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Student Anxiety in Active Learning Classrooms: Apprehensions and Acceptance of Formal Learning Environments

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The number of undergraduate students who report having at least one disability has been on the rise since the 1970s. With the advent of Active Learning Classrooms (ALCs), understanding how these students experience ALCs is critical to creating a fair and equitable experience for all students. This report examines one subset of this population: students with some form of diagnosed Anxiety Disorder. Although over a quarter of U.S. undergraduates report a diagnosis of some kind of Anxiety Disorder, this study focused on those who sought disability accommodations in their ALC classes. Using structured interviews, this paper identifies 11 elements of the classroom and learning experience that affect such students in these spaces. The paper concludes with recommendations instructors can take to improve the learning experience for students with anxiety and anxiety disorders.

After two decades of research, many of the positive effects of active learning classrooms (ALCs) have been confirmed. ALCs have been associated with improved problem-solving skills, better conceptual understanding, reduced failure rates, strengthened social relationships, and better academic achievement for students who, by virtue of low ACT scores, would have been predicted not to have performed well (Ridenour et al., 2013; Beichner et al., 2007; Baepler et al., 2016; Walker & Baepler, 2018; Brooks, 2011; Cotner et al., 2007). All of these findings have reinforced the promise that ALCs would improve the learning environment for students in higher education and advanced the implementation of active learning, which is known to improve academic achievement and durable learning (Prince, 2004; Freeman et al., 2014). While this body of research is impressive, it's also incomplete since it hasn't fully investigated how ALCs might differentially affect student subpopulations. For instance, we are only now beginning to understand the positive impact of active learning (in any type of classroom) on underrepresented minority and low-income students, which is bound to have implications for these students in ALCs (Theobald, et al. 2020). Another population of learners who have received little attention is students with disabilities.

The National Center for Education Statistics reported that 19% of undergraduates in 2015-16 reported having at least one disability (Institute of Education Sciences, 2016). This is generally recognized to be an increase since 1970, due in large part to the passage of both the 1973 Rehabilitation Act and the 1990 Americans with Disabilities Act (ADA) which was amended as the ADA Amendments Act of 2008 (Miller, Zayac, Paulk, & Lee, 2019). Disabilities, in this context, might include visual, hearing, mobility or speech impairment; learning, mental, emotional, or psychiatric conditions (e.g., serious learning disability, depression, Attention deficit disorder (ADD), or Attention deficit hyperactivity disorder (ADHD); or other health impairments. As a result of its passage, the ADA compelled institutions receiving federal funds to provide reasonable accommodations for students living with disabilities that don't alter the academic standards. These accommodations may include adjustments to the physical learning environment or modifications of the institution's practices and policies.

Given the transformation of both the physical learning environment in ALCs and the pedagogical approaches instructors use in these spaces, it's critical to understand their impact on students with disabilities. The question that drives this project is: How do students with disabilities believe Active Learning Classrooms support or disrupt their learning? Students experience their disability differently, depending upon the character of the disability and how they integrate it into other elements of their identity. Someone who describes themselves as blind or visually impaired may find different factors of the space helpful or disruptive to her learning. For the purposes of this exploration, I chose to focus on a single type of disability, anxiety disorders, as a way to begin exploring the impacts of ALCs on students with disabilities. The research question for this initial study is: How do students with anxiety disorders believe active learning classrooms support or disrupt their learning?

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Anxiety in Academia

The National Alliance on Mental Illness (NAMI), drawing on data from the National Comorbidity Survey, estimated that in 2003, 19.1% of U.S. adults had a form of anxiety disorder in the previous year (National Alliance of Mental Illness, 2017). According to the Spring 2020 National College Health Assessment III, which sampled nearly 40000 undergraduate students before the start of the Covid-19 pandemic, 27.7% of college students reported that they were diagnosed at least once with anxiety, such as generalized anxiety, social anxiety, panic disorder, or specific phobia. (American College Health Association, 2020, p.14). What does it mean to be diagnosed with an anxiety disorder? The simple answer is that it varies. The National Alliance on Mental Illness (2018), however, observes that there is a commonality among the disorders. People typically experience "persistent, excessive fear or worry in situations that are not threatening." (para. 3). This could potentially seem inconsequential to many, but to those experiencing it, this fear or worry can manifest in a sense of dread or tension or being overly cautious. It might present symptoms such as an upset stomach, diarrhea, shortness of breath, fatigue, and insomnia. While moderate levels of anxiety have the capacity to motivate students, high levels of anxiety can be debilitating and counterproductive to academic achievement (Seipp, 1991; Brook & Willoughby, 2015). In general, high anxiety is an undesirable difficulty.

The connection between active learning and anxiety is complex and seemingly contradictory. Some specific active learning practices tend to exacerbate anxiety, while others alleviate fear. For instance, researchers in a large biology course investigated five active learning strategies and found that each one increased anxiety. In descending order of anxiety induction, they are: cold calling, volunteering to answer a posed question, completing worksheets, working in groups, and using clickers (England, Brigati, & Schussler, 2017). In contrast, working in groups has a largely but not completely unambiguous, positive affect on student anxiety. In another large enrollment biology course, researchers identified several aspects of group work that helped alleviate stress. They included confirming what concepts a student does or does not know, clarifying understanding, realizing that other students struggle with concepts, and feeling comfortable with work partners (Cooper, Downing, & Brownell, 2018). These findings are particularly illuminating given that we know active learning that draws on these strategies and on effective group work creates the conditions for students to learn more (Freeman et al., 2014). Active learning, however, while extremely helpful to the learning process, can inadvertently contribute to the stressful state that feeds anxiety.

Many active learning strategies provide an opportunity for some kind of formative or summative evaluation and feedback. ALCs are designed with this in mind, and they frequently are furnished with whiteboards and LCD screens to allow students to display their work to the instructor and other students (see Figure 1). The whiteboards and screens create an effective mechanism for everyone to scan the room to see what others are doing, which can be particularly helpful during a problem-solving session. Evaluation, however, can inadvertently exacerbate anxiety and a fear of failure as students anticipate their peers' and instructor's judgement. It's possible that *fear of negative evaluation* could be addressed through several interventions or re-framings of evaluative activities. These include creating situations that would allow students to succeed in low-stakes assessments; implementing relaxation techniques in advance of high-stakes assessments; and altering student perceptions of evaluation accuracy, particularly with more seemingly subjective assessments like oral presentations (Hull et al., 2019). More broadly, designing a student-centered classroom might mitigate some of the fear of negative evaluation by (a) fostering relationships among students so that they don't necessarily feel negatively evaluated and (b) creating a classroom climate that demonstrates inquiry and collaboration are valued over the need to always be correct (Cooper & Brownell, 2020).

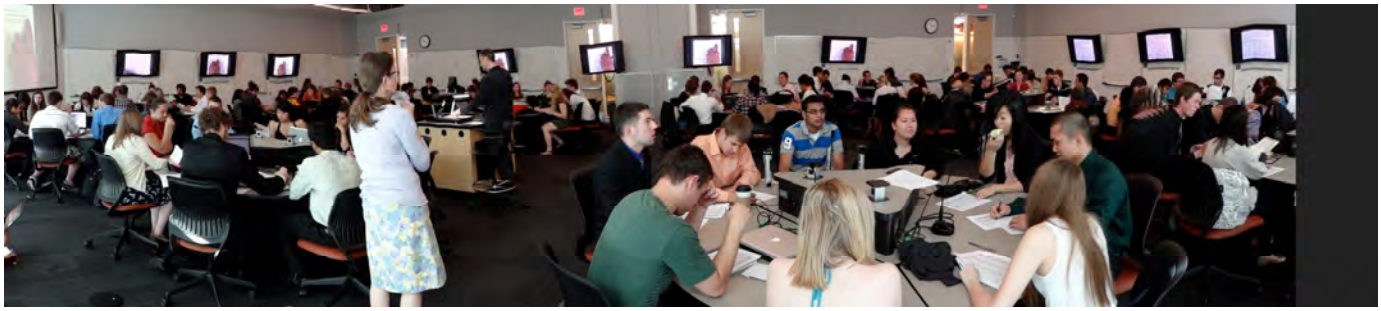

Figure 1. **A large active learning classroom (ALC) with 14 tables and seating for 126 students in a Foundations of Biology course.**

Methods

This study was conducted at a large R-1 institution in the Midwest beginning in the spring of 2019. An email recruitment letter was issued directly from the institution's Disability Resource Center and via instructors who had been teaching courses in ALCs. The study used purposeful sampling to select students who fulfilled two selection criteria. To be eligible for the study, students had to have completed at least one course in an ALC and have a documented disability. The type of disability was not restricted, so students with apparent disabilities, including blindness and mobility restrictions, were also interviewed, but their data were not included in this study.

The recruitment letter outlined the purpose of the study and asked students to contact the researcher directly if they wanted further information. For those who replied, they received the interview protocol and the study consent form to better weigh whether or not they wanted to participate. As an incentive for participating in the hour-long interview, students were given a $25 gift card. Of those who responded and met both criteria, four students declared a documented disability that included an anxiety disorder. In some cases, students had additional diagnoses. At the start of the interview, students were asked a few demographic questions. This study was conducted under the auspices of the university's Institutional Review Board.

Interviews

To conduct semi-structured interviews, an interview protocol was developed (Merriam & Tisdell, 2015) to examine how students with diagnosed disabilities of any kind experienced the ALCs. The items focused on the physical space rather than on the particularities of the disabilities or a particular pedagogy. Think-aloud interviews were conducted with two undergraduate students, and changes were made when points of confusion arose or responses veered off-topic due to wording confusion. At the time the protocol was sent to students, a photograph and a description of a typical room accompanied the items. During the interview itself, a photograph of the room was projected to help students focus on the space, and a second photograph of a more traditional room was briefly displayed to remind students of the contrasting features of the environments.

Questions made reference to the design of the space and its physical affordances, including the whiteboards, tables, screens, microphones, seating, and room topography. In some cases, mention was made of invisible characteristics of the space, such as how sound carried in the room, the effect of lighting, and the propensity for distraction due to circular seating. Students were also asked about the accommodations they received or wish they had received. Toward the end of the interview, students were asked to imagine and describe a space optimized for their learning, given their disability. These questions were generated, in part, from analyzing hundreds of open-ended responses to survey questions related to ALCs (Walker, et al., 2011).

Each interview was deidentified and transcribed by student workers. Themes were initially divided into contributory (positive) and distracting (negative) categories. After initial analysis, the data was re-categorized to focus on interactions with the physical space, interactions among students, and interactions with the instructor (Weber 1990). Data regarding the hypothesized "ideal learning environment" was excluded from the final analysis. Though interesting, these insights didn't help to resolve the initial research question. Given the small sample, no attempt was made to quantify the responses.

Participants

A general call for participation in the study was issued through instructors who had taught in ALCs and through the disability center. They were given a short description of the study and told to contact the researcher directly for additional information. For participation in the study, they were also told they would receive a $25 Amazon gift card. Once accepted into the study, they were sent the interview protocol and the consent form to review in advance of the actual interview.

The four participants selected for this study were each assigned a pseudonym. They all came from STEM fields and were either freshman or sophomores. Each had a documented disability that included anxiety, and three of the four had additional diagnoses, including depression. All students had worked with the University's disability center and had asked for and received some form of accommodation. Three of the four students had taken more than one course in a large ALC. Two students were Asian and two were white.

Lydia was a freshman majoring in Physiology with a Studio Art minor. She described her disabilities as including ADHD (hyperactivity and impulsivity) and chronic depression. She mentioned that she did not experience social anxiety. The accommodations she received included 50% more time for exams, the ability to take exams at the disability support services office, and allowance to write on the whiteboard, "I'm taking a break. I'll be back in 5 minutes." Lydia identified as white.

Frank was a senior in high school but had already had enough credits to be considered a sophomore and was majoring in Chemical Engineering. He described his disabilities as including bipolar disorder, PTSD, depression, and social anxiety. He received additional time for exams.

He also applied to take his exams in a semiprivate room, but this was not allowed. Frank identified as Asian.

Milly was a transfer student and a sophomore majoring in Biology. She considered herself pre-med with a goal of becoming a physician's assistant. She described her disability as general anxiety. She received 50% more time for her exams, which were administered online. The fact that the exams were delivered online was an additional source of anxiety. Milly identified as white.

Vanessa was a freshman majoring in Chemistry. She described her disability as depression and severe anxiety. She was allowed some exemption on attendance, extensions on assignments, and additional time on exams. Vanessa identified as Asian.

Results and Discussion

The data below are sorted into four interactions and subdivided into 11 elements affecting those interactions. At the conclusion of these findings, a set of practical recommendations for instructors are listed.

Interaction #1: Student and the ALC Learning Space

We know from previous research that students can be unprepared for what they see when they walk into an ALC for the first time (Baepler, et al., 2016). Round tables, microphones, whiteboards, screens; no obvious focal point, no clear front or back of the room. To many students, the sight of an ALC is puzzling and altogether new. When you suffer from an anxiety disorder, questions that every student might have are magnified in proportion. "Where is the back of the room?" "Where can I sit so I won't be noticed?" The answer to these questions is existential for someone who feels he needs to remain unnoticed. Frank commented, "My goal is never to disrupt, and, you know, make a scene or anything like that." Not knowing how to protect your anonymity can be daunting and can create a negative first impression of the classroom. From the first day, a student with anxiety can feel the challenge of the space and will continue to feel that sense of unease until she begins to feel comfortable and enjoy some success. In summing up her experience, Vanessa said, "The ALC initially gave me anxiety, but in the long run it helped a lot."

Initial Seating Impressions. Some of the stress these rooms provoke comes from the uncertainty of how the seating arrangements will affect student interactions. Vanessa explained, "I was really confused in how the discussions worked because you walk in and there's 100 people in one classroom but you're only limited to 10 since you only work with the people at your table." The sheer size of the room can compound the issues. Frank mentioned, "I guess with the size of the room, the amount of people made it very hard to concentrate and then spiked my social anxiety as well." Milly also commented upon how the size and configuration of the room was misleading. While a large ALC can initially spike anxiety, that anxiety can fade if they conceive of their local space—their table—as essentially the critical bounds of their learning environment.

> I think also sometimes my anxiety prohibits me from wanting to interact with other students, because I get anxious about it. I think, in this setting, it was way easier for me because I could see all of them. It was randomly assigned groups. So on the first day, you just sat wherever, so no one knew each other, and then throughout the entire course we all established a relationship with one another because we had been working together through the whole semester, and it was just like way easier to talk to the person sitting next to me because we're all in a circle, and we can see each other, versus in the lecture hall where there's people everywhere.

Sound. For some students with anxiety, simply focusing on material can be challenging. Anything that detracts from their ability to focus on a topic compounds the issue. Whereas a traditional lecture in a lecture theater has a single focus and an instructor who can be spotted and mic'd, the ALC lacks these features by design. ALCs are created to place the focus on students, so when an instructor speaks, even with a microphone, it doesn't take much of a disruption to become a distraction.

Students can mistake the non-traditional configuration of the space as an informal setting, which prompts casual side conversations. Additionally, many ALCs fill their walls with whiteboards that inadvertently reflect sound, creating some audio distortion and reverberation. Vanessa mentioned, "I realized that when I'm having those days where I'm having severe depression and anxiety, I felt I had to go to class and I wasn't focused so I would be sitting there doing nothing but even more, so I couldn't focus due to the hindering noises, the off topic conversations, and stuff like that."

First time observers of the ALCs are frequently impressed with the general activity and buzz of the room, and instructors often comment upon the difficulty they face in modulating between mini-lectures and discussions. Sound from nearby conversations, both at a student's own table and those tables around her, are a frequent source of distraction and complaint (Rezaei, 2020; Petersen & Gorman, 2014). For students who can more easily focus, this situation, while not ideal, works well. For those who are easily distracted or are looking back and forth between their work and someone a few seats down from them, the ability to hear and focus is compromised. One might imagine that working in sub-groups at a table might make things easier, but that's not always the case. Frank pointed this out:

> It's like the sound was super hard to understand…there was always plenty of examples of me saying like, "what did you say? I couldn't hear you." Granted I don't have the best hearing, but it's not bad by any means…. It was with people near us, if other people on the other side of the table really didn't talk, they just were doing their homework. And then it was the group of like five of us that were trying to just communicate just across this little portion of the table like right here. Even that was difficult, which it shouldn't have been, really. No, it wasn't a distance thing. And they were talking quite loudly.

Lighting. The light in an ALC can be jarring. It reflects off the whiteboards and emanates from perhaps a dozen mounted LCD displays. If your eyes are sweeping the room to locate the instructor, you're scanning through a field of varied light sources which can be unsettling. In and of itself, it's probably easily overlooked. For some, glaring light is a signature of the space. Frank remarked upon the institutional character of the lighting: "Yeah, the brightness of the room. Hot. It was really rough on the eyes. It's similar to when you're going into a hospital room and it's like all white. It's obviously different, but it's like the same concept. So bright and distracting." While the lighting alone might not appear a substantial distraction, it is one element layered into the ALC experience that can be irritating and ultimately distracting.

Eye Contact. A standard configuration of an ALC includes a distribution of tables with enough room between the furniture to allow an instructor to walk among the students to engage them, answer questions, and assess their progress. When speaking to the entire class for any length of time, some instructors might wander the space with their microphone. This might be a casual attempt to be near all students, or it could be a subtle way to monitor attention. It might simply be the style of the instructor who chooses to move freely in the room or move closer to someone who is asking a question.

For students, however, it can be difficult to follow someone in motion. In a traditional amphitheater, instructors have a fairly limited stage to prowl and are easy to locate. Their location is predictable, and the design of the room focuses attention on them. This can be counterproductive for students who feel they need to both hear and see the instructor simultaneously in order to maintain focus. Frank put it in terms of the importance of eye contact, and how the ALC didn't always allow for this:

> She would walk over to the other side of the room and I couldn't make that contact, like that eye contact. And I feel like that helps a lot when understanding stuff. I don't know if that's just me, but when I'm looking and visually seeing someone do something, it helps me learn. I'm a visual person.

Losing sight of the instructor, her eyes, and her facial expression as she moves through the room can be disorienting for someone who needs to focus his attention on the person who is speaking. He might feel, intuitively or explicitly, that he is missing key non-verbal signals (Boyle, Anderson, & Newlands, 1994). The inability to receive eye contact from someone can also lead to a sense of ostracism and potentially increase anxiety (Lyra, Wirth, & Hietanen, 2017).

Interaction #2: Students Learning with Students

In the ALCs, the design of the space suggests that students will necessarily be interacting with each other, and many student apprehensions center on how this might occur. Students are unable to avoid social situations when they are sitting at round tables and distributed into working groups. They are expected to help make those groups function, and to fail to do so could bring them unwanted attention and worsen the situation.

Seating Arrangement: Sight Lines. As mentioned earlier, students who enter an ALC for the first time have often commented upon the seemingly informal character of the new classroom. Unlike in an amphitheater, the seating is typically moveable and situated around team tables rather than fixed in long rows with "one-armed bandit" desks or tablet arms. Some students, however, don't necessarily equate "comfort" with a lack of focus or inattention. For students with anxiety disorders, comfort might also mean a reduction in social stress and a better environment in which to meet peers for constructive associations.

The seating arrangement around a table creates an opportunity for students to naturally see each other, prompt casual conversations, and make friends in ways that are less intimidating. Vanessa mentioned, "The table design is very nice. Everyone has the ability to look at each other and talk. It gave me more comfortability to speak." Milly noted that the round tables created a different kind of social norm in which it was natural to look at those around the table and potentially make friends with people who could help her when she was grappling with a problem. Comfort, in her perception, is a kind of shorthand for breaking down social barriers that otherwise might hinder learning:

> I think the classroom was a very comfortable learning environment. I felt very comfortable. I liked how the tables were circular so you know I could see all of my classmates and from the first day we like exchanged numbers so if we had any questions through the semester, we could just text

> each other, which was awesome, because I also find it difficult, and also I would always be anxious about, you know, if I was just sitting in a huge lecture, kind of like making those friends is kind of intimidating. Like if you need help in the class, some people have friends already in the class, so you don't really know who to talk to or sit by and this way it was way easier and more beneficial.

Learning in Groups/Teams. The novelty of the ALC space can create a sense of foreboding for some students. It creates a sense of uncertainty because the arrangement of the space forecasts a different and uncertain way of interacting in the classroom. After a short period of time, however, what typically happens in an ALC becomes clear, and students realize that the dynamic of being a single individual in a great sea of students no longer applies. The tables become small sanctuaries as students get to know each other. The sense of isolation dissipates as students come to rely on each other for help or confirmation about a solution to a problem. Milly pointed out that her tablemates all faced the same problems and had common questions: "I think that being able to discuss things with my peers so openly, we were like all on the same page about everything. I think that was really helpful, because, I felt, you know, *I'm not alone in this*, you know everyone is going through the same thing, and we all have the same questions."

The pedagogical value of cooperative learning is well documented (Johnson, Johnson, & Smith, 2014). For students with anxiety, the sense that "I'm not alone in this," can be critical. The ALCs provide a social scaffold that allows for seemingly safer interactions and inquiry. Many students lack confidence about what they don't know, and they don't want to call attention to themselves or slow down the rest of the class by asking something obvious. In the ALCs, students can test their questions in their groups and resolve the simpler problems. "Not being alone in this" can mean that everyone in my group has the same question that needs to be answered, and it decenters the origination of the question from the individual to the group. Lydia phrased it this way:

> I might have several questions that I'd like to ask. Instead of getting embarrassed and wanting to raise your hand and having everyone look at you, you are just able to ask your group mates and then click a button [call light] if you don't understand it. And then [the instructor comes over and is] answering this question for several people and not the whole classroom.

Some students value the isolation and the anonymity of a large class. Frank mentioned that he became more antisocial when he was stressed, and Lydia feared letting down her tablemates when she was mentally absent. Several of the four in this study, however, also found that their table group helped them focus. It limited their field of vision so that they could concentrate not on the chaos of the large class but on the conversations in their microcosm. For instance, Milly described her attention as being constrained to her immediate circle: "When I was sitting with my group, I honestly felt like it was just me and my group." Her focus narrowed from the larger room to just her tablemates:

> I honestly focused way better in the active learning classroom because, like I said, I was very engaged in my group, and I think that my anxiety was pretty relaxed during that time because I wasn't with like a bunch of people everywhere, where I could see what everyone was doing, I was just like in my group.

Interaction #3: Instructors and Students

In traditional classrooms, students are accustomed to maintaining a distance between themselves and the instructor. To interact with the instructor is to potentially draw undue focus and attention to themselves. The ALCs disrupt this dynamic in largely positive ways.

Mobility. Instructors have been enacting active learning strategies in traditional large classrooms for decades, despite those rooms' suboptimal conditions for interaction and the fact that the spaces were designed for lectures (Frederick, 1987). The fixed seating environment creates challenges not only for students who can't easily rearrange themselves to face other students, but also for the instructor who can't get physically close to students to answer questions or simply observe their progress. The ALCs eliminate this issue by allowing space between tables for instructors to navigate the rooms. They become more mobile and can walk up to every table, if not to every student. This changes the dynamic for students who have questions because instructors can attend to students where they are sitting amidst their group. As Milly mentioned, "I was much more comfortable interacting with her because she would get to come up to the groups and It was way easier to talk to her."

Elevation. Auditoriums are typically designed with a sloped floor and rows of chairs to reduce the seating footprint and to maximize the number of students in the room. One design advantage of these classrooms is to create a focal point on the lecturer for the students. If students have questions at the end of a lecture, they might descend the stairs and wait in line to speak to the instructor. For students with an anxiety disorder, however, this action can be daunting because they "feel like everyone behind me is staring at me." The student believes that they are part of the focal point, which is exactly where they don't want to be. They don't want to be watched. To some degree, the ALCs

don't replicate that issue. The lack of a sloped classroom reduces an exaggerated sense of surveillance. Milly explained:

> I wasn't really too anxious about going to talk to [the instructor], even if it was a very brief question. Even if there were people lined up behind me, I still didn't really have a problem. I don't know if that was because it wasn't a typical lecture hall where the seats are kind of slanted down, and you're right in front, she was kind of in the corner of the classroom.

Shifting the Center of Focus. A key premise behind any definition of active learning is that students are engaged through meaningful activities or discussion in contrast to passively listening (Prince, 2004; Freeman, et. al, 2014). The ALCs are designed to facilitate active learning rather than lecture. The attention is less on the instructor and what she does and more on the student's engagement with the material and with each other. The tables and whiteboards create the student workspace, and the lack of a defined "front" of the room reduces the prominence of the instructor. Lydia commented on this, "Now that I think of it, it's just like kind of a nice environment physically compared to all of us being, you know, putting all the attention on her. It feels a little less focused on the teacher." This decentering of attention may make it easier for students with anxiety to approach an instructor or call her over for assistance.

Interaction #4: Pedagogical Choices

The design of the ALCs allow a reassessment of pedagogical choices. Instructors, for sound reasons, might insist upon required seating arrangements or might redesign the course to "flip" the class. These changes present unforeseen challenges to students with severe anxiety.

Required Seating. The question of why students choose to sit in a particular location in a lecture hall and that location's bearing on academic achievement has been researched for several decades with somewhat conflicting findings. Research has focused on whether the environmental factors (room size, room density, row location) influence achievement or if a student's personality (motivational level and confidence) condition the choice of where and with whom they sit (Kalinowski & Taper, 2007; Smith, Hoare, & Lacey, 2018). Some evidence suggests that instructors' perceptions of why students sit where they sit aligned with what students actually claimed: Instructors perceived that students who wanted to engage largely sat in the front of the room, while those who cared not to engage sat in the back, though no correlation between location and achievement surfaced (Shernoff et al., 2017). Although students generally choose the back of the hall because they do not want to engage with the instructor or the discussion, some students will choose the back of the room for a better overall view of the lecture or because they experience some anxiety (Smith, Hoare, & Lacey, 2018).

The advent of the ALCs eliminated the obvious front and back of the room, and this was perceived as a benefit by many. One instructor frequently welcomed the change because they perceived that the students who sat in the rear of the class were not paying attention and in some cases were distracting other students. She described the situation as a "passive-aggressive gradient" that she had to constantly battle (Baepler, et al., 2016). The ALCs disrupted the passive-aggressive gradient and created the opportunity of greater student accountability. Instructors could assign students to sit at numbered tables and even at designated subgroups (or pods) within each table. They could call on students from a particular table to answer a question or to display their work on the whiteboard or the monitor associated with the table. This design eliminated perceptions of a passive-aggressive back row and simultaneously the safe haven for students with anxiety who didn't want to engage with the class.

In a traditional lecture hall, students with anxiety would choose to sit in the back or along the periphery of the room. Students stated that they preferred those locations for easy egress to escape the room or because they didn't want anyone watching them from behind (Smith, Hoare, & Lacey, 2018). The ALCs present a pair of issues for students with anxiety disorders: (a) Students face the likelihood of being assigned a seat, and (b) they need to locate a new safe place to sit. In an ALC, the seats near a door become the safest locations for students with anxiety. One of the students in our study, Frank, was assigned a random location in the corner of a large ALC. He said, "It made me super anxious that I was in the corner." Although he had his back to the wall and there was nobody looking over his shoulder, he had no way to surreptitiously leave the classroom. He was cornered, and any time he felt he was having "a little bit of a panic attack, I couldn't escape. I was kind of stuck." He recognized his situation and envisioned a solution:

> I was sat [sic] near the opposite side of the doors. So, if I wanted to get up and leave for a couple of minutes, it was very obnoxious and noticeable when I would. I would've loved to like maybe have gotten moved to a table a little closer to a door, so I knew I had the escape if I needed it.

Research shows that there is a correlation between where students sit in a lecture hall and their academic achievement, but it's not based on whether or not they sit in the front of the room. Students who sit within "friendship clusters" perform better than people who are isolated (Smith, et al., 2018). Because of the ALC design with numbered tables,

whiteboards, and monitors, students are less anonymous. Active learning frequently requires participation in groups, and groups are called upon to share their results with the rest of the class. To manage groups, instructors frequently design them to increase their diversity and distribute academic skills and backgrounds (Oakely, Felder, Brent, & Elhajj, 2004; Hong & Page, 2004). The practice of assigning students to seats or tables disrupts the plans that students with anxiety might have to sit where they feel safest.

On the other hand, however, assigning groups eliminates the need for students to find others with whom to work. Being assigned to groups provides students with readymade companions who are sanctioned by the instructor. It eliminates choice and decisions and breaks up pre-existing friendship clusters that might be difficult to join. Assigning seats and forming groups benefits students by reducing social isolation, but it risks heightening anxiety by making it difficult for them to leave the classroom unobtrusively. If an instructor knows a student has an anxiety disorder, a way to accommodate that student would be to place that group near a door. The student would have easy access to an exit and benefit from the defined group experience.

Flipped Versus Lecture. Some instructors will choose to "flip" their class when they move to an ALC. Flipping the class typically means organizing material so that low order learning tasks (reading background information, learning key terms, reviewing example problems) are situated outside of class, and higher order learning activities (solving problems, applying concepts, clarifying misconceptions, and creating material) happens during class. In practice, this might mean that students read material, review a recorded lecture, and take a quiz outside of class. In class, students might complete problem sets and seek clarification on bottleneck issues with their peers or instructor (Talbert, 2017; Jensen, Kummer, & Godoy 2015; Baepler, Walker, & Driessen, 2014).

Students with anxiety disorders can find it difficult to concentrate with a lot of extraneous stimuli, including other students in a large classroom. Milly noted, "I can get super overwhelmed with just all this information just being thrown at me, and you know, there was at least two hundred students in my lecture." Listening to recorded lectures seemed to help her. She also mentioned that because she wasn't likely to ask a question in a large class, reviewing lectures ahead of when she met with her group or instructor allowed her a chance to formulate her questions:

> Okay, I'm sitting in this lecture hall with like 300 other people, and I have like one professor, and if I'm not getting something in the lecture, I'm not realistically going to raise my hand and ask cause I'm anxious about that, whereas, watching the videos at home, if I had a question, I'm like, okay, I don't understand this, so when I go in to the lecture, I can ask her and it's just in front of my group members and realistically they probably have the same question as me.

Flipped classes with recorded lectures allow students to view content at a moment when they feel they are most able to absorb the material. They can also exercise more control over the flow of information, since they can pause and re-view material if they feel they have lost focus. This strategy also allows students time to formulate questions they can later choose to ask of their peers or their instructors. The flipped classroom, however, can also increase anxiety if a student can't concentrate in class at a time when she has to interact with other students. Students feel the pressure to attend and participate in class, whether or not the instructor requires attendance. Vanessa described the spiral of anxiety she experienced on a bad day:

> There were days where I would be scared to miss a class, where I would run or go there but I'm not feeling well and I couldn't really leave a class, I had to stay there. There were days where I felt I was just wasting an hour of my time. I didn't know what was going on, I didn't want to do anything, and I was really unmotivated. Those days where I'm motivated, I'm able to interact with my peers and really do my work and understand it. Even some days where I try to do it and I wouldn't retain anything because I'm just mentally not there, I'm physically there but I'm not mentally prepared or I'm worrying about something else, I'm anxious about something else. I'm worried that I'm affecting my group mates because I'm not really present. I'm worried about if they're like, "oh why isn't she prepared?" I'm worried about something else other than the content that we're working with so that's what I mean by being present.

The flipped classroom with recorded lectures can allow students the chance to focus on learning foundational concepts on their own time and at a comfortable location. It helps them prepare for peer interactions that otherwise might be intimidating. When students are feeling particularly anxious, however, the pressure of concentrated group work might exacerbate anxious feelings.

These student perceptions, divided into 11 elements, present instructors with opportunities to intervene and make the ALC environment more amenable for students with anxiety disorders, as show in *Table 1*.

Limitations and Future Directions

This study employed a small sample of four students who were non-randomly selected; this may mean the results are

less generalizable. Students in the study were required to have a diagnosed disability to be included; however, we know that many more students either experience anxiety without diagnosis or choose not to disclose (Deasy, et al., 2014). The insights and recommendations reported here may not fully reflect the experience of those who have not been diagnosed or who chose, for whatever reason, not to disclose their condition. A future study might involve a larger sample and choose to administer an anxiety measurement instrument, such as the Generalized Anxiety Disorder scale, to include students with a greater range of anxiety levels (Cooper, Downing, & Brownell, 2018).

To protect students' privacy, the author did not request or examine any diagnostic documentation, relying instead upon students' self-description of their disability. In almost all of the cases in this study, students described multiple non-apparent disabilities that included anxiety, and thus it was difficult to isolate their experience to anxiety alone. How anxiety interacted with other issues, including depression, ADHD, and ADD, was not considered in these findings.

Table 1. **Recommendations for Instructors to Support Students with Anxiety in ALCs**

Interaction	**Element**	**Recommendation**
Interaction #1: Student and the ALC Learning Space	Initial Seating Impressions	• Advise students that although the class seems large, their table is really their small classroom. • Help students understand that their first impression won't likely be their lasting impression.
	Sound	• Acknowledge that the ambient sound can be overwhelming. • Allow for the chaos of group work, but signal the need for quiet when returning to full class activities.
	Lighting	• Ask students to keep monitors turned off unless they are being used. • Consider dimming the lights.
	Eye contact	• Designate a "front" of the room. If a podium is near a wall, this might be your location.
Interaction #2: Students Learning with Students	Seating Arrangement: Sight Lines	• Assign ice breaking activities multiple times during the semester.
	Learning in Groups/Teams	• Facilitate the development of study groups outside of class. • From the start, coach students to ask each other their initial questions and to raise them with the entire class if their initial results aren't sufficient.
Interaction #3: Instructors and Students	Mobility	• Circulate within the room and be in students' vicinity as frequently as possible. • Develop a system for attending to raised hands or call lights in the order they appeared.
	Elevation	• Encourage students to meet with you before and after class.
	Shifting the Center of Focus	• Prompt students to view their table, whiteboard, and monitor as their own localized learning space.
Interaction #4 Pedagogical Choices	Required seating	• Suggest students, especially those with an accommodation, sit next to a door. • Relocate the group to a table near a door.
	Flipped vs. Lecture	• If using a flipped learning approach, suggest that students take a few minutes at the start of the class to check in with their group to see if there is anything they didn't understand. • If they still can't answer questions among themselves, ask them to bring them up to the entire class.

As noted, the original interviews for this study included students with other types of disabilities, including those with mobility issues and visual impairments. Future researchers might generate new interviews with students who experience other types of apparent and non-apparent disabilities. Eventually, results from these studies might be presented within a Universal Design for Learning (UDL) framework that could provide both a general design strategy for teaching within the ALCs and specific tactical adjustments for students with particular learning needs.

As a subpopulation, students with anxiety may have a tendency to be more isolated in traditional classrooms. Within the ALCs, when students are placed into groups, their social interactions are likely altered. A study that measured the social context of students with and without high degrees of anxiety might reveal differential results, especially when examining the dimensions of "student-as instructor" and "student-student general relations" and how they predict learning outcomes (Walker and Baepler, 2018).

Conclusion

Early in our interview, Milly sounded a note of relief when she said that at some point, she realized that "I'm not alone in this." She would later say,

> When I was sitting with my group, I honestly felt like it was just me and my group…I know that was a huge room, it had close to 200 people in it. But it didn't feel like it at all. It felt like there were eight people in it.

This dual realization – that "I'm not alone," but I'm also not crowded – might be at the heart of what makes the space feel comfortable for her and others with anxiety. There is a sense that the initial disorienting impression of the ALC shifts over time to one in which the functional space bounded by the table becomes practical and intimate. This may be what Vanessa meant when she said, "The ALC initially gave me anxiety, but in the long run it helped a lot." Certainly, there are visual and auditory distractions, and some groups will function better than others, but there are opportunities to manage the experience to make the ALCs more accessible. This is particularly important because many students with disabilities won't disclose them, and many who do don't have a positive experience (Gierdowski, Brooks, & Galanek, 2020). When instructors make a few pedagogical adjustments and exercise some flexibility in seating, more students can benefit from the ALCs.

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