

Students' Perceptions of Active Learning Classroom Community

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Classroom community plays a pivotal role in student success, especially when students have the opportunity to interact with their peers and instructors. This study explores how students perceive classroom community and its impact on their learning. We present findings from an essay reflection assignment where students were asked to share their experiences with learning mathematics. We found that students felt more comfortable to ask questions and were able to develop interpersonal skills in conjunction with mathematical skills because of the classroom community. Conclusions drawn from this research can provide insights for instructors who are interested in fostering strong classroom communities in engaging learning environments.

Keywords: community, active learning, group work, student-instructor relationships

Being part of a classroom community has been described as having feelings of belonging and obligation to one another so that each members' educational needs will be met through commitment to shared goals (Rovai, 2002). Research has shown that these two facets of a classroom community, sense of belonging and social interdependence, are crucial to students' well-being and academic success (Awang et al., 2014; Johnson & Johnson, 2008). Classroom community develops through interactions between students, instructors, and content (Cohen et al., 2003; Lampert, 2001). These interactions often depend on the pedagogical choices of instructors and how students are positioned (e.g. active learners vs. passive recipients). In recent years, research has shown that active learning instructional strategies increase student engagement and success in undergraduate mathematics (Freeman et al., 2014). While several studies have focused on academic student success (Freeman et al., 2014; Laursen et al., 2014; Theobald et al., 2019) and differences in student outcomes in active learning classrooms based on gender (Johnson et al., 2020; Reinholz et al., 2022), few studies have looked at students' perceptions of the classroom community in an active learning setting and how they perceive community to impact their learning.

The purpose of our study is to investigate students' perceptions of an active learning classroom community and how they interacted with their peers, their instructors, and the mathematical content. This proposal focuses on the following research question: How do students report that the community of an active learning class supports them in their mathematical learning? Our work provides insight for other institutions, departments, and instructors who are interested in incorporating more active learning into their undergraduate mathematics courses and highlights areas where more research is needed.

Context

Our study takes place in the context of a mathematics department that has recently undergone several major changes to its first-year mathematics program. Prior to Fall 2021, all first-year mathematics courses at this institution were taught using the emporium model (Twigg, 2011; Webel et al., 2017). Under this instructional model, students would attend a one hour lecture each week and then were required to spend a minimum of three hours in a computer lab working independently on online homework problems. Students were able to get individualized help from undergraduate tutors who worked in the computer lab, but there was little community developed

amongst students and their peers. When COVID-19 emerged in Spring 2020, issues associated with the emporium model were exacerbated. Lectures and tutoring hours were held over Zoom making it easy (and normalized) for students to turn off their video cameras and avoid interactions with their peers and instructors altogether.

In Spring 2021, a team of faculty members were hired to improve first-year mathematics courses at this institution. Course redesign efforts began in Summer 2021, and major changes were implemented in Fall 2021. Instead of using the emporium model, courses were scheduled to meet for 75 minutes twice a week, and sections were capped at 40 students. Each section had a designated instructor of record along with two classroom learning assistants. Courses were tightly coordinated with a team of faculty members working together to develop curricular materials, assess student learning, and make revisions to courses throughout the semester. The instructional team's overall goal was to improve student learning in these first-year mathematics courses by creating an inclusive classroom environment where students felt safe to make mistakes and learn from them while working together with their peers. Thus, developing a strong sense of classroom community was central to the course redesign efforts.

Background Literature and Theoretical Framing

Classroom community is difficult to define, and many definitions exist in research literature (Summers & Svinicki, 2007). Baturay (2011) defines classroom community in terms of two components: “(a) social community or the feelings of connectedness among community members and (b) learning community or their common expectations of learning and goals” (p. 564). In our study, we viewed classroom community through the lens of the instructional triangle; i.e. considering how students’ experiences in the classroom are influenced by interactions between students, instructors, and mathematical content, and the environment in which these interactions occur (Lampert, 2001; Cohen et al., 2003). Community is developed (or not) through these interactions, and classroom communities are formed when there is a “culture of learning, where students come to see themselves as contributors to their own learning and that of the community” (Bielaczyc & Collins, 2009, p. 10).

Our study is situated within the context of an active learning classroom environment. Several definitions of active learning exist in the literature (Williams et al., 2022). For this study, we define active learning broadly as “classroom practices that engage students in activities such as reading, writing, discussion, or problem solving, that promote higher-order thinking” (CBMS, 2016, p. 1). Another common definition of active learning draws on the four pillars of Inquiry-Based Mathematics Education: students engaging deeply with mathematics, students working collaboratively, instructors inquiring into student thinking, and instructors fostering equity in their teaching (Laursen & Rasmussen, 2019). In this study, we investigate how students perceive the classroom interactions described by these pillars (between students, instructors, and mathematical content) and how these interactions relate to the classroom community.

Finally, our work builds on the SEMINAL Project, which focuses on incorporating more active learning into first-year undergraduate mathematics programs. As part of this project, the second author and colleagues analyzed survey data from over 2500 students taking a range of first-year mathematics courses at several institutions across the United States. In their open-ended survey responses, students discussed five major topics: student-to-student interactions, relationships with instructors, course format, assessment, and students’ affective experiences (Uhing et al., 2021). While this data was gathered in a different context, similar themes arose in our findings. In this proposal, we discuss and build on student-to-student interactions and relationships with instructors and relate these themes to classroom community.

Methods

Data for this study come from a Mathography assignment that was assigned to students enrolled in a College Algebra course at a large, Midwestern, metropolitan university during Fall 2021. The assignment was based on Drake (2006) and included prompts such as “Describe what you learned in College Algebra. These can be mathematical topics but also non-math things, like anything you learned about yourself or your ability to do math or what math is.” Out of 459 students enrolled in the course at the beginning of the semester, 228 completed the assignment, which was collected at the end of the semester. Students were informed that class assignments would be gathered for research and course evaluation purposes.

Mathographies were analyzed using Dedoose (2022). To establish a preliminary set of codes, deductive coding was conducted with an initial set of codes from the SEMINAL Project (Uhing et al., 2021). In order to refine our analysis, a set of subcodes was created for most initial codes. At least two researchers tagged each response to prompts in the Mathographies with these initial and secondary codes. Researchers then met to discuss and reconcile disagreements until agreement was reached. Excerpts were then sorted by initial codes and the code “Community and Culture” was selected for a second round of coding. Inductive coding was used to create sets of themes for each subcode, which illustrate how students experienced the classroom community.

Findings

Secondary analysis of the “Community and Culture” code yielded four subcodes. We describe themes that emerged under two of them, Student/Student Interactions and Student/Instructor Interactions, in this proposal.

Student/Student Interactions

Group work was a large focus of the College Algebra active learning curriculum. Students spent the majority of class time working together to solve problems posed by the instructor or complete classroom activities. As a result, Student/Student Interactions was the most common secondary code from Community and Culture (n=234 excerpts out of a total of 538 excerpts). Table 1 provides an overview of the most common themes under the Student/Student Interactions code.

Table 1. Major Themes for Student/Student Interactions

Theme	Summary	Student Excerpt
Working in a team	Learning mathematics through positive experiences with peers	“I liked having people around me in my group that can help me understand concepts and I can do the same for others.”
Meeting new people	Building social networks and friendships with classmates	“I got a lot out of this class lik em ynew [<i>sic</i>] friends that I happened to get partnered up with at the beginning of the class.”
Building collaboration skills	Developing collaboration and other interpersonal skills	“I learned how to better manage my time, how to work in a group with efficiency, and how to learn alongside my peers.”

Disliking group work	Preferring step-by-step instruction (i.e. lecture) or individual work over group activities	“Something that didn’t work so well for me in this class was all the independent work time we had with our groups to work on worksheets/packets.”
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Working in a team. The notion of working with others was a common, positive response from students as almost 37% of the Student/Student Interactions excerpts referred to the concept of teamwork. In many cases, students felt that working with their peers allowed them to grasp mathematical concepts in a way that they had not been able to in prior math courses. There was a realization amongst students that the ability to collaborate with one another gave them additional resources, other than just the instructor, when they struggled with a mathematical concept. One student’s response illustrates this idea: “the use of groups allows students to help each other so more people learn than if the teacher was answering every individual student’s question. This also allows students to create some connection to the people in the course.”

Several students also mentioned feeling comfortable working in groups and asking their classmates questions. One student remarked, “I think that discussing the problems in a judgement free environment helped me advance in this class a lot.” Another student explained how this course felt different from past experiences in which they had felt rushed or judged:

We were giving each other pointers, and just getting along well and we weren’t rushing anyone, or judging one another if one was confused. It felt good on how well we were responding to each other. In the past there would always be someone trying to rush you, or make you feel less if you don’t understand, or catch on right away. Even teachers would do that. It made me realize people are respectful and patient when it comes to trying new things.

As illustrated by these excerpts, students felt comfortable working in teams in a “judgement free environment”, and as a result were able to more deeply engage with the content and “advance” their mathematical knowledge.

Meeting new people. Since College Algebra is a first-year mathematics course, many of the students who take this course are early in their academic careers. Moreover, during the Fall 2021 semester, when data were collected, many students had just experienced several months of remote or online classes due to COVID-19, emphasizing the significance of this theme. About 18% of the Student/Student Interactions excerpts described how students made new friends or developed close relationships with classmates while taking College Algebra. One student mentioned how they were new to the area and making friends and forming connections was critical in their success in College Algebra:

I feel that I got friends out of the class and a more in-depth version of a high school math class, except it was college. Friends are important to me because I am new to [this city], and I felt welcomed by everyone in that class. It made me feel like I belonged to a big math family and community.

This excerpt highlights how a strong classroom community can help students build social networks. Even though this student was new to the area, they were able to make friends with other students in College Algebra because of the “welcoming” environment, thus helping them feel a sense of belonging to a “big math family and community”.

Building collaboration skills. In addition to developing mathematical skills, some students felt that they were able to develop their collaboration skills as a result of the emphasis on group work in College Algebra. Approximately 10% of excerpts under Student/Student Interactions

referenced building these collaboration and networking skills. One student described their experience:

While I learned many new mathematical skills in this class, which I will no doubt be carrying into my future classes, I think that the most important lessons that I learned in this class did not pertain to math. While in [College Algebra], I learned a lot about myself and about networking. I learned that I could put aside my pride and independence when I need help. I can ask questions and not be judged – something that I had feared before. I also learned that I am capable of networking. By this, I mean that I was able to form relationships with my colleagues and professor that could help me in the future.

Although this student acknowledged that their new mathematical skills will be useful in future classes, they emphasized that the “most important” part of College Algebra was building their collaboration (“networking”) skills.

Disliking group work. Although the interactions with their peers resulted in many positive experiences for students, some students felt that this style of learning did not work as well for them. Around 8% of the excerpts indicated some kind of negative experience in relation to Student/Student Interactions. One student conveyed: “the style of learning that I learn best with is lecture-type style where I have an instructor explaining the concept step-by-step and less of me and my table partners working together to figure it out ourselves.” In this case, the student explicitly stated that they preferred learning in a passive, lecture-style learning environment compared to the active learning environment in which the class was designed, which is consistent with other research (e.g. Deslauriers et al., 2019).

Not all excerpts tagged under this theme, however, were critical of the active learning environment. Some students were able to provide specific interactions with other students which created a negative experience for them. One student recounted such an experience: “I really liked working in groups however some of them were hard to get along with [...] I didn’t feel comfortable asking my group for help in certain cases because another member was very aggressive.” Another interaction a student discussed related less to the fact that they did not like working with their peers, but more that they found it easier to compare themselves to other students which resulted in a feeling of inadequacy:

I remember when we were to work with our small groups over a set of problems that involved identifying parts of a quadratic function via a graph. While all three of them could understand how to find [the] domain, how to locate the vertex, and so much more, I couldn’t. I felt like if I asked for help, that I’d be labeled as something rather than intelligent. I was scared to even share my answers.

Although most students who submitted the Mathography assignment enjoyed learning in a more active setting, these excerpts show that some students had uncomfortable experiences in this classroom setting due to poor group dynamics or personal insecurities.

Student/Instructor Interactions

After Student/Student Interactions, Student/Instructor Interactions was the next most common subcode under the Community and Culture (n=186 out of 538 excerpts). Table 2 describes common themes associated with Student/Instructor Interactions and example student excerpts. Overall, comments under this subcode were positive in nature; only six out of 186 excerpts were somewhat negative. The majority of these negative comments referred to students wanting more direct guidance from instructors (e.g., “I also feel like the guessing games waiting for someone to magically conjure an answer out of thin air gets annoying, I would prefer to be guided and shown the way rather than having to find the way myself.”).

Table 2. Major Themes for Student/Instructor Interactions

Theme	Summary	Student Excerpt
Creating a supportive, engaging classroom environment	Providing in-class general instructional support to students	“My professor was very engaging and always emphasized participation and asking questions.”
Providing opportunities for support outside of the classroom	Interacting with students outside of class time (including tutoring, review sessions, and office hours)	“I also felt better about this when I went into tutoring the next week and my teacher told me I did really well.”

Creating a supportive, engaging, classroom environment. Several students expressed how their interactions with instructors in class affected their learning. Some students appreciated how they were able to quickly get support from instructors as compared to other experiences where an instructor would lecture for the duration of the class. One student compared this course with others that they had taken saying, “this was my favorite I was able to talk to the professor or his Aids [*sic*] for help.” This student went on to say that “having the constant support was better than just having a professor stand in the front and just do problems all lecture and instead walk around and engage students.” Thus, because of the instructional methods and classroom community, students felt like they could get help immediately from instructors in class when they needed it.

As mentioned in the Student/Student Interactions section, students occasionally felt reluctant to ask instructors for help or to ask them a question. Some students wrote that they appreciated when an instructor would approach them and ask how they were doing. As one student commented:

Both the teacher and the teacher assistants, [TA Name] in particular, were very helpful and were always going around asking if people needed help and were most often able to provide an answer. Communication between everyone was very good and helped me feel more comfortable in the class when asking questions to the teacher or TA.

Since the community of the classroom allowed for instructors to check on individual students and groups, students who were apprehensive about initiating a conversation with their instructors were still able to get the help they needed. Moreover, this type of classroom environment also allowed instructors to build trust with their students and eventually some students felt that they could ask their instructors questions when they did not understand a topic. Another student reflected on this growth:

I also liked these assignments because I was able to ask my professor questions one-on-one and get the clearer answers that I needed. At the beginning of the semester, I was a very shy and independent student. I think that these peak experiences helped me to “come out of my shell” and become more participative in class. I think that these experiences helped me to realize that it’s okay to ask questions.

Overall, students appreciated the in-class support provided by their instructors. These in-class student/instructor interactions allowed students to not only get the help that they needed when dealing with challenging mathematical concepts, but also learn how to ask questions and speak up when they needed help.

Providing opportunities for support outside of the classroom. In addition to their in-class experiences, students also wrote about getting help outside of the classroom. Although getting help with classwork outside of class can be a daunting task for students, one student recounted when they went to their first review session:

A high point for me in [College Algebra] was when I went to the review session for the class. I felt a bit uneasy and nervous about going there at first because I thought it would be awkward. When I gained the courage to go there, I saw the professors and students from other class periods. The environment was friendly. The professor sat down with me to help go step by step through the [learning outcomes] I had problems with. They answered all my questions, made me feel relieved about the coming [exam], and lifted the stress of not completing this class.

The community aspect of the course and students' relationships with their instructors allowed them to have the courage to ask for help when they needed it and better advocate for themselves outside of class. One student commented:

What did I get out of this class? Honestly, I feel like this class taught me to approach my professors regarding any questions or concerns I may have. Honestly, that's what they're there for, and really to take the initiative to attend office hours because they are beneficial in the success of this course.

These excerpts illustrate that students felt comfortable enough to approach instructors and ask them for help outside of class because of the open classroom community that was cultivated.

Discussion

The majority of excerpts about Student/Student Interactions were positive, showing that students were able to form a strong classroom community in an active learning setting. For the most part, students felt comfortable working together and asking each other questions even though there were some students who expressed disliking group work and feeling inadequate compared to their classmates. In addition, the excerpts relating to Student/Instructor Interactions show that students appreciated being able to develop close relationships with their instructors in an active learning setting. Due to the supportive classroom community that instructors helped to cultivate, students felt comfortable enough asking questions in class and seeking help from their instructors outside of class.

These findings provide insight for others who are interested in developing supportive classroom communities in active learning settings. To facilitate positive student interactions, instructors should be intentional about structuring group activities and helping students create group norms that promote the sharing of ideas in a "judgement free environment". In addition, instructors should strive to develop individual relationships with their students to help students feel more comfortable asking for help. Although this paper sheds light on interactions between students and instructors in active learning settings, further research is needed to better understand how these types of supportive classroom communities are cultivated.

Positive interactions between students and their classmates and instructors are crucial to creating a strong classroom community in which students are able to excel in their mathematical learning. First-year mathematics courses play a pivotal role in students' overall college success, so it is important that students feel like they belong in these classes. As demonstrated by our findings, a strong sense of community can help students feel both comfortable and confident in their interactions with other students and their instructors, thus supporting students in their learning and helping them to succeed in these courses.

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