

FEAR OF NEGATIVE EVALUATION AND STUDENT ANXIETY IN COMMUNITY COLLEGE ACTIVE LEARNING SCIENCE COURSES.

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Introduction to the Subject and Problem

Anxiety is increasingly common and can have negative impacts on college students and more specifically on college science students. Particularly, as we transition our classes to active learning, studies have demonstrated that anxiety can have negative effects, but anxiety can also have positive effects on students (Cooper, Downing, et al., 2018; Cooper and Brownell, in press).

To our knowledge, all of the studies exploring the relationship between active learning and student anxiety in college science have been conducted exclusively at four-year institutions. However, community colleges have been recognized as key contributors to undergraduate science education (Fletcher and Carter, 2010); in fact, on average 46% of undergraduates are enrolled at a community college each year and 44% of students with science and engineering undergraduate degrees attended community college (Tsapogas, 2004; Labov, 2012). Further, because community colleges tend to have more diverse student populations, community colleges have the potential to play a major role in the persistence of underrepresented and unserved students in undergraduate science (Hagedorn, 2012). Understanding the educational practices as well as the challenges facing students in community college science courses is critical because the attrition rates of students pursuing science careers are higher at community colleges compared to four-year institutions; specifically Bettinger (2010) reported that only 14% of community college students who intended to major in a science, technology, engineering or math (STEM) fields were still enrolled in a STEM field at the time of their last enrollment, compared to 43% of all college students. Therefore studying factors, such as student anxiety, that may

negatively affect student persistence in science (England et al., 2018) adds to a growing body of literature aimed to further elucidate ways in which community colleges can maximize student success.

In this study, we examine the factors that influence student anxiety in active learning community college science courses, and propose a framework incorporating the experiences of community college students that elucidates the factors influencing student anxiety in the context of active learning.

Methods and Procedures

Interview recruitment

We used a theoretical sampling approach by recruiting community college students enrolled in active learning science courses to be interviewed. Specifically, we emailed the chairs of biology departments across nine community colleges and asked them to send an email to all instructors in their department on our behalf. Six instructors replied to the solicitation and agreed to participate; they sent out a recruitment email to all students in their active learning science courses to participate in the study. We conducted interviews with twenty-nine students.

Student levels of anxiety

To get an estimate of students' anxiety levels, we asked each participant to complete the Generalized Anxiety Disorder 7-item scale (GAD-7) to measure the severity of anxiousness experienced regularly.

Student interviews

Semi-structured interviews were conducted by one interviewer via Skype to accommodate students' schedules as students were recruited from nine community college

campuses in the region. Students were asked to explain why specific aspects of active learning increased or decreased their feelings of anxiousness. To contrast students experiences in active learning and traditional lecture, we also asked students what aspects of their traditional lecture science courses, if any, increased and decreased their feelings of anxiousness.

Interview Analysis

Our intent was to develop a framework elucidating the relationship between active learning and student anxiety in the context of college science courses. We used grounded theory when conducting our analysis. Constant comparison of quotes was meant to ensure that the description of the theme adequately represented all quotes within the same group and that the quotes were not different enough from one another to warrant a separate theme. These approaches allowed for multiple revisions of coding themes and allowed the authors to define a final set of codes.

Analyses and Findings

Participants and study context

In this study, we interviewed 29 community college students who were enrolled in at least one community college active learning science course at the time of the interview. Among the 29 students, they had attended nine of the community colleges in the district because students frequently take courses at multiple colleges. Of the students interviewed, 76% identified as female and 24% identified as male. Forty-five percent of the students identified as White/Caucasian, 31% identified as Hispanic/Latino/a, 7% identified as Black/African American, 7% identified as Asian/Pacific Islander, 3% identified as American Indian/Alaskan

Native, 3% identified as multiple races and 3% declined to state. Forty-one percent of participants identified as a first generation college student, 21% identified as a primary caregiver in their familial unit, and 48% reported working more than 20 hours per week during the semester. The majority of the students (79%) intended to transfer to a four-year institution. Over half of the students (55%) were interested in pursuing a major in nursing or allied health (e.g. x-ray technician, dental hygienist), 7% of students were interested in pursuing science-focused majors (i.e. biological sciences, exercise science), 7% of students were undecided, and the remaining 31% of students were interested in other non-science careers, such as education, business, or psychology. Categorizing students' day-to-day anxiety levels using the GAD-7 scale (Spitzer et al., 2006), we found that 38% of students identified with experiencing minimal anxiety (GAD-7 score < 5), 34% identified with experiencing mild anxiety (GAD-7 score 5-9), and 28% reported experiencing moderate anxiety (GAD-7 score 10-14).

Finding 1: Active learning decreases community college student anxiety in college science courses because students perceive they learn better in active learning.

We found that overwhelmingly, community college students enrolled in active learning science courses felt that active learning practices decreased their anxiety because they perceived they learned more during active learning compared to traditional lecture (Cooper, Downing et al., 2018).

Students indicated that traditional lecture science courses often move too quickly and cover too much content, which students perceived hinders their learning and increases their anxiety.

Students often described that community college traditional lecture science courses increased their anxiety because their instructors were trying to fit too much science content into a limited amount of time, and therefore it felt as though the lectures were moving too fast.

Active learning provides students with access to help from the instructor and opportunities to learn from other students during class, which decreases their anxiety.

In contrast to traditional lecture, active learning courses decreased student anxiety because of the number of opportunities present to clarify students' understanding of science content during class. Specifically, students highlighted how the opportunity to talk with instructors during class helped alleviate their anxiety.

Students also described that active learning also decreased their anxiousness because they were often asked to work in groups, which they perceived helped to improve their understanding of science content. Specifically, students highlighted that hearing different ideas from other students was particularly helpful in reducing their anxiety.

Finding 2: Active learning increases community college student anxiety in college science courses because it can induce fear of negative evaluation.

Fear of negative evaluation (FNE), or the sense of dread associated with being unfavorably evaluated while participating in a social situation (Watson and Friend, 1969; Weeks, 2005), was a prominent factor underlying student anxiety in active learning college science courses at four-year institutions. In this study, we identified ways in which FNE can affect students as well as key aspects of active learning courses that can alleviate and exacerbate student FNE.

Student FNE in group work seems to stem from students not identifying as a science person or not feeling knowledgeable enough about biology.

Students described experiencing FNE when working with other students during group work, particularly because they viewed themselves as someone who is “not good at science.” For example, Claire explained that she is not good at biology and subsequently worries that she might say something “stupid,” which would cause other students to negatively evaluate her intelligence.

FNE was pervasive among students who were enrolled in science courses where the instructor called on students when they did not volunteer.

Many students described that their most severe feelings of anxiety were caused by FNE were associated with being called on in front of the whole class without volunteering to speak. Generally, students described that instructors used cold call during class, or called on students who did not volunteer without using any system to ensure randomness and without any opportunity to discuss an answer with others before speaking (Eddy et al., 2015), elicited the highest FNE. Importantly, students never referenced having time to think through a question before being asked, or having time to discuss the question with their neighbor, which has been suggested to be important for student learning during cold call (Nicol and Boyle, 2003; Nielsen et al., 2012). Students were afraid that if they were called on by an instructor when they did not volunteer and they didn’t know the answer they might look “foolish,” or “dumb.”

FNE can motivate students to learn course content

Calling on students when they do not volunteer to answer a question has been listed as a key active learning practice to help students learn better (Eddy et al., 2015). In this current study, students' fear of negative evaluation seemed to inspire them to pay attention in class or study the science content because they were afraid of how others would view them if they were to get the answer wrong.

Interestingly, students exclusively described that they perceived their community college instructors used cold call as a way to get students to pay attention in class, and no students perceived it was meant to promote a deeper learning of content. While paying attention in class may be helpful to students' learning, we would suggest that giving students notice about when an instructor would use cold call may cause students to prepare for class before coming, which has been shown to improve student learning (Rahman et al., 2015)

Contribution

High levels of anxiety have been shown to inhibit students' academic performance and persistence in science (England et al. 2018). This study aimed to explore the relationship between active-learning practices and student anxiety in hopes of providing community college instructors with information about how to minimize students' high-anxiety in their classrooms. Overwhelmingly, we found that active learning decreases student anxiety because students felt like they learned more, had more opportunities to practice, and more opportunities to engage with their peers and their instructor. However, fear of negative evaluation was identified as underlying students' anxiety during active learning activities, specifically when the instructor called on students when they did not volunteer. Student anxiety may negatively affect student

persistence in science (England et al., 2018), which is particularly important when considering ways in which community colleges can maximize student success and reduce attrition rates.

General Interest

This study illustrates that active learning can both increase and decrease students' anxiety depending on the techniques being used. We hope that this study encourages instructors to create more inclusive active learning science courses by implementing active learning in ways that minimize students' anxiety.

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