Journal of Human Sciences and Extension

Volume 9 | Number 1 Article 3

3-1-2021

Analysis of Networks in a College of Agriculture Course

Brittany Dees-Leek
Drew Central High School, brittany.leek@drewcentral.org

Don W. Edgar
New Mexico State University, dedgar@nmsu.edu

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Drew Central High School

Don W. Edgar
New Mexico State University

Technology advances occur almost daily, and how information is shared constantly evolves. Educators must understand how their students prefer communicating related to coursework. By mapping social networks present in courses, it may allow educators to determine how students prefer to communicate and also determine if there are constant identities that are stable throughout the semester. For the participants in this study, contacts between students increased from the initial to the final assessment of the semester. Face-to-face communication was the preferred method of communication, followed by text messaging and Facebook. Communicating for social reasons was most cited, with planning and venting being the reasons cited for contact after social. Overall, venting increased substantially, as did planning throughout the course of the semester but social kept somewhat constant. No perpetual key players were identified through this study, except one from the middle to the end iteration, which differs from previous research.

Keywords: social network, communication, technology, key player

Introduction/Conceptual Framework

Numerous advances occur almost daily toward technology (Jones et al., 2011). One significant advancement was the creation of the internet. With the development of the internet, today's students have been given a plethora of resources to gain knowledge and share knowledge with peers (Chen et al., 2015; The Levin Institute, 2013). The first recognizable social network site was launched in 1997 and was titled SixDegrees.com (Boyd & Ellison, 2007). Online social networks have become a popular way for users to connect and share information, and popular social networks have hundreds of millions of users continually growing (Viswanath et al., 2009). Furthermore, social networking sites have grown to such a great phenomenon that sites such as Facebook had 1.59 billion active users monthly (Facebook Newsroom Fact Sheet, 2019).

Continual advances in technology have changed the way people share information (Gray et al., 2010; Leidner & Jarvenpaa, 1995). It is important for educators to know how their students are communicating about coursework. If misinformation is provided for students through other students, expected understanding and learning may not occur. Coinciding with advances in

Direct correspondence to Don W. Edgar at dedgar@nmsu.edu

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technology, learners, and how they learn vary. Today's learners gain information through an active process where they build understanding and make sense of information (Woolfolk, 2010). Some learners use a cognitive approach, while others use interactions with peers to impact their knowledge construction. Students who interact socially may process and use information more efficiently than those who use only the cognitive approach (Fosnot, 1996). With the importance of social interaction, especially where students make connections with peers, behaviors may change, and how learning occurs can be affected (Bandura, 1969; Prawat et al., 1994).

Social networks are formed when individuals share a connection about a common topic through some type of communication. To explore communication among members of a network, we must ask questions that elicit social network data and address the overall question: "Who talks to whom about what?" We know communities are not built on instrumental relations alone; therefore, to tap into both learning and community relations, it is important to ask questions that explore both task-oriented and socially-oriented relations. Social network questions are phrased to gather data on each person's interactions with each other in the group (for whole network data) or each person's interactions with others that they name (ego-centric network data) (Renninger & Shumar, 2002).

Social network analysis is tracing, mapping, and analyzing social, economic, and political relationships between people and between organizations (Gomm, 2009). It is one popular analysis method used within the social sciences for exploring human and social dynamics. From the mid-1930s, social network analysis progressed slowly and linearly until the end of the century when advancements such as sociometry, graph theory, and subgroups appeared and were quickly adopted by the relatively small number of "network analysts" (Carrington et al., 2005). "Social network analysis provides a precise way to define important social concepts, a theoretical alternative to the assumptions of independent social actors, and a framework for testing theories about structured social relationships" (Wasserman & Faust, 1994, p.17).

Therefore, with the increasing use of technology in today's society and education, understanding how students interact with it and socially interact is paramount towards impactful education of students. By exploring social systems present in today's classrooms, further understanding of how best educators can utilize and gain understanding is imperative. The purpose of this study was to explore social interaction among University of Arkansas students. The following research questions guided this study:

1. How do students in classrooms communicate (personally and course-related)?
2. How proficient are students at using technology, and how does this relate to course content access?
3. Are key players initially identified, and are they constant throughout the course during the semester?

Journal of Human Sciences and Extension Volume 9, Number 1, 2021

Methodology

This study was an exploratory, descriptive design using survey methodology. An exploratory design was chosen because it focused on a relatively unstudied subject in the context of agriculture. In survey research, investigators ask questions about peoples' beliefs, opinions, characteristics, and behavior (Ary et al., 2006). The target population consisted of all students (male and female) at the University of Arkansas enrolled in a university core elective course. The purposive sample included the number of students who were present, participated, and completed instruments of the total class enrollment for each iteration (three times throughout the semester).

The sample consisted of students enrolled in the fall semester at the University of Arkansas enrolled in HESC 1403 Lifespan Development. This course was selected to represent the sample population based on the variety of students enrolled and degree programs sought. Nonresponse error was calculated based on the number of students enrolled in the course ($N = 245$) and the number of students that were present, participated, and completed instruments. The first iteration resulted in 214 responses, followed by 163 at the middle, and 177 in the final iteration. Response rates for each iteration were calculated at 87.35%, 66.53%, and 72.25%, respectively. Although the response rate for the middle iteration was lower than 70%, the descriptive nature of the research does not allow for generalizations to be made and only represents the respondents.

A researcher-developed instrument was used to assess interaction between students. The instrument was developed through a review of literature and previous research assessments (Edgar et al., 2009; Roberts et al., 2010). The six-question instrument was constructed as a matrix survey. Initially, students were asked to list up to six names of the students with whom they interacted in the enrolled course. The instrument was reviewed by an expert panel of social science researchers where face and content validity were deemed appropriate for the population. Post-hoc reliability resulted in a Cronbach's alpha = .84. Because the instrument queried respondents' past behavior, it was deemed respondents could reliably and accurately provide needed responses (Dillman, 2000). Respondent answers (names) were used to answer the following questions. The first two questions were designed to solicit the frequency with which each student interacted with each of their peers: (a) On *average*, how often did <u>you contact</u> this student? and (b) On *average*, how often did this student <u>contact you</u>? Respondents were instructed to respond using an eight-point rating scale from 0 = *never* to 7 = *several times a day*. The third question instructed respondents to indicate all methods used for communicating with each peer where a list of methods was available (email, text messages, instant messages, Facebook® or MySpace, phone, face-to-face). The fourth question sought to determine the reasons each respondent communicated with each of their peers. Respondents were given the opportunity to list the purposes for communication by identifying them as venting/reflection about class, planning/information related to class, or social/personal reasons unrelated to class. Respondents could choose none, one, or multiple reasons. Options were deemed sufficient to cover the breadth of potential interactions and supported by the panel review of the instrument

(Roberts et al., 2010). Respondents were also asked to rate their technology proficiency level using a self-reported, scaled assessment (0 = *no skills* to 5 = *very skillful*) to determine if those reporting higher or lower levels of ability might impact the findings of this study.

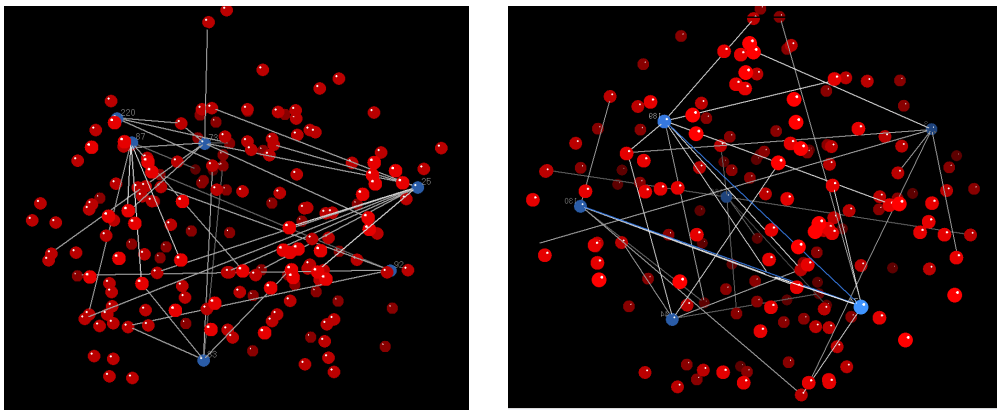
Social networks were examined using network analysis software, *KeyPlayer* (Borgatti, 2012). In network analysis, *nodes* are points on a network, and *edges* are connections. *KeyPlayer* is a software program for identifying an optimal set of nodes in a network for one of two basic purposes: *Remove* and *Observe* (Borgatti, 2012). In this social network analysis, nodes are people, and edges are interactions that occurred between them. The *Remove* function allows researchers to remove persons from the analysis but was not utilized in this analysis. *Observe* has only one option titled *Reach* that is programmed to find the fewest number of nodes reaching the greatest number of others (nodes). For the overall network, the *Reach* was increased to six to allow for the interactions to find the key players (most connected inside a network) that might exist between essentially six networks with different purposes.

Findings

How do students in classrooms communicate?

Research question one examined how students communicate with each other. The initial analysis found that of the possible respondents ($N = 245$), only 114 respondents contacted someone in the beginning, and 103 contacts were made (Figure 1). It should be noted that respondents did not have to list a contact, and it is assumed that many students did not know others enrolled in this course. This initial contact showed, of the 114 who contacted someone, 103 students reciprocated, and some contacts were duplicated. At mid-semester, an increase in those who contacted someone rose to 127, and 122 were reciprocated. The final iteration showed 133 students contacted someone, and 131 were reciprocal. Those contacted in each iteration were the initial contact of each student, and those increased in amount of contact over the course/semester.

Figure 1. SNA of Key Players Identified Through Contact(s) at Beginning and End of Semester



Note. Blue dots indicate key players, and red dots indicate others in the network.

To determine the amount of contact by students in the course, contacts were analyzed. The total contacts for each evaluation were 312 (initial), 392 (mid-semester), and 373 (final), indicating contacts increased from the beginning to mid-semester and then lessened by the end of the semester (see Table 1).

Table 1. Contact Among Students per Week (N = 245)

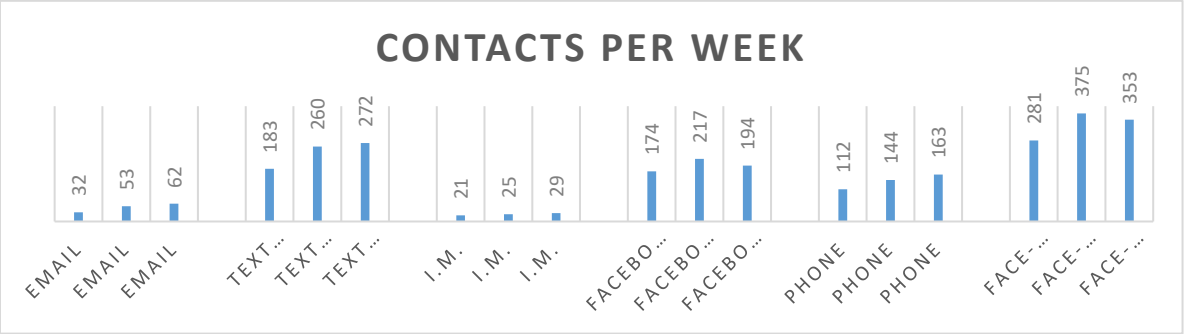
	f	*M*	*SD*
Initial (*n = 214)*			
Contact 1	114	3.59	2.22
Contact 2	72	3.22	2.18
Contact 3	48	2.92	2.14
Contact 4	37	3.54	1.92
Contact 5	25	3.20	2.56
Contact 6	16	3.69	2.27
Total	312		
Mid-Semester (*n = 163)*			
Contact 1	127	4.11	2.11
Contact 2	93	3.25	1.82
Contact 3	65	2.75	1.54
Contact 4	47	2.77	1.62
Contact 5	34	2.32	1.22
Contact 6	26	2.38	1.33
Total	392		
Final (*n = 177)*			
Contact 1	133	4.05	2.04
Contact 2	93	3.17	1.94
Contact 3	55	2.87	1.80
Contact 4	43	2.84	1.80
Contact 5	27	3.15	1.88
Contact 6	22	2.86	2.01
Total	373		

Note. Contacts are for only those that had contact with another respondent in the course.

How proficient are students at using technology?

Research question two explored students' level of proficiency with technology and how this might affect accessing course materials. To determine how students communicate to each other about course work (Figure 2), determining how they communicate was explored. Students (N = 245) were asked to identify what outlet they utilized to contact other students. Each respondent could choose any of the presented methods of contact. Summated responses were used to describe contacts weekly. Additionally, respondents were allowed to state the amount of contacts per method for each individual, which could be none or more than one time. Face-to-face was the most preferred way to contact others (n = 281), with text messaging being second (n = 183). Facebook was third (n = 174), with instant messaging being almost nonexistent at 21 contacts.

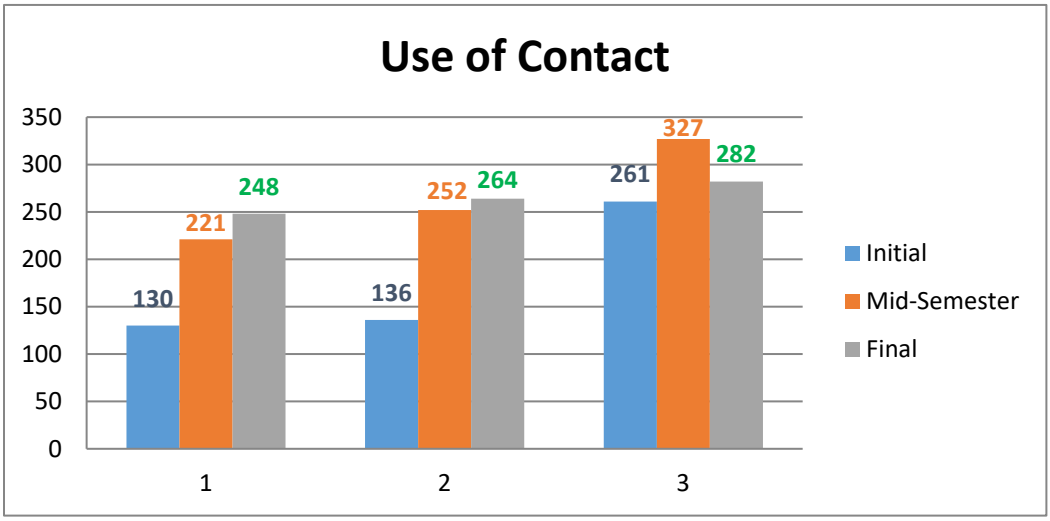
Figure 2. Frequencies of Contacts Weekly



Note. Results represent each iteration of data gathered for this study based on method identified.

Researchers further investigated the purpose of communication between students. Students were given three options for discussion choice; venting/reflecting about course, planning/information related to course, and social/personal reasons unrelated to course. Figure 3 displays whether social was the preferred reason (n = 261), planning (n =136), and/or venting (n =130). Social was the most prominent reason for contact, followed by planning and venting. Overall, venting increased substantially (f = 130 to 248) as did planning (f = 136 to 264). Social uses for contacts remained somewhat constant (f = 261 and 282) as the preferred reason for classmate contact.

Figure 3. Frequency of Respondents Using Networks for Venting, Planning, and Social Functions



Additionally, student proficiency with technology was analyzed to investigate how proficient students are at using technology and how this might impact how and why they communicate about a course. Respondents extolled a technology skill level of 3.63 (Table 2). The scale used for this question on the instrument reflects that respondents self-reported a technology proficiency level between average and above average skill. Respondents reported similar levels of proficiency from the beginning to the end of the semester.

Table 2. Self-reported Proficiency Level of Technology Use (n = 208)

	M	*SD*
Initial	3.63	0.84
Mid-Semester	3.57	0.82
Final	3.61	0.73

Note. Scale = 0 – No skills, 1 – Little skills, 2 – Below average skills, 3 – Average skills, 4 – Above average skills, and 5 – Very skillful.

Additionally, researchers investigated if students would use technology to access course materials or additional course materials if available. Of the respondents (N = 245), 208 answered they would indeed use technology to access materials needed or additional materials offered for a course. During data analysis, "yes" was coded as 1, while "no" was coded as 2 (see Table 3). The initial observation reported a mean of 1.00 (SD = 0.07). The mid-semester and final observations both reported a mean of 1.00 (mid-semester SD = 0.82) (final SD = 0.12). Respondents consistently self-reported that they would use technology to access materials needed or additional materials for a course.

Table 3. Use of Technology to Gain Course Materials

	M	*SD*
Initial	1.00	0.07
Mid-Semester	1.00	0.82
Final	1.00	0.12

Are key players initially identified, and are they constant throughout the course?

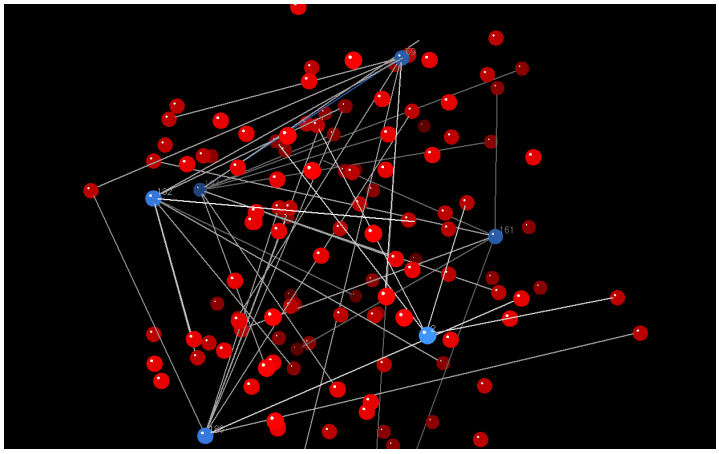
To investigate the presence of social networks in the course, *KeyPlayer* was utilized to determine the presence of networks and key players. In this study, only one key player kept their status through 2 of 3 iterations (see Table 4). Analysis revealed six key players at each iteration (x 3) based on the observe and reach parameters for this assessment. The strength of ties to other respondents was not analyzed and are displayed in ascending numerical value only. Although key players were identified at each iteration, only one was identified across collection periods, and it was only for the second and third collection periods (Figure 4). It should be noted that in this illustration, stronger ties to key players and their ties to others are shown with lines. When lines between players are not shown, those ties are considered weaker.

Table 4. Identification of Key Players Throughout the Course

Key player*	1	2	3	4	5	6
Iteration #1	25	73	83	87	92	220
Iteration #2	3	44	74	130	160	**189**
Iteration #3	2	59	132	161	**189**	194

Note. Identification of key players (1, 2, … 6) does not describe sorting based on strength. Key players are listed from numerical identification only (low to high numbers).

Figure 4. Key Player(s) Identification and Reach



Note. Blue dots indicate key players. Red dots indicate others in the course. The lines indicate reach of the key players and a stronger tie to individuals.

Discussion

Vygotsky (1978) acknowledged the importance of social interaction when he stated, "every function in the child's cultural development appears twice; first, on the social level, and later on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological)" (p. 57). To incorporate social interaction into the learning process, answering the questions of how students relate in today's society is paramount for instructor understanding. Developing instructional aids and incorporating best practices aligned with this understanding could impact learning at a high level.

Research question one examined how students communicate with each other. Data analysis revealed that of the respondents (N=245), contacts increased throughout the semester but were at their highest in the middle of the course. Overall, from beginning to end, students made more contact with other students. This finding is plausible because the diversity of students seen in many courses would allow connections to grow. In this instance, the decrease of contact from middle to end should be noted. What caused this decrease? Was it lack of needs exuded by course content? Was the nature of the connection not strengthening through course needs? Many factors could cause this occurrence, and it should be investigated further to determine how connections could be strengthened, which in turn could aid in knowledge and skills developed in the course (Bandura, 1969; Edgar et al., 2010; Roberts et al., 2010; Vygotsky, 1978).

Renninger and Shumar (2002) stated, "To explore communication among members of a network, we must ask questions that elicit social network data and address the overall question: 'Who talks to whom about what?'" (p. 169). Social communication (n = 261) was the preferred reason based on collected responses. Social communication remained constant, while there was an increase in venting (f = 130 to 248) and planning (f = 136 to 264) throughout the semester. Data suggest that although social contact remains constant throughout a given amount of time

together, those connections used socially can develop into a platform for other uses such as venting and planning.

Regarding question two towards determining proficiency levels of students, it should be noted that of the almost 7 billion people living in the world, approximately 3 billion use the internet and technology. With the development of the internet, today's students have been given a plethora of resources to gain knowledge and share knowledge with peers (The Levin Institute, 2013). Coinciding with the advances in technology, learners and how they learn is changing. Students in this study self-reported a technology proficiency level between average and above average skill (GM = 3.60, SD = .80). This suggests that even though students are living and learning in an ever-advancing technological world, they report high skill levels but may not be prepared to use technology to its fullest extent.

Furthermore, faculty and students are utilizing technology more than ever, and a concern/thought by many is can students access course content with proficiency, and will they? With advances in technology, the way people share information is changing (Gray et al., 2010; Leidner & Jarvenpaa, 1995). Although using technology for communicating is rapidly changing, scholars still have a limited understanding of who is and who is not using enhanced technology and for what purposes (Boyd & Ellison, 2007). Of the respondents (N = 245), 208 answered that they would indeed use the technology access to aid in materials needed or additional materials offered for a course. Gathered data suggested that implementing or using technology to share information about classwork or to enhance learning is what today's students would use to seek assistance for coursework. Using technology could encourage student-faculty contact, prompt feedback, and respect diverse ways of learning (Chickering & Gamson, 1999).

Research question three sought to determine key players present in the selected course initially and see if they kept that presence throughout the course. Data analyzed through this study revealed that no common key players were present from the beginning to the end of the course, which does not align with previous research. Although some key players were present at the middle and end of the data collection, none were present initially and still at the end of the course. Previous research in a similar course found that three of the six identified key players held that status throughout the semester (Edgar et al., 2010). This research does not indicate that key players keep their status throughout the semester. Further, according to Renninger and Shumar in *Building Virtual Communities, Learning and Change in Cyberspace* (2002), relations tie two people–two nodes–in a network. This research defined the nodes that were already networked before the course and how the contact changed over the semester. How respondents interacted and their frequency impacts identification of key players. It is also important to understand how they interact with each other, especially towards course needs. Furthermore, data suggested that though social networking sites are available, the connections are first made with face-to-face contact and grow into a visible social network using social networking sites.

Implications and Recommendations

According to Renninger and Shumar (2002), communities are not built on instrumental relations alone; therefore, to tap into both learning and community relations, it is important to ask questions that explore both task-oriented and socially-oriented relations. The primary purpose of this study was to explore social interaction among University of Arkansas students. Overall, from beginning to end, students made more contact with other students. Additionally, data indicated students prefer face-to-face contact (n = 281) over other methods such as email, text messaging, instant messaging, Facebook, and phone. Students preferred to use methods to communicate primarily about social/personal matters (n = 261), with planning (n = 136) and venting (n = 130) being the means of contact after social. Also, students self-reported a technology skill level of 3.63, indicating that students perceive their proficiency level related to technology use between average and above average. Of the respondents (N = 245), 208 answered that they would indeed use technology access to aid in materials needed or additional materials offered for a course. Therefore, a majority of students feel confident to access electronic materials and are willing to do so.

Because students make connections by mid-semester, as revealed in this and other research, teachers should consider this when determining groups for class projects and research, presentation groups, or possibly spreading information about coursework. Identifying key players or leaders of communication could allow instructors/faculty to have students who communicate more readily to guide groups, if needed. Even with updates to technology, students still prefer face-to-face contact. Based on this finding, instructors/faculty can realize that the addition of technology to a course can provide an excellent supplement towards learning, but regarding course communications, it is essential to the success of students for face-to-face communication to occur.

Students reported proficiency level towards technology to vary from average to above average. Teachers may expect a student's level to be higher since we are living in a technology-based world. With the resulting data, teachers should be aware of this level when designing courses and understanding these lower than expected levels of confidence towards their self-perceived technology usage skills. While most students agreed they would use technology to gain resources and materials needed for a course, online learning specifically may be something to reconsider based on the findings.

Recommendations for future research are to replicate and investigate background information such as major, course status, age, etc., for each student in the course to distinguish possible networking opportunities in the course. Additionally, further research should be conducted to determine if the contacts made using face-to-face communication are the same or different than the students that respondents are text messaging, Facebook-ing, or communicating. Furthermore, research should determine if prior sub-groups (major, course status, age, etc.) can play a substantial part in social network analysis. One limitation of this study is the sample accessible

for this study. Although the population was selected due to its diverse parameters, it may not represent essential population demographics seen across the college of agriculture. If subgroups can be determined and analyzed rather than an entire course, data could be compared to prior research in different course sizes or specific major requirements. Perhaps the course size and large differences in subgroups disturb the opportunity for entire network data analysis and specific findings. With students' self-reporting skill level related to proficiency in technology somewhere between average and above average, further research should be conducted to determine the types of technology in which students are skilled versus the types of technology they struggle utilizing at a proficient level. Data from this research would not only aid the teacher but the student in understanding communication preferences.

References

Ary, D., Jacobs, L. C., Razavieh, A., & Sorensen, C. (2006). *Introduction to research education*. (7th ed.). Thomson Wadsworth.

Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*,*13*(1), 210–230. https://doi.org/10.1111/j.1083-6101.2007.00393.x

Bandura, A. (1969). Social-learning theory of identificatory processes. In D. Goslin (Ed.), *Handbook of socialization theory and research* (pp. 213–262). Rand McNally & Company.

Borgatti, S. (2012). *KeyPlayer 1.44 instruction manual*. Retrieved August 1, 2017, from http://www.analytictech.com/products.htm

Carrington, P. J., Scott, J., & Wasserman, S. (Eds.). (2005). *Models and methods in social network analysis*. Cambridge University Press.

Chen, X., Sin, S. J. S., Thang, Y., & Lee, C. S. (2015). Why students share misinformation on social media: Motivation, gender, and study-level differences. *The Journal of Academic Librarianship, 41*(5), 583–592. https://doi.org/10.1016/j.acalib.2015.07.003

Chickering, A. W., & Gamson, Z. F. (1999). Development and adaptations of the seven principles for good practice in undergraduate education. *New Directions for Teaching and Learning*, *1999*(80), 75–81. https://doi.org/10.1002/tl.8006

Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method* (2nd ed.). Wiley.

Edgar, D. W., Amaral, K. N., & Edgar, L. D. (2009). *Networks of communication and knowledge transfer among students in a college of agriculture introductory course* [Research Poster]. Proceedings of the 2009 Southern Region American Agricultural Education Conference.

Facebook Newsroom Fact Sheet. (2019, June 30). *Facebook Newsroom*. https://newsroom.fb.com/company-info/

Fosnot, C. T. (Ed.). (1996). *Constructivism: Theory, perspectives, and practice*. Teachers College Press.

Gomm, R. (2009). *Key concepts in social research methods*. Palgrave Macmillan.

Gray, L., Thomas, N., Lewis, L., & Tice, P. (2010). *Teachers' use of educational technology in US public schools: 2009*. https://files.eric.ed.gov/fulltext/ED509514.pdf

Jones, R., Fox, C., & Levin, D. (2011). *National educational technology trends: 2011*. State Educational Technology Directors Association.

Leidner, D. E., & Jarvenpaa, S. L. (1995). The use of information technology to enhance management school education: A theoretical view [Special Issue]. *MIS Quarterly*, *19*(3), 265–291. https://doi.org/10.2307/249596

Prawat, R. S., & Floden, R. E. (1994). Philosophical perspectives on constructivist views of learning. *Educational Psychology, 29*(1), 37–48. https://doi.org/10.1207/s15326985ep2901_4

Renninger, K. A., & Shumar, W. (Eds.). (2002). *Building virtual communities: Learning and change in cyberspace*. Cambridge University Press.

Roberts, T. G., Murphy, T. H., & Edgar, D. W. (2010). Exploring interaction between student teachers during the student teaching experience. *Journal of Agricultural Education*, *51*(1), 113–125. https://doi.org/10.5032/jae.2010.01113

The Levin Institute. (2013). *Information technology.* http://www.globalization101.org/information-technology/

Viswanath, B., Mislove, A., Cha, M., & Gummadi, K. P. (2009, August). On the evolution of user interaction in Facebook. In *Proceedings of the 2nd ACM workshop on online social networks* (pp. 37–42).

Vygotsky, L. S. (1978). *Mind in society.* Harvard University Press.

Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge University Press.

Woolfolk, A. (2010). The learning sciences and constructivism. In *Educational psychology* (pp. 306–345). Pearson.

Brittany Dees-Leek is a secondary agricultural teacher at Drew Central in Arkansas. She has taught for more than five years and completed her MS degree at the University of Arkansas.

Dr. Don W. Edgar was an agricultural teacher in Texas for 14 years and has been a faculty member involved with agricultural education for more than 12 years. His interest in student cognition and methods of instruction guides his research line of inquiry.