Students watch out Results
Year 2 S1: 2 for them and explaining 10 (2018). https://doi.org/10.1186/s40594
Rainey, K., Dancy, M., Mickelson, R.
Year 2 S2: Next day, students work in groups for two Sometimes I worry that I do not belong in this physics class Students' complete homework problems out Rainey found that students who persist in STEM majors report a greater sense of belonging than those who I feel comfortable in this physics class
On average, students who earned higher overall letter grades reported a stronger sense of belonging; these I feel like I belong in this physics class
Students' sense of belonging, like Lewis et al. (2017), as the extent a student feels valued, accepted, and a legitimate member of the scientific community. 1
• Rainey found that students who persist in STEM majors report a greater sense of belonging than those who choose to leave STEM. 2
• Callian and Smith found that students' course performance is not correlated with the gender composition of students' studio groups but is correlated with students' self-reported level of test anxiety and sense of belonging in the course. 3

Sense of Belonging

Methods
General structure of PHGN200:
• Students watch out-of-class preparatory video
• Followed by interactive one-hour class, extensive discussion among students
• Next day, students work in groups for two-hours of problem-solving and lab activities (Studio)
• Students' complete homework problems out-of-class

Differences in course structures:
• Year 1 Semester 1 (S1) and Semester 2 (S2): Rotated between attending in-person and remotely during in-class portions of the course. Three midterm exams. Final exam but optional in Year 1 S1.
• Year 2 S1: Attendance all in-person for in-class portions of the course. Three midterm exams and required final exam.
• Year 2 S2: Attendance all in-person for in-class portions of the course. Seven quizzes using homework problems and required final exam.

Survey administered at the end-of-semester:
• I feel like I belong in this physics class
• I feel like an outsider in this physics class
• I feel comfortable in this physics class
• I feel like I can be myself in this physics class
• Sometimes I worry that I do not belong in this physics class

Results
Sense of belonging ranges from 1 (weak sense of belonging) to 5 (strong sense of belonging)

○ On average, students who earned higher overall letter grades reported a stronger sense of belonging; these means, when segregated by letter grade, were relatively consistent across different course structures.
○ Course structure with quizzes corresponded to higher overall letter grades and a stronger sense of belonging in the course than course structures with midterm exams.
○ Surprisingly, students' sense of belonging did not change drastically from a hybrid course structure to being entirely in-person when the midterm exam structure was in place.

Students' Comments
"One thing I have found helpful during my physics experience at Mines is seeing people of color as professors and TAs. As a person of color, seeing someone who looks more like me in positions of power is inspiring. I am sure other students feel the same, as it can often make students of color relate to their instructors on a deeper level."
"After taking the two different versions of PHGN200 (midterm and quiz), I believe that the current quiz system is much better, and I feel that I have enjoyed physics and learned a lot more this semester than when I took it before."
"I like the quiz style over the big midterm exams, I feel like it has helped me to understand the concepts more and I've bonded with my peers over studying for them and explaining problems together."
"If I could have a say, I would recommend the quizzes. Like I said it was it been a lot less stressful, and I feel like I can take more time to understand concepts. The last time took Phys 2; I was trying to cram a lot before every exam. Going through both versions, the quiz system has been a lot better on my mental health."

Preliminary result: Students express a stronger sense of belonging with quiz structure in Year 2 S2 compared to their prior experience in a physics course with midterm exams

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