


# Feeling Like an Imposter: The Effect of Perceived Classroom Competition on the Daily Psychological Experiences of First-Generation College Students

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## Abstract

Many college students intend to pursue science, technology, engineering, and math (STEM) careers but quickly abandon these goals when confronted with notoriously competitive STEM courses that often pit students against each other. This emphasis on interpersonal competition could be especially detrimental for first-generation (FG) college students, an underrepresented group in STEM fields which more strongly values communality and collaboration relative to their continuing-generation peers. Thus, FG students may experience more imposter feelings in STEM courses perceived as having a competitive culture. A longitudinal study (with 818 students and 2,638 experience-sampling observations) found that perceived classroom competition was associated with greater daily in-class imposter feelings among all students—but especially among FG students. Imposter feelings in turn predicted students' end-of-term course engagement, attendance, dropout intentions, and course grades. Classroom competition and the imposter feelings it engenders may be an overlooked barrier for promoting the engagement, performance, and retention of FG students in STEM.

## Keywords

first-generation college students, classroom competition, imposter feelings, experience-sampling methodology

First-generation (FG) college students—those who are the first in their family to attend college—comprise nearly one third of all college attendees (Skomsvold, 2015; Staklis, 2016), but they face a number of economic and social obstacles that make succeeding in and completing college more difficult. Compared to continuing-generation (CG) students (i.e., students whose parents or siblings attended college before them), FG students have less familial guidance for navigating higher education and consequently experience more difficulty adapting to college, earn lower grades, and drop out of college at higher rates (Cataldi, Bennett, & Chen, 2018; Holmes & Slate, 2017; Redford & Hoyer, 2017; Terenzini, Springer, Yeager, Pascarella, & Nora, 1996; U.S. Department of Education, 2017). These performance and retentions gaps are most pronounced in science, technology, engineering, and math (STEM) fields (American College Testing, 2015; Chen & Carroll, 2005; Shaw & Barbuti, 2010). This is problematic because individuals who pursue these STEM occupations tend to earn significantly higher salaries (U.S. Department of Labor, 2019). Therefore, the attrition and underperformance of FG students in STEM has the potential to maintain FG-CG achievement gaps in higher education, the STEM workforce, and to sustain or exacerbate the existing economic inequality.

While a number of factors contribute to the underperformance and attrition of FG students in STEM fields, these gaps may also reflect psychological processes that are initiated by the structure of STEM environments (e.g., Aspelmeier, Love, McGill, Elliott, & Pierce, 2012; Cabrera, Miner, & Milem, 2013). Most of the research to date has focused on the individual and cultural differences between FG and CG students and how these differences explain students' experiences in college in general. For instance, researchers have shown that FG students' precollege experiences (e.g., lack of academic preparation and college “know how”; American College Testing, 2015; Calarco, 2014; Chen & Soldner, 2013; Gaddis, 2013), cultural features of universities at large (e.g., interdependent vs. independent culture and institutional support; Garriott & Nisle, 2018; Stephens, Fryberg, Markus, Johnson, &

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Covarrubias, 2012; Stephens, Hamedani, & Destin, 2014), and the personal academic goals and approaches of FG college students (e.g., performance vs. mastery goals and academic self-concepts; Bruno, Jury, Toczek, & Darnon, 2019; Darnon, Jury, & Aelenei, 2018) all contribute to FG-CG achievement and retention gaps. Although these approaches explain why FG students underperform in college in general, they fail to explain why FG students are more likely to underperform and drop out of STEM fields in particular. What is it about STEM learning environments that is particularly disadvantageous for FG students? We hypothesize that a specific feature of STEM classroom environments—perceived classroom competition—can negatively influence FG students' daily psychological experiences within those classroom environments and ultimately contribute to decreased engagement, attendance, retention, and performance in STEM courses.

STEM courses are notoriously competitive and often involve pitting students against each other in a zero-sum manner through the use of (still) common pedagogical practices such as applying a curve to students' performance or through explicit competitive messages (e.g., "look to your left, look to your right, at the end of the semester only one of you will be left"). Indeed, American stereotypes about the genius "lone scientist" suggest that to be successful in STEM, one must outperform others to reach the top (Brown, Steinberg, Lu, & Diekmann, 2017). STEM careers are often associated with agentic or individualistic goals (e.g., power, achievement and self-promotion) rather than communal or interdependent goals (e.g., helping others and collaborating; Diekmann, Brown, Johnston, & Clark, 2010; Diekmann, Clark, Johnston, Brown, & Steinberg, 2011). This clash between the individualist and zero-sum emphasis of classroom competition and the interdependent and communal values of FG students (Jackson, Galvez, Landra, Buonora, & Thoman, 2016; Markus & Connor, 2013; Stephens et al., 2012) may lead FG students to doubt their academic abilities and worry that others may doubt them too (i.e., imposter feelings). Commonly called "imposter feelings," Clance (1985) defined the imposter phenomenon as an "intense feeling of intellectual inauthenticity." These feelings of being an imposter in class may in turn decrease classroom engagement, discourage students from attending class altogether, increase their thoughts of dropping out, and contribute to lower grades in their STEM courses.

## The Negative Consequences of Classroom Competition

Decades of research focusing on classroom goal structures has shown that classrooms that emphasize competition between students have negative consequences for students' confidence, motivation, well-being, and learning (Ames & Archer, 1988; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Meece, Anderman, & Anderman, 2006; Urda, 2004). Competitive academic environments are associated with higher levels of anxiety and stress and often lead students to doubt their competence (Abouserie, 1994; Sommet, Pulfrey, & Butera, 2013;

Wilkinson & Pickett, 2009). In competitive academic environments, students are encouraged to gauge their own competence by comparing themselves to others, which can have deleterious effects for all students in the classroom regardless of generational status.

Yet, we argue that classroom competition could have especially detrimental consequences for FG students due to cultural mismatches between the interdependent and communal values that FG students are commonly raised with (e.g., relying on and connecting with others) and the individualist and zero-sum values regularly emphasized in courses with competitive classroom dynamics (Stephens et al., 2012; Stephens et al., 2014). In one correlational study, FG college students enrolled in a competitive STEM major (i.e., civil engineering) reported significantly less motivation to learn compared to CG students; however, no differences were found in motivation between FG and CG students in a less competitive STEM major (i.e., life sciences; Sommet, Quiamzade, Jury, & Mugny, 2015), suggesting that classroom competition may be especially demotivating for FG students. Similarly, in an experimental study, FG college students performed worse on a math test compared to CG college students when they were given a message that universities were highly competitive (Jury, Smeding, & Darnon, 2015). However, when they were given a message that universities were not highly competitive, the performance gap between FG and CG students was eliminated. Most relevant to the current work, Posselt and Lipson (2016) found in a nationally representative sample of over 40,000 college students that when students perceived their classes as more competitive, they were at greater risk for anxiety and depression. Moreover, FG students were at even higher risk than their CG counterparts when they perceived high levels of classroom competition.

## Imposter Feelings

Classroom competition encourages comparisons with others and can therefore foster feelings of self-doubt, concerns about being a "fraud," and ultimately a heightened sense of imposter feelings (Hutchins, 2015; Leary, Patton, Orlando, & Funk, 2000; Parkman, 2016). Self-perceived "imposters" often worry that, although their charade may currently fool others, it is only a matter of time before they are exposed as incompetent and unfit for their current context (Clance & Imes, 1978; Clance & O'Toole, 1987). Such beliefs stoke anxiety, self-doubt, and fear of failure (Cokley, McClain, Enciso, & Martinez, 2013; Cozzarelli & Major, 1990; Kumar & Jagacinski, 2006; Leary et al., 2000), which in turn undermines motivation (Kumar & Jagacinski, 2006; Vaughn, Taasobshirazi, & Johnson, 2019).

To date, researchers have documented increased rates of imposter feelings among women (e.g., Clance & Imes, 1978; McGregor, Gee, & Posey, 2008; Vaughn et al., 2019) and racial minorities (e.g., Cokley et al., 2013; Dancy & Brown, 2011; Peteet, Brown, Lige, & Lanaway, 2015). We add to this literature by examining imposter feelings among FG college students. FG college students—a minority group that is

sometimes stigmatized as having low ability (Croizet & Claire, 1998; Croizet & Dutr vis, 2004)—may be especially likely to develop imposter feelings, especially in STEM environments with competitive classroom dynamics where their intellectual ability may be questioned. Classroom competition may invoke threat among FG students and highlight the fear that their perceived intellectual inferiority may be “found out.” The more FG students feel like an imposter on a day-to-day basis, the more they may become disengaged, stop going to class, or even consider dropping out of the class altogether—and all of these behaviors may have negative implications for classroom performance. Taken together, we predict that the negative relationship between classroom competition and imposter feelings may be stronger among FG students, compared to CG students.

Although imposter feelings have been linked to a number of negative academic outcomes (Cozzarelli & Major, 1990; LaDonna, Ginsburg, & Watling, 2018; Leary et al., 2000; Tao & Gloria, 2018), almost all previous research relies on imposter feelings measured at a single time point—suggesting that these feelings are trait-specific, rather than context-specific. We hypothesize that perceived classroom competition would ignite imposter feelings and therefore might fluctuate on a day-to-day basis. We fill this gap in the literature by measuring students’ daily in-class experiences of imposter feelings as they occur in real time and linking these experiences to students’ end-of-semester academic outcomes including their engagement, attendance, dropout intentions, and course grades.

## The Current Study

The present research makes several contributions. First, in a large sample of STEM courses, we examine whether the longitudinal effects of perceived classroom competition are moderated by students’ generational status. Second, we utilize experience-sampling methodology (ESM) to assess students’ daily in-class feelings of being an imposter in class. This method allows students to report their experiences as they are happening in real time, which provides more accurate assessments of what students are thinking, feeling, and doing in the moment compared to retrospective reports that suffer from common biases in retrieval (Csikszentmihalyi & Larson, 2014). The current study uses ESM to capture the daily in-class experiences of FG students and analyzes over 2,500 daily ESM reports. Finally, we examine the downstream consequences of students’ in-class imposter feelings on their course motivation and achievement such as students’ class engagement, attendance, thoughts about dropping the class, and course grade. We predict that greater perceived STEM classroom competition will be associated with greater imposter feelings in class, particularly for FG students, and that these daily psychological experiences would be associated, in turn, with lower class engagement, decreased attendance, greater intentions to drop the course, and lower grades in the class.

## Method

### Participants

Nine hundred and forty-eight freshmen and sophomores enrolled in 1 of the 48 introductory-level STEM courses<sup>1</sup> at a large, public Midwestern university participated in this study. We recruited participants from the university’s largest introductory STEM courses that had the highest enrollment of freshmen and sophomores. All freshmen and sophomores in these 48 courses were eligible to participate. Each student was linked to a single STEM course—that is, students were enrolled in only 1 of the 48 participating courses. One hundred and thirty participants were excluded from the analyses by listwise deletion (see Supplemental Material). The final sample included 818 students (12% FG; 65.6% female; 72.2% White, 8.9% Asian/Asian American, 4.3% Black, 4.0% Hispanic, 10.6% Other/Biracial). We conducted a sensitivity analysis using Monte Carlo power simulations in Mplus Version 8.1 (Muth n & Muth n, 1998–2017) as recommended for multilevel models. Results of this sensitivity analysis indicated that we had adequate power to detect effect sizes as small as .10 (standardized coefficients from the multilevel model). Additional details regarding the sensitivity analysis are reported in the Supplemental Material.

### Procedure

At the beginning of the semester and after the drop deadline (Weeks 2–4), students completed a survey in which they reported their perceptions of classroom competition in their STEM class and their demographics (e.g., FG status). Students received a link to the survey via e-mail and completed the survey a few weeks into the semester so that they had some experience with the course to gauge the classroom dynamics. Because students were still enrolled by the drop deadline, we had some confidence that participating students intended to stay in the class throughout the semester. Then, during a 2-week period starting in the 6th or 7th week of the semester, students received text messages immediately following their specific STEM class that provided them a link to complete experience-sampling (ESM) surveys. Communications were customized so that students received text messages only on the days in which they had class. Therefore, students enrolled in a course that met 2 (or 3) days per week received the link to the same survey 4 (or 6) times during the 2-week period. Students responded to the ESM surveys using their smartphones and reported whether they attended their STEM class that day. If a student did not attend class, they were prompted to explain why they did not attend, after which the survey was terminated. For students who did attend class that day, they were asked to report their in-class imposter feelings. On average, students completed 3.23 surveys ( $SD = 1.32$ , range = 1–9) during the 2-week period. Students who did not own smartphones ( $n = 3$ ) were provided with a smart device to facilitate their participation. At the end of the semester (Weeks 14–15),

students received a link to a final survey via e-mail in which they reported their engagement over the course of the semester in their particular STEM class, how often they attended the STEM class, and how often they thought about dropping the STEM class. Students' end-of-semester grades in the STEM class and their (standardized test scores) SAT scores were retrieved from university records.

## Measures

Supplemental Material includes the full text of all measures.

**Perceptions of classroom competition.** Two items measured students' perceptions of classroom competition (i.e., "The professor seems to pit students against each other in a competitive manner in this class" and "Students tend to be very competitive with each other in this class";  $\alpha = .68$ ), ranging from 1 (*strongly agree*) to 7 (*strongly disagree*). Items were recoded so that higher scores reflect greater perceived classroom competition.

**Demographics.** Students reported their FG status by answering yes/no to the question, "Are you first in your family to attend college?" ( $-1 = no/CG$ ,  $+1 = yes/FG$ ). Given that our primary research question concerned students' imposter feelings, we felt it necessary to measure generational status from the students' perspective—that is, did students perceive *themselves* to be FG? Some students might not consider themselves FG if they have siblings or extended family who attended college, so assessing students' self-construals seemed most appropriate if we wanted to understand their psychological experiences in class. Other variables assessed as covariates included self-reported gender ( $+1 = female$ ,  $-1 = male$ ), race/ethnicity ( $+1 = underrepresented\ racial\ minority: Black, Hispanic, Native\ American$ ;  $-1 = majority: White, Asian$ ), and students' perceived family socioeconomic status (SES; assessed by the item: "How would you describe your family's social class?" and rated on a scale of 1 = *working class*, 2 = *lower middle class*, 3 = *middle class*, 4 = *upper middle class*, and 5 = *upper class*). Family SES was recoded to create a dichotomous variable (1 = *working class, lower middle class, and middle class*,  $-1 = upper middle class and upper class$ ), although results remain the same when using the continuous measure. Finally, students' SAT (or ACT equivalent) scores (range = 400–1,600) were collected from university records as a measure of prior academic achievement.

**Imposter feelings.** Students completed experience-sampling (ESM) surveys on their smartphones directly after their specific STEM class. Imposter feelings were assessed with 4 items, adapted from Leary, Patton, Orlando, and Funk (2000; e.g., "In class, I felt like people might find out that I am not as capable as they think I am";  $\alpha = .86$ ), rated on a scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Higher scores reflect greater imposter feelings.

## Course outcomes

**Engagement.** To assess students' STEM class engagement over the course of semester, students responded to the item: "In [specific STEM class] this semester, how often did you feel engaged during lecture?" using a 5-point scale (1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*, and 5 = *always*). Higher scores reflect greater feelings of engagement.

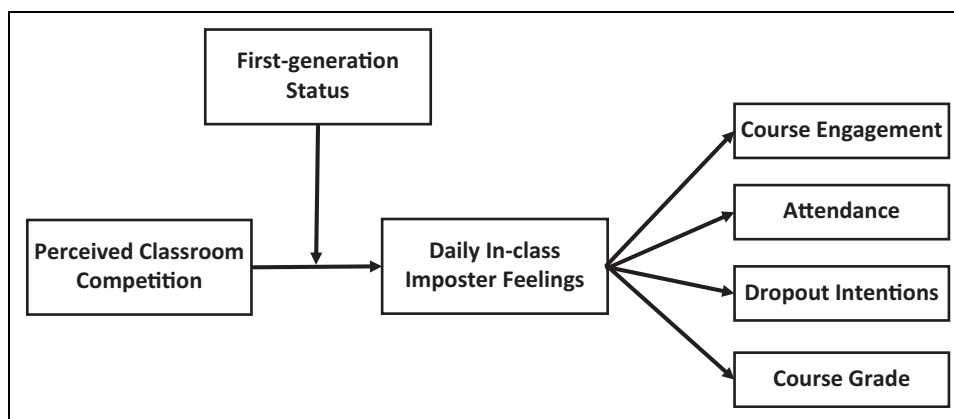
**Attendance.** Students self-reported their class attendance with the item: "In [specific STEM class] this semester, how often did you attend class?" using a 5-point scale (1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*, and 5 = *always*). Higher scores reflect greater attendance. There was a significant positive correlation between this self-reported measure of attendance and ESM survey completion during the 2-week ESM period,  $r(775) = .16$ ,  $p < .001$ , indicating that students' retrospective accounts of how often they attended class was associated with their attendance behavior during the semester.

**Dropout intentions.** To assess students' thoughts about dropping the STEM class during the semester, students responded to the item: "In [specific STEM class] this semester, how often did you think about dropping out of the class?" using a 5-point scale (1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*, and 5 = *always*). Higher scores reflect greater dropout intentions.

**Grades.** Students' final grades in their STEM course were collected from university records and were coded using the university's Grade Point Average (GPA) Scale (A = 4.0, A– = 3.7, B+ = 3.3, B = 3.0, B– = 2.7, C+ = 2.3, C = 2.0, C– = 1.7, D+ = 1.3, D = 1.0, D– = 0.7, F = 0).

## Analytic Approach

We analyzed the data in three steps. First, using multilevel modeling (Raudenbush & Bryk, 2002), we tested perceived classroom competition and its interaction with FG status ( $-1 = CG$ ,  $+1 = FG$ ) as predictors of daily in-class imposter feelings. Second, we tested direct effects of perceived classroom competition and its interaction with FG status on each course outcome (i.e., engagement, attendance, dropout intentions, and course grades). Third, we tested our hypothesized indirect effects models of classroom competition, moderated by FG status, on engagement, attendance, dropout intentions, and course grades via daily feelings of being an imposter in class (see Figure 1). Table 1 provides bivariate correlations among all variables and Table 2 provides descriptive statistics, separated by student generation status. We included gender, underrepresented racial minority status, and SAT scores as covariates in all analyses. All results remained statistically significant when covariates were removed from the models. More details regarding the multilevel models, covariate rationale, and results without covariates are reported in the Supplemental Material.



**Figure 1.** Visualization of the theoretical indirect effects model. Perceived classroom competition is theorized to predict students’ feelings of being an imposter in class, which in turn is theorized to predict their course engagement, attendance, intentions of dropping the course, and their end-of-semester course grade. The direct effects of perceived classroom competition to all outcome variables are reported in the Results section.

**Table 1.** Correlations and Overall Descriptive Statistics for All Variables.

Variable	1	2	3	4	5	6	7	8	9
FG status	—								
Perceived classroom competition	-.06	—							
Daily in-class imposter feelings	.02	.13**	—						
Course engagement	.03	.03	-.16**	—					
Attendance	.04	-.04	-.16**	.30**	—				
Dropout intentions	.05	.09*	.31**	-.26**	-.19**	—			
Course grade	-.07	-.05	-.17**	.27**	.32**	-.46**	—		
SAT	-.22**	-.05	-.04	-.02	.01	-.18**	.35**	—	
Gender	.04	-.06	.06	-.03	.01	.07	-.05	-.18**	—
N	837	837	837	696	700	694	808	837	837
Grand mean	—	2.14	2.17	3.35	4.58	1.57	3.20	1,236	—
SD	—	1.16	0.92	1.06	0.71	1.09	0.90	158.22	—

Note. FG status was coded: 1 = FG, -1 = continuing generation. Gender was coded: 1 = female, -1 = male. FG = first generation; SAT = standardized test score. \* $p < .05$ ; \*\* $p < .01$ .

**Table 2.** Descriptive Statistics for All Variables, Separated by Generation Status.

Variable	Continuing Generation			First Generation		
	n	M	SD	n	M	SD
Perceived classroom competition	720	2.18	1.19	98	1.95	0.94
Daily in-class imposter feelings	720	2.15	0.98	98	2.15	1.01
Course engagement	598	3.34	1.06	80	3.39	1.01
Attendance	601	4.57	0.72	81	4.64	0.68
Dropout intentions	596	1.54	1.07	80	1.68	1.10
Course grade	697	3.22	0.89	93	3.01	0.98
SAT	720	1,249.39	155.30	98	1,138.88	153.80

Note. SAT = standardized test score.

## Results

### Imposter Feelings

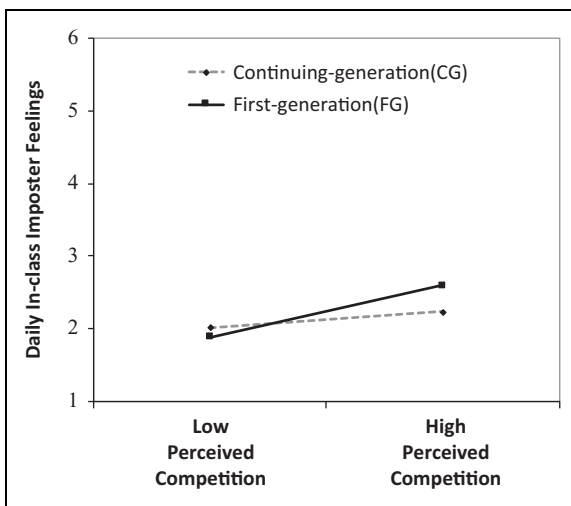
We found that students who perceived their STEM class to be highly competitive experienced greater daily feelings of being

an imposter in that class, compared to students who perceived less classroom competition,  $B = .23, p < .001$  (see Table 3). However, consistent with the cultural mismatch hypothesis, we found a significant interaction with perceived classroom competition and FG status,  $B = .12,$

**Table 3.** Fixed Effects Estimates From Multilevel Models Predicting Daily In-Class Imposter Feelings.

Variable	B	t (df)	p	B	t (df)	p
Perceived classroom competition	.23	4.00 (788)	<.001	.23	4.01 (787)	<.001
FG status	.06	1.15 (792)	.253	.05	1.03 (789)	.305
Perceived Classroom Competition × FG	.12	2.15 (783)	.032	.12	2.15 (782)	.032
SAT	-.02	-0.57 (761)	.571	-.01	-0.39 (769)	.696
Underrepresented racial minority	.17	1.72 (795)	.087	.16	1.65 (794)	.099
Gender	.08	2.27 (803)	.024	.08	2.25 (802)	.025
Family SES				.02	0.72 (794)	.470

Note. FG status was coded: 1 = FG, -1 = continuing generation. Gender was coded: 1 = female, -1 = male. Underrepresented racial minority was coded: 1 = Black, Hispanic, Native American, -1 = White, Asian. Family SES was coded: 1 = working class, lower middle class, and middle class, -1 = upper middle class and upper class. FG = first generation; SAT = standardized test scores; SES = socioeconomic status.



**Figure 2.** Average daily in-class imposter feelings as a function of perceived classroom competition and first-generation (FG) status (-1 = CG, 1 = FG). Competition values are predicted values based on  $\pm 1$  SD above and below the mean of perceived classroom competition.

$p = .032$  (see Figure 2). In courses perceived to have high levels of classroom competition ( $+1$  SD), FG students experienced more daily feelings of being an imposter in class, compared to CG students,  $B = .18$ ,  $p = .030$ . However, in courses perceived to have less classroom competition ( $-1$  SD), imposter feelings did not differ between FG and CG students,  $B = -.07$ ,  $p = .333$ .

An important question is whether FG status is simply a proxy for SES. If so, we should find the same results when examining family SES as a predictor. To examine this alternative, we conducted analyses on daily in-class imposter feelings controlling for family SES (e.g., working class and middle class vs. upper class). Including family SES in the model did not change statistical significance (see Table 3), suggesting that classroom competition is particularly harmful for students who perceive themselves to be first in their family to attend college rather than simply for students who perceive themselves to have less financial privilege. In other words, the link between classroom competition and imposter

feelings is especially pronounced for students with less familial experience with college (i.e., FG college students) and is not primarily due to social class (see Supplementary Material for additional analyses).

### Direct Effects on Course Outcomes

There were no statistically significant direct effects of perceived classroom competition on any end-of-semester course outcomes: class engagement,  $B = .03$ ,  $p = .657$ ; attendance,  $B = -.02$ ,  $p = .717$ ; dropout intentions,  $B = .09$ ,  $p = .215$ ; course grades,  $B = -.03$ ,  $p = .528$ . The interactions with perceived classroom competition and FG status on the course outcomes were also not significant, all  $ps > .58$  (see Table 4).

### Indirect Effects on Course Outcomes

Moving to our hypothesized indirect effects models (see Figure 1), we examined whether students' perceptions of classroom competition predicted students' daily feelings of being an imposter in class, which in turn predicted students' engagement, attendance, dropout intentions, and performance in their STEM class. Separate models were run for each course outcome variable. We found significant indirect effects of perceived classroom competition for FG students on all end-of-semester course outcomes: course engagement (*indirect effect* =  $-.12$ , 95% CI [ $-.23$ ,  $-.04$ ],  $p = .003$ ), attendance (*indirect effect* =  $-.10$ , 95% CI [ $-.18$ ,  $-.03$ ],  $p = .002$ ), dropout intentions (*indirect effect* =  $.26$ , 95% CI [ $.10$ ,  $.44$ ],  $p = .002$ ), and course grades (*indirect effect* =  $-.09$ , 95% CI [ $-.18$ ,  $-.03$ ],  $p < .001$ ). These indirect effects were significant for CG students (see Table 5), however, these effects were much larger (approximately 3 times as large) among FG students. In other words, perceived classroom competition predicted greater daily feelings of being an imposter in class among all students, on average, which in turn, predicted lower engagement, lower attendance, more dropout intentions, and lower grades. However, perceived classroom competition was especially harmful for FG students as these perceptions had a much stronger association with students' daily in-class psychological

**Table 4.** Fixed Effects Estimates from Multilevel Models Predicting Course Outcomes.

Variable	B	t (df)	p
<b>Course engagement</b>			
Perceived classroom competition	.03	0.45 (698)	.657
FG status	.03	0.51 (695)	.612
Perceived Classroom Competition × FG	.03	0.48 (695)	.632
SAT	-.05	-1.16 (708)	.247
Underrepresented racial minority	-.21	-1.80 (696)	.073
Gender	-.06	-1.33 (710)	.184
<b>Attendance</b>			
Perceived classroom competition	-.02	-0.36 (704)	.717
FG status	.06	1.40 (701)	.161
Perceived Classroom Competition × FG	.03	0.55 (701)	.583
Standardized Test Scores (SAT)	-.05	-1.69 (711)	.091
Underrepresented racial minority	-.26	-3.08 (701)	.002
Gender	-.02	-0.55 (715)	.585
<b>Dropout intentions</b>			
Perceived classroom competition	.09	1.24 (695)	.215
FG status	-.04	-0.57 (691)	.569
Perceived Classroom Competition × FG	-.01	-0.15 (690)	.881
SAT	-.19	-4.18 (691)	<.001
Underrepresented racial minority	.31	2.59 (692)	.010
Gender	.10	2.31 (707)	.021
<b>Course grades</b>			
Perceived classroom competition	-.03	-0.63 (825)	.528
FG status	.01	0.26 (824)	.794
Perceived Classroom Competition × FG	-.01	-0.25 (822)	.801
SAT	.36	11.58 (859)	<.001
Underrepresented racial minority	-.16	-1.87 (824)	.062
Gender	.00	-0.07 (849)	.942

Note. FG status was coded: 1 = FG, -1 = continuing generation. Gender was coded: 1 = female, -1 = male. Underrepresented racial minority was coded: 1 = Black, Hispanic, Native American, -1 = White, Asian. FG = first generation; SAT = standardized test scores.

**Table 5.** Indirect Effects of Perceived Classroom Competition on Engagement, Attendance, Dropout Intentions, and Grades via Daily In-Class Imposter Feelings.

Outcome	Estimate	LLCI	ULCI	p
<b>Indirect effects for FG college students</b>				
Course engagement	-.12	-.2332	-.0351	.003
Attendance	-.10	-.1781	-.0325	.002
Dropout intentions	.26	.1020	.4417	.002
Course grades	-.09	-.1781	-.0307	<.001
<b>Indirect effects for CG college students</b>				
Course engagement	-.03	-.0610	-.0059	.008
Attendance	-.02	-.0467	-.0058	.003
Dropout intentions	.06	.0158	.1168	.005
Course grades	-.02	-.0473	-.0074	<.001

Note. All models controlled for prior academic achievement (SAT scores), gender, and underrepresented racial minority status (Black, Hispanic, Native American). LLCI = lower level 95% confidence interval; ULCI = upper level 95% confidence interval; FG = first generation; CG = continuing generation; SAT = standardized test scores.

experiences and their subsequent engagement, attendance, dropout intentions, and course grades, compared to CG students.

## Discussion

To attract and retain more students in STEM fields, it is critically important to promote the performance and retention of both CG and FG students in introductory STEM courses (National Association of Colleges and Employers, 2018; U.S. Department of Labor, 2019). In the largest experience-sampling study of FG students to date, we found that classroom environments perceived to be rife with competition were associated with negative course outcomes for all students and especially for FG students. For all students, perceived classroom competition was associated with greater feelings of being an imposter in class, which indirectly predicted students' course engagement, how often they attended the course, how often they thought about dropping the course altogether, and the grades that they earned in those courses. However, perceived classroom competition was most problematic for FG students. Both the direct effect of perceived classroom competition on daily experiences of feeling like an imposter and the indirect effects of these psychological experiences on course outcomes were 2–3 times larger among FG students, compared to CG students.

Why is classroom competition linked to more imposter feelings among FG students? These in-the-moment psychological experiences may be due to the cultural mismatch between the interdependent values that FG students bring to college and the individualistic or zero-sum values communicated by classroom competition (Stephens et al., 2012; Stephens et al., 2014). When asked for their reasons for attending college, FG students are more likely to list communal motivations (e.g., to use their degree to help others, give back to their families and communities); whereas, CG students are more likely to list more self-serving reasons (e.g., self-exploration, becoming an independent thinker; Harackiewicz et al., 2014; Stephens et al., 2012). Thus, competition within a STEM course may force students to adopt agentic, self-serving goals (e.g., to compete with and best others) and reinforce the common perception that STEM fields are less likely to serve the helping motives and communal goals that FG students often report for obtaining a STEM degree (Diekman et al., 2010; Diekman et al., 2011).

Although many times FG status is used as a proxy for social class (Pascarella & Terenzini, 1991; Snibbe & Markus, 2005), our results suggest that perceived classroom competition and the imposter feelings it breeds are specific to students who are the first in their family to attend college rather than generalizing to all students from low socioeconomic backgrounds. While FG status is indeed highly correlated with social class (Davis, 2012; Ward, Siegel, & Devenport, 2012), some FG students come from backgrounds with high degrees of wealth and economic capital and some CG students come from more economically disadvantaged backgrounds. In our analyses, even when holding social class constant, the effects of FG status remain, suggesting that higher financial privilege does not erase the daily imposter feelings that FG students experience in classes they perceive as competitive. Although, in general, most students reported relatively low perceptions of classroom



competition, STEM courses perceived to be competitive seemed to heighten FG students' concerns about being discovered as a fraud in class. Thus, courses that are structured to be less competitive and that emphasize collaboration and learning together—skills that are increasingly called for among STEM graduates (Adams, Black, Clemmons, & Stephan, 2005; U.S. Department of Education, 2016)—may provide a pathway for FG students' success in STEM.

### *Limitations and Future Directions*

While the current study enhances our understanding of how FG students experience competitive classroom environments, it is important to acknowledge its limitations. To answer our primary research question, we were limited to measures collected as part of a larger study examining college students' experiences in introductory STEM courses. Therefore, many of our outcome variables are single-item measures. Future research could replicate our study with multiple-item scales. Another limitation of using data from a larger study is that our measure of classroom competition was administered only once a few weeks into the semester and course engagement, attendance and dropout intentions were measured only once—asking students to reflect on these experiences and behavior over the course of the semester. Future research could use ESM surveys to examine fluctuations in each of these experiences and how they relate to daily in-class imposter feelings.

All research methodologies have trade-offs, and experience-sampling methods are no exception. ESM has high ecological validity—by testing psychological constructs immediately in real-world contexts—and, thus, reduces memory biases relative to other sampling methods (Beal, 2015; Scollon, Kim-Prieto, & Diener, 2003); however, it also has drawbacks (Conner, Tennen, Fleeson, & Feldman Barrett, 2009; Scollon et al., 2003). ESM ratings may be biased by repeated exposure to questions and survey fatigue. That is to say, repeatedly seeing questions about imposter feelings may have activated those feelings, particularly among FG students who are sensitive to cues to threat. However, our ESM measures were limited to once per day over a 2-week period to minimize the risk of activating imposter feelings with repeated inquiries. In addition, if the effects described were purely due to the sampling method, we would expect to see the link between FG status and imposter feelings regardless of perceived classroom competition. Nonetheless, it will be important for future research to replicate our findings using other methods.

It will also be important for future research to extend our findings to groups with intersecting identities. For instance, prior research indicates that women and racial minorities are more at risk of developing imposter feelings than their male and racial majority counterparts (Cokley et al., 2013; Dancy & Brown, 2011; Kumar & Jagacinski, 2006; Peteet et al., 2015). Therefore, FG women and FG racial minorities might be more likely to experience imposter feelings in classrooms perceived to be competitive than FG men and FG nonminority students. We could not detect effects for intersectional groups

in our sample due to power, though these hypothesized intersectional differences should be explored in the future.

### **Conclusion**

How can faculty make their STEM courses less competitive? This question is also ripe for future research. We know very little about the cues students use to determine whether a classroom is perceived to be high or low in classroom competition. Our measure of perceived classroom competition captured both faculty-driven (e.g., pitting students against each other) and student-driven (e.g., students are competitive with each other) practices. Thus, it will be important to document the statements and behaviors that signal competition to students (e.g., from faculty, students, or both), how these messages may interact (e.g., faculty messages stoking competitive behavior among students), and how these cues to competition can be mitigated. By understanding the source of competitive classroom cultures, researchers can better address those specific classroom cues in targeted interventions. Our hope is that such work will lead to useful practice and policy recommendations for faculty and students, which will transform competitive STEM classroom environments into collaborative spaces where all students (and especially FG students) thrive.

Nationwide, FG students represent a large pool of potential scientists, engineers, and mathematicians. To provide the most equitable learning environment for these individuals, and to maximize the number of FG students that are retained in STEM fields, it is critical to examine how features of the classroom environment are associated with negative experiences in introductory STEM courses. Our results suggest that perceived classroom competition may be one overlooked barrier for FG students in STEM courses.

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## Supplemental Material

The supplemental material is available in the online version of the article.

## Note

1. We used the National Science Foundation's definition of science, technology, engineering, and math when recruiting courses, which includes disciplines such as math, physical science, computer science, and some social sciences (National Science Board, 2015).

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