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Separate worlds: The influence of seating location on student engagement, classroom experience, and performance in the large university lecture hall

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ABSTRACT

The purpose of this study was to examine the influence of students' seating location in a large, lecture-style university course on student engagement, attention, classroom learning experience, and course performance. Participants ($N = 407$) were students in two cohorts of an undergraduate financial accounting course at a large university in the United States. They participated in the Experience Sampling Method measuring their self-reported seating location, engagement, attention, and other experiential dimensions throughout the one-semester course. Results showed that students reported lower engagement, attention, and quality of classroom experience when sitting in the back of the classroom than when sitting in the middle or front. Those sitting in the back of the classroom most of the time also received lower course grades. Engagement, attention, and other experiential factors mediated the influence of seating location on course grade. Multilevel models revealed both within-student and between-student effects of seating on classroom experience.

1. Introduction

A considerable portion of university classes are large lecture classes (Armstrong & Chang, 2007). Most instructors would readily admit that it is difficult to connect with all students in these classes. Those who sit in back may be particularly hard to reach. They may appear to be disengaged, doing activities unrelated to class, or socializing. Meanwhile, students in the front of the classroom may respond to questions and make comments more frequently. This raises the question as to if seat location may affect students' engagement, attention, quality of classroom experience, and performance in the course.

The literature is suggestive of an effect of seating location on engagement, attitudes and participation (Montello, 1988). Possible reasons include the belief that it is easier to see and hear the instructor; that proximity to the instructor can encourage attention, engagement, and greater participatory behavior; and that mutual favorability between the instructor and front-sitting students can develop (Meeks et al., 2013). However, findings of the effect of seating on performance are decisively mixed, with some studies finding an impact of seating proximity (e.g., sitting in the front vs. back of the room) on course grades (e.g., Benedict & Hoag, 2004; Perkins & Wieman, 2005), and others finding little or no relationship (Armstrong & Chang, 2007; Kalinowski & Taper, 2007). To the extent that there are effects of seating, the preponderance of the evidence suggests that front and center seats facilitate positive attitudes, participation and better performance. However, it is difficult to disentangle the causal mechanism(s) from self-selection, or the possibility that higher performing students may prefer and select seats close to the front, while lower performing students or those with lower self-esteem in the class prefer seats close to the back of the classroom.

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1.1. The present experience sampling study

The Experience Sampling Method (ESM) can help to illuminate the black box of students' actual, momentary experience of the class when sitting in the back, middle or front of the classroom. The ESM is a time- and context-dependent method of measuring subjective experiences at the moment of instruction. In ESM studies, participants complete brief surveys about their immediate environment, thoughts, and feelings several times in succession over the period of time studied (Hektner, Schmidt, & Csikszentmihalyi, 2007). Thus, it can allow insight into students own perceptions about their engagement, attention, and other aspects of experience during classroom instruction.

We attempted to illuminate the issue of selection effects by utilizing multilevel models separating within- and between-student effects: within-student effects would not be attributable to seating preference, personality, or other between-student differences. When effects on performance have been found, students' engagement, attention, and other experiential variables are frequently surmised to mediate the relationship between seating and performance. We therefore sought to utilize meditational models explicitly testing engagement and experiential factors as a potential mediator of the influence of seating on performance.

1.2. The influence of seating location on student performance and experience

1.2.1. Seat location and performance

Taking up the issue of seat location and performance as part of a larger investigation of classroom ecology, researchers in the 1960s through the early 1990s found that students sitting in the front and center of a classroom generally outperformed those sitting farther back and to the sides (e.g., Becker, Sommer, Bee, & Oxley, 1973; Brooks & Rebeta, 1991; Levine, Oneal, Garwood, & McDonald, 1980). Two mechanisms were proposed to explain the differences: a variety of classroom advantages such as those describe above, and the proposition that those sitting in front were a self-selected group as also described above.

Studies since the 1990s have been mixed in their findings. Perkins and Wieman (2005) found that students randomly assigned to sit in the back of the classroom at the beginning of the year attended fewer classes and had lower test scores than those sitting in the front. Moreover, these differences persisted even when seats were reassigned halfway through the course and the same students were moved to the front. Studying students in large lecture economics courses, Benedict and Hoag (2004) found that sitting in the back of the classroom increased the probability of getting a D or F by 23%. In contrast to the study by Perkins and Wieman (2005), however, they found that forcing students forward during the course overrode the negative effect of an initial preference for a back seat, and increased the probability of getting an A or B by 33.5% and 8.5%, respectively. Vander Schee (2011) found that seat selection had no correlation with GPA, but did predict performance in the course. Overall, these studies suggested that seat location can influence course performance.

Other studies have found little or no effect whatsoever. Armstrong and Chang (2007) found a correlation between seat location and test scores in seven out of 20 large enrollment classes, with 6 out of 7 correlations positively relating proximity to the instructor with test scores. However, the relationship was reported to be weak, accounting for less than 7% of the variation in scores. Meeks et al. (2013) collected data over a 10-year period from 1138 undergraduate senior business students during a capstone course, and found that performance was not altered by seating type. In addition to the mixed findings, it remains unclear as to whether effects found are due to classroom factors such as attention or engagement to learn class materials associated with seating proximity; the motivation, interest, self-esteem, or positive personality traits of students as they make seating selections; or some combination thereof (Kalinowski & Taper, 2007).

1.2.2. Influence of seating on motivation, engagement, and attention

Millard and Stimpson (Millard & Stimpson, 1980) randomly assigned introductory psychology students ($n = 43$) and found no effects of seating location on multiple choice tests results and grades after two weeks, but did find that increasing distance was related to decreases in self-reported enjoyment, interests, motivation, and feelings of inclusiveness. Kinarthy (1975) found that students sitting in front were rated by both other students and the teacher as being more attentive and liked by the teacher. Burda and Brooks (1996) showed that students near the front indicate higher levels of motivation on self-description scales, concluding that pre-existing personality traits drive motivated students to select seats near the front of the classroom, while students selecting back seats may be more passive, feeling more comfortable sitting a far distance from the instructor to guarantee less interaction. Indeed, students in the back of the class have been observed to disengage from the class and not attend to the lecture while going relatively undetected (Kalinowski & Taper, 2007). Studies using random or alphabetical seating assignment have found higher participation among students sitting toward the front or in the center than those sitting in the back or toward the sides (e.g., Levine et al., 1980). More recently, Parker, Hoopes and Eggett (2011) randomly assigned half of the class a permanent seat, and randomly assigned the other half (alternating every other seat) a different seat each class. Students near the front of the class in the stay group made significantly more comments per class, while there was no significant difference in participation between front and back sitters in the move group. Overall, most researchers have concluded that seat location can have an effect on engagement, motivation, attention, and involvement (Montello, 1988).

1.3. Flow, engagement, interest, and attention, and as mediators of learning and performance

To the extent that there are classroom effects of seat location on student engagement, they may be partially explained by flow theory (Csikszentmihalyi, 1990). According to the theory, exerting effort and exercising one's skills in pursuit of a challenge can result in a state of emerging motivation known as flow. Flow is experienced as a heightened state of concentration, interest, and enjoyment, and has been related to positive academic outcomes including talent development and school performance (Shernoff, Abdi, Anderson, & Csikszentmihalyi, 2014). Increased involvement and immersion in educational experiences can promote learning, understanding, and retention (Weaver & Qi, 2005). A compromised opportunity to participate in instruction and increased exposure to distractions associated with sitting in the back of the classroom would be expected to result in lower subjective involvement and concentrated attention characterizing flow, impeding classroom learning and course performance. Flow experiences have often been referenced in environmental psychology (see Rainisio & Inghilleri, 2012) because they overlap with transcendent and sublime experiences characterized by positive affect and a feeling of union with nature or the universe (Mitchell, 1983; Williams & Harvey, 2001). More relevant to the university lecture hall, Kaplan and Talbot (1983) suggested that the attention is provoked by environmental contexts and cues that capture involuntary attention, and is maintained by triggers to recover from

involuntary attention fatigue such as forces of fascination. The ability to control attention and psychic energy is a hallmark of flow experiences.

An increasing number of studies, including large surveys of student engagement in U.S. colleges and universities such as the National Survey of Student Engagement (2013), have related active engagement in classrooms to a higher quality of student learning and higher order thinking skills (also see McKeachie, 1990), as well as to academic achievement (See also Shernoff & Schmidt, 2008; Kelly, 2008; National Research Council, 2004). However, research and theory suggest several possible causal pathways characterizing the relationship. For example, students with higher levels of achievement motivation may prioritize reaching an in-depth understanding of course material and obtaining competence during instruction (Bempechat & Mirny, 2005). On the other hand, more contemporary views of engagement as a state (Larson, Shernoff, & Bempechat, 2014) and *situational interest* (Mitchell, 1993; Zhu et al., 2009) demonstrate the importance of situational and contextual factors in generating engagement that can lead to course performance and achievement. These views provide support two possible propositions: 1) sitting in the back of the classroom may be associated with contextual disadvantages and a lower quality of learning experience (i.e., less flow, more distraction) that contributes to low student engagement and ultimately lower course performance, and 2) more motivated students may select seats in greater proximity to the instructor and participate in class as characteristic a set of behaviors typical of high academic achievers (See Parker, Hoopes, & Egget, 2011).

1.4. The present study

In this study, we administered the ESM to capture students' engagement, attention, other experiential variables while sitting at different classroom locations at multiple time points during a typical semester of a large lecture course in introductory undergraduate accounting (See Hektner et al., 2007 for considerable validity and reliability evidence of the ESM). We did so not only to test for the impact of seat location on course performance, but moreover, to test explicitly whether engagement and the quality of student experience mediates this relationship. We also utilized multilevel mediation models in order to examine the following questions:

Research Question 1. How did students' experience with the course differ depending on seating location (i.e., front, middle, or back of the classroom) in terms of their engagement, attention, and other dimensions of their subjective experience?

Research Question 2. What person-level differences were there between students who sat mostly in the front, middle or back of the classroom? How did their performance in the course compare in terms of their final grade and assessments leading up to it?

Research Question 3? Did engagement, attention, or other aspects of students experience mediate the between-student relationship between seating preference and final grade in the course? Was there an influence of seating location on engagement and other aspects of experience within students?

Based on previous studies as reviewed above, we hypothesized a positive answer to the first research question but were unable to form hypotheses regarding the second and third research question due to the mixed results of previous studies.

2. Method

2.1. Pilot study

In an initial pilot study, the ESM was administered to students ($N = 114$) in one class each of three different courses in the business school of a large university on the East Coast of the U.S.: Financial Accounting ($n = 44$; total enrollment = 160 undergraduate students), Managerial Accounting ($n = 36$; total enrollment = 36 undergraduate students), and Intermediate Accounting ($n = 33$, total enrollment = 40 graduate students). The pilot sample was evenly distributed by gender. Approximately 31% of the sample was Asian, 25% was White, 22% was Hispanic or Latino; 12% was Black or African American; and 10% was another ethnicity including Indian and Pakastani. The analytic sample after excluding those who did not complete all instruments was $N = 83$. Results showed that there were minimal differences in mean student engagement, attention, and the quality of classroom experience among the three classes. Mean differences by seating were notable, although power was insufficient to detect statistical significance. However, Duncan's post-hoc multiple range test revealed that mean engagement when sitting in the back of the class ($M = 2.67$, $SD = 0.79$) was in a separate statistical category from mean engagement when sitting in the front of the class ($M = 3.26$, $SD = 1.14$). Fairly consistently across multiple experiential items and factors, students sitting in the back of the class reported the lower mean engagement and quality of experience than students sitting in the front of the classroom. In the large class, the mean difference between sitting in the front and back of the class was approximately 0.75 of a standard deviation. In the smaller classes, the mean difference was approximately 0.5 of a standard deviation. The pilot study provided preliminary evidence that differences in engagement and other aspects of experience was worthy of further investigation with a larger sample size, especially in large classrooms.

2.2. Participants

Participants were students ($N = 407$) in two cohorts of undergraduate Financial Accounting course offered in the fall of 2014 ($n = 162$) and 2015 ($n = 245$) in the same university as the pilot study. All classes were held in the same amphitheater-style classroom; there were approximately 16 rows of seats, and the distance between the instructor and the back rows was approximately 70 feet. All students in both courses participated in an informed consent procedure. Approximately 88 students did not complete a student background survey. The following sample demographics emerged among those who did (n = 319): 82% were freshmen, 13% were sophomores, and 5% were juniors; 50% were female; 40% were Asian, 24% were White, 20% were Hispanic or Latino, 10% were Black or African American, 4% were self-identified as “Other − Indian,” and 2% were another ethnicity. Approximately 23% were not native English speakers; approximately 33% were accounting majors, 29% were finance majors, 5% were other business majors, and 33% were other non-business majors. The same experienced, white, male professor of the Business School taught the course in both years.

2.3. Procedures

2.3.1. Background survey

Early in each semester, all participants completed a Student Background Survey.

2.3.2. Experience sampling method (ESM)

Next, the ESM was administered in one class in the first third, one class in the second third, and one class in the final third of the semester in both years of the course. Classes were 80 min in length. All participants were sent a text message on their personal smartphones once in the first half and once in the second half of each class sampled. Students were asked to place their phones on

vibrate mode. The text message provided a link to a Record of Experience (RoE) survey prepared on Qualtrics. Students then completed the RoE, reporting the time of completion and 30 (in 2014) or 33 (in 2015) multiple choice and scaled items about their engagement and aspects of their subjective experience in class in it just before the prompt. The RoE took approximately four to five minutes to complete. Students were divided into 10 groups; and each group received a text message in staggered succession within a 30 min period in the first and last half of the class. Each student thus had the opportunity to complete the RoE twice in each of the three classes in which the ESM was administered (*Max* = 6). A total of 1081 RoEs were collected.

2.4. Measures

2.4.1. Experience sampling variables

In the first year of the study (2014), there were 30 items on the RoE. Seven items on the RoE measured students' perceptions of the activity being performed at the time of the signal; and 23 items measured participants' cognitive and emotional states on 5-point Likert-type response scales ranging from *not at all* to *very much*. In 2015, three items on cognitive and emotional states were added for a total of 33 items.

2.4.2. Seat location

Seat location was measured by the item, "Where were you sitting when you were texted?" Responses categories were: a) Back of the room, b) Middle of the room, and c) Front of the room.

2.4.3. Student engagement and attention

Based on flow theory, *student engagement* was a composite of three items (α = 0.79 with variable responses conforming to a normal distribution): *enjoyment* (i.e., "Did you enjoy what you were doing?"), *concentration* ("How hard were you concentrating?"), and *interest* (i.e., "Was it interesting?") as has been utilized in previous studies. *Attention* was derived from the item, "What was the main thing you were thinking about?" Attention was attributed by the response, "The work or subject matter of this class," and not attributed by the responses "something else," or "nothing/daydreaming."

Other experiential dimensions were identified based on the ESM and flow literature, and the factorial structure emerging from the RoE data (i.e., factors with Eigenvalues over 1) as revealed by Exploratory Factor Analysis (EFA). Identified factors were: *Learning Orientation* (three items: perceived learning; believing that goals were clear, and the perception that activity facilitated learning, α = 0.79)[1], *Classroom Self-Esteem* (five items: feeling successful, in control, in a good mood, a sense of belongingness, and a sense of active participation; α = 0.74)[2], *Intrinsic Motivation* (five items: feeling excited, being enthusiastic, wishing to do the activity, regarding it as important, and perceiving its relevance for the future; α = 0.81); *Flow Conditions* (three items: perceiving the task as challenging, self-assessment of skill level, and perceived use of effort; α = 0.76); and *Distraction* (four items: mind wandering, feeling irritated, feeling bored, and perception that something is interfering with learning; α = 0.72).

[1] A fourth item (feeling prepared for class) and fifth item (knowing expectations for the class) also loaded onto this factor, but was not utilized in the multilevel models because it was not added until 2015.

[2] A sixth item, feeling connected to other students, also loaded onto this factor, but was not utilized in the multilevel models because it was not added until 2015.

2.4.4. Student performance measures

Students' scores on two regular exams and a final exam, as well as students' final course grades, were provided by the instructor.

2.4.5. Measures from background survey

The following student information was obtained from the Student Background Survey: the year in which students began university coursework, major, cumulative GPA, expectations for educational obtainment, native language, gender, and race/ethnicity.

2.5. Analytic approach

For research question 1, one-way ANOVAs with Duncan's post-hoc comparison tests were utilized to compare engagement and other learning experience factors. A comparison of mean engagement and experiential variables by seating preference was also computed with multilevel models in Mplus 7.2, and nearly identical results were obtained (i.e., none of the statistical test results differed). These multilevel analyses were used for affirmation purposes only. ANOVA results are provided because the results of the post-hoc comparisons (also affirmed in multilevel models) provide notations for the efficient interpreting mean differences.

For research question 2, four comparison groups were identified: those who sat in the a) back of the classroom most of the time (i.e., over 50% of the time reporting), b) middle of the class most of the time, and c) front of the classroom most of the time, as well as d) a small "other" group whose seating pattern was mixed. We then compared demographic characteristics and course performance by seating preference group. Chi-square tests were performed on cross tabulations of seating preference with demographic characteristics, and one-way ANOVAs with Duncan's post-hoc comparison were utilized to compare mean scores of all course performance measures.

The mediational hypotheses were tested through multilevel path analyses in MPlus 7.2. In the multilevel models, the level-two unit was the individual student, and the level 1 unit was the RoE completed by the students in repeated occasions. These analyses examined the effect of seating on engagement (and other experiential mediators), and the effect of engagement on course grade. The focal predictors were two dummy variables (i.e., coded 1 or 0), one indicating sitting in the front of the classroom and one indicating sitting in the middle of the classroom, with the reference group being sitting in the back of the classroom. Both within- and between-person regression parameters were estimated when possible (i.e., where the regressed effect involved only level 1 variables). Student-level covariates including gender; race/ethnicity; business, finance, or related major; English as one's native language, and year of study participation were controlled at level 2 in all models. Because 68 students did not submit any RoEs, the analytic sample for the mediation models consisted of 339 student participants who completed 1081 RoEs. Full-information maximum likelihood estimation was utilized to recover missing data determined to be missing at random. All level-1 variables were person-mean centered, which means that within-person engagement scores (and those of other experiential variables) were relative to each individual's own average engagement score throughout the study. As both the focal predictors and mediators were assessed within persons (level 1) and the outcome (grade in class) was a between-person variable (level 2), the mediation model took the 1-1-2 level structure (Preacher, Zyphur, & Zhang, 2010). Confidence intervals for the indirect effects were estimated using a Monte Carlo procedure (MacKinnon, Lockwood, & Williams, 2004).

Table 1
Mean differences in Students' Engagement and Quality of Experience by Seating (Front, Middle or Back of the Room).

	Back of room (n = 233)	Middle of room (n = 392)	Front of room (n = 445)	F-test
Engagement	2.89[a]	3.12[b]	3.31[c]	15.69***
Concentration	3.02[a]	3.26[b]	3.54[c]	17.89***
Interest	2.91[a]	3.13[b]	3.26[b]	7.31**
Enjoyment	2.73[a]	2.96[b]	3.13[b]	9.15***
Paying attention	56%[a]	68%[b]	75%[b]	12.08***
Learning orientation	3.35[a]	3.67[b]	3.82[c]	23.21***
Perceived learning	3.37[a]	3.65[b]	3.89[c]	19.45***
Clear goals	3.64[a]	3.87[b]	3.95[b]	8.02***
Instruction was helpful	3.20[a]	3.49[b]	3.69[c]	10.35***
Class preparation[d]	3.32[a]	3.64[b]	3.83[b]	8.70***
Knowing expectations[d]	3.41[a]	3.91[b]	3.92[b]	9.56***
Classroom self-esteem	2.67[a]	2.94[b]	3.13[c]	22.74***
Successful	3.20[a]	3.44[b]	3.58[b]	8.11***
In control	2.90[a]	3.05[ab]	3.13[b]	3.00
Good mood	2.81[a]	3.12[b]	3.35[c]	16.08***
Student connectedness[d]	2.60[a]	2.78[b]	3.11[b]	7.22**
Feeling valued	2.41[a]	2.80[b]	2.98[b]	14.09***
Active participation	2.13[a]	2.35[b]	2.62[c]	19.45***
Intrinsic motivation	2.99[a]	3.23[b]	3.43[c]	19.07***
Excited	2.44[a]	2.65[b]	2.86[c]	10.01***
Wishing to do the activity	2.65[a]	2.87[b]	3.13[c]	10.35***
Importance to self	3.50[a]	3.81[b]	3.92[b]	12.84***
Relevance and utility of topic	3.63[a]	3.93[b]	4.12[c]	13.49***
Enthusiastic	3.05[a]	3.26[b]	3.58[c]	15.43***
Flow conditions	2.90[a]	3.08[b]	3.31[c]	19.71***
Perceived Challenge	2.95[a]	3.03[a]	3.10[a]	0.21
Perceived skill level	2.61[a]	2.83[b]	3.06[c]	13.07***
Level of effort	3.06[a]	3.19[a]	3.54[b]	18.51***
Distraction	2.54[b]	2.45[b]	2.25[a]	9.62***
Mind wandering	2.89[b]	2.81[b]	2.61[a]	10.35***
Irritated	1.84[a]	1.98[a]	1.97[a]	1.78
Bored	2.95[c]	2.74[b]	2.95[a]	15.43***
Interference with learning	2.34[b]	2.26[ab]	2.14[a]	2.27

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Within each row, superscripts denote statistically separate categories according to Duncan's multiple range test (c > b > a). Factor-based composite scales in bold were comprised of indented, unbolded items beneath. Analyses conducted at the Record of Experience Level (N = 1070). [d]Item asked only in 2015.

3. Results

3.1. Differences in engagement and quality of the learning experience

With respect to research question 1, mean differences in student engagement, attention, perceived learning, and other learning experience factors are presented in Table 1. There were statistically significant differences in engagement and other experiential dimensions based on where students were sitting (i.e., front, middle, or back of the room) at the moment of completing their RoE. Students reported being more engaged when sitting in the front of the room than when sitting in the middle of the room, and when sitting in the middle of the room compared to sitting in the back of the room F (2, 1067) = 15.69, $p < 0.001$. Students indicated that they were paying attention to the subject matter of the class 56% of the time when sitting in the back of the room, 68% of the time when sitting in the middle of the room, and 75% when sitting in the front of the room F (2, 1068) = 12.08, $p < 0.001$. Students reported a higher quality of learning experience when sitting in the front compared sitting in the middle, and when sitting in the middle compared to sitting in the back, for every positive learning experience factor that we measured, including Learning Orientation F (2, 1068) = 23.21, $p < 0.001$, Classroom Self-Esteem F (2, 1067) = 22.74, $p < 0.001$, Intrinsic Motivation F (2, 1068) = 19.07, $p < 0.001$, and Flow Conditions F (2, 1068) = 19.71, $p < 0.001$. For the Distraction factor, students reported higher levels of distraction when sitting in the back and middle compared to the front of the class, F (2, 1068) = 9.63, $p < 0.001$.

All items comprising these factors were also analyzed separately in order to obtain a full profile of experience when sitting in the back, middle, or front of the room. The lower quality of experience when sitting in the back compared to sitting in either the middle or front of the room was statistically significant for every positive item on the survey with the exception of control and challenge.

The items under Learning Orientation suggest that, when sitting in the back of the classroom, students were less oriented towards learning both during class (i.e., were less clear on the goals of the class, believed that they were not learning as much, and saw class activities as less likely to help them learn) as well as prior to the class (i.e., came to the class less prepared and with lower understanding of class expectations). With respect to Classroom Self-Esteem, students reported feeling not only less successful, in a worse mood, and less active in participating (i.e., asking questions) when sitting in the back of the room; they also felt less valued and a lower sense of belongingness and connection with their student colleagues. Most of the items comprising Intrinsic Motivation revealed that sitting in the front of the room was significantly associated with a more positive motivational profile. Students were more excited, had a greater desire to do the class activity, regarded the topic as more relevant or practical, and were more enthusiastic when sitting in the front of the room compared to the middle and back of the room. Sitting in the back of the room was associated with significantly lower levels of believing the content was important.

With respect to Flow Conditions, self-appraisals of skills and effort were highest when sitting in the front of the room; and there were no significant differences in the perceived level of challenge of

class activities. With respect to the Distraction dimension, students in sitting in the front reported the lowest ratings with respect to their mind wondering and being bored; and the highest ratings of boredom were reported when sitting in the back of the room.

3.2. Comparison of student characteristics and course performance by seating preference

Twenty percent ($n = 69$) of the student participants sat in the back of the classrooms, 33% ($n = 111$) sat in the middle of the classroom, and 38% ($n = 128$) sat in the front of the class when submitting most (i.e., over 50%) of their RoE's. Nine percent ($n = 32$) fell into an "other" category indicating a seating selection pattern that was mixed (i.e., 50% in each of two of the above categories). Sixty-eight percent ($n = 47$) of students who sat mostly in the back of the classroom sat there exclusively (i.e., did not sit in the middle or front) when submitting their RoEs; 70% ($n = 78$) who sat mostly in the middle of the classroom sat there exclusively; and 87% (n = 111) of students sitting mostly in the front sat there exclusively. Therefore, students who tended to sat in the front appeared more consistently committed to this choice. We refer to those who sat mostly in the back, middle, and front of the classroom when surveyed as "back sitters," "middle sitters," and "front sitters," respectively. To inform research question 2, differences among back sitters, middle sitters, front sitters, and the "mixed" seating group in terms of demographic characteristics and course performance are presented in Table 2.

3.2.1. Demographic characteristics

Keeping in mind that the sample was approximately evenly divided by gender, 58 (62%) of the front sitters were female compared to 35 males (38%). Conversely, 65% of middle sitters and 58% of back sitters were male. This proportional difference was statistically significant, $\chi^2(3, N = 258) = 14.30$, $p < .01$. There were no notable racial/ethnic differences except that all 5 students in the "other ethnicity" category were all middle sitters. There were no significant differences by seating preference among any of the other person-level characteristics tested.

3.2.2. Performance differences

Course grades at the end of the semester significantly differed by seating pattern groups, with back sitters earning lower course grades than did students in the other three groups, F (3, 286) = 4.05, $p < .01$. As course grade was measured on the traditional grading scale (i.e., A = 4, B = 3, C = 2, D = 1, and F = 0), average course grade of back sitters was 0.57 of a grade lower than front sitters and 0.41 lower than middle sitters. The average grade of front sitters was 0.16 of a grade higher than that of middle sitters. There were no significant differences among groups either with respect to cumulative GPA or anticipated grade in the course at the beginning of the semester.

3.3. The influence of seating location on course grades mediated by classroom engagement and experience

With respect to research question 3, Fig. 1a – g illustrate the results of multilevel models testing the influence of seat location on course grades as mediated by engagement and other dimensions of classroom experience. These other dimensions included attention and each of the factor-based quality of experience composites. Each model was tested separately in MPlus 7.2. Both within and between student effects of seating on engagement and other experiential mediators were tested. As depicted in Fig. 1a, sitting in the front of the class (compared to the default category of sitting in the back)

Table 2
Characteristics of student participants by seating pattern.

	Back sitters ($n = 69$)	Middle sitters ($n = 111$)	Front sitters ($n = 128$)	Mixed ($n = 32$)	χ^2/F-test
Female	20 (42%)	31 (35%)	58 (62%)	13 (45%)	14.30**
Male	28 (58%)	57 (65%)	35 (38%)	16 (55%)	
Total	48 (100%)	88 (100%)	93 (100%)	29 (100%)	
Asian	15 (31%)	25 (29%)	29 (32%)	12 (41%)	1.63
White	16 (33%)	27 (31%)	22 (24%)	6 (21%)	2.36
Hispanic	10 (20%)	19 (22%)	18 (20%)	9 (31%)	1.72
African American	3 (6%)	6 (7%)	13 (14%)	1 (3%)	5.17
Indian	3 (6%)	1 (1%)	6 (7%)	0 (0%)	5.33
Other ethnicity	0 (0%)	5 (6%)	0 (0%)	0 (0%)	9.90*
Total	47 (96%)	83 (96%)	88 (96%)	28 (96%)	
Native english speakers	40 (82%)	67 (76%)	78 (83%)	19 (65%)	4.58
Non-native english	9 (18%)	21 (24%)	16 (17%)	10 (35%)	
Total	49 (100%)	88 (100%)	94 (100%)	29 (100%)	
Accounting or business major	39 (67%)	76 (77%)	73 (70%)	16 (53%)	6.35
Other majors	19 (33%)	23 (23%)	31 (30%)	14 (47%)	
Total	58 (100%)	99 (100%)	104 (100%)	30 (100%)	
Freshman	39 (80%)	73 (83%)	79 (85%)	26 (93%)	2.49
Sophomores	7 (14%)	10 (11%)	12 (13%)	2 (7%)	0.97
Juniors	3 (6%)	5 (6%)	1 (1%)	0 (0%)	4.89
Total	49 (100%)	88 (100%)	92 (100%)	28 (100%)	
GPA	3.13 [a]	3.16 [a]	3.21[a]	3.04 [a]	0.38
Anticipated grade	2.47 [a]	2.56 [a]	2.56 [a]	2.34 [a]	1.34
Earned course grade	2.23 [a]	2.64[b]	2.80 [b]	2.83 [b]	4.05**
1st exam	73.94 [a]	75.88 [a]	77.45 [a]	77.13 [a]	1.09
2nd exam	68.55 [a]	70.82 [ab]	70.21 [ab]	73.01 [b]	1.17
Final exam	60.21 [a]	63.49 [ab]	63.58 [ab]	67.20 [b]	1.85

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Within each row, superscripts denote statistically separate categories according to Duncan's multiple range test (b > a).

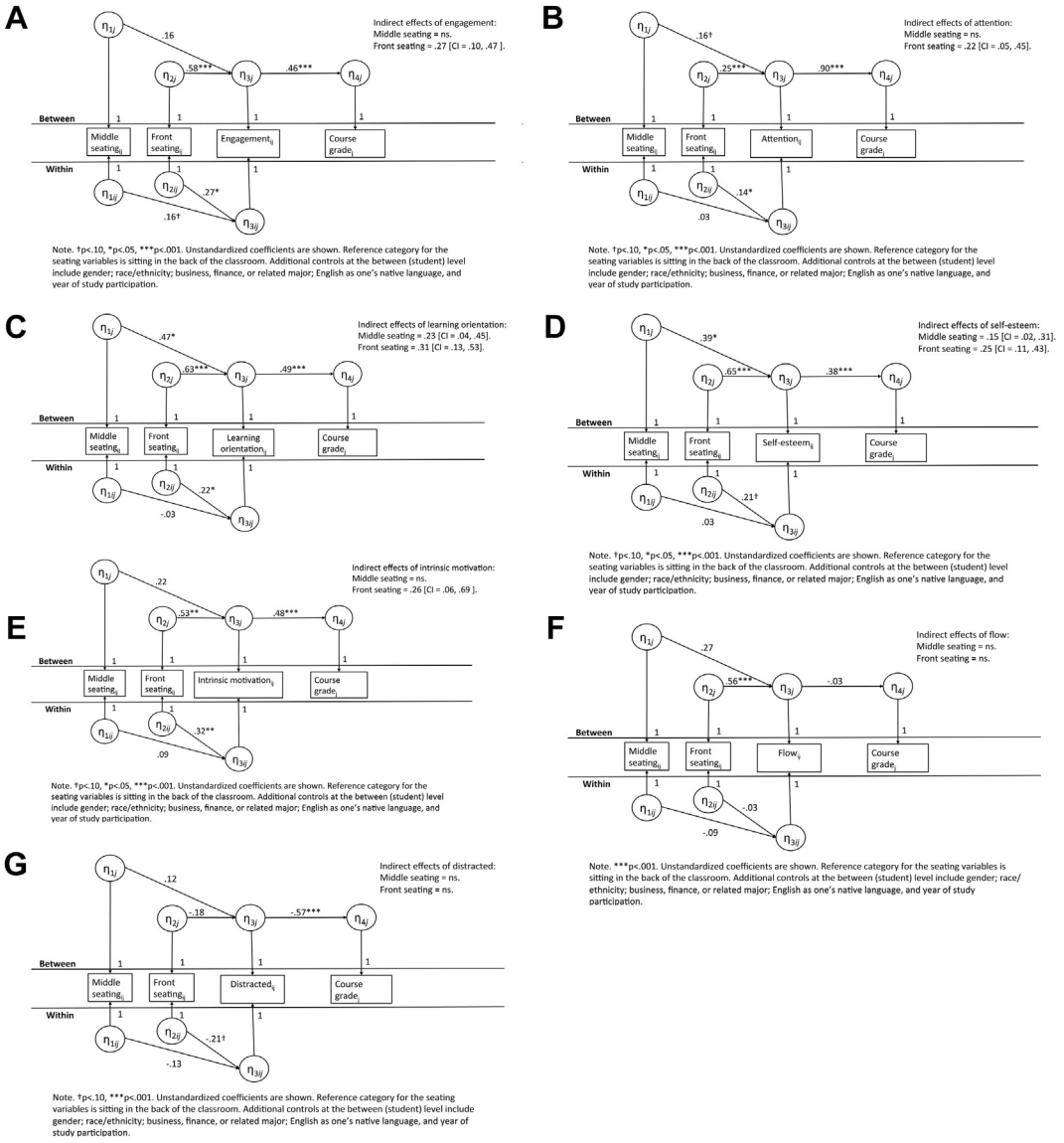

Fig. 1. a. The indirect effect of seating location on course performance as transmitted by student engagement. b. The indirect effect of seating location on course performance as transmitted by attention. c. The indirect effect of seating location on course performance as transmitted by learning orientation. d. The indirect effect of seating location on course performance as transmitted by classroom self-esteem. e. The indirect effect of seating location on course performance as transmitted by intrinsic motivation. f. The indirect effect of seating location on course performance as transmitted by flow conditions. g. The indirect effect of seating location on course performance as transmitted by distraction.

had a significant effect on engagement within students (B = 0.27, β = 0.12, $p < 0.05$). This means that when the same student sat in the front and also sat in the back of the classroom at least once when experience sampled, engagement was significantly higher when sitting in the front. The within-students effect of sitting in the middle of the classroom had only a marginally significant effect on engagement (B = 0.16, β = 0.09, $p < 0.10$), and also was not significant for the other experiential variables. The within-students portion of Fig. 1b, c, and e illustrate that attention, learning orientation, and intrinsic motivation were also significantly higher when sitting in front (B = 0.14, $p < 0.05$; B = 0.22, $p < 0.05$; and B = 0.32, $p < 0.01$ respectively). All other within-student effects were not significant.

Because the outcome of interest was at level 2, the mediational hypothesis was analyzed in the between-student part of the model (Preacher et al., 2010). The percentage of time students sat in the front (which we henceforth refer to as a students "*propensity* to sit in front" compared to the default category of the propensity to sit in back) had a significant effect on students' average engagement as sampled through the course (see Fig. 1a; B = 0.58, β = 0.32, $p < 0.001$). Average engagement, in turn, had a significant effect on course grade (B = 0.46, β = 0.32, $p < 0.001$). Thus, an average difference in engagement of one point on the rating scale corresponded approximately one half (0.46) of a grade difference Furthermore, the direct effect of one's propensity towards front sitting on course grade was significant (B = 0.60, β = 0.23, $p < 0.05$, not shown). The unstandardized coefficient revealed that there was 0.6 of a grade difference between students who had sat entirely in the front and those who sat entirely in the back after controls. The test of the indirect effect of the propensity towards front sitting on grade as transmitted by engagement was significant, indirect = 0.27 [CI = 0.10, 0.47]. The total combined indirect effect from the propensity to sit in the front and in the middle seats (not shown in Fig. 1a) was also significant, indirect = 0.34 [CI = 0.01, 0.68]. Overall, this indicated that students with a higher propensity to sit in the front or middle seats compared to the back had higher

mean engagement throughout the course, and that those with higher mean engagement performed better in the course on average.

Fig. 1b–e shows that the indirect pathway from the propensity towards front sitting on course grade was also statistically significant as mediated by attention, indirect = 0.22 [CI = 0.05, 0.45], $p < 0.05$), learning orientation, indirect = 0.31 [CI = 0.13, 0.53], classroom self-esteem, indirect = 0.25 [CI = 0.11, 0.43], and intrinsic motivation, indirect = 0.26, [CI = 0.06, 0.69]. The total combined indirect effect (from both the propensity to sit in the front and in the middle seats) as transmitted by all four mediators was also significant. The indirect effect pathways from the propensity to towards middle sitting on course grade through learning orientation (Fig. 1c) and classroom self-esteem (Fig. 1d) was also significant. As depicted in Fig. 1f and g, however, indirect effects as transmitted through flow conditions and distraction were not significant.

3.3.1. Post-hoc multiple mediator model

Given the fact that five of the seven mediators we tested in separate models had significant indirect effects, we ran a post-hoc multiple mediator model in which we focused on engagement and attention as mediators in the same model. Results from this model, not shown, indicated that students with a higher propensity to sit in the front were significantly more engaged and paid significantly more attention than students with a higher propensity to sit in the back. However, only a student's average engagement was significantly associated with their final grade, and only the specific indirect effect of the propensity towards front sitting on grade as transmitted by engagement was significant, indirect = 0.27 [CI = 0.08, 0.53]. Thus, the mediating effect of engagement appeared to account for some of the mediating effect of attention.

4. Discussion

4.1. Findings and interpretations

In this study, seating location in large lecture, undergraduate courses in financial accounting influenced students' engagement and other dimensions of classroom experience. Students' pattern of seating was also significantly related to their grade in the course. When students sat in the back of the classroom, they were less engaged than when sitting in the front or middle of the classroom; and they were more engaged when sitting in the front than when sitting in the middle or the back. This same pattern held true for almost every experiential factor examined, including learning orientation, classroom self-esteem, intrinsic motivation, and flow conditions. The one exception was distraction. Students indicated being less distracted when sitting in the front of the classroom, and while the level of distraction was highest while sitting in back, it was not significantly higher than when sitting in the middle seats. Students also indicated paying significantly less attention when sitting in the back of the classroom: 56% of the time compared to 68% of the time in the middle and 75% in the back.

Results also showed that students who sat exclusively or mostly in the back of the classroom (referred to as “back sitters”) performed more poorly than the other students – about one half of a grade more poorly on average. Although those who sat exclusively or mostly in the front of the classroom (i.e., “front sitters”) received the highest grades on average, the difference between these students and those who sat exclusively or mostly in middle seats (i.e., “middle sitters”) was not statistically significant. Results also demonstrated that the effect of seating pattern on course performance was mediated by student engagement, as well as by learning orientation, classroom self-esteem, and intrinsic motivation. Flow conditions and distraction were not confirmed as significant mediators, however.

4.2. Research implications

While claims of causality must be approached with caution due to the correlational nature of this study, results provided some valuable information regarding the question of whether the influences found reflected a “classroom effect” (i.e., sitting in different seats directly relates to a qualitatively different student experience), a “student effect” effect (i.e., different kinds of students select seats that are part and parcel of student differences related to performance), or both. In this study, we found some evidence that both mechanisms may be at work. Due to investigating a full profile of student experiential dimensions using the Experience Sampling Method, we found consistent differences in student experience “in the moment” by seating location. Thus, one contribution of this study was illuminating the black box of student experience as varying by seating location as a possible mediator of performance differences by seating patterns. Although evidence was strong that most aspects of students' classroom experience varies by seating location, the question of whether this experiential difference is caused by a fundamentally different quality of learning opportunity associated with proximity to the instructor, or whether it is related to dispositional differences between students who develop different seating patterns, is a separate issue. Some experiential items (e.g., enjoyment, attention, active participation, distraction) were more suggestive of the quality of learning experience associated with properties of seat location in a large classroom; others (e.g., class preparation, knowing expectations of the class), were suggestive of dispositional differences among students. Both types varied significantly by seating location, and varied both within and between students.

Multilevel mediational models, however, helped to illuminate this issue. Because variation in final grade varied only between students, the mediational hypothesis that was confirmed for engagement and other significant mediators was strictly a between-student effect. Had a repeated measure of performance been available at the same time points that student experience was captured, we would be able to test whether or not each students' variation in engagement and experience mediated the effect of seating on performance within students. Although we were unable to test for this possibility, we were able to determine that, on average, engagement, attention, learning orientation, and intrinsic motivation were lower when sitting in the back of the classroom compared to the front for students who sat in both locations during the course of the semester. The within-person effect of seating on classroom self-esteem and distraction was marginally significant (i.e., $p < 0.10$). These within-student effects are not attributable to personality, dispositional, or other student-level differences. Altogether, however, results of the multilevel models provided evidence that seating made a difference in student experience both as a within-student classroom effect and as a between-student effect. There was significant between-person covariation in seating with respect to dispositions towards the class such as the tendency to be prepared and know expectations for the class. Personality traits were not systematically examined, however. Overall, results suggest that both student and classroom contextual factors coexisted, and were likely interactive in contributing to the influence of seating on student engagement, experience and course performance.

The only student-level covariate examined that was related to differences in seating pattern was gender. Although the sample of students was evenly distributed along gender lines, almost twice as many females as males were front sitters, almost twice as many

males as females were middle sitters, and nearly 50% more males than females were back sitters. This may be related to higher engagement or a stronger learning or achievement orientation in classrooms among female students compared to male students (Shernoff, 2013; Koestner & Zuckerman, 1994).

4.3. Implications for practice

The salience of student engagement and experience as a mediator of the effect of seating location on performance has implications for classroom ecologies (e.g., Becker et al., 1973; Brooks & Rebeta, 1991), and the social psychology of learning environments (Goldin, Epstein, Schorr, & Warner, 2011; Shernoff, 2013; Levine et al., 1980). For example, students in this study felt more distracted and unfocused, and in a worse mood, when sitting in the back of the classroom than when sitting elsewhere. They not only felt less successful; they also felt less valued and reported a lower sense of belongingness and connection with their student colleagues – all of which can contribute to student disengagement (Shernoff et al., 2016; Shernoff, Ruzik, & Sinha, 2016). On the other hand, sitting in the front of the room was associated with higher levels of participation and a more positive motivational profile in most respects.

This dynamic has implications for environmental psychology: students' locus in the classroom may determines inclusion in qualitatively different physical environments in which the psychological experience of flow, interest, and attention are unequal. Thus, findings suggest that at least two distinctive *psychological environments* were socially constructed within the same classroom – the front and back of the classroom. Since classrooms are educational environments, this can and does influence the quality of educational experiences, impacting perceived learning and academic performance.

Central findings regarding differences in student experience and/or disposition based on seating location were consistent with the observations of the classroom environment and student behaviors made by the instructor and researcher-observers. A variety of factors (e.g., the distraction of students arriving early and leaving late, loud metal doors in the back of the classroom, socializing and cell phone usage among back sitters) caused additional distraction for students sitting in the back, including those attempting to become engaged in the class. Although unaware that seating location was an explicit focus of the study, researcher-observers indicated in their field notes that they were struck by the lack of attention and engagement demonstrated by students in the back of the classroom, and by the greater level of participation of students in the front of the classroom. This suggests that observed differences in students' level of engagement and attention by seating may indeed reflect students' subjective experiences of instruction, and may also be related to student performance.

While the implications of the study findings are complex, studies such as this one provide critical information to inform discussions on context-specific educational and policy decisions. For example, study results support the view that large lecture classrooms are not ideal learning environments for a demanding subject such as financial accounting; and that the back of the classroom can be a particularly unconducive environment for learning. Creating such compromised learning environments may be a likely even if unintended consequence of large classrooms and class sizes. Therefore, students who are identified as being at risk of underperformance, scholastic failure, or dropout might be discouraged from sitting in the back of large lecture-style gateway courses due to the additional risk factor of sitting in the back. While it is true that in some classes not all students can sit in front, sitting farther from the instructor may not jeopardize the successful course performance of students with no or fewer other risk factors.

What policies and/or pedagogies should be instituted to encourage weaker students to move to the front and/or encourage them to become more actively engaged in class? The instructor of the accounting course in this study formed the impression that large lecture classrooms are not ideal learning environments for a demanding subject such as financial accounting, and that the back of the classroom can be a particularly unconducive environment for learning. Study results generally supported this view. In one study, however, 20% of students who sat towards the back commented that they did so in order to leave the class early (Benedict & Hoag, 2004). This suggests that some students may prioritize convenience, or act on a variety of motivating desires (Goldin et al., 2011) other than the motivation to learn and master the content knowledge. This might also be considered in decisions of class size and whether to leave seat selection entirely up to student discretion.

4.4. Suggestions for future research

Further research is needed to better understand the reasons that students make their seating selections; future studies would profit by asking students this explicitly to augment other data collected. Future studies focusing on student engagement and experience should also explore the influence of seating under conditions of intervening policies (e.g., smaller classes, seating assignments, rotating seating assignments) and pedagogies (e.g., small group work within larger classrooms).

4.5. Study limitations

This was a correlational study, making inferences of causality speculative. Another consideration when interpreting results is that the measure of seating location was based strictly on student self-report. We note that while it is true that where students draw the line between front, middle and back of the classroom categories may vary in self-reports, there is no universal standard for such cut-offs, and researcher cutoffs vary across studies. In addition, the study was limited to two cohorts of a single undergraduate course in financial accounting occurring in a large, amphitheater-style classroom. The nature of the financial accounting course, which was one that included a good deal of theory as well as computation, and demanded a high of concentration to be successful, may also be related to the study results. Although a previous pilot study obtained preliminary evidence of similar patterns of the influence of seating on student experience, including in smaller classrooms and in graduate classes, the generalizability of the study remains somewhat limited by the particular population and context that characterized the study. Important contextual factors may include the nature of the performance assessments (i.e., type of exams), and the degree to which they are based on lecture versus assigned readings.

4.6. Conclusion

The literature on the effect of seating on academic performance is decisively mixed. Although some studies have found significant influences of seating on performance, others have found no or weak effects, leading researchers to conclude that, “in general, seating simply doesn't matter” (Meeks et al., 2013, p. 383). The results of this study suggest an opposite conclusion: seating location, and proximity to the instructor in particular, can have a consistent relation to multiple aspects of student experience. It can also have an influence on course performance. In addition, the influence of seating on performance appears to be at least partially mediated by students' engagement and quality of classroom experience. This

does not mean that seating matters in all conditions and contexts, however. Future research should focus on the contexts and conditions that influence students' seating behavior and their relationship to students' motivations, classroom engagement, and course performance.

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