Think, Pair, Freeze: The Association between Social Anxiety and Student Discomfort in the
Active Learning Environment

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This manuscript contains 6,394 words (excluding title page and references).

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Abstract

Active learning instructional techniques, often characterized by paired or small group work (e.g., problem solving, discussion), are typically associated with improved student performance. Socially anxious students may, however, experience unique interpersonal and learning challenges due to the social nature of these techniques. Despite its prevalence among college students, little research has examined how social anxiety relates to students experience of active learning, and whether socially anxious students derive the same benefits from it. Across three studies conducted in college classrooms (combined $N = 569$), we found that many college students met clinical thresholds for social anxiety (30.1%, 58.9%, and 61.3%), social anxiety was positively associated with discomfort in the active learning environment ($r = .52$, $\beta = .61$, and $\beta = .65$), early course performance did not moderate the social anxiety and active learning discomfort relationship ($\beta = -.01$ and $\beta = .11$), and even after controlling for GPA, social anxiety and active learning discomfort interacted to predict final course grades ($\beta = -.22$). These studies add nuance to the active learning literature, and suggest the need for further research on how to best utilize these techniques for socially anxious students.

Keywords: SOCIAL ANXIETY, ACTIVE LEARNING, PEDAGOGY, INCLUSIVE TEACHING, SOTL

Think, Pair, Freeze: The Association between Social Anxiety and Student Discomfort in the Active Learning Environment

As teaching practices have evolved over the last several decades, the active learning instructional model has been the subject of increased attention. Active learning differs from traditional pedagogical approaches in that instruction is more centered on students' active engagement with the material. It involves significant amounts of talking, explaining concepts to one another (Eddy, Brownell, Thummaphan, Lan & Wenderoth, 2015), completing higher-order cognitive activities, and problem solving cooperatively (Eddy, Brownell & Wenderoth, 2014). This model is typically contrasted with the traditional lecture format, wherein students tend to inhabit a relatively more passive, information-receiving role.

Active learning has been typically, though not exclusively, associated with positive student outcomes (see Bernstein, 2018 for review), such as improved writing and critical-thinking skills (Bonwell & Eison, 1991; Linton, Pangle, Wyatt, Powell, & Sherwood, 2014). For instance, a recent meta-analysis of 225 studies found that STEM classes using active learning techniques had, on average, a half letter-grade higher final grades, and halved DFW rates, compared to lecture-only classes (Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, & Wenderoth, 2014). Active learning has also been found to promote inclusivity in classrooms. A study of 28 introductory Biology classes found that the underrepresented minority achievement gap was halved in classrooms using active learning techniques (Haak, Hillerislambers, Pitre & Freeman, 2011), and a similar study in introductory Physics classrooms found that the gender achievement gap was completely eliminated in active learning classrooms (Lorenzo, Crouch & Mazur, 2006). Moreover, active learning techniques seem to have benefits for students' mindsets. Students feel more engaged (Chen & Chiu, 2016), have more positive attitudes

towards learning, and report higher levels of motivation (Svinicki & McKeachie, 2014) compared to those experiencing a lecture-only approach.

What precisely constitutes an active learning technique is ambiguously defined in the current literature (Bernstein, 2018), but two relatively common features are that active learning techniques involve students “doing” and, in particular, doing with peers. For instance, the “think-pair-share” technique prompts students to consider a question individually and then pair with a nearby classmate to compare responses and discuss the content, before reporting out to the larger class. The “jigsaw” or “group-regroup” technique also involves peer interaction. Students individually present specific content to a small group along with key thought questions (e.g., “How can this idea be applied to the idea that we discussed in the previous chapter?”) before joining a second group wherein every member had presented on the same topic to their initial group, and discussing it further. These examples highlight the interpersonal nature of many active learning techniques and the implied expectation that students will play a significant role in promoting each other’s learning. They also illustrate that the active learning classroom requires students to exercise academic *and* social skills.

The interpersonal nature of much of active learning may create new challenges for some college students. Anxiety is widespread among college students (e.g., Blanco et al., 2008), and a specific form, social anxiety, is especially prevalent. Research estimates that approximately 13% of the student population experiences social anxiety disorder, with many more experiencing non-clinical symptomology (Jefferson, 2001). Characterized by an intense fear of negative evaluation by others, social anxiety is a social impairment (Nardi, 2003) and is maintained by several, interrelated social cognitive processes (Hofmann, 2007).

Socially anxious individuals tend to exaggerate the probability of a negative social

outcomes (Foa, Franklin, Perry & Herbert, 1996), such as humiliating themselves or being viewed as awkward, when facing an impending social interaction. This is due, in part, to a tendency to perceive unrealistically high social standards of performance (Hofmann, 2007) and underestimate their own social skills (Strauman, 1989). Once in a social situation, attention often shifts toward the self (Clark & Wells, 1995), monitoring for feared anxiety responses (e.g., sweating, blushing, stammering; Purdon, 1999) that might be perceived by the interaction partner as evidence of their perceived social ineptitude. This attentional shift minimizes their awareness of positive social cues present in the situation (Wells & Papageorgiou, 1998). Safety behaviors, such as standing or sitting in a spot in the room to avoid being noticed, are often performed in social situations as a means of temporary anxiety relief. Paradoxically, these same behaviors, while temporarily reducing anxiety, play a role in its long-term persistence by disallowing habituation (Rowa et al., 2015). After exiting a social interaction, socially anxious persons are also more likely to ruminate on their perceived social failings than successes (Mellings & Alden, 2000), thereby biasing their memory of the episode as more aversive than it might have actually been.

This tension between pedagogical best practices (e.g., active learning techniques) and the experience of students with social anxiety reflects, and reinforces, Bernstein's (2018) recent call for a "second generation" of research on active learning. That is, the need for research to provide a deeper, more nuanced understanding of how active learning works, for whom it works (or does not), and the specific conditions under which it works best. To wit, although overall students seem to benefit from learning in more active classrooms, socially anxious students in particular may experience greater burden persisting in environments that facilitate regular social interaction.

Based on the social anxiety maintenance model described above (Hofmann, 2007), there are several ways in which social anxiety processes may potentially interfere with student functioning during active learning. These include trepidation before entering a class known to be associated with socially-based active learning techniques, missing valuable information during discussions due to self-monitoring for anxiety responses, engaging in safety behaviors to avoid entering discussion activities with other students, and negative attitudes toward active learning techniques as learning processes, due to the aversive experiences and negatively-biased ruminations to which socially anxious students would be prone.

Issues of student inclusivity and course accessibility must also be considered, given that socially anxious students may not benefit from active learning in a manner similar to their non-anxious peers. If the active learning classroom generates significant discomfort, socially anxious students may not feel the same sense of belonging in the environment (Deci & Ryan, 1991) and may develop more negative attitudes toward it. These negative attitudes may be driven primarily by the social concerns of the student, rather than concerns about poor performance that could be interpreted by the instructor as revealing of poor course preparation. This is consequential because research has demonstrated that a sense of belonging and positive attitudes in the classroom are associated with student achievement (Biner, Dean, & Mellinger, 1994; Gottfried, 1990; Deci & Ryan, 1991) and because student performance anxiety is both impacted in part by social concerns and is predictive of persistence in future course material (England, Brigati & Schussler, 2017).

Whereas these issues are plausible given what is currently known about active learning and social anxiety separately, few empirical studies have directly investigated their association and the synergistic affect that may result. Some research has, however, provided indirect support

to this notion (Cooper, Downing, & Brownell, 2018). For example, recent qualitative work found that students who experienced increased anxiety during group work reported a fear of negative peer evaluation as the primary reason, suggesting that social anxiety in particular may heighten their classroom discomfort (Cooper, et al., 2018). Similarly, it is unclear whether content mastery, providing a sense of efficaciousness, would moderate such a relationship in a socially anxious sample. Thus, despite the broad findings that students benefit from active learning, students with social anxiety may have a qualitatively different experience of active learning techniques.

As colleges and universities make efforts to increase the inclusivity of their classrooms concurrently with growing active learning approaches, the needs of students who experience greater social anxiety represents an important area for pedagogical research and discussion. The present work intends to further refine the empirical active learning literature by 1) establishing the association between social anxiety and student discomfort in the active learning environment; 2) investigating the potential moderating effect of early course performance on the social anxiety and active learning discomfort association; and 3) investigating the interaction between social anxiety and active learning discomfort as it relates to final course grades.

The Present Research

We conducted three studies to investigate how students' social anxiety relates to their active learning experience. In study 1, we assessed students' social anxiety and examined its association with active learning discomfort. In study 2, we replicated and extended this finding by investigating a possible moderator, students' early course performance. In study 3, we again replicated these findings and extended them by investigating the interaction between social anxiety and active learning discomfort as it relates to students' final course grades.

Study 1

The goal of study 1 was to examine the association between trait social anxiety and student discomfort with the active learning environment. To do so, we recruited an undergraduate student sample to complete a psychometrically validated measure of social anxiety as well as a measure of active learning discomfort. We hypothesized that students with higher social anxiety would report more discomfort in the active learning environment.

Method

Participants. Undergraduate Psychology students ($N = 342$) volunteered to participate in this study in the fall of 2015 (68.4% female, 31.6% as male). The sample was 66.1% European American, 14.0% Latinx, 10.5% Asian/Asian American, 4.4% Bi- or Multiracial, 3.5% African American, and 1.5% chose not to report their race. One quarter of the participants identified as first-generation college students.

Materials

Social Anxiety. To assess social anxiety, participants completed the Social Interaction Anxiety Scale/Social Phobia Scale (SIAS-6/SPS-6; Peters, Sunderland, Andrews, Rapee, & Mattick, 2012). The SIAS-6/SPS-6 is a twelve item self-report questionnaire assessing general social interaction fears and scrutiny concerns respectively. The amended 12-item scale was developed from the original 40-item SIAS and SPS questionnaire (Mattick & Clarke, 1998). Participants are asked to endorse each item (e.g., I have difficulty talking with other people.) on a 0 (*not at all characteristic or true of me*) to 4 (*extremely characteristic or true of me*) Likert scale. Following the guidelines of Peters et al. (2012), we summed items 1-6 to create a composite SIAS score ($\alpha = .80$).¹

¹ We believe that the SIAS, which measures general social interaction fear, is the most appropriate measure given the current project's research question, and therefore we only report these results. Specifically, the SIAS was

Active Learning Discomfort. We used a three-item measure to capture students' discomfort with the active learning environment: "I feel uncomfortable when I am asked in class to turn to someone sitting near me to discuss class material," "It is difficult for me to work collaboratively with classmates because I get so caught up in what other people might think about me," and "I have skipped lectures in the past when I knew we might have to make a presentation or do group work." Students provided responses on a 5-point Likert scale ranging from 0 (*not true at all of me*) to 4 (*extremely true of me*). We summed the three items to create a composite active learning discomfort score ($\alpha = .68$).

Procedure

At the beginning of a class session at the start of the second week of the semester, students were asked if they would be willing to complete a five-minute survey assessing "general student dispositions." Those who agreed to do so were directed to Qualtrics, an online survey software system wherein they completed the study. Those who choose to not participate were asked to sit quietly or review class notes. After providing informed consent electronically, participants were directed to the questionnaires described above, which were counter-balanced to prevent order effects. Upon completion of the questionnaires, participants were debriefed online and thanked for their participation.

Results

Social Anxiety. We first examined students' self-reported social anxiety. Composite scores on the SIAS-6 ranged from 0 to 21, with a mean score of 5.41 ($SD = 4.01$). The median

designed to measure levels of general anxiety that individuals experience when they initiate or maintain social interactions; we believe that this operationalization best captures our specific variable of interest within the active learning environment. Moreover, all SPS (i.e., social phobia) data is open and available for analysis at the OSF (osf.io).

score was 5.00 and the modal score was 3.00. In total, 30.1% of the sample reached the social anxiety disorder diagnostic cutoff score of 7 or higher (Peters et al., 2012).

Active Learning Discomfort. Composite scores for active learning discomfort ranged from 0 to 11, with a mean of 2.06 ($SD = 2.32$). In order to examine the association between social anxiety and active learning discomfort, we computed a zero-order correlation between the SIAS-6 and the active learning discomfort scale and found a significant positive association, $r(340) = .52, p < .001$. Figure 1 is a scatterplot of the association between trait social anxiety and active learning discomfort.

Figure 1. The association between trait social anxiety and active learning discomfort (Study 1).

Brief Discussion

Social anxiety was positively associated with active learning discomfort, such that students experiencing the most social anxiety also felt the greatest discomfort in the active learning environment. This study provides initial evidence that social anxiety may be related to socio-emotional challenges during active learning.

To increase confidence in this finding, we next conducted a conceptual replication. Specifically, we recruited a new undergraduate student sample to complete the same questionnaires used in study 1. Additionally, we collected homework and quiz grades in order to examine whether the association between social anxiety and discomfort with active learning moderated course performance.

Study 2

The goal of study 2 was to replicate and extend the findings of study 1. To do so, we recruited a new sample of undergraduate students, replicated the procedures of study 1, and also collected information about the students' course performance up to the date of the study. We collected performance information because research on domain-specific anxieties (e.g., math anxiety) has demonstrated a decrease in anxiety after the experience of successful performance (e.g., Ma, 1999; Jansen, Louwerse, Straatemeier, Van der Ven, Klinkenberg, & Van der Maas, 2013). It is plausible that content mastery may facilitate relatively easier social interaction by providing students with more accessible information, which forms the basis of most interpersonal discussions during active learning techniques. Conversely, it is possible for students to perform well academically in a course without performing well socially *per se*. Thus, we ultimately predicted that course performance would not influence the association between social anxiety and active learning discomfort.

Method

Participants. Undergraduate students ($N = 90$) from a Social Psychology course volunteered to participate in the spring of 2016 (77.8% female, 21.1% male, 1.1% genderqueer). The sample was 61.1% European American, 11.1% Asian/Asian American, 11.1% Latinx, 8.9%

African American, 3.3% Native American, 3.3% Bi or Multiracial, and 1.2% chose not to report. The sample contained 27.2% first-generation college students.

Materials

Social Anxiety. We used the same social anxiety scale as was used in study 1, the SIAS-6 ($\alpha = .72$).

Active Learning Discomfort. We used the same active learning discomfort scale as was used in study 1 ($\alpha = .67$).

Student Performance. We matched students' course performance (i.e., grades up to the point of the study) from the first two weeks of the semester: two pre-class worksheets, each containing 30 multiple choice questions, and two post-class learning checks, each containing 10 multiple choice questions. We equally weighted the four assignments before creating the composite, mean student performance score.

Procedure

Study 2 used the same procedures as study 1, with the addition of collecting students' course performance information.

Results

Social Anxiety. As in study 1, we examined the degree to which students reported social anxiety. The range of responses to the SIAS-6 was from 0 to 22, with a mean score of 8.72 ($SD = 4.21$). The median was 8.50 and the modal response was 6. In total, 58.9% of the sample reached the social anxiety disorder diagnostic cutoff score of seven or higher (Peters et al., 2012).

Active Learning Discomfort. Composite scores for active learning discomfort ranged from 0 to 11, with a mean of 3.40 ($SD = 2.53$). We next associated SIAS-6 scores and student course performance, operationalized as their course grades, with active learning discomfort.

Average course grades ranged from 71% to 100%, with a mean of 89% ($SD = 7\%$) and median of 89%. In order to avoid issues of high multicollinearity, we first centered the predictor variables before creating an interaction term by taking their product (Aiken & West, 1991). We then regressed the centered SIAS-6, student performance scores, and the interaction term on students' active learning discomfort scores. The predictors jointly explained approximately 41.2% of the variance in active learning discomfort, $R^2 = .41$, $F(3, 85) = 19.88$, $p < .001$. The SIAS-6 ($\beta = .61$, $p < .001$, 95% CI [0.44, 0.78], $sr^2 = 0.35$) was a significant predictor, whereas student performance ($\beta = -.01$, $p = .88$, 95% CI [-0.18, 0.16], $sr^2 = 0.00$) and the interaction ($\beta = .10$, $p = .22$, 95% CI [-0.06, 0.27], $sr^2 = 0.01$) were not significant predictors of active learning discomfort. Figure 2 demonstrates the association between social anxiety and active learning discomfort, sampled at one standard deviation below and above the mean student performance score. Higher- and lower-performing students show similar associations between social anxiety and discomfort with the active learning environment.

Figure 2. The association between social anxiety and active learning discomfort at lower (-1 SD) and higher (+1 SD) levels of course performance (Study 2).

Brief Discussion

Replicating the findings of Study 1, we found that social anxiety was positively associated with active learning discomfort. Moreover course performance was not significantly related to active learning discomfort, nor was there an interaction between performance and social anxiety. While we believe that this outcome is consistent with what is currently known about reducing social anxiety, these data cannot support the view that discomfort in the active learning environment is impacted by successful or unsuccessful early academic performances. Indeed, due to the limitations of these analyses it is unclear whether having the requisite knowledge or understanding to discuss material during active learning techniques is in itself sufficient to affect (i.e., alleviate) socially anxious students' social interaction concerns, and corresponding anxiety responses, during those discussions.

However, social anxiety does appear to be related to a significant discomfort with active learning. A final important question pertains to whether or not these phenomena also predict future student outcomes, such as their final course grades. We conducted a third study to address this question.

Study 3

The goal of study 3 was to further explore the association between social anxiety and active learning discomfort. We did this by conceptually replicating and extending the findings from studies 1 and 2. To provide converging evidence for the association, we used the same measure of social anxiety (i.e., the SIAS-6), an expanded measure of active learning discomfort, which included fourteen items covering affective, behavioral, and cognitive responses to active

learning. We also obtained students' final course grades in addition to their performance up to the date on which the questionnaires were distributed (as was done in study 2). We hypothesized that social anxiety, but not course performance, would be related to active learning discomfort. Moreover, we hypothesized that social anxiety would interact with active learning discomfort to predict final course grade.

Methods

Participants. Undergraduate students ($N = 137$) enrolled in a social psychology course in the spring of 2018 volunteered to participate in this study (77.4% female, 21.0% male, 1.6% chose not to report their gender). The sample was 70.1% European American, 12.3% Asian or Asian American, 9.1% African American, and 8.5% Latinx. The average age was 20.29 years ($SD = 2.67$), and 24.6% of the sample was first-generation college students.

Materials

Social Anxiety. We used the same social anxiety scale that was used in studies 1 and 2, the SIAS-6 ($\alpha = .72$).

Active Learning Discomfort. We developed an expanded measure of active learning discomfort for study 3 (see Table 1). The 14-item measure included questions about students' affective, behavioral, and cognitive response to the active learning environment.

Table 1

Active Learning Discomfort Scale (Study 3)

Items

1. I feel uncomfortable when I'm asked to turn to someone sitting near me to discuss class material
2. I have felt dread about attending class when I knew that I would have to interact with my peers a lot
3. I often worry that what I have to share in class discussions isn't worth saying or isn't right
4. It's difficult for me to work collaboratively with classmates because it makes me feel nervous
5. Discussing class material with other students during class can be exhausting

6. I find it hard to participate in group work unless I'm working with people that I already know
 7. I try to avoid picking a partner or joining a group when my professors ask students to work together in class
 8. I only speak up in group discussion if I know exactly what I'm going to say
 9. I don't participate that much during class discussions or group work
 10. I don't always listen to fellow students while we're working together
 11. I find it difficult to concentrate on learning when I know that I will have to interact with my peers during class
 12. I have a hard time thinking clearly when I'm interacting with other students during class
 13. I'm not good at articulating my thoughts when discussing things with other students during class
 14. I sometimes miss out on things in class because I am practicing what I'm going to say in my mind before I say it
-

Students responded to the items on a 5-point Likert scale, with response options ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). We averaged all items to create a composite active learning discomfort score ($\alpha = .92$), with higher scores indicating more discomfort in the active learning environment.

Student Performance. As in study 2, we matched students' grades from the first two weeks of the semester with their questionnaire responses through their personal ID numbers. Student performance scores consisted of two pre-discussion worksheets, each containing 30 multiple choice questions, and two in-class² learning checks, each containing 10 multiple choice questions. All assignments were equally weighted before creating the composite student performance score.

Course Grades. We matched students' final course grades with their questionnaire responses through their personal ID numbers as well. Final course grades consisted of students'

² This is a notable change from study 2, which occurred in a classroom with a different structure. Study 2 sampled a class in which students completed post-discussion quizzes after class, whereas study 3 sampled a class in which students completed post-discussion quizzes in-class.

performance across ten pre-discussion worksheets, ten in-class learning checks, three examinations, and a research project.

Procedure

Study 3 used the same procedures as studies 1 and 2, with the addition of collecting students' final course grades after the conclusion of the semester.

Results

Social Anxiety. As in studies 1 and 2, we initially examined the degree to which students reported feeling socially anxious. The range of responses to the SIAS-6 was from 0 to 18, with a mean score of 5.95 ($SD = 3.71$). The median was 5.00 and the modal response was 3.00. In total, 61.3% of the sample reached the social anxiety disorder diagnostic cutoff score of seven or higher.

Active Learning Discomfort. Composite scores for active learning discomfort ranged from 0 to 3.64, with a mean of 1.51 ($SD = 0.84$). As in study 2, we next examined the association between social anxiety, student performance, and active learning discomfort. Average course grades ranged from 20% to 100%, with a mean of 90% ($SD = 12\%$) and median of 94%. We first centered the predictor variables, and then created an interaction term by taking their product (Aiken & West, 1991). We then regressed active learning discomfort on the SIAS-6, student performance scores, and their interaction. The predictors jointly explained approximately 41.2% of the variance in active learning discomfort, $R^2 = .41$, $F(3, 126) = 29.51$, $p < .001$. The SIAS-6 ($\beta = .65$, $p < .001$, 95% CI [0.51, 0.78], $sr^2 = 0.41$) was a unique predictor of active learning discomfort, whereas student performance scores ($\beta = .11$, $p = .16$, 95% CI [-0.04, 0.25], $sr^2 = 0.01$) and their interaction ($\beta = -.03$, $p = .48$, 95% CI [-0.17, 0.11], $sr^2 = 0.00$) were not.

Final Course Grades. Finally, we examined the association between social anxiety, active learning discomfort, and final course grades, controlling for student GPA. Course grades were calculated out of 1000 points and ranged from 699.80 to 964.55, with a mean of 876.59 ($SD = 51.82$). To conduct the main analysis, we centered the social anxiety and active learning discomfort scores and then created an interaction term by taking their product. Next, we conducted a hierarchical regression with final course grade as the outcome variable. We entered GPA in step one, and the SIAS-6, active learning discomfort, and their interaction in step two. In step one, GPA accounted for significant variance in final course grades, $R^2 = .26$, $F(1, 123) = 44.63$, $p < .001$. The addition of the SIAS-6, active learning discomfort, and their interaction as predictors in step two explained significant additional variance, $R^2 \text{ change} = .05$, $F \text{ change} (3, 120) = 3.07$, $p = .03$. Taken together, the final model explained approximately 31.9% of the variance in final course grades, $R^2 = .32$, $F(3, 120) = 14.03$, $p < .001$. Social anxiety ($\beta = -.03$, $p = .79$) and active learning discomfort ($\beta = .07$, $p = .47$) were not significant predictors, but GPA ($\beta = .48$, $p < .001$) the social anxiety & active learning discomfort interaction term were ($\beta = -.22$, $p = .007$).

We probed this interaction further by testing the association between social anxiety and final course grades at one standard deviation above and below the mean active learning discomfort score. As can be seen in Figure 3, social anxiety was significantly negatively related to final course grades for those who report high active learning discomfort ($p = .03$), whereas it was not related to final course grades for those who report lower levels of active learning discomfort ($p = .20$).

Figure 3. The association between social anxiety and final course grades at lower (-1 SD) and higher (+1 SD) levels of active learning discomfort, controlling for GPA (Study 3).

Brief Discussion

The results of study 3 replicated the findings of studies 1 and 2 in that social anxiety was positively associated with active learning discomfort. Replicating study 2, we found no significant interaction between social anxiety and student performance on active learning discomfort. This finding adds weight to the evidence that being proficient academically is insufficient to buffer socially anxious students' aversion to the active learning environment. Extending our previous findings, study 3 also demonstrated an interaction between social anxiety and active learning discomfort on final course grades. Specifically, course grades tended to decrease as students with higher social anxiety also reported greater discomfort with active learning, whereas there was no such association for socially anxious students reporting lower levels of active learning discomfort.

General Discussion

Across three studies we examined how students' social anxiety relates to their discomfort in the active learning environment. In addition to finding that many students reported significant social anxiety³, we found, for the first time, that greater social anxiety was related to increased discomfort in active learning classrooms. Moreover, performing well academically during the early stages of the semester did not moderate this association. The combination of these variables may be particularly important for student outcomes, as social anxiety and active learning discomfort interacted to predict final course grades. Taken together, these findings highlight the presence of social anxiety and discomfort during active learning techniques, and the impact this may have on students' academic performance. We believe that this set of studies contributes to Bernstein's (2018) "second generation" of research on active learning, which moves beyond the question of whether active learning does or does not work, and toward a more nuanced understanding of for whom, and under what conditions, it works best.

In study 1, social anxiety was positively associated with active learning discomfort. Students experiencing the most social anxiety also demonstrated the greatest trepidation about the active learning environment. This study provided initial evidence that social anxiety may be related to socio-emotional challenges specifically in response to active learning techniques.

In study 2, we replicated and extended the results of study 1. Given the evidence that subject-based anxiety (e.g., statistics anxiety) may be diminished after the experience of positive academic performance (Jansen, et al., 2013), we investigated the possibility that the association between social anxiety and active learning discomfort would vary by students' academic performance in the course, up to the time of the study. In terms of socially anxious students, a

³ Operationalized as meeting the established clinical threshold for social anxiety disorder (Peters, et al. 2012).

strong understanding of the course material could have facilitated their social interactions by providing a means of social success – i.e., the ability to fluently discuss the topic during active learning techniques. Whereas a poor understanding of the course material may have strengthened the social anxiety and discomfort association due to the lack of the aforementioned means of social success. We found no such interaction, however, suggesting that understanding the course material may not ameliorate the association between social anxiety and discomfort with the active learning environment. Interpretations of this finding should be made cautiously given the limitations of correlational designs and understanding null effects, but a possible explanation is that the specific operationalization of academic performance used was not dependent on students engaging socially, and that some form of habituation is a critical factor in reducing the social anxiety and discomfort relationship.

We replicated the findings from studies 1 and 2 in study 3, adding weight to the evidence that social anxiety is correlated with active learning discomfort. We did so while providing converging evidence by utilizing a new operationalization of active learning discomfort, an expanded 14-item scale. Further, we demonstrated an interaction between social anxiety and active learning discomfort in predicting academic performance. For students with relatively higher social anxiety (+1SD), experiencing greater discomfort in the active learning environment, measured during the third week of the semester, was associated with lower final course grades. There was no such association with final course grades for socially anxious students who reported lesser discomfort in the active learning environment. This finding suggests that students who feel both social anxiety and discomfort with active learning may not derive the same academic benefit from active learning techniques as their peers. Further, it implies that some students are high in social anxiety but do not experience the same extent of active learning

discomfort. Given the heterogeneity of social anxiety, it is highly possible that individuals endorsing overall high levels of social anxiety may experience varying degrees of discomfort across situations (e.g., high anxiety in dating situations but less so in academic situations).

Given the correlational design of study 3 interpretation must again be made cautiously, but this association could be due to the cognitive and behavioral processes associated with social anxiety maintenance interfering with students' willingness or ability to fully engage with content or classmates during active learning periods. Specifying these processes (e.g., the form and frequency of safety behaviors in the active learning environment) is a particularly important area of future research, and should help to inform potential interventions or advance best practices for inclusive active learning techniques.

There were additional limitations across these studies that should be considered as well. First, although a similar set of active learning techniques (e.g., think, pair, share; jigsaw technique) were used in the classes in which we gathered data, the specific active learning techniques were not systematically catalogued. Therefore, this project is not able to address which techniques are more or less aversive for socially anxious students or are possibly driving the social anxiety and active learning discomfort relationship. Second, as noted by the descriptive statistics for studies 2 and 3, students were generally performing well in each class with most pre- and post-class quiz scores falling in the 71-100% range. The restricted variability in scores may have limited the emergence of relevant relationships from these data; a frequent limitation when data is gathered in real-world classrooms. In addition, it is possible that an assessment representing a greater proportion of students' overall grade (e.g., midterm examination) would be a stronger operationalization of student performance. Further, every class sampled was a 200-level Psychology course. This limits the generalizability of these findings,

given research demonstrating that students across academic majors report personality trait differences (Vedel, Thomsen, & Larsen, 2015). Finally, we could find no previously validated active learning discomfort scale, and therefore created those used in the process of conducting this research.⁴ We believe that future research can address these limitations by sampling a more diverse group of classes, systematically manipulating or measuring the active learning techniques used in them, and utilizing multiple operationalizations of student performance.

In one regard, the findings that emerged from this collection of studies are perfectly obvious. The most socially anxious students find the most social components of the active learning environment the most aversive. Although intuitive, this specific link between social anxiety and active learning discomfort has not been examined. Our findings highlight the potential for negative experiences associated with a range of teaching techniques that are quickly gaining popularity in higher education. Active learning techniques may not be a uniformly positive or beneficial experience for all students; rather, a subset seem to experience greater emotional burden during them than others. Thus, we believe that there is a need for further research on this topic, designed to create a more inclusive classroom environment for all active learners.

Integrating evidence from clinical and cognitive psychology can help teaching and learning researchers to envision how a model of active learning can address the needs of socially anxious students. For example, a step towards addressing this issue in the classroom could include “psychoeducation” – a brief, low-cost, foundational component of clinical treatment that has been shown to be effective in reducing mood and anxiety disorders (Dixon et al., 2001; Donker, Griffiths, Cuijpers, & Christensen, 2009). In practice, this could involve creating a short

⁴ Validation studies on the 14-item active learning discomfort scale used in study 3 have begun but as of yet are unpublished.

slide show that defines social anxiety, normalizes the experience of feeling fear in social situations, and clarifies that most people's reflex in anxiety-inducing situations is to avoid in order to reduce discomfort, but that total avoidance actually maintains anxiety. Importantly, Psychoeducation is not therapy per se, and one does not need to be a Clinical Psychologist to deliver this information. Indeed, psychoeducation about anxiety, delivered by non-clinical faculty at the Stanford and Yale Schools of Law, has already demonstrated feasibility and acceptability in a classroom setting (e.g., Ayers, Bankman, Fried, & Luce, 2017).

We may also draw from the principles of exposure therapies (Hofmann & Otto, 2017). Exposure therapy is designed to help individuals approach feared social situations until (a) their anxiety decreases, or (b) they learn that they can tolerate feeling anxious (Hofmann & Otto, 2017). One common method is for patients to take a gradual approach, starting with activities that provoke low levels of anxiety. They are encouraged to remain in the situation until their anxiety reduces, and then to continue with exposure exercises until they have experienced learning that disconfirms their feared thoughts, allowing them to persist in the situation. Once patients habituate to situations that bring about low levels of anxiety, they then transition to more feared situations. To mirror this approach, an inclusive active learning model might involve limiting social interactions early on in the semester and gradually introducing more socially intensive tasks over the course of the semester. We do caution at this point, however, that while there is strong research support for the effectiveness of these treatments in the clinical psychology literature, more research is needed on how this approach might affect students in the classroom before it is considered a viable practice in the active learning environment.

In all, these studies demonstrate that social anxiety is experienced by many college students and that it is associated with discomfort in the active learning environment. Moreover,

student competence over the course material does not appear to moderate this association, and the interaction between social anxiety and active learning discomfort may be related to final course grades. These findings provide important nuance to the active learning literature, which currently features little empirical research into the potential issues related to using these techniques. As higher education strives to make its classrooms more inclusive for all students, we must recognize that while active learning techniques are beneficial for most students, they can be more burdensome for others. We hope that the present work will serve as an impetus for more research on social anxiety in the active learning environment, and on the ways in which college instructors can use these techniques to the benefit of all students.

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