | 3(17.65%) | 9(13.64 %) |
| R | 4(13.79%) | 3(15.00%) | 2(11.76%) | 9(13.64%) |
| Total | 29 | 20 | 17 | 66 |

|  |
| --- |
| *Table 5*. LP Counts –Module 6 Week 2 Discussions  |
|  | Discussion 1 | Discussion 2 | Discussion 3 | Total |
| FP | 0(0.00%) | 0(0.00%) | 1(4.76%) | 1(1.39%) |
| M | 9(56.25%) | 17(48.75 %) | 6(28.57%) | 32(44.44%) |
| S | 7(43.75 %) | 15(42.86%) | 13(61.90%) | 35(48.61 %) |
| R | 0(0.00%) | 3(8.75%) | 1(4.76%) | 4(5.56%) |
| Total | 16 | 35 | 21 | 72 |

|  |
| --- |
| *Table 6*. LP Counts –Module 6 Discussion Total |
|  | Week 1 | Week 2 | Total # | Total % |
| FP | 0 | 1 | 1 | 0.72% |
| M | 47 | 32 | 80 | 57.97% |
| S | 9 | 35 | 44 | 31.88% |
| R | 9 | 4 | 13 | 9.42% |
| Total | 66 | 72 | 138 |  |