



Status in a psychological statistics class: The role of academic and status-based identities in college students' subjective social status

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Abstract

Great effort has been invested in increasing STEM achievement among students, but feelings of low status among underrepresented or otherwise vulnerable students may be creating additional challenges. The present study assessed how perceptions of social status within the classroom—termed subjective social status—aligned with objective course performance and differed by sex, first-generation status, work status, and race/ethnicity among 713 students enrolled across three introductory statistics classes. Findings indicated that final exam score was moderately related to ratings of subjective social status, suggesting that factors besides objective course performance may influence classroom subjective social status. When asked to explain how they evaluated their standing in the course, students reported five main themes, including both academic achievement with respect to exam scores and their understanding of course content. When examining differences by status-based identities in subjective social status, we found that female and first-generation students had lower subjective social status compared to their male and continuing-generation peers, although results were less robust for first-generation status. Likewise, working students reported lower subjective social status relative to non-working students, despite showing no difference in final exam score. In contrast, although Asian/Asian American students outperformed Latine students, there were no differences in reports of subjective social status between Asian/Asian American, Latine, and white students. Taken together, results suggest that factors beyond course performance may relate to students' subjective social status, and subjective social status may contribute to disparities in academic performance, especially by sex and work status.

Keywords Subjective social status · College · Work status · Ethnicity · Marginalization

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1 Introduction

Self-concept refers to one's beliefs about themselves based on their experiences, and self-concept theory posits that students' perceptions of their academic abilities are dynamically informed by social contexts and comparisons (Marsh, 2007). Despite objectively performing well in a course, a student may feel that they are underperforming relative to their classroom peers and consequently feel discouraged from further course engagement (Oyserman & Destin, 2010). Ecological systems theory posits that individuals are living within varied interconnected systems, including the microsystem—one's immediate environment including one's family, peers, home environment, and school—and the macrosystem—the broader cultural norms and societal values (Bronfenbrenner & Morris, 2006). Despite efforts to promote equitable learning in proximal environments, systems of oppression from the macrosystem likely pervade all systems and thereby shape student experiences. Although systems of oppression disadvantage all individuals, those from marginalized identities are most negatively impacted (Crocker & Major, 1989). Structural barriers, stigma, and societal messages that certain groups are relatively more valued may cause underrepresented students to be especially inclined to negatively appraise their classroom standing (Fischer, 2007; London et al., 2011; Park et al., 2020).

One facet of self-concept is gauging one's standing relative to other individuals, referred to as subjective social status (Adler et al., 2000). Subjective social standing may be particularly salient in STEM courses including statistics courses, which are often considered anxiety-inducing and competitive for many students (Chew & Dillon, 2014; Stoloff et al., 2010). Promoting equity within statistics courses is essential because these courses are required for varied majors and play a foundational role in students' development of critical thinking and reasoning (Lawson et al., 2003; Son et al., 2021). The present study aimed to investigate the degree to which objective academic performance and subjective social status in the classroom are related and to identify the factors that contribute to students' perceptions of their standing. Guided by ecological systems theory (Bronfenbrenner & Morris, 2006), we examined whether subjective social status differed by status-based identities with the hypothesis that underrepresented groups may have lower subjective social status relative to peers in the classroom, even after accounting for course performance.

1.1 Subjective standing in educational contexts

According to self-concept theory, classroom contexts inform the development of academic self-concept because students naturally tend to assess their standing relative to peers (Chevalier et al., 2009; Marsh, 2007). Relative standing may have lasting implications for students' achievement. Evidence supporting the big-fish little-pond effect suggests that students who perform relatively better than peers in their school or class tend to become more successful than those with comparable academic ability but lower standing, at least partially due to contextually-driven contrastive social comparison with peers (Huguet et al., 2009; Marsh, 1987; Marsh et al., 2007; Wang, 2015; Wang & Bergin, 2017). Among elementary, middle, and

high school students, higher objective standing relative to class peers was associated with higher rates of high school and college completion, even after accounting for students' objective academic ability (Denning et al., 2020; Elsner et al., 2018; Yu, 2020). Adults who perceive themselves as having low status, termed having low subjective social status, in society tend to feel that life circumstances are beyond their control (Keltner et al., 2003; Kraus et al., 2009). Students with low subjective social status may similarly internalize these feelings and believe that they cannot succeed academically, which can impact their overall achievement (Oyserman & Destin, 2010).

Ecological systems theory suggests that factors across systems, including both distal (i.e., macrosystem) and proximal (i.e., microsystem) factors, have implications for students' experiences that should be considered (Bronfenbrenner & Morris, 2006). Researchers have examined the formation of subjective social status in society and relative to peers at one's school (e.g., Destin et al., 2012; Loeb & Hurd, 2019; Rahal et al., 2020), but individuals tend to evaluate themselves relative to their most proximal group as a frame of reference (Zell & Alicke, 2010). Consequently, students may be inclined to compare themselves with classmates rather than with other students at their school or society more generally. Indeed, achievement relative to other secondary students within the same class was comparably more related to students' self-concept than achievement relative to other secondary students in the same school (Liem et al., 2013). Identification of the factors that contribute to one's subjective social status proximally within a classroom may enable courses to be developed to better scaffold these perceptions and thereby address the consequences of low subjective social status. Just as self-concept is posited to differ by varied factors (Marsh, 2007), subjective social status may be related to both conscious and subconscious social comparison as well as other factors, such as achievement. Therefore, research is needed regarding how students perceive their subjective social standing and the factors that students consider when evaluating their social standing within the context of a course—a highly proximal system—particularly in higher education and in STEM classes.

1.2 Factors that shape subjective social status in the classroom

Students' perceptions are often discordant with objective academic standing, potentially due to varied contextual factors and experiences beyond academic performance (Brown et al., 2015; Chemers et al., 2001; Chevalier et al., 2009). Prior studies have found that middle school students' academic self-concept and their perceived standing relative to their classmates, with respect to how good they were at the subject or how challenging the subject was for them, are interrelated but not identical (Huguet et al., 2009; Wang & Bergin, 2017). Ecological systems theory highlights the need to consider how aspects of the macrosystem may impact these processes (Bronfenbrenner & Morris, 2006). Thus, in addition to dispositional factors (e.g., one's academic achievement or motivations), experiences related to identities that have been historically tied to status in society may be associated with differences in students' perceptions.

Students with social identities that are marginalized by systems of oppression in society including sexism, classism, and racism—particularly women, students of lower socioeconomic status, and racially/ethnically minoritized students—may also be positioned to have lower status proximally in their classes. Racism and sexism contribute to disparities in STEM retention and performance by reducing perceived belonging and beliefs about success in the classroom (Dika & D’Amico, 2016; Tellhed et al., 2017; Walton & Cohen, 2007). For example, women and racially/ethnically minoritized students—especially Black and Latine students—often experience negative stereotypes and additional costs related to the course that can cause them to feel unwelcome or that their accomplishments are underappreciated relative to those of their peers (Blackburn, 2017; Lindsay, 2021; Smith et al., 2015; Sutter et al., 2023; Van Es & Weaver, 2018; Wong et al., 1998). Salience of these stereotypes may cause students to receive, be vigilant for, and internalize negative feedback in academic settings (Master & Meltzoff, 2020; Mayo et al., 2012; Mor & Winquist, 2002; Vanderhasselt et al., 2018). Research on socioeconomic status has shown that children and adults of lower socioeconomic status tend to both experience more frequent and intense stressors and to be more sensitive to ambiguous or threatening cues (Chen et al., 2004; Gallo & Matthews, 2003; Gianaros et al., 2007; Kraus et al., 2011). This sensitization may prompt students to have low subjective social status relative to peers in higher education.

Students from varied underrepresented backgrounds (i.e., low-income, racially/ethnically minoritized, first-generation students) tend to report lower subjective social status relative to college peers after the college transition, potentially because of academic challenges (Loeb & Hurd, 2019). Because students reported subjective social status relative to college peers across varied academic courses, it remains unclear whether there are differences by status-based identities in students’ perceived standing in a single course, where students may compare their academic performance with that of their classmates. Social comparison may be particularly salient in courses known for unequal representation of students, such as STEM courses (Patall et al., 2018; Woodcock et al., 2012). Therefore research is needed regarding whether subjective social status in the context of a single STEM course differs by social identities historically and culturally tied to status such as gender, socioeconomic status, and race and ethnicity students’, over and above objective academic performance.

1.3 Present study

The present study is a preliminary investigation of how classroom subjective social status is related to course performance, as measured by cumulative final exam score. Subjective social status was expected to be affected by proximal factors related to the class (e.g., social comparisons) and distal factors (i.e., status-based social identities) in addition to course performance in line with both self-concept theory and ecological systems theory. We examined subjective social status in three classes of an introductory statistics college course because statistics is a STEM domain that is challenging and can be a barrier for many students (Patall et al., 2018; Yamada &

Bryk, 2016). Students in the same course engaged with the same material and thus constituted an ideal sample for assessing classroom subjective social status. The present study had two goals: (1) to understand how students evaluate their subjective social status within the classroom using quantitative and qualitative data and (2) to examine the degree to which status-based identities related to subjective social status, over and above objective course performance. We addressed the first aim quantitatively by examining the association between subjective social status and objective course performance, as measured by final exam score. Just as perceptions of socioeconomic status only moderately relate to objective markers of socioeconomic status such as income (e.g., Adler et al., 2000), classroom subjective social status was predicted to be moderately related to course performance. Qualitatively we identified the common themes that participants considered when evaluating their subjective social status based on open-ended responses without a priori hypotheses.

We addressed the second aim by examining how students' subjective social status differed by status-based identities (i.e., sex, first-generation status, work status, race/ethnicity). It is important to note that there is great heterogeneity in the academic experiences of students with similar identities. Guided by ecological systems theory (Bronfenbrenner & Morris, 2006), we assessed whether students with underrepresented status-based identities may have shared experiences proximally within the classroom that position them to have lower subjective social status, in line with prior evidence that adolescents who are minoritized with respect to gender, socioeconomic status, and race/ethnicity tend to have lower subjective social status in society relative to peers across the transition from high school (Rahal et al., 2020). Students from lower-status or underrepresented groups (i.e., female, first-generation, working, and Latine and Asian/Asian American students) were hypothesized to have lower classroom subjective social status relative to high-status groups (i.e., male, continuing-generation, non-working, and white students, respectively), even after accounting for objective final exam score. As an exploratory analysis, we assessed whether differences in classroom subjective social status among lower-status or underrepresented groups varied by students' final exam scores.

2 Method

2.1 Participants

There were 824 students enrolled across three classes of psychological statistics that were taught in Spring 2019, Fall 2019, and Winter 2020, and the latter two classes had the same professor. However, 98 students either dropped the class or added the class late and therefore did not provide data, including demographic information regarding status-based identities. An additional 13 participants did not consent for their data to be used in research. Therefore, the analytic sample comprised 713 undergraduate students from three classes of the same introductory statistics course (see Table 1). All participants attended a university in Southern California with a racially and socioeconomically diverse student population, and sample demographic were comparable to those of the university (58% female; 26% white, 21% Hispanic,

Table 1 Sample size, mean, and standard deviation of subjective social status and final exam scores for status-based identities

<i>Final exam</i>	All classes			Class 1			Class 2			Class 3		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
All students	707	88.26	10.06	200	86.89	9.91	267	86.26	12.23	240	91.64	5.57
Female	523	87.61	9.95	158	86.12	9.95	191	85.41	11.87	174	91.39	5.71
Male	158	90.44	9.12	41	89.76	9.43	60	89.40	11.60	57	92.02	4.90
Asian/Asian American	267	90.62	7.41	83	89.24	7.84	82	89.75	9.39	102	92.46	4.30
Latine	136	82.49	12.18	36	79.63	13.16	57	79.38	13.14	43	89.00	6.24
White	208	89.59	8.88	60	88.33	7.92	86	88.67	10.74	62	92.08	6.10
Working	306	87.72	10.07	100	85.96	9.87	106	85.79	12.37	100	91.52	5.56
Not working	372	88.86	9.55	100	87.82	9.91	140	86.99	11.54	132	91.61	5.53
First-Generation	300	86.71	10.71	65	85.44	11.09	121	84.02	12.74	108	90.65	5.52
Continuing-generation	379	89.63	8.83	135	87.59	9.25	127	88.96	10.47	121	92.54	5.13
<i>Subjective social status</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
All students	677	6.85	2.18	200	7.15	1.65	257	5.96	2.48	220	7.60	1.84
Female	503	6.72	2.14	158	6.97	1.62	183	5.77	2.44	162	7.54	1.78
Male	147	7.49	1.88	41	7.80	1.62	58	6.9	1.92	48	7.94	1.91
Asian/Asian American	258	7.19	1.89	83	7.01	1.73	79	6.61	2.20	96	7.82	1.56
Latine	133	6.17	2.46	36	6.86	1.76	56	5.27	2.57	41	6.78	2.50
White	190	7.08	1.97	60	7.45	1.44	80	6.18	2.17	50	8.08	1.54
Working	358	7.13	2.05	100	6.80	1.73	100	5.81	2.42	89	7.37	1.94
Not Working	289	6.63	2.15	100	7.50	1.49	136	6.22	2.35	122	7.84	1.71
First-Generation	287	6.53	2.33	65	7.08	1.77	122	5.66	2.54	100	7.24	2.03
Continuing-generation	361	7.21	1.87	135	7.19	1.59	116	6.46	2.14	110	8.04	1.51

33% Asian & Pacific Islander, 5% African American, 4% unknown or other ethnic identities; 31% first generation; 34% Pell Grant recipients for financial aid).

The sample was mostly female (74.05%), and students identified primarily as Asian/Asian American (38.71%), white including Middle Eastern (29.60%), Latine (19.50%), African American (3.37%), and different racial/ethnic backgrounds (7.43%). Analyses of race/ethnicity were limited to Asian/Asian American, white, and Latine participants due to low representation of African American participants and students from different backgrounds, although these participants were included in all other analyses. Slightly under half of participants were first-generation students (42.21%) and reported having some form of paid employment (42.92%). Chi-squared tests indicated that there were no significant differences by race, gender, or working-status across the three classes, all $ps > .10$. Students in the Spring 2019 class were significantly less likely to be first-generation students (32.50%) relative to those in the Fall 2019 (51.90%) or Winter 2020 (45.56%; $\chi^2(2) = 17.00, p < .001$) classes. Demographics by class and associations between status-based identities are presented in Table S1.

Of note, five students did not complete the end of course exam and 31 students (4.38% of consenting students) did not complete the survey including assessment of subjective social status. Despite the low level of missing data, we examined whether missingness of subjective social status, the primary variable of interest, varied by status-based identities and class using chi-squared tests, and by final exam score using a t -test. Participants who did not report subjective social status did not differ from other participants with respect to sex, first-generation status, work status, or final exam score, all $ps > .09$. However, level of missing data varied by class, $\chi^2(2) = 20.23, p < .001$, which was included as a covariate in all analyses. Also, white students were more likely to be missing data on subjective social status than Asian/Asian American or Latine students, $\chi^2(2) = 9.73, p = .008$ (3.37% for Asian/Asian American students, 2.21% for Latine students, and 8.65% for white students). Quantitative analyses used listwise deletion, such that participants who were missing subjective social status were excluded from analyses with subjective social status as the outcome.

2.2 Procedure

Data were collected as a part of a larger project that aimed to develop, implement, and improve an undergraduate introductory statistics course in the psychology department, which was declared exempt by the University of California, Los Angeles Institutional Review Board (see Stigler et al., 2020). The 10-week course provided an introduction to statistics using a general linear model framework. Course goals included understanding basic concepts underlying descriptive and inferential statistics, applying these concepts to new situations, preparing to learn more advanced techniques in the future, and conducting data analysis using R programming. Prior to the first day of class, students completed an online survey in which they reported demographic information and their attitudes and expectations about the course (Stigler et al., 2020; see Supplemental Materials for a summary of these measures). At

the end of the course, students had three hours to complete a cumulative final exam, which contributed up to 70% of their course grade and was administered online in the class. After submitting their exam, students had the option to complete a survey, which included rating their subjective social status relative to other students in the class. To better understand the various factors that students use when assessing their subjective social status, students in the third class were asked to briefly explain the factors they considered when evaluating their subjective social status. Research questions, hypotheses, and data analyses were pre-registered at <https://osf.io/pfa7r>.

2.3 Measures

2.3.1 Status-based identities

Students reported sex (*male, female, nonbinary/other/prefer not to answer*) and race/ethnicity (*African American, Asian, Latino/Hispanic, White, Other*) on the pre-course survey. Participants did not report gender as part of this study, although we acknowledge that socialization within the classroom may be more related to gender than sex and that sex and gender often do not align. Students also reported average hours worked per week, which was used to differentiate working (any hours) and non-working students (0 h). Students in the first class reported status as a first-generation student (0=no, 1=yes). Because there are varied definitions of being a first-generation student, this prompt was changed such that students in the second and third classes reported the highest level of their mother's education [*1=elementary or middle school, 2=some high school, 3=high school graduate, 4=post high school vocational training, 5=some college, 6=associate's degree, 7=bachelor's degree, 8=post graduate degree (master's, doctorate, etc.)*]. Mother's highest level of education was asked because this is among the most common measures for socioeconomic status that also has implications for college completion (Addington, 2005; Entwisle & Astone, 1994; Schlechter & Milevsky, 2010). Although students with these identities have varied academic experiences, we were specifically interested in how students who may be similarly affected by systems of oppression (i.e., sexism, racism, classism) may show similar patterns of perceived standing within the classroom. We tested differences by these demographic factors because we could not administer rigorous measures of these systems.

2.3.2 Subjective social status

Students rated their perceived standing relative to their classmates using an adaptation of the MacArthur Scale of Subjective Social Status—Youth Version (Adler et al., 2000; Goodman et al., 2001). Students viewed a 10-rung ladder (see Supplemental Information) with the following prompt: “Think of this ladder as showing where people stand in this course. At the top of the ladder are students who have the highest standing in the course. At the bottom are students who have the lowest standing. Where would you place yourself on this ladder?” Similar prompts

have been used to examine status in local communities (e.g., Habersaat et al., 2018). Higher scores indicated higher perceived standing.

2.3.3 Factors affecting subjective social status

For the third class, we had the opportunity to add an additional question for participants to answer after they completed the adapted MacArthur Scale of Subjective Social Status. To understand factors in addition to objective course performance that may have affected subjective social status, we asked students to explain their chosen subjective social status ranking. Specifically, we asked participants to, “Please explain why you assigned yourself that rank on the ladder and identify any factors that influenced your ranking.” Five participants did not complete the open-ended response (2.08%), leaving 235 participants with available data.

2.3.4 Course performance

Performance was operationalized as the percentage score students received on the cumulative final course exam.

3 Results

3.1 Subjective social status and course performance

Descriptive statistics for subjective social status and final exam scores are presented in Table 1. Overall, students rated themselves as above the midpoint in classroom subjective social status ($M=6.85$, $SD=2.18$, range = 1–10) and performed well on the exam ($M=88.24\%$, $SD=10.04$). To assess the extent to which objective course performance was related to perceived standing in the classroom, we first correlated subjective social status and final exam score for all students. Subjective social status and final exam score were moderately correlated, such that students with higher exam scores reported higher subjective social status, $r(669)=0.49$, $p<.001$, 95% Confidence Interval [0.43, 0.54], suggesting that 24% of the variability in students’ subjective social status was explained by final exam performance.

3.2 Qualitative themes in students’ reports of subjective social status

To identify additional factors that influence students’ subjective social status, we asked students from the third class to explain why they selected their subjective social status ranking. We then explored common themes across responses using thematic content analysis (Braun & Clarke, 2006; Smith et al., 1992). Three members of the research team independently reviewed all responses and after discussion agreed upon five common themes in the data: achievement, mastery of content, effort invested in the class, study habits and time availability, and comparisons to class peers. Responses were also coded for mention of the final exam, as students

reported subjective social status immediately after the final exam and therefore may have been biased by their performance on the final exam as opposed to their performance throughout the course. After establishing a codebook, two separate raters reviewed each student's response, coded whether it referenced any of the six themes, and then met to reconcile any discrepancies. Final values for these responses were confirmed by a third rater. All categories had a Cohen's κ interrater reliability score of 0.66 or higher, which meets criteria for "substantial agreement" among raters (Landis & Koch, 1977; see Table 2 for theme examples and Cohen's κ interrater reliability values). Across participants, 2.55% did not reference any themes in their responses, 28.51% reported only one theme, and 68.94% reported multiple themes.

3.2.1 Achievement versus mastery

As shown in Table 2, students most frequently referenced academic achievement and mastery of course content when evaluating their subjective social status in the classroom. Achievement refers to students' performance on class assignments, whereas mastery of content refers to students' perceived understanding of course material. These categories were not mutually exclusive, as 36% of students provided explanations that encompassed both aspects of achievement and mastery. For example, one student stated, "I have produced good grades and attended all lectures. I absorbed the material and enjoyed the class" and another student explained "I gave myself a 9 [out of 10] because I feel like I have mastered the course quite well. I also did well on most of the quizzes which shows my skill." Of all student responses, 27% referenced achievement but not mastery (e.g., "I have done well on the quizzes and my grades influenced my ranking", "Because I know my standing through the test grades and results. I don't think I was in high academic standing in this course"). Finally, another 27% of student responses related to mastery without mention of achievement (e.g., "I still don't understand certain concepts in the class," "I know R pretty well and understand the concepts pretty well"). Notably, students may be aware of their achievement and mastery but prioritize these factors differently. For

Table 2 Categories of themes and descriptive statistics from students' open ended responses

Theme	Example	Percent	Average subjective social status	Cohen's Kappa
Achievement	"I did really well on all the quizzes"	62.76%	8.02	.80
Mastery	"I still don't understand everything"	63.18%	7.60	.75
Effort	"I put a lot into this class"	42.68%	7.40	.75
Comparison peers	"I earned higher grades than my friends did"	30.96%	7.60	.81
Study habits / availability	"I didn't have enough time to study"	27.62%	7.80	.66
Final exam	"I feel like I failed the final"	10.88%	8.30	.80

instance, one student noted, “I believe understanding the material is more important than simply getting good grades, so I valued understanding the material more when deciding my rank on the ladder.”

3.2.2 Effort

Students also frequently mentioned how their subjective social status was influenced by the amount of effort they invested into the class. These responses generally involved students’ perceptions of how much effort they invested compared to what they expected of themselves, as opposed to referencing a specific amount of time they expected to invest in the course. For example, one student who rated themselves a 10 stated, “...I feel as though I have finally reached the top of the ladder. I achieved what I could and gave this class my all, which is all that matters to me in the end.” Another student, who rated themselves a 1 explained, “I placed myself at the very bottom. The reason why is because I did not really give my all. Not really at the top or worthy of it.”

3.2.3 Study habits/time

Roughly a quarter of students (27.62%) referenced good study habits as a reason to feel of relatively higher or lower status in the class. For example, one student who rated themselves a 9, explained that “I have gotten 100 on 3 quizzes with minimal studying” while another stated, “I often find my friend asking me for help when they are studying for the class... I also always completed my homework early in the week.” Additionally, students who rated themselves at the bottom of the ladder also pointed to their study habits and availability to study. A student who rated themselves a 1 shared that, “While most of the work could have been done through the numerous supportive resources at hand, I just struggled in finding the time and asking for help.” Another student who rated themselves a 5 explained that “I stopped doing the reading ahead of time and taking notes on the readings,” which resulted in their performance suffering.

3.2.4 Comparison to other students

Importantly, students also mentioned that the performance of their peers influenced their own evaluations of subjective social status. For instance, one student rated themselves a 9 because “The majority of the questions asked by other students [in class] were things I understood entirely.” Comparison with high-achieving peers also prompted students to rate themselves lower on the ladder, despite performing well in the class. One student shared that although they believed they were at the top of the class, they rated themselves a 7 because “I know that there are some straight A-students in the class that probably understand the content from this class on a deeper level than I do!” These responses suggest that students can be high-achieving but still feel of lower status in the class relative to their peers. However, although the prompt explicitly asked students to evaluate their standing relative to other students

in the class, only 31% explicitly referenced gauging their performance relative to other students.

3.2.5 Final exam

Although students reported their subjective social status immediately after taking the final exam, a minority of students (10.88%) directly referenced their performance on the final exam when explaining their subjective social status in the class. Whereas some of these participants primarily referenced their perceived performance on the final exam (e.g., “I believe that I have performed well on this final, and have previously done all the homework and done well on the quizzes.”), a few referenced the final exam in conjunction with their experiences in the class as a whole. For instance, one student wrote:

I calculated the grade that I have for this course before taking the final, and I have a 98% in the class right now. I feel like that puts me up at the top of the class, which is why I said 10. I almost put 9 because I feel like a lot of students do well in this class, but I think I did really well on the quizzes so I deserved to be at 10. I think that reading the textbook carefully, trying to understand concepts in class rather than jotting down notes, and going to Professor [X]’s office hours helped me get to the 10 on the ladder.

Most students reflected on the course overall, and the final exam was referenced less frequently than the other themes (i.e., achievement, mastery, effort, study habits, comparisons to peers).

3.2.6 Differences in reported themes

Logistic regression models tested whether subjective social status and demographic factors were related to the odds of individuals considering specific factors when evaluating their subjective social status. Students with higher subjective social status were more likely to reference achievement than those with lower subjective social status, $B=0.42$, $SE=0.11$, $p<.001$, $OR=1.52$, 95% CI [1.24, 1.88]. Subjective social status was not related to any other themes, and odds of referencing themes did not differ by any status-based social identities, all $ps>0.10$.

3.3 Differences in subjective social status by status-based identities

Next, we investigated links between status-based identities—sex, first-generation status, work status, race/ethnicity—and students’ classroom subjective social status, over and above course performance. Students (Level 1) were nested within classes (Level 2). Results were tested with random-intercept multilevel models, and the interclass correlation was .096, suggesting a moderate to high degree of nesting. We tested random-effect models, which allow the associations between student-level factors (i.e., status-based identities) and subjective social status to vary across classes. However, models suggested that all associations did not show

a significant degree of random variation across classes. Because random-intercepts models are statistically equivalent to ANCOVAs (Garson, 2013), we tested all analyses using ANCOVAs covarying for class. All results were then replicated in a multilevel framework (Table S2).

For each status-based identity, we tested two ANCOVAs: one descriptive model examining group differences in final exam score that may theoretically contribute to subjective social status, and another model examining group differences in subjective social status after controlling for final exam score, which was z -standardized for each class. Significant differences in subjective social status after controlling for final exam score would suggest that individuals were systematically reporting differences in subjective social status related to that status-based identity, irrespective of their course performance. Separate ANCOVAs were tested for each status-based identity. Models examining sex were limited to participants who identified as male or female ($N=696$), and models examining race/ethnicity were limited to participants who identified as Asian/Asian American, Latine, or white ($N=626$) because of low sample size for other identities.

All ANCOVA results are presented in Table 3. Results indicated that, on average, female students scored worse on the exam relative to male students. They also reported lower subjective social status in their classroom, and this difference remained significant after controlling for exam performance. Likewise, first-generation students on average had both lower exam scores and lower subjective social status than continuing-generation students. Although exam score did not differ by work status, working students reported lower subjective social status than students who did not work. Finally, racial differences emerged in exam scores. Post-hoc Tukey–Kramer comparisons revealed that Latine students on average had lower scores than Asian/Asian American, $q(3,576)=11.91$, $p<.001$, and white students, $q(3,576)=9.83$, $p<.001$. Despite these differences in final exam score, results indicated that subjective social status did not differ between Asian/Asian American, Latine, and white students. We then repeated this analysis and incorporated all participants by grouping African American students and students of different racial/ethnic backgrounds with Latine. This resulted in an identical pattern of results (Table 3).

To account for overlap across social identities (summarized in Table S1), we tested a final ANCOVA predicting subjective social status from all status-based identities simultaneously, controlling for final exam score. Again, results suggested that female students reported lower subjective social status than male students, and working students reported lower subjective social status than students who were not working. Race/ethnicity was still unrelated to differences in subjective social status, and differences in subjective social status by first-generation status were no longer significant when controlling for other status-based identities. Again, we retested this final model incorporating all participants by grouping African American and different racial/ethnic backgrounds with Latine participants, which also resulted in an identical pattern of results (Table 3). To ensure robustness of analyses, all quantitative results were replicated using random-intercept multilevel models, with participants nested within classes (Table S2).

Table 3 Differences in subjective social status and final exam scores by status-based identities

	Status-based identities				Final exam score				Subjective social status			
	F	p	η^2	95% CI	F	p	η^2	95% CI	F	p	η^2	95% CI
Separate tests												
Sex	9.81	.002	.016	[.002, .04]	10.23	.002	.016	[.002, .04]	10.23	.002	.016	[.002, .04]
Work status	1.94	.16	.003	[0, .02]	8.76	.003	.013	[.002, .04]	8.76	.003	.013	[.002, .04]
First-generation status	17.93	<.001	.024	[.007, .05]	4.87	.028	.008	[.00004, .03]	4.87	.028	.008	[.00004, .03]
Race/Ethnicity	38.18	<.001	.11	[.07, .16]	0.60	.55	.002	[0, .01]	0.60	.55	.002	[0, .01]
Single test												
Sex	4.46	.035	.007	[0, .03]	8.95	.003	.016	[.002, .04]	8.95	.003	.016	[.002, .04]
Work status	0.01	.92	.000	[0, .004]	7.31	.007	.013	[.001, .04]	7.31	.007	.013	[.001, .04]
First-generation status	0.35	.55	.001	[0, .01]	2.78	.096	.005	[0, .02]	2.78	.096	.005	[0, .02]
Race/Ethnicity	26.43	<.001	.08	[.04, .12]	0.23	.80	.001	[0, .01]	0.23	.80	.001	[0, .01]
Single test including multiracial and African American participants												
Sex	6.67	.01	.010	[0, .03]	9.56	.002	.015	[0.002, 0.03]	9.56	.002	.015	[0.002, 0.03]
Work status	0.22	.64	.000	[0, .009]	7.04	.008	.011	[0.001, 0.03]	7.04	.008	.011	[0.001, 0.03]
First-generation status	1.95	.16	.003	[0, .02]	2.69	.10	.004	[0, 0.02]	2.69	.10	.004	[0, 0.02]
Race/ethnicity	24.07	.00	.07	[.03, .11]	0.22	.80	.001	[0, 0.007]	0.22	.80	.001	[0, 0.007]

Differences in final exam scores were tested in separate ANCOVAs controlling for class, and differences in subjective social status were tested in separate ANCOVAs controlling for final exam score and class; analyses were repeated in a single model, testing sex, work status, first-generation status, and race/ethnicity as predictors simultaneously in one model; analyses were then repeated in a single model grouping Black and multiracial individuals as Latine so that they could be included in the model

Lastly, we explored whether associations between subjective social status and status-based identities differed by students' objective course performance. We predicted subjective social status from Final Exam Score \times Status-Based Identity interactions in regression in order to determine whether differences in subjective social status by status-based identities were more apparent for high versus low levels of course performance. Regression models consistently did not suggest this, as no interaction terms were significant, all $ps > .05$ (Table S3).

4 Discussion

Although perceptions of social status relative to peers at their school and in society can impact students' cognitive resources and physiology (Johnson et al., 2011; Rahal et al., 2019), the proximal academic and distal identity-related factors that influence students' perceptions of their standing relative to classroom peers in a statistics course remain unclear. The present study, motivated by ecological systems theory (Bronfenbrenner & Morris, 2006), investigated students' subjective perceptions of their standing across three classes of an introductory college statistics course. We examined how subjective social status related to objective course performance and differed by status-based identities, and we coded students' qualitative responses to identify factors beyond objective course performance that may influence students' subjective social status. Results highlighted that subjective social status was only weakly to moderately related to objective course performance, and the qualitative responses suggested that other factors such as mastery, effort, study habits, and comparison with other students could contribute to differences in subjective social status. The present study was a preliminary investigation of whether there were general patterns of differences in perceived standing by status-based identities, such that students from underrepresented backgrounds may report lower status than their peers in the classroom. Consistent differences emerged by sex and work status, suggesting that experiences related to these status-based identities may be associated with how students view themselves within the classroom. By examining perceptions of status within the classroom, this study extended prior evidence that underrepresented students tend to report lower status than other students at their institution (Loeb & Hurd, 2019; Rahal et al., 2020). Taken together, these findings suggest that distal and proximal factors beyond one's course performance affect perceived standing in the classroom.

4.1 Subjective social status, course performance, and other factors

As hypothesized, classroom subjective social status was only moderately related to course performance. In the context of our study, this finding suggests that subjective social status in the classroom may be informed by factors beyond final exam score. This finding aligns with prior evidence that students' perceptions of their standing were only moderately related to their class performance (Brown et al., 2015; Chemers et al., 2001; Chevalier et al., 2009) and that people's evaluations of their

subjective social status in society are only weakly to moderately related to objective aspects of socioeconomic status (i.e., income, education; e.g., Adler et al., 2000). Students' open-ended responses further clarified that factors beyond objective performance influence students' subjective social status, and that these factors vary across students. There were no differences in theme endorsement by social identities, likely because the thematic coding was designed such that participants could address each theme as a reason for having higher (e.g., I invested time in the course) and lower (e.g., I did not invest time in the course) subjective social status. Although students reported that they considered their assignment scores when evaluating their subjective social status, the majority of students also considered factors beyond achievement such as mastery, effort, study skills, and their understanding relative to peers. Specifically, students frequently referenced both their objective achievement and their mastery of material in their explanations, and many referenced their mastery but not their achievement, in agreement with the current understanding that students can have goals regarding both performance and mastery (Dweck & Leggett, 1988). Therefore, regardless of course performance, students may feel of lower status if they fail to meet their own expectations of the course or struggle in areas that they personally value, such as failing to invest enough effort into learning the material.

Many students explained that they felt of lower status within the classroom because they invested less time in the course than they would have liked, either due to having limited time or not prioritizing the course. They also noted their engagement in effective study practices (e.g., completing homework before lecture, completing optional problems), and learning about effective study habits has been found to increase students' performance and confidence in their academic abilities (Wernersbach et al., 2014). These findings highlight how courses might improve students' subjective social status relative to course peers by scaffolding assignments with multiple due dates, telling them the number of hours that they are expected to invest in the course each week, and teaching effective study practices (Ewell et al., 2022). Furthermore, this statistics course involved working through an interactive online textbook, computer programming activities, and attending lecture. Inability to properly engage with all aspects of the course could also contribute to lower subjective social status.

Importantly, participants' responses suggested that they compared themselves to both the class as a whole and to other students whom they personally know, such as their friends in the class. Social comparisons require metacognitive awareness, as high-performing students are often aware of what they do not know and therefore overestimate the ability of others, whereas underperforming students often overestimate their own abilities (e.g., Boud et al., 2013). Peers can set norms regarding studying and academic values, such that students may be particularly inclined to gauge their performance relative to their friends, especially in a large lecture class of students whom they may not know. However, most students did not explicitly mention comparing themselves with other students when evaluating their subjective social status. This finding is at odds with the local dominance effect, or the idea that people tend to compare themselves with more personally relevant or proximal reference groups (Zell & Alicke, 2010). It is possible that comparisons to other students

may be more salient in evaluations of subjective social status for middle and high school students, who tend to be highly concerned with the perceptions of peers (e.g., Forbes & Dahl, 2010), rather than for college students.

4.2 Differences in subjective social status by status-based identities

Given that subjective social status may have implications for disparities in achievement, we examined differences in subjective social status and exam scores across four status-based identities that are traditionally underrepresented in academic fields: sex, first-generation status, work status, and race/ethnicity. It is important to note that there is large heterogeneity among individuals with any shared identity, and it would be erroneous to argue that individuals with a certain identity have identical experiences or view themselves, their academics, or their group in identical ways. All analyses were preliminary in that we leveraged data from a large-scale project to assess differences by status-based identities, and future work will be needed to identify whether shared experiences with systems of oppression (i.e., sexism, classism, racism) explain these mean-level differences across identity groups.

We hypothesized that female students, first-generation students, working students, and racially/ethnically minoritized students would have lower subjective social status relative to their male, non-working, non-first-generation, and white peers. As hypothesized, female and working students reported lower subjective social status than male and non-working students, respectively, over and above objective course performance and other status-based identities. These findings replicate prior research suggesting that female students and students of lower socioeconomic status—especially working students—are inclined to have lower expectations of their own performance relative to other students (Chevalier et al., 2009). We also found that first-generation students had lower subjective social status than continuing-generation students, although this difference was not maintained when controlling for other status-based identities. These findings extend past research regarding the implications of students' status-based identities for their perceived standing in relatively distal environments (i.e., society, at their school) to their perceived standing in a specific classroom as a proximal environment (Loeb & Hurd, 2019; Rahal et al., 2020). In line with ecological systems theory, they further suggest that marginalization related to societal structures may have downstream implications for one's perceptions within proximal environments, which should be considered when evaluating equity within the classroom.

Sex differences emerged such that male students on average reported higher subjective social status in the class than female students, and working learners also reported lower subjective social status in the classroom on average compared to non-working students, despite showing no average differences in exam score. These findings align with prior evidence that female students tend to have lower academic self-efficacy than male college and elementary school students and that working students report more stress than non-working students, despite comparable or better objective academic performance (e.g., Diseth et al., 2014; MacPhee et al., 2013; Mounsey et al., 2013; Pomerantz et al., 2002). Sexist and classist stereotypes that women and

students with lower socioeconomic status underachieve in STEM may contribute to these feelings of lower status (e.g., Leaper & Brown, 2008). Furthermore, working students may feel that their work detracts from time spent on homework and studying (Kalenkoski & Pabilonia, 2012). Given that students identified effort and study time as factors that influenced their evaluations of subjective social status in the class, working-students may feel that they are investing less effort into the course relative to peers and consequently report lower subjective social status, despite performing as well as their classroom peers. Future studies can assess whether differences by sex and working status are unique to STEM versus other subjects, including those in which female students outperform male students on average.

Though first-generation status was related to both lower final exam score and lower subjective social status in the class, differences were not present when accounting for other status-based identities. Working learners and first-generation students are both likely to be of lower socioeconomic status, and people of lower socioeconomic status tend to feel more insecure in their status and inclined to interpret neutral stimuli more negatively (e.g., Chen et al., 2004). We therefore expected both groups to interpret their performance as poorer than their peers, regardless of how well they perform (e.g., Chevalier et al., 2009). This university had a higher percentage of first-generation students (32%) relative to four-year institutions nationally (25%; Skomsvold, 2014). As a result, it is possible that first-generation status was less stigmatized at this campus and that available resources attenuated differences in subjective social status by first-generation status. Inconsistency in findings regarding first-generation status may also be related to measurement across classes. Participants self-reported whether they identified as a first-generation student in one class, but there are varied definitions of first-generation status (Toutkoushian et al., 2019). Therefore, this item was adjusted to mother's education in the second and third classes. Ideally, education of both parents can be measured so that differences in subjective social status between first-generation and continuing-generation students can be examined using more stringent criteria for being a first-generation college student.

No differences emerged in subjective social status on average between Asian/Asian American, Latine, and white students, although Asian/Asian American students and, to a lesser extent, white students showed higher average performance than Latine students. The lack of differences in subjective social status was surprising because racially/ethnically minoritized students experience barriers such as stereotypes that, similar to sexism- and classism-based stereotypes, can prompt them to feel of lower status in the class irrespective of their performance (e.g., Blackburn, 2017; Lindsay, 2021; Park et al., 2020; Smith et al., 2015; Sutter et al., 2023; Van Es & Weaver, 2018; Wong et al., 1998). Differences may emerge by other social identities but not by race/ethnicity because pathways linking racism to poorer academic achievement may be highly salient to students (Levy et al., 2016). Racially minoritized students may consequently change their expectations and their reference group (i.e., comparing themselves with higher versus lower performing students) when evaluating their subjective social status.

Minoritized individuals have been posited to compare themselves with other members of their group rather than individuals who do not experience shared

hardship to maintain self-esteem (Crocker & Major, 1989). Although both women and racially minoritized individuals both encounter challenges including stereotypes, these differences may be less salient to sex than race/ethnicity due to relative progress in eradicating sex-based disparities in STEM (Cheryan et al., 2017). When rating their subjective social status in society, Black adults' subjective social status was weakly related to objective indicators of socioeconomic status, potentially because they were comparing their socioeconomic standing with other Black adults or because they were accounting for other factors (e.g., inherited wealth, debt, racism) that impact their financial situation; racism has caused certain minoritized groups to benefit less from gains in education such that internal comparisons with privileged groups may not be meaningful (Assari & Bazargan, 2019; Ostrove et al., 2000). Latine students may similarly compare themselves with other Latine students when evaluating subjective social status in the class (i.e., have a different referent). Although Asian/Asian American students earned higher scores on the exam, they may also have different expectations of themselves and their peers. High-achieving students often overestimate the ability of their peers and consequently feel of lower status (e.g., Boud et al., 2013), and stereotypes may cause Asian/Asian American students to underestimate their performance or alter their criteria for evaluating their class status.

Finally, we explored whether differences in subjective social status by status-based identities differed by course performance. For instance, given that working students had lower subjective social status in the class, it is possible that differences in subjective social status by work status may be greater for students who perform better in the course. However, there was no evidence that associations varied by course performance; on average female and working students reported lower subjective social status than male and non-working students to a comparable extent for both high-performing and low-performing students regardless of students' objective course performance. This finding aligns with prior evidence that, despite sex differences in elementary school students' perceptions of their own competence, the correspondence between performance and self-assessment did not vary by sex (Pomerantz et al., 2002). Taken together, these findings suggest that female and working students tend to have lower subjective social status in the class than their male and non-working peers for both high- and low-achieving students.

4.3 Limitations

This study was a first attempt to identify differences in subjective social status in a STEM course by status-based identities. However, further work should aim to include more varied social identities. For instance, transfer students often experience hardships that can affect students' confidence in their ability to succeed as they transition to a new university (Shaw & Chin-Newman, 2017). Although other ethnically minoritized students (e.g., Middle Eastern, African American students) may also experience lower status in the class, there were too few students with these identities in the study to properly examine differences in subjective social status across these

groups. Future work should specifically recruit students with these identities to promote inclusivity and generalizability of the current findings.

Current findings are preliminary, and the study lacked measures regarding students' experiences with systems of oppression. Status-based identities were used as a proxy for exposure to systems of oppression, and future studies would be better served by explicitly measuring students' experiences with these systems. Extensive measures regarding stereotypes and exposure to sexism, classism, and racism are needed to determine whether these factors may explain observed differences in subjective social status across status-based identities. Additionally, because we assessed status using a broad prompt, it is possible that groups can use different criteria when rating their subjective social status. Qualitative data included brief responses to a short-answer question after a final exam and highlight potential themes that should be specifically assessed in future investigations. In-depth responses from open-ended questions, interviews, and focus groups are needed to understand the psychological mechanisms underlying the formation of subjective appraisals of status within the classroom. Specifically, Latine and Asian/Asian American students had no difference in subjective social status despite differences in final exam scores. We posit that these students may compare their performance with other students of the same racial/ethnic group rather than with the class more generally, and focus groups can provide a means to have students evaluate the validity of this hypothesis.

The study was limited by aspects of the university context and by the study design. Results are limited to students enrolled in an introductory statistics course at a large public university. We anticipate that differences in subjective social status may have emerged by sex and work status because of stereotypes in STEM specifically. Therefore, these differences may differ with course subject and difficulty. Future studies should extend these findings by examining how it may vary by course context (e.g., content, class size, lower- versus upper-level courses) and individual differences (e.g., competitiveness, cognitive appraisals). Finally, an additional limitation is that we measured subjective social status immediately after the final exam of the class. Although a minority of students referenced the final exam, it is possible that more valid evaluations of subjective social status may be provided at other points in the course, such as the day after the exam when students can reflect on their exam and discuss with peers.

4.4 Future directions

Future research should investigate bidirectional pathways relating subjective social status and academic experiences. Whereas the present study examined subjective social status at the end of the course, subjective social status could change throughout the course as students complete additional assignments. Factors that informed students' evaluations at the end of the course were surmised from the qualitative responses. Future studies can examine how these individual factors (e.g., achievement orientation), daily experiences, and cognitions may inform subjective social status development and consequences of low classroom subjective social status over time.

Studies should examine whether differences in subjective social status consistently relate to academic outcomes. Negative self-appraisals and feelings of low status may prompt students to engage less with course material or pursue fewer courses in a given area (Chevalier et al., 2009; Destin et al., 2012; Oyserman & Destin, 2010). Feelings of low status have been linked with physiological dysregulation and increased cognitive load, which can reduce class engagement (Johnson et al., 2011; Rahal et al., 2019), and may thereby contribute to existing disparities in academic achievement (Levy et al., 2016). Further research can also assess whether such associations are attenuated at institutions that foster more equitable campus environments.

5 Conclusions

Students have varied experiences within the classroom, and experiences related to underrepresented status-based identities may position certain groups of students to feel of lower status in the classroom. The present study aimed to replicate findings regarding differences in perceived standing in school and society within the context of a specific course, in order to determine whether the hardships associated with underrepresentation are related to students' subjective social status proximally in their classes (Loeb & Hurd, 2019; Rahal et al., 2020). Findings indicated that female students and working learners felt of lower status compared to male and non-working students, even after accounting for students' objective course performance. Differences in subjective social status were inconsistent for first-generation status and did not emerge by race/ethnicity. Furthermore, students referenced aspects of their academic experiences beyond objective performance in qualitative responses, including mastery of material and effort invested in the course, that impact their self-perceived subjective social status in the course. Taken together, these results suggest that students from underrepresented backgrounds may be positioned for feelings of low status in STEM courses, and that subjective social status relative to classroom peers is related to factors beyond academic performance. Further research is needed to foster more equitable course environments and to better understand the implications of feeling of lower status relative to classroom peers for academic achievement.

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Declarations

Conflict of interest The authors have no conflicts of interest to report.

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