Randomized Controlled Trial of 1st Semester Linked Course Learning Communities for STEM Retention

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Abstract: Linked-course learning communities are a widely used strategy to promote connections between students and support student retention. This grant project created linked-course learning communities at Bridgewater State University, a public University in southeastern Massachusetts. The communities paired a central 3-credit seminar focused on one or more United Nations Sustainable Development Goal (UN SDG) with the student's first science class and appropriate mathematics class. This choice was inspired by social psychology research literature showing that students traditionally underrepresented in STEM often value, and look for, the social relevance of science and benefit from structures that provide a more communal, as opposed to individualistic, orientation in their studies.

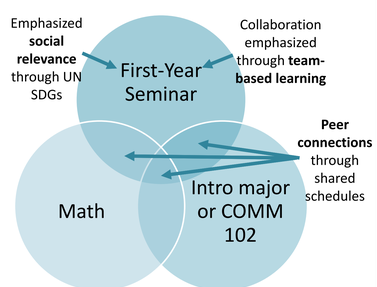
Background

- Peer connections are widely seen as a powerful force in student success (Pascarella & Terenzini, 2005)
- Students who come from more communal cultures (e.g., students of color, first-gen students, women) often feel a cultural mismatch with individualistic collegiate norms (e.g., Boucher et al., 2017; Stephens et al., 2012)
- Peer connections occur in the classroom when students take multiple courses together, which correlates with increased student success (Ramsey et al., 2023)
- Linked-course learning communities have been utilized on many campuses in a variety of forms (Fosnacht & Graham, 2022), but the research tends to suffer from selection effects

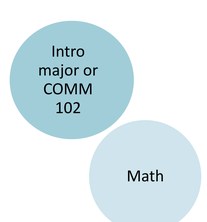
Research Question: In a randomized controlled trial, do linked-course learning communities increase student success?

Study Design

- **Matched random assignment** based on major, math placement, race, gender, first-generation status, and Pell eligibility
- All incoming students were emailed a schedule, corresponding to their random assignment to either the community (linked courses) or control group (unlinked courses)
- Students opted in to the study by taking the schedule they were assigned, or opted out by creating their own schedule
- Mediating variables:
  - Social networking variables: shared classes with STEM peers
  - Psychological variables (sense of belonging, communal perceptions of STEM, etc.): first semester pre/post surveys
- Dependent variables:
  - Student success: retention, grades, credits earned



MicroCOSM Communities (*n*=127)

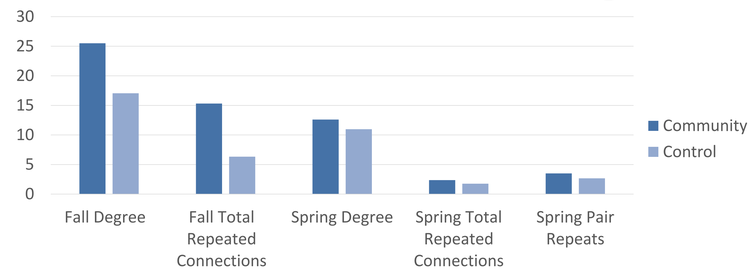


Control Group (*n*=164)

Participants (*N*=291)

- All first-time, first-year STEM majors in STEM in Fall 2021, 2022, or 2023
- Demographics:
  - Gender/Sex: 38.1% female, 60.5% male, 1.3% missing
  - Race: 41.2% Students of Color, 58.8% White
  - First-generation: 47.1% first-gen, 52.6% continuing-gen, .3% missing
  - Low-Income: 33.0% Pell-eligible, 57.4% non-Pell-eligible, 9.6% missing
  - Commuter: 35.4% commuter, 64.6% residential
- Majors: Biology (30%), Chemistry (5%), Comp Sci (38%), Geography (2%), Geology (4%), Mathematics (14%), Physics or Photonics (7%)

Results: Social Networking



Degree: Number of different STEM majors enrolled in same course sections.
Total Repeated Connections: Tally of number of times a connection repeated.
Spring Pair Repeats: Tally of number of peer pairs in classes both fall and spring.

Community students had significantly more connections overall and repeated connections in both the fall and spring, compared to the control group.

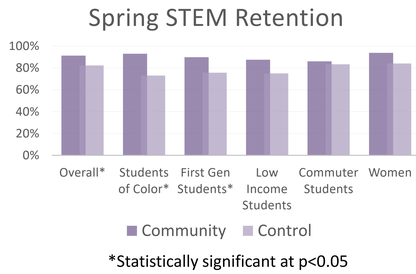
Results: Psychological Variables

Through pre/post surveys, we measured the following variables:

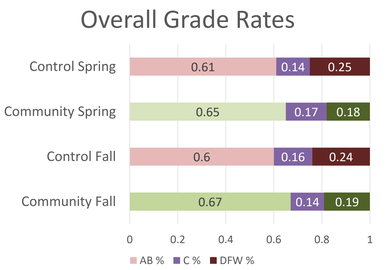
- Sense of belonging
- Intrinsic motivation
- Efficacy
- Communal perceptions of STEM
- Faculty support
- Peer support
- Isolation
- Global impact of STEM
- Awareness of SDGs
- Importance of teamwork in STEM

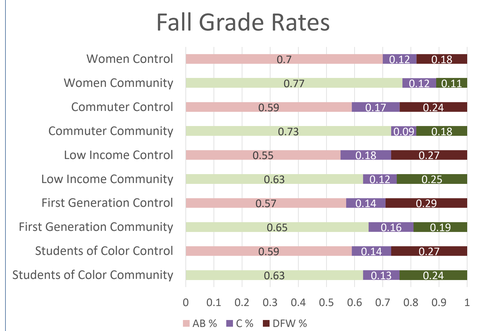
None of these measures showed meaningful differences between the community and control groups. This could be the result of a positive response bias, as well as a relatively low response rate.

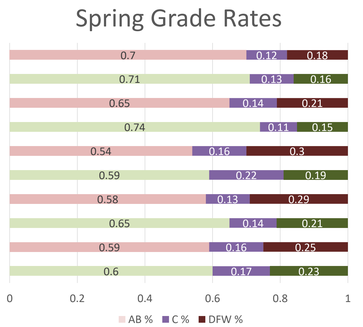
Results: Student Success



*Statistically significant at p<0.05







Discussion

Limitations:

- Low response rate for the surveys (*n*=93)
- Cannot tease apart the impact of peer connections versus social relevance of STEM content in our communities

Future Directions:

- Keep tracking students to assess longer-term outcomes, such as social networks in sophomore through senior years, graduation rates, GPA at graduation, etc.
- Expand the integration of social relevance in STEM courses beyond the first-year seminars

Conclusion:

- Communities increase social connectivity as measured by social network variables
- Communities increase STEM retention and broadly assist student in achieving higher grades.

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