Building Community in an Online-Only Statics Class

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Abstract

In Fall 2020 no student meetings were allowed, but experience tells us that students who feel more connected to the course are more likely to succeed. To combat the lack of contact, Engineering Statics at NC State University made use of assigned learning communities and learning assistants.

Before classes began, students were surveyed and split into 25-person learning communities. Each learning community was assigned a paid undergraduate learning assistant. Learning communities were assigned first on synchronous class time, then on communication preferences, then on minority status so that to the greatest extent possible no one was the only member of their minority in the learning communities.

Breakout sessions in the synchronous classes were populated with five people from these learning communities. The learning assistants attended class to answer questions during class. Student breakout session groups were rotated after each exam though learning communities remained the same. By the end of the semester students had worked with a majority of the 25 people in their learning communities.

Students were surveyed mid-semester to assess their feelings of community. Additionally the learning assistants were asked about the activity in the learning communities mid-semester and at the end of the semester. Some communities were more active than others with Discord channels showing the biggest usage. Student breakout sessions were adjusted for spring semester to require student assent to join.

Keywords

Statics, online-only, community, distance education, student engagement

Background

NC State Engineering students begin their career with a one-hour introduction to engineering. After that Engineering Statics is usually the first three-hour class students take in Engineering. The Statics class in Mechanical and Aerospace Engineering is a service course for primarily five degrees (Mechanical, Aerospace, Biomedical, Civil, and Nuclear) with small numbers of students from twenty different majors (such as Chemical, Industrial, Biological, Textiles, etc). Fall semester 2020 began with more than 400 students enrolled.

Statics is taught as a flipped class. Students are generally placed in assigned teams of three to work problems during class using problems out of the class course pack. NC State moved to entirely online instruction during Spring 2020 and remained online-only through Summer 2021.

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The flipped aspect of this class allowed instruction out of class to continue as it had before with the in-class portion in synchronous Zoom sessions. In an attempt to keep students working problems during class, during each Zoom session students were placed in breakout rooms to discuss their work out of the course pack.

During Spring 2020, students were placed in random breakout rooms each day. Certainly most students did learn the material, but not all. I had several students who were already retaking the class after failing it in Fall 2019. I met with one of those students in January to give him some hints on how to approach the class. He buckled down and engaged with his small team. He was passing with a solid B at Spring Break. After break his performance disintegrated. When I met with him again, he explained that when he was working with a group, he could ask questions at each step. Once we moved online, he was willing to ask me occasional questions in class, but he couldn't stop me as often as he needed to be able to understand the material. As a consequence of not being in a consistent small group, he failed my class again.

Literature

Liu et al reviewed the connection between the sense of community and student satisfaction.[1] They were able to correlate the sense of connectedness with student satisfaction (and incidentally also used the phrase “learning communities”). The students reported difficulty finding that community in online classes. Their suggestions included the importance of social introductions and niceties to establish feelings of familiarity among the students.

Brown and Bursal mapped the National Survey of Student Engagement to identify feelings of community.[3] While they were able to see a correlation with satisfaction and feeling part of the community at the school, trying to prove a correlation with engagement and student success was elusive. Young and Bruce investigated social engagement across the campus.[3] Some colleges (notably The College of Education) saw higher levels of connection than others; most crucial were the feelings of community with instructor and with other students.

Engineering Education literature counts tens of thousands of papers which investigate increasing student engagement. Lockwood and Hunt, for example, showed improvement in retention but not a statistically significant improvement.[4] Most authors I was able to find were unable to show that increased engagement led to increased learning. Nonetheless, anecdotal evidence and personal experience lead many faculty to agree with the importance of helping students stay involved with the class.

The Classroom Setup

Engineering students need to learn to work as an engineering team. The employers who hire our students tell us that the ability to work together and communicate with others is highly regarded.

Moving from an in-person flipped classroom to online-only education was of course a challenge. Having students work together over a single work-surface as an engineering team was not possible in a socially-distanced classroom. Having students work with random others rather than teammates with whom they had built some rapport was also less than optimal. Having students in a class 50% of the time and watching online the other 50% of the time was worse.

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In June 2020 I requested that regardless of the state of the lockdown in North Carolina, Statics be taught entirely online with required synchronous problem sessions for the duration of the COVID-19 pandemic. My goals were to recreate as much as possible small, consistent teams where students could learn to work together and could build sufficient rapport to help each other learn.

Students were surveyed before classes began to collect their preferences: (The full survey is in Appendix A.)

- time of day they could come to a synchronous class or if they preferred asynchronous learning
- gender preferences and/or minority status
- time of day they worked best (larks vs night owls)
- and preferred text application such as Discord, Slack, GroupMe, Hangouts, etc.

Students were carefully sorted into 25-person learning communities. The primary sort criterion was time of day for synchronous class or asynchronous learning. The total enrollment for my sections was high which allowed learning communities to be created so that no minority student was the only one in a learning community. The final sort criterion was on preferred text application. Students stayed with their learning community all semester.

Undergraduate Learning Assistants (LA's) were assigned to each learning community. The LA set up a texting channel in the preferred application. One learning community used Slack, five used Discord, three used a Google Meet, and seven used GroupMe for SMS texting. The LA's were paid one hour a week to engage with the students by text and to monitor the chats for inappropriate behavior. All the students also had access to message boards in Moodle which I monitored and where I answered questions.[5]

This class is flipped, so students were expected to read the book and watch a few short videos before class time. A short prep quiz (five to eight multiple choice questions) was available to encourage participation: Students who failed to take the quiz before class time had a 25% penalty on their quiz grade. Prep quizzes could be taken three times with their highest grade counting. The average of their prep quizzes contributed 5% to the semester grade.

Most students (87%) chose to participate in the synchronous classes. During class students were placed in 5-student breakout rooms with members selected from their learning community. These breakout rooms were consistent for each phase of the class leading up to a midterm. The LA assigned to that learning community also attended the synchronous Zoom class and bounced between their five assigned breakout rooms to assist their learning community members. Any breakout room could also use the “Ask for Help” button to summon me to their breakout room.

The problem statements from the course pack were edited to be available in Google slides. These slides were shared so students could copy them into their own university-provided Google drive. During each breakout room, one student shared the screen with their copy of the blank slides. There was enough blank space on each of the slides so all the students could use Zoom's annotate tools to work the problems on the screen. Drawing free-body diagrams on the shared screen was

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specifically requested so that either the LA or I could pop into the breakout room and assess quickly how the team was proceeding.

These groups changed after each test (four different groups over the semester) but students were always in a breakout room with others from their learning community. These groups represented a safe place for students to engage with each other and ask as many questions as they desired.

Attendance was taken during each class using TopHat. Students were asked 5-10 questions during each class in TopHat to assess their learning. These questions allowed students to get extra feedback on their group work. TopHat grades contributed 5% of the overall semester grade for synchronous students.

Results

The learning communities were successful at creating community for some students. At the end of the semester, I requested the LAs count or approximate the number of conversations which had happened over the course of the semester. These values ranged from 1 to >100. One Discord channel had more than 1500 messages over the course of the semester: "The [count of messages from the] 9:30 group is a harsh rounding because they talked 24/7," said the LA. Average conversations (questions and responses) over the semester: Discord 64, Groupme 49, Google Meet 9, and Slack 40. Over the semester, students with synchronous Zoom connections to their learning community averaged 55 conversations in their chat while asynchronous student chats averaged only 23 conversations.

By the end of the semester I noticed many groups working past the end of class. The online version of the class allowed greater flexibility in time: No class was waiting for their seats and the students had no need to walk to a library. Some groups worked as much as a half-hour after my 50-minute class almost every class period.

Mid semester I polled the students. The question text read: "Human beings generally thrive better in communities rather than as hermits in a mountain cave. While 2020 has certainly been challenging, have you found any of these to be helpful for you feeling like part of this class? (select all that apply)" Out of the 343 responses received, students reported the following as having helped them.

• the discussion board for my learning community	86	25.07%
• the discussion boards in Moodle	109	31.78%
• the breakout sessions in class	176	51.31%
• office hours	43	12.54%
• a study group that you met in this class	123	35.86%
• something else that has helped you feel like a part of this community	70	20.41%
• None of these has helped me connect to anyone in the class.	57	16.62%

The results suggest to me that the students experienced community principally through their breakout rooms and that they did not really associate that community with the chat channel for their learning community.

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Students were allowed to switch between asynchronous and synchronous experiences of the class after each of the three midterms. Fifty-nine students (17%) of my class tried out each kind of learning but the majority of students stuck with either being synchronous or asynchronous. A comparison between the grades for the synchronous and asynchronous is found in Table 1.

Table 1. Asynchronous vs Synchronous Student Grades

	Synchronous throughout N = 205, 59%	Percentage	Asynchronous throughout, N = 85, 24%	Percentage
A	42	20.5%	12	14.1%
B	77	37.6%	27	31.8%
C	49	23.9%	21	24.7%
D, F, or Late Drop	37	18.0%	25	29.4%

The best student I had was asynchronous throughout the semester as was the third-best student, indicating that there was sufficient material available for a dedicated student to learn the material without any community at all. However for the majority of students, coming to class was better than not coming to class. Students were 60% more likely to fail if they were asynchronous throughout the semester.

Comparing student grades during Fall 2020 is complicated by the enhanced pass-fail option students were offered. Even after the semester was completed, students were offered the chance to convert their grades to pass-fail or to process a late drop without penalty. This option (or perhaps just the pandemic in general) led to a greater number than I normally see of students who just stopped doing the work. Also there is no way to gauge whether working problems with a group made a difference or whether students with that sense that others were depending on them led to a better work ethic.

Premature Reshuffling

The original plan for Fall 2020 was to pull new groups after each of the three midterms – four unique groups over the course of the semester for each student.

Before the third midterm when groups were to be reshuffled anyway, the participation in the breakout rooms had become subpar. Too many students were logging in but not turning cameras on, not coming prepared, and not annotating on the screen. The LAs and I discussed our options and experiences. I decided to reassign the groups for the breakout rooms one week early and to allow students to sign up with their friends. Students were also given the option of coming to class and being in a quiet breakout room where they had no expectations placed on them.

184 students (52%) signed up for an active breakout room with other students and pledged to come to class prepared and ready to work together. 51 students (14%) wanted to have to come to class and answer TopHat questions but did not want to work with anyone else. This inactive yet synchronous option was called the Library. 120 students (33%) opted to finish out the semester

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as asynchronous students, ten of whom did not even take the final. After allowing this reshuffling, the LAs and I felt that the breakout rooms were a much livelier place.

Most students ended up signing up for a breakout room in the last weeks of the semester with students whom they had met in previous breakout rooms. Unfortunately, there is no way to identify who will successfully finish out the semester with a consistent level of effort and then to populate all the breakout rooms with only those students.

At the end of the semester, students were asked, "If you had a beloved cousin who was taking my class in Spring 2021, what would you tell them to choose in the class types?" with the choices 1) synchronous in an active breakout room, 2) asynchronous, or 3) synchronous in a quiet breakout room. 70% of students responded that they would recommend an active breakout room. 21% would recommend an asynchronous experience and only 8% recommended a quiet breakout room.

Spring 2021

These where the three choices given to students in Spring 2021. Students were surveyed to build the learning communities with the added requirement that they had to choose an active breakout room to be in one: The default for students who did not complete the survey was to be placed in the Library, a synchronous but inactive breakout room. As they chose, students were reminded that the Active Breakout Rooms had the highest success rate for students passing the class. Students who did not fill in the survey were put into the Library.

The Library has proven to be a useful tool for students who needed the routine of time set aside for class but for whom working with a team in a breakout session was too distracting for whatever reason. Three weeks into the spring semester, 10% of students remain in the Library.

Some students originally placed in the Library requested a more active breakout room. Including both students who picked an Active Breakout Room and who chose to move in afterwards, 74% of students are active. The LAs and I have more standing to nudge students to participate since everyone in an active breakout room chose to be there. The remaining 16% of the students are in an asynchronous group.

Conclusions

Being online for the entire semester reduced the disruption of pivoting mid-semester. Creating learning communities in this way was complicated but resulted in some fantastic groupings of students. Consistent populations in breakout rooms was markedly better than randomly assigned breakout rooms with more than 50% of my students reporting that the breakout rooms increased their sense of community within the class. The text discussions outside of class time within the learning communities had mixed success but had a low cost to implement so that even groups that had low volume of conversations did not suffer because of a text place they didn't use.

It may be that enforcing longer posts or including students in content creation could assist in feelings of community.[6] The terribly sad part is the 17% of the class for whom nothing I tried worked to help them feel connected to the class. It is worth noting that the primary survey of students indicated that fully 48% of my students reported mental health challenges in Spring

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2020 at least once a week which interfered with their schoolwork. Future work could investigate whether a correlation exists between the students with mental health challenges and those who felt no sense of community in the class.

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Appendix A: Introductory Survey

Each student must express a preference for synchronous or asynchronous instruction for each phase of the class (the period before each exam, 4 in total.)

This form is only for the first 8 days of class. After exam 1, you will be asked how you wish to learn for phase 2 (between exam 1 and exam 2.)

Required Section:

Email:

What would you like for Phase 1 (the first 8 class days):

- I commit to coming to class at 8:30. (only for sections 1 and 605) 46 (12.1%)
- I commit to coming to class at 9:30. (open to anyone) 158 (41.5%)
- I commit to coming to class at 3:00. (only for section 3) 75 (19.7%)
- I will be an asynchronous student. Please place me in an asynchronous Learning Community. 98 (25.7%)
- I will be an asynchronous student. And I don't want to be in a Learning Community at all. (Not recommended.) 4 (1%)

Optional Section:

Answers to the rest of this survey are just to increase communication between us. Leave anything blank you'd like. Just trying to get to know my students!

In your educational experience this spring, how often was your productivity limited by:

	never	1-4/week	1-2x/day	constantly
caring for children	330	18	7	0
caring for someone else	273	66	12	6
working more hours than planned	197	120	20	20
looking for a job	245	87	15	6
poor wifi	187	136	26	11
unreliable electricity	332	25	0	0
sharing a device	337	17	0	0
finding enough quiet	156	124	57	23
time management	108	159	63	28
mental health	185	101	42	31
physical health	263	56	29	5
guard deployment	351	1	0	0

Anything big going on that I should know about? Any limitations you expect to face this fall?

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Would you identify yourself as an individual from a rural, suburban, or urban background? (You may pick more than one.)

• Rural	121	32.9%
• Suburban	267	72.6%
• Urban	52	14.1%

Did you have family dinners growing up where you could argue with your parents?

• Argument/debate with grownups was celebrated.	41	11.5%
• Argument/debate with grownups was accepted.	185	52.1%
• No dinners as such.	43	12.1%
• Argument/debate with grownups was frowned on.	62	17.5%
• Argument/debate with grownups was not tolerated.	28	6.8%

Are you a night owl or a lark (morning person)?

• Night Owl -- I work best after 6 pm	161	44.4%
• Lark -- I work best before 2 pm	93	25.6%
• Neither -- I work best between 2 pm and 6 pm	88	24.2%
• Honestly, I just have a hard time working at all.	21	5.8%

Given the course prerequisites and your background from high school or other schooling, rate your level of preparation for this class.

• I have serious concerns about whether my preparation is sufficient.	6	1.6%
• I am uncertain whether my preparation will be good enough.	136	36.9%
• I'm pretty sure that my preparation is good enough.	189	51.2%
• My background is really solid. I'm ready.	38	10.3%

When you think of your own identity, do you identify with any of these groups which are historically underrepresented in engineering classes? Note: I'm only asking so I can make sure (to the best of my ability) that no one is the only ____ in a learning community.

• Female	64	50.4%
• Agender, Gender Fluid, Genderqueer, Non-Binary, Two-Spirit, other	4	3.1%
• African-American, Black	13	10.2%
• Hispanic	20	15.7%
• Native American	2	1.6%
• LGBT	11	11.0%
• non-native English speaker	14	11.0%
• nontraditional student (more than 30 years old)	5	3.9%

What's your preferred way to communicate with a group of friends?

• Discord	119	33.4%
• Slack	15	4.2%
• Groupme / Text	151	44.8%
• Hangouts	18	5.1%
• I've never used any of those to communicate with a group.	25	7.0%

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Appendix B: Welcome Message

Hi all! I am your learning assistant for the 3:00 [dept] class. My name is Mason Petrusic, I am currently a junior in Mechanical Engineering at [university]. I took Statics last semester during the period in which the college was altered to the online format. Having said that, I have experienced a little of what you all are going to go through with this class changing to online and hope to assist Dr. [instructor] in making Statics as fun an experience as it can be online.

Statics itself is a tough class. There is no way to sugar coat it. There are some topics that may stump you to the point of giving up. It is important to know that this class is not trying to weed you out. Dr. [instructor] has more than enough resources in order to ensure your success, from multiple learning assistants to message boards that are monitored multiple times a day. This class showed me that there is nothing wrong with reaching out for help if you do not understand something or need help keeping up with the class. You would be able to find me weekly sitting down with the LA's in the library working out the homeworks last spring semester.

With the course being online, we have to change our main modes of communication. Discord is going to be used for our group. Below is the invite link to the Discord.

https://[link]

After joining, I would like you all to first introduce yourself and then tell us why you are excited for the semester! Do this in the general chat. Let me know if you have any issues joining the Discord and I will try my best to assist you.

I look forward to developing this Learning Community with you all!

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