Evaluation of Student Collaboration in a Capstone Agriculture Course through Social Network Analysis

Guang Han; Thomas H. Paulsen, Ph.D.; OP McCubbins; Lawrence Caudle
Department of Agricultural Education and Studies - Iowa State University

Overview

Student collaboration encourages students to articulate their thoughts and promotes learning outcomes (Lazonder, 2005). Instructors in CALS should integrate student collaboration into undergraduate curriculum's design to create an effective learning environment (Strong, Irby, and Wynn, 2012).

The AG450 Farm is an undergraduate capstone farm management course with the key components in teamwork, problem solving, and decision making. Student collaboration is the foundation to achieve the course components.

All decisions regarding the operation of the farm were made by the student committees. Eight committees were formed: (1) marketing, (2) custom operations, (3)machinery, (4) finance, (5) buildings and grounds, (6) crops, (7) public relations, and (8) swine. Students were divided into two sections for labs: Section 1 and Section 2.

The purpose of this study was to evaluate the collaboration between and among students in the AG450 Farm course and determine the changes after implementing specific assignments and activities tailored to improve collaboration.

Theory and Methods

Social Network Analysis (SNA) is a methodology that provides complementary visual and statistical components for analyzing the traits of individuals and their relationships (Scott, 1988).

Step 1: Identifying the network

Nodes: 50 senior students were enrolled in the Ag450 Farm course during spring 2014.

Ties: The collaboration relationship between/among students can be either one-way or both ways.

Step 2: Collecting social interaction data

Each student was surveyed to indicate the name(s) of other student(s) with whom they had collaboratively worked/consulted, for projects, study, assignments, and problems related to the capstone course. Demographic information was also collected. The survey was given two times: at the midpoint and the end of the semester respectively.

Step 3: Data analysis

UCINET, a software package, is a network visualization tool. UCINET was used to analyze the matrix data from step 2, and a network map and centrality measures tables were developed (Springer & de Steiguer, 2011).

Step 4: Interpretation of outcomes (Scott & Carrington, 2011)

Top-Down

Size: the number of nodes
Density: the proportion of all possible ties, k*(k-1), are actually presented
Distance (Geodesic distance): the number of relations in the shortest possible pathway from one actor to another
N-Cliques: N members of a subgroup tie with each other.

Bottom-Up

Centrality: Nodes who are more "central" to social structures are more likely to be influential or powerful.
Degree centrality (influence and power): Number of connections per node categorized as in-degree or out-degree.
Closeness centrality (neighbor influence): The number of direct ties, measure the geodesic distance.
Betweenness centrality (broker): The extent which the node falls on the geodesic paths between other pairs of actors in the network.

Results

Midpoint of the semester

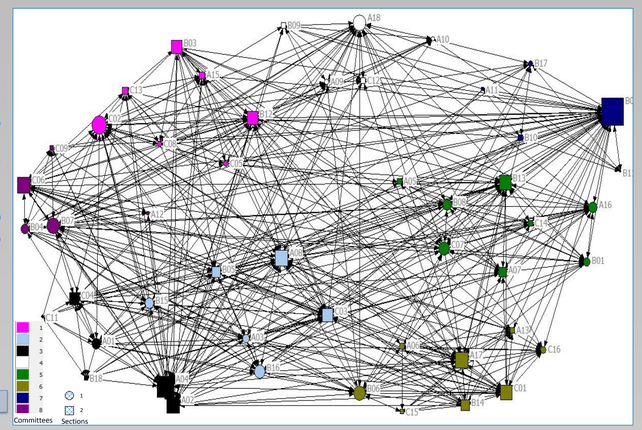

Figure1-AG450 Students' Collaboration Network Map at the midpoint, layout by committees, sized by degree centrality

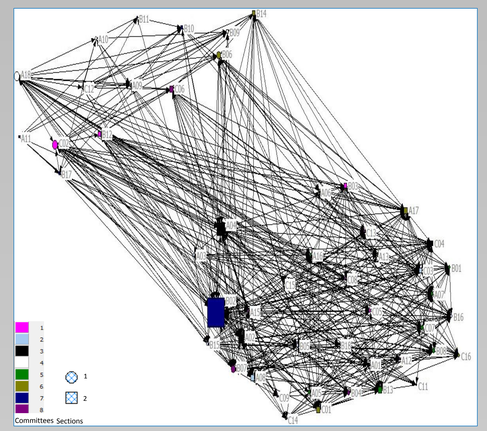

Figure2-AG450 Students' Collaboration Network Map at the midpoint, layout by gender, sized by betweenness centrality

Item	Number
Size	50
Avg. Degree	12.3
Density	.25
Avg. Distance	1.88

Table 1- Cohesion of the midpoint network

Cliques	Number
3-Cliques	23 (31.1%)
4-Cliques	34 (45.9%)
5-Cliques	14 (18.9%)
6-Cliques	3 (4.1%)
7 or more-Cliques	0 (0%)
Total	74

Table 2- Subgroups of the midpoint network

Assignments and activities tailored to improve collaboration

- *Business meetings*
- *State of the Farm Report/Presentation*
- *Strategic Issue Report/Presentation*
- *Final State of the Farm Report/Presentation*
- *4-Hour Experiential Learning Experience*

End of the semester

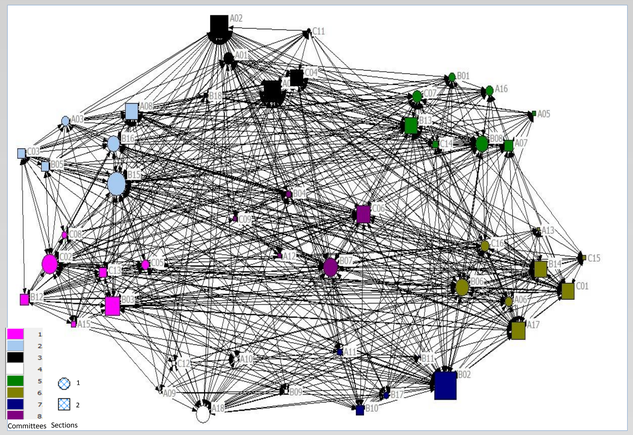

Figure 3-AG450 Students' Collaboration Network Map at the end, layout by committees, sized by degree centrality

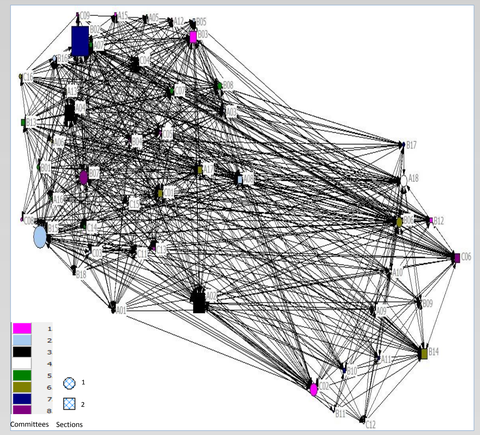

Figure 4-AG450 Students' Collaboration Network Map at the end, layout by gender, sized by betweenness centrality

Item	Number
Size	50
Avg. Degree	17.2
Density	.35
Avg. Distance	1.66

Table 3- Cohesion of the end network

Cliques	Number
3-Cliques	11(7.5%)
4-Cliques	49 (33.6%)
5-Cliques	51 (34.9%)
6-Cliques	25 (17.1%)
7 or more-Cliques	10 (6.8%)
Total	146

Table 4- Subgroups of the end network

Findings

- The average degree centrality of each student increased from 12.3 to 17.2 (Table 1 & Table 3; Figure 1 & Figure 3).
- The density of the network increased from .25 to .35 (Table 1 & Table 3; Figure 1 & Figure 3).
- The average distance between two students decreased from 1.88 to 1.66 (Table 1 & Table 3).
- 5 additional students became potential brokers in the network (Figure 4) in addition to the only initial broker (Figure 2).
- More large and middle size subgroups were formed in the network, while small size subgroups decreased (Table2 & 4).

Conclusions and Recommendations

After implementing the assignments and activities, student collaboration was improved in several aspects:

- Each student's influence to the whole network was reinforced.
- More connections of collaboration developed, the magnitude of collaboration became larger, and an inclusive collaboration environment was formed.
- The network of collaboration became more efficient.
- The risk of collapse was reduced.

For future study, this evaluation will be applied to identify optimized teaching strategies for student collaboration in future Ag 450 Farm courses. A comparison will be made between a traditional teaching cohort and a Team-Based Learning teaching cohort.

References

- Lazonder, A. W. (2005). Do two heads search better than one? Effects of student collaboration on web search behaviour and search outcomes. British Journal of Educational Technology, 36(3), 465-475.
- Scott, J., & Carrington, P. J. (Eds.). (2011). *The SAGE handbook of social network analysis*. SAGE publications.
- Scott, J. (1988). Social network analysis. *Sociology, 22*(1), 109-109.
- Strong, R., Irby, T. L., Wynn, J. T., & McClure, M. M. (2012). Investigating Students' Satisfaction with eLearning Courses: The Effect of Learning Environment and Social Presence. *Journal of Agricultural Education*, *53*(3), 98-110.
- Springer, A. C., & de Steiguer, J. E. (2011). Social network analysis: A tool to improve understanding of collaborative management groups. *Journal of Extension*, *49*(6). Retrieved from http://www.joe.org/joe/2011december/rb7.php