

Building Cohesive Classroom Communities

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Research shows that a cohesive classroom community, or the relationships built between students within a classroom setting, leads to a long list of positive student outcomes in higher education. This research seeks to better understand how to build cohesion in a classroom community, a goal that has become even more urgent given the student isolation caused by the COVID-19 pandemic. It uses the tool of social network analysis, a tool particularly well suited for studying networks of relationships, to examine how two common collaborative learning techniques—small group discussions and team-based projects—affect the structure and strength of the classroom community networks in two public affairs undergraduate courses. The results show that both collaborative learning techniques created a network of denser, more inclusive relationships between students. Teamwork, in particular, had a large impact on the formation of relationships between students. Further, the collaborative teaching strategies were effective in improving student learning outcomes. Students received higher grades and reported higher satisfaction with the course if they were more embedded in the classroom community network. The results of this research reveal the importance of focusing on relationship-building instructional techniques for student success in higher education.

The students and instructor in a class form a classroom community, which McMillan and Chavis (1986) define as “a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together” (p. 9). Research has shown many benefits of supportive and tight-knit classroom communities in higher education including increased student persistence and motivation, lessened feelings of isolation, better flow of information among students, and increased comfort in seeking help from others (e.g., Bruffee, 1999; Dede, 1996; Haythornthwaite et al., 2000; Morgan & Tam, 1999; Northey et al., 2018; Watkins, 2005; Wellman, 1999; Wu & Nian, 2021). While these benefits are normatively good, the COVID-19 pandemic and the corresponding increase in student isolation has introduced an even greater urgency to understand how classroom techniques can create more cohesive classroom communities. As a result, instructors can better help their students succeed both emotionally and academically.

The concept of classroom community has been a focus of research for several decades. For example, Rovai (2002) developed the Classroom Community Scale to test how different elements of course design affect the overall sense of classroom community (e.g., Dawson, 2008; Ritter et al., 2009). This study sought to measure classroom community more directly using a different technique: social network analysis (SNA). SNA is a method that enables researchers to map the network of relationships between nodes which can be any unit of analysis including a person, an organization, a country, etc.—and measure different properties of that network structure such as the level and form of cohesion and the existence of subgroups (Borgatti et al., 2009; Saqr et al., 2020). It allows researchers to measure the actual changes in relationships instead of asking students

for their perspective on how the community as a whole changed.

Because of its focus on mapping relationships, SNA is particularly well suited to studying classroom community. In fact, scholars have used SNA to understand which collaborative learning techniques increase friendship and advice relationships between students (Kapucu et al., 2012; Naim et al., 2010); which types of relationships students are most likely to form in a classroom setting (Chen et al., 2010), and as a way to measure the growth in collaboration between students (Han et al., 2016). Additionally, recent scholarship on collaborative learning across traditional, online, and hybrid environments points to social networks as an integral aspect of collaboration effectiveness (Kofinas & Tsay, 2021; Love et al., 2020). Building on their work, this study seeks to answer two questions. First, in what ways do two collaborative learning techniques, small group discussions and team-based projects, contribute to the cohesion of the classroom community network? Second, how does a student's structural position in the classroom community network affect their learning course?

This research was conducted in the context of public affairs education but is applicable across many higher education disciplines. The concept of classroom community itself has been examined in disciplines as varied as psychology (McMillan & Chavis, 1986), higher education (Rovai 2002; Webb & Engar 2016), and even farm management and operations (Han et al., 2016). The public affairs signature pedagogies examined here, team-based projects and small group discussions, are likewise not limited to the context of public affairs. Collaborative or cooperative learning in higher education is a common approach in many disciplines (Millis 2010), though we do not fully understand the connection between specific methods and classroom community networks.

Literature Review

This article reports on an exploration of the link between classroom community and learning through teaching strategies that emphasize student collaboration. The following literature review incorporates two overlapping areas of research that informed our exploration and analysis. First, we address connectivism as a conceptual framework for social networks as pathways to learning. Second, we discuss classrooms as learning communities.

Connectivism and Social Networks

Connectivism is a conceptual framework for learning and knowledge in the digital age. Key principles of connectivism include deriving knowledge from a diversity of viewpoints, learning through connecting nodes or information resources, and decision-making across connections to maintain currency of knowledge (Siemens, 2005). Connectivism has found a place in both digital and traditional learning environments due to the emphasis on navigating changing information environments and leveraging a community of learners through dialog, collaboration, and interaction (Goldie, 2016). As such, a connectivist lens provides insights to in-person, hybrid, and online modalities. Bates (2015) summarizes the influence of connectivism as “[focusing] more on individual participants, networks and the flow of information, and the new forms of knowledge that result” (p. 63). Therefore, learning in a networked environment is contingent on learners’ ability to construct and navigate personal and digital networks (Downes, 2007; Kropf, 2013).

A connectivist lens for learning in higher education embraces the reality of students’ social networks within the larger context of a complex field (Dennis, 2020). It accepts the evolving nature of knowledge and the benefits of collaboration. Specifically, recent conceptualizations of connectivism include personal networks and human interaction in contexts that are significantly shaped by digital-age tools and resources (Dennis, 2020). In many higher education classrooms student interactions are part of typical class sessions, but these interactions may or may not directly relate to social networks.

Peer relationships, including student interactions and collaborations, contribute to social networks that influence learning experiences (Biancani & McFarland, 2013; Israel et al., 2020). These networks may include physical, associative, or behavioral connections within or beyond a course of study (Carolan, 2013). Recent research on social networks contributing to learning experience points to both student connectedness during projects and instructor facilitation as relevant factors. Wu and Nian (2021) noted frequent student discussions

in a hybrid learning environment facilitated comfort with help-seeking from peers and the instructor. Similarly, Han, McCubbins, and Paulsen (2016) found collaboration-oriented activities helped students build information networks among peers that positively influenced skill-building. Navigating information networks and peer relationships is a foundational process for 21st century learning through a connectivist lens (Goldie 2016; Northey et al., 2018; Siemens, 2005). As such, viewing the classroom as a community of learners provides a pedagogical foundation for collaborative learning.

Classrooms as Learning Communities

Extant research grounds the concept of learning in community as both socially and academically valuable. Learning is an individual and social phenomenon and is inherently influenced by students’ environments (Bandura, 1986, 1997). Learning is a process of individual sense-making embedded in community activities that help students co-construct knowledge through collective and collaborative efforts (Watkins, 2005). Being part of a learning community includes sharing group values and goals as well as the interaction of individual students through discourse, socialization, and a sense of connectedness (Rovai & Jordan, 2004). Intentional community building as part of higher education teaching and learning approaches and frameworks is common in traditional classrooms (Bain, 2004), hybrid environments (Patterson Lorenzetti, 2014; Rovai & Jordan, 2004), and fully online learning (Akyol & Garrison, 2008; Lambert & Fisher, 2013).

Learning communities include peer to peer interaction as well as interaction with the instructor or facilitator. Research suggests interaction with peers through team-based projects and other collaborative learning techniques is an anchor of successful learning in the field of public affairs (Abel, 2009; Reinke, 2001). Through these activities, skills like critical thinking, working in groups, conflict resolution, and effective writing are developed (Fenwick, 2018; Reinke, 2001). Given the instructor’s role in facilitating these collaborative activities and assignments, instructional decisions seem to enact community through structured social connections.

Research on instructors’ decisions and roles in a learning community emphasizes several approaches for intentional community building. Li et al.’s (2010) assertion that instructors are coauthors of new knowledge rests heavily on instructional design and learning as interconnected with community patterns and shared goals. As such, instructional decisions and teaching strategies that promote pathways for community among students strengthen connections with peers and, potentially, buy-in for learning goals (Becnel

& Moeller, 2017; Kilia & Yildirim, 2018). Public affairs instructors' roles in deliberately connecting students through teamwork, dialogue, and group projects such as simulations and role-playing situate instructors as facilitators of the learning community (Merritt & Kelley, 2018; Silvia, 2012). Beyond these strategies enacted by the instructor, questions remain as to the function of connectedness within the classroom community. The present study sought a better understanding of students' social networks as a pathway for more connectedness and learning with peers.

Method

The research context was two 35-person sections of an Introduction to Public Policy course taught by the same instructor at a selective mid-Atlantic liberal arts university during the Spring 2021 semester (see Appendix A). Because of COVID-19, the course was structured as a hybrid course where the students watched asynchronous recorded lectures and then attended class in person, every session, to participate in class discussions. Although teaching during a pandemic is different than teaching in a normal semester for several reasons—among them, the integration of more digital learning aspects, the increased need for flexibility, and more intentional student interaction—the aspects of peer interaction that were studied here were almost entirely in person.

The course was designed with a strong emphasis on peer interaction to facilitate student connection and community. In particular, two instructional techniques were relied on to foster this interaction: small group discussions and teamwork-based projects. Based on experience, the instructor was familiar with and comfortable facilitating both approaches. First, the in-person class time was almost entirely devoted to small group discussion. During small group discussions, the instructor asked students to turn to those sitting around them to discuss two or three prompts related to lecture content. The class would reconvene between questions so small group insights could be shared with the larger group and the instructor, but the small groups kept the same members for the entirety of a class period. Small groups were not assigned, but students were encouraged throughout the semester to sit in different seats and to turn to different people for each class session. The instructor noted the composition of the small group discussions during every class period. For example, if Ben and Jill talked during a class, they would be marked as a group. At the end of the semester, a matrix was developed wherein the value in the cell of Ben and Jill was the number of class sessions they were jointly in a small group discussion together. This matrix will henceforth be called the small group discussions matrix.

Second, structured teamwork was a major part of the course. Teams composed of three to four students were

assigned based on the results of a survey on policy areas of interest given to the students during the first week of class. All attempts were made to put students together who shared similar interests. Teams worked together throughout the semester to produce three sequential deliverables: a problem fact sheet detailing a public problem, a cost-benefit analysis comparing two solutions to that problem, and a team presentation that summarizes the findings. In all, the team assignments comprised 60% of the final grade. The Scrum framework (Schwaber & Sutherland, 2020) was used to structure teamwork, with time in class for brief team check-ins, peer evaluations, and a team meeting with the instructor after each deliverable was graded. A matrix showing which students belonged to each team was created. This matrix will henceforth be called the team assignment matrix.

Data and Methods

The data for this project come from two waves of a survey. The first wave captured baseline relationships and was deployed during the second full week of the semester. The second wave captured the final classroom community network and was deployed during the last week of the semester. The survey included demographic questions on the first wave and learning outcome questions on the second wave but was mainly focused on the network analysis question. This question was modelled on a question used in previous research on peer relationships in a classroom setting (Lee & Bonk, 2016). It included a roster of all students in that section. The respondent was then asked to mark his/her relationship to each student from the following options: 0 (I don't know this person), 1 (I know this person's name), 2 (I would feel comfortable talking to this person outside of class), and 3 (I consider this person a friend). The resultant networks likely undercount the number of relationships that really exist because it relied on students knowing other students' names. In fact, several students noted on the second wave of the survey that they felt comfortable talking to more people outside of class than they noted, but just forgot some of those students' names.

Participation in both surveys was high, which increased the reliability of the results. All students who took the first wave of the survey also took the second wave. All 35 students in Section 1 and 33 out of 35 students in Section 2 completed the surveys. Students who participated signed an informed consent prior to participating and were given random names so as to protect their anonymity.

Several social network analysis measures were then used to analyze the resultant networks. This method is ideally suited for understanding the composition of, and change in, networks of relationships. It is premised on

the idea that relationships matter and that understanding these relationships will provide better understanding of phenomena that have traditionally only been studied by case studies and large-N quantitative analysis. As a method, it allows researchers to visualize a network of relationships between people and then measure different structural properties about that network (Wasserman & Faust, 1994). Because the analysis tool is built around the idea that actors in a network do not behave independently—they influence each other’s decisions, learn from each other, communicate with one another, etc.—traditional regression analysis models cannot be used. Instead, social network analysts have come up with their own methods and models that are built around this idea that we are all interconnected (Scott, 2017). It has been used in many different studies that occur in the classroom environment (e.g., Dawson 2008; Han et al., 2016; Israel et al. 2020) as well as in several studies focusing specifically on Public Affairs classrooms (e.g., Chen et al., 2010; Kapucu et al., 2012; Naim et al., 2010).

Results

This research was guided by two questions:

- (1) In what ways do two collaborative learning techniques, small group discussions and team-based projects, contribute to the cohesion of the classroom community network?
- (2) How does the degree to which a student is embedded in the classroom community network affect their learning in the course?

First, summary statistics about how the network changed over the course of the semester are discussed, followed by the main findings.

Summary Statistics

The classroom community networks changed in ways consistent both with what previous research has found (Naim et al., 2010; Kapucu et al., 2012; Webb and Engar 2016) and what we would expect to happen as students spend more time with one another. In both course sections, the relationships between students became more cohesive. Next, we present two key summary statistics that best describe this change in cohesion: density and clique composition.

First, the classroom community networks became denser over the course of the semester. In social network analysis, density is a proportion that measures the number of ties that exist as compared to the number of ties that could theoretically exist (Wasserman & Faust, 1994). Here, the closer the density is to 1.0, the more (intense) relationships students reported. For this analysis, we calculated density on different

transformations of the classroom community networks in order to better tease out the differences between the different intensities of relationships. In particular, we split the overall networks into smaller networks composed only of one intensity of relationship (e.g., a network that only included the “know this person’s name” ties). Table 1 reports these results.

The density results show that all types of densities increase over the course of the semester consistently across both sections. The biggest increases occurred for the most intense ties. In other words, more students added friends during the semester than added acquaintances. These changes suggest that classrooms are forums wherein students can form meaningful relationships with one another.

Second, the number and size of close-knit groups of students in each section increased between the two waves of the survey. Cliques are a social network analysis measure that find groups of students who are all connected to one another. A clique of size three, for example, would mean a group of students where all three students reported some type of relationship to all other members of that group. Cliques are a more nuanced measure of cohesion as compared to density because they accommodate the natural inclination of people to form smaller groupings of people (Friedkin, 2004). Table 2 reports these results.

The clique results show that all groupings of students increased over the course of the semester. In particular, though, the larger sized groups, groups in which five students all reported relationships with all other members of the group, increased most, which shows that the sections became more inclusive over the course of the semester. This finding is interesting because assigned teams only had three or four students on them. This suggests that cohesion increased beyond just cohesion within the assigned teams. In other words, students likely got to know other students and then used those connections to meet even more students. This finding will be explored in greater detail using multiple regression quadratic assignment procedures (MR-QAP).

Findings for Research Question 1

Previous network studies examined the isolated effect of different instructional techniques on the building of classroom community networks in a public affairs context (e.g., Chen et al., 2010; Kapucu et al., 2012; Naim et al., 2010). This study uses a MR-QAP regression model to examine the relative contributions of two of the most widespread peer-based techniques: small group discussion groups and teamwork. MR-QAP is a model that uses quadratic assignment procedure to simulate regression for social network data that is in the form of matrices. Much like a traditional regression, it allows the researcher to include control variables, something that the previous studies did not do. We used

UCINET software (Borgatti et al., 2002) to regress the team assignment and the small group discussion matrices on the self-reported classroom community network at the end of the semester. We controlled for previous relationships between students (captured in Wave 1 of the classroom community network survey), as well as shared major and shared graduation year.

Table 3 displays the results of the MR-QAP regression using standardized regression coefficients and p-values. The two models use different configurations of the dependent variable matrix to test for robustness. The dependent variable in the first model is the original weighted data in which students chose between three intensities of relationship. The second model excluded the weakest relationship of just knowing someone's name. In other words, if a student listed that they only knew someone's name, that relationship was not counted in the matrix for the second model. With that said, the results are very consistent across both the models and the sections. For the sake of clarity, this discussion will mainly focus on Model 1, as it produced the highest R2 values.

Across both sections, the most important factor in who students had relationships with at the end of the semester was their baseline relationship as measured by Wave 1 of the survey. In other words, if Ben reported being friends with Jill during Wave 1, he was likely to still be friends with her during Wave 2. This makes sense. More interesting, though, is that other variables still have a significant effect on the classroom community even after controlling for existing relationships. In particular, team assignment is more important than small group discussions across both sections. Small group discussions also have a positive and significant effect across the sections, albeit on a smaller scale. The control variables of same major and same graduation year had more variation across the sections, with both variables having a positive and slightly significant effect for Section 2 but not for Section 1.

Concentrating on the effects of team assignment and small group discussions, the result makes sense both from a time perspective and from the open-ended questions that students answered at the end of the semester about their experiences. First, students spent considerably more time with the same students in the team projects over the course of the semester, so it is reasonable to expect more and more intense relationships to develop over that time. Small group discussions, on the other hand, had the potential to change every class session.

The positive and significant coefficient for small group discussions across all models is an important finding. Consistent with the finding that five-person cliques increased the most during the semester, the MR-QAP results show that even less

structured and less consistent student interaction contributes to more cohesive classroom communities. Moreover, the results for the effect of small group discussions on classroom community networks on the lower level of relationship type, being acquaintances with one another, almost certainly underemphasizes their importance. Several students noted in their open-ended question response that they actually do feel they know more people than they were able to identify in the survey but could not identify them because they did not know their names. With that said, we do not think this underestimation is a serious concern for the findings because it is debatable how lasting an impact an unnamed acquaintance is likely to have on a student.

Model 2 yields similar results to Model 1 with one important difference. When only the stronger relationships are included in the dependent variable matrix, the size of the team assignment effect was even larger. This finding suggests that the strongest relationships may require more consistent and longer-term interaction between students.

Findings for Research Question 2

The second research question focused on understanding the degree to which a student's position in the classroom community network affects their individual learning. We measured increased learning in two ways: first, we looked at final course grades. Second, we asked students to answer three questions about learning outcomes on the second survey.

Starting with final grades, we correlated final grades with an individual-level measure of centrality called degree centrality. Simply put, degree centrality measures the number of other nodes to which each node is tied (Freeman, 1978). Because our ties are directional in nature, meaning student A could report a different relationship to student B than vice versa, the measure is divided into directed versions of the measure: outdegree and indegree. In this context, students with higher outdegree scores reported more and more intense relationships to others. We can think of these students as the "go-getters" who actively try to establish relationships with others. Students with higher indegree scores received the most and highest intensity nominations. In other words, they were most frequently listed—and listed with a higher intensity relationship—by others who took the survey. We can think of these students as the "popular" students.

Table 4 shows the results of the correlations between final grades and degree centrality using Pearson's correlation coefficients. Once again, the two class sections produced consistent results. Interestingly, though, the results show that the direction of the tie—whether a student is a go-getter or whether they are popular—matters. Go-getter students, or those with high

Table 1
Density Results

Density Type	Class Section	Wave 1	Wave 2	% Change
<i>Density of ties (all ties)</i>	1	0.494	0.843	71%
	2	0.342	0.87	154%
<i>Density of ties=1 (Know this person's name)</i>	1	0.171	0.279	63%
	2	0.157	0.325	107%
<i>Density of ties=2 (Comfortable talking to outside of class)</i>	1	0.093	0.145	56%
	2	0.067	0.148	121%
<i>Density of ties=3 (Consider this person a friend)</i>	1	0.045	0.092	104%
	2	0.017	0.074	335%

Table 2
Clique Results

Class Section	Clique Size	# Cliques in Wave 1	# Cliques in Wave 2	% Change
1	3	31	103	232%
1	4	16	81	406%
1	5	5	45	800%
1	6	0	17	
2	3	26	71	173%
2	4	9	69	667%
2	5	3	62	1967%
2	6	0	40	

Table 3
MR-QAP Results

Variables	Model 1		Model 2	
	All Relationships		Stronger Relationships	
	Section 1	Section 2	Section 1	Section 2
Baseline relationships	0.637 *** (0.001)	0.706*** (0.001)	0.558*** (0.001)	0.393*** (0.001)
Small group discussion matrix	0.128*** (0.001)	0.077*** (0.007)	0.098*** (0.001)	0.088*** (0.003)
Team assignment matrix	0.209*** (0.001)	0.111*** (0.001)	0.307*** (0.001)	0.232*** (0.001)
Same major	0.017 (0.253)	0.434* (0.082)	0.012 (0.309)	0.059** (0.032)
Same graduation year	0.024 (0.146)	0.058* (0.028)	0.009 (0.341)	0.036 (0.116)
<i>R</i> ²	0.624	0.370	0.576	0.354

Note. The dependent variable in this analysis is the second wave of the classroom community network. Coefficients are standardized. MR-QAP does not report standard errors, so p-values are in parentheses. Significance: * $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.001$.

outdegree scores, have higher final grades while popular students, or those with high indegree scores, have lower final grades. Caution is advised when trying to read into the indegree correlations in particular, given that Section 2's correlation coefficient is very close to 0. With that said, the results suggest that putting the time and effort into developing relationships with fellow students in a course could be a potential strategy for academic success. Just being well known in and of itself, on the other hand, does not contribute to more success in a course. Put more succinctly, to reap the benefits of student interaction, a student must first put in the effort to develop those relationships.

Table 4
Correlations Between Final Grades and Degree Centrality Scores for Sections 1 and 2

	Outdegree Centrality	Indegree Centrality
Final Grades: Section 1	0.276	-0.247
Final Grades: Section 2	0.259	-0.066

Note. Out/Indegree centrality scores were calculated on the final wave of the classroom community network.

The positive impact of forming relationships with others in a classroom setting is made even clearer through the analysis of the learning outcome questions. The second survey included three Likert-scale questions whose answers ranged from a 1 (Strongly Disagree) to 5 (Strongly Agree). The wording of those questions and the short names we use to refer to them are provided in Table 5.

Table 5
Learning Outcome Questions

Short Name	Survey Question
Learning	To what extent do you agree with the following statement: My learning in this course was positively affected by the students I got to know.
Content Engagement	To what extent do you agree with the following statement: The students I got to know in this class motivated me to engage more with the content of this course.
Student Engagement	To what extent do you agree with the following statement: My experience with the students I got to know in this class motivated me to engage more with other students in this class.

The results, shown in Table 6, show the average score students gave for how peer interaction affected

their learning outcomes. All three variables had high average scores, with the Learning variable scoring the highest across both sections, Content Engagement next, and Student Engagement last. These results provide more evidence of the importance of peer interaction. Of particular interest are the results for Student Engagement, which suggest that student-led collaborative learning can be self-reinforcing. Positive student interactions not only increase individual learning and engagement, but actually make students seek out and engage more meaningfully with collaborative activities. This, in turn, will create even more positive outcomes.

Table 6
Average Likert-Scale Scores on Learning Outcome Questions

Variable	Section 1	Section 2
Learning	4.324	3.940
Content Engagement	4.086	3.545
Student Engagement	3.857	3.455

Note. Scores are average score on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree).

Discussion and Application

This study explored the relationship between two teaching strategies that emphasize collaborative learning—small group discussions and teamwork—and the building of a classroom community network over the course of a semester. Consistent with previous literature, our findings suggest that collaborative learning strengthened the two classroom community networks that were studied. Both networks became denser and more inclusive over the course of the semester. In other words, relationships between students were both formed and strengthened during the semester, a notable achievement on its own because students were wearing masks and socially distancing while in class. Asking students to work collaboratively with other students benefited them in tangible and intangible ways. In particular, the students in our study who were more embedded in the classroom community network performed better academically and reported both learning more and wanting to engage more with peers in the future. As our students come out of the pandemic, fostering this interaction will be more important than ever as students face the challenge of reestablishing social and information networks. Moreover, the results suggest that student-led collaborative learning can create a positive cycle.

Of the two instructional techniques studied, teamwork was particularly effective in building a dense

and inclusive classroom community network. In the class that was studied for this research, students were assigned to a team for the entirety of the semester. The fact that teams were more important than small group discussion—which changed every class period and were not assigned by the instructor—may be related to the increase in inclusivity of the network during the semester. Specifically, assigning teams based on interest area rather than allowing students to form teams on their own may lead to more cohesive classroom community networks because students who may otherwise feel isolated are not left out. Future research can explore this connection further. The research also found a positive and significant effect for small group discussion. This finding suggests that even unstructured, more sporadic student interaction can still be meaningful. Future research can explore this effect in greater nuance by contrasting the effect of consistent memberships in small discussion groups with those studied here.

Finally, this research points to advantages more generally for connectivist learning models that intentionally incorporate information networks and collaboration regardless of teaching modality. The importance of peer interaction in the learning process is clear, but exactly why it is so important needs more research. A connectivist framework can help the field to better understand the mechanisms that drive the influence of peers in a classroom setting. We offer two themes aligned to a connectivist approach with applications for practice in classrooms of higher education.

Student Networks as Dynamic Information Resources

If we think of the students in the class as a source of information resources, we may be able to better harness their knowledge. Collaborative and cooperative learning, with an emphasis on small groups, are well established strategies for learning in K–12 environments (Slavin, 2010). In higher education contexts, student collaboration is also necessary for the development of discrete skills needed for success in career fields (Merritt & Kelley 2018; Reinke, 2001). We suggest educators leverage the learning advantages of collaborative learning in a way that situates students within areas of personal interest or experience. In doing so, students can both gain the practical benefits of collaborative learning as well as expand their information networks.

Collaborative Learning Includes Applied Critical Decision-making

Participation in decision-making processes requires building consensus and understanding the role of various stakeholders (Kapucu, 2012). Learning activities that

emphasize the navigation of various networks of information may lend themselves to collaborative or team-based learning in that all students have a shared goal. We recommend various group sizes and longevity of tasks to maximize practice in decision-making and consensus building.

Conclusion

This research contributes to the literature on collaborative learning strategies and the importance of social networks. Our findings confirm the previous scholarship regarding social networks in the classroom while offering complementary insights on community building in a hybrid environment affected by COVID-19. Though a connectivist lens for understanding social networks can be utilized to explore any class modality, our emphasis here was in-person instruction as an element of a hybrid environment. Higher education is a context marked by evolution of ideas and the need for students to learn in environments with incomplete information. Therefore, competency in any field requires ongoing learning and exposure to information networks to maintain currency and effectiveness. Building on Abel's (2009) ideas of learning in and through uncertainty or chaos, we recommend teaching strategies that emphasize navigating and synthesizing social and information networks as a function of student collaboration. Further research on applications of social networks across teaching modalities, such as online and hybridized classrooms, will continue to aid our understanding of potential links between collaborative teaching strategies and social networks.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author, Alexandra Joosse, upon reasonable request.

Statement of Ethics

This project was found to comply with appropriate ethical standards and was exempted from the need for formal review by the William & Mary Protection of Human Subjects Committee. All participants in the research signed an informed consent prior to taking the surveys.

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Appendix A

The two waves of the network survey had the same network question but varied with regard to additional questions asked. In the following, the two surveys are presented as one. Items that appeared only on the first wave are marked “*” while items that appears only on the second wave are marked “**.”

Classroom Community Network Survey

Thank you for taking this survey and helping us learn more about classroom community. You can complete this survey on a computer, tablet, or mobile device. It should take you 10 minutes or less to complete.

What is your full name? (This is the only question on the survey that is mandatory. Remember that we will anonymize all names at the first possible opportunity.)

*In what year do you expect to graduate?

- 2021
- 2022
- 2023
- 2024
- Who the heck knows?

*What is your declared or intended primary major?

- Public Policy
- Government
- Economics
- Environmental Science & Policy
- Other
- I am undecided and truly do not know yet

This question will allow us to map out the classroom community network. To complete this question, please rate your perceived degree of closeness with every student in this class. Remember that all names will be made anonymous. The students are listed in alphabetical order

	0 (I don't know this person)	1 (I know this person's name)	2 (I feel comfortable having a conversation with this person outside of class)	3 (I consider this person a friend)
Student 1 name				
Student 2 name				
Student 3 name				

*Note: This matrix had all student names from the corresponding section filled in in the first column.

**To what extent do you agree with the following statement: My learning in this course was positively affected by the students I got to know.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

**To what extent do you agree with the following statement: The students I got to know in this class motivated me to engage more with the content of this course.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

**To what extent do you agree with the following statement: My experience with the students I got to know in this class motivated me to engage more with other students in this class.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

What class activities do you think most helped create connections between you and other students in this class?
Why?
