

# Student and Faculty Perception of Engagement in Two Active Learning Classroom Designs

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Faculty and student perception of engagement in two (mobile desks or mobile tables and chairs) low-tech active learning classroom (ALC) designs were compared. Student ( $n = 413$ ) perceptions of engagement were measured with the Engaged Learning Index (ELI) and the Social Context and Learning Environments (SCALE) instruments at the beginning and end of a semester in a large, multi-disciplinary department. Faculty ( $n = 14$ ) rated perception of engagement using only the SCALE instrument. Perceptions of engagement from faculty and students using SCALE were significantly more positive for both ALCs compared to perceptions of traditional classrooms. There was no clear evidence of differences in student and faculty perceptions of engagement between the two ALC designs. No or small differences between the two ALC designs means departments might consider cost, maintenance, and other pragmatic factors in ALC design.

## Introduction

Over the past thirty years there has been considerable growth in research and application of active learning instruction in higher education built from a longer history of constructivist learning theory and research (Driessen et al., 2020; Holec & Marynowski, 2020). Despite a variety of definitions of active learning and fragmented literature on active learning impacts across disciplines (Holec & Marynowski, 2020; Idsari, 2020), these techniques have been consistently reported to result in dramatically improved engagement (Bolden et al., 2019; Wiltbank et al., 2019), satisfaction (Hyun et al., 2017), motivation (Adedokum et al., 2017), and academic performance or learning (Beichner et al., 2007; Dori et al., 2003; Freeman et al., 2014; Prince, 2004; Theobald et al., 2020) compared to traditional lecture. Research on the utility and efficacy of different active learning strategies has been reviewed (McConnell, 2017). Active learning for this paper considered a variety of

instructional strategies beyond lecture that include interactive activity, discussion, group work, higher-order thinking, and metacognition (Driessen et al., 2020; Holec & Marynowski, 2020).

Many academic programs and universities have begun investing in redesigned classroom spaces to enhance active learning instruction (Adedokum et al., 2107; Baepler et al., 2016; Beichner, 2014; Freeman et al., 2014; Holec & Marynowski, 2020; Wiltbank et al., 2019). Research on active learning classrooms (ALCs) is important and contributed to the founding of the *Journal of Learning Spaces* in 2011. Research on this investment is also timely with recent COVID-19 impacts decreasing budgets and increasing pressures to transition to online instruction. Evidence on what contexts (formal, informal, virtual) active learning instruction is most effective in is needed to inform classroom design investment.

Initial research on investment in ALCs indicate beneficial effects of both low-tech (Campana & Agarwal, 2019; Soneral & Wyse, 2017) and electronic, technology enabled (Lasry et al., 2013; MacLeod, Yang, & Shi, 2019; Shi et al., 2019) designs. Large-scale studies have reported greater effectiveness of ALCs compared to traditional classrooms (Beichner et al., 2007; Dori & Belcher, 2005; Van Horne et al., 2012). ALC designs are more conducive than traditional classrooms in fostering student engagement (Brooks, 2012; Zimmermann et al., 2018) and collaborative learning (Clinton & Wilson, 2019). A review of research on ALCs indicate several benefits to learning including, 21<sup>st</sup> century

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collaboration skills, engagement, and positively impacting instructor practice and class culture (Talbert & Mor-Avi, 2019). Evidence also supports equal improvement in academic performance between low-tech and high-tech ALCs over traditional classrooms (Nicol et al., 2018; Soneral & Wyse, 2017). A recent study that controlled for instructor effects and comparing a traditional and an ALC reported the classroom design had a direct positive effect on student perception of engagement, independent of the effects of the instructor and classmates (Holec & Maryninski, 2020). Research also has examined investments in instructor training in use of ALCs (Birdwell & Uttamchandani, 2019; Copridge et al., 2021) and interaction of instructor philosophy and instructional behaviors (Sawers et al., 2016).

There are variety of ALC designs varying mobile seating, work surfaces, multiple screens, group sizes, and boards (white and electronic) so research has begun to compare designs in search of effective and lower-cost instructional support. The most well-controlled study involved mixed methods comparison of ALC designs with paired data of course and instructor (Odum et al., 2021). In this study student perceptions of engagement between the two classroom designs did not differ, while instructor and observed student-to-student engagement were slightly better in the mobile tables versus the mobile desks. ALC designs that facilitate student interaction are likely mediated by instructor and student perceptions, however, research indicate these perceptions differ.

Students and faculty differ in their perception of the effectiveness of technology in the classroom (Granito & Santana, 2016) and the utility of teacher location and table surfaces (Rezaei, 2020). The benefits of ALC designs may therefore be mediated by the interaction of differing perceptions between students and the instructor (de Borba et al., 2019; McDavid et al., 2018; Odum et al., 2020) or interaction with autonomy/learning environment (Bonem et al., 2019). Expanding our understanding of student and faculty perceptions of ALC designs may provide keener insight into student and faculty interaction.

Students generally have positive perceptions of ALCs compared to traditional classrooms (Clinton & Wilson, 2019; King et al., 2015; Odum et al., 2020; Wiltbank et al., 2019) and this preference may not be a novelty effect (Mui et al., 2012). Students also have greater satisfaction with mobile furniture in ALCs than common, traditional classroom furniture, however no difference in perceived engagement (Harvey & Kenyon, 2013). To the authors' knowledge, only the Odum and coworkers' (2020, 2021) studies have reported different student and instructor perceptions of student engagement between different ALC designs. Odum et al. (2020) reported that both instructors and student preferred an ALC to a traditional classroom, however the instructors considered

the modular tables difficult to move and a barrier to active learning, while the students thought they were key to the effectiveness of engagement with classmates. A follow-up study comparing two ALC designs in two class sections taught by the same instructor reported no difference in student perceptions of engagement between the classrooms, while the instructor and researcher observations of engagement indicated superiority of mobile tables over mobile desks classroom design (Odum, et al., 2021).

The purpose of this study was to document a larger sample of student and faculty perceptions of engagement and potential interaction in two low-tech ALC designs, one using mobile tables and one using mobile desks (Odum et al., 2021). Two research questions were explored. First to establish if both ALC designs were perceived superior to users' past experience in traditional classrooms at the beginning of the semester. Second, to determine if there were differences in student and faculty perception of engagement and their interaction in two classroom designs at the end of the semester. We also explored several dimensions of student perceptions of engagement in the two classroom designs. We hypothesized that students and faculty would perceive greater engagement in the ALCs over past traditional classrooms at the end of the semester. We also hypothesized there would be a significant difference between student and faculty perception of engagement across the two ALC designs, expecting to confirm student and instructor preference for the mobile tables over the mobile desks design reported by Odum and coworkers (2021).

## Method

### *Context and Sample*

This study is part of a series of investigations documenting the effectiveness of active classroom renovation and faulty development in a large, diverse department (Knudson & Meaney, 2018; Odum et al., 2020, 2021). The Department of Health and Human Performance serves almost 3,000 students with seven undergraduate majors and five masters programs within a large public university with a 'doctoral university higher research activity' Carnegie classification and Hispanic Serving Institution designation. The major programmatic fields represented in the faculty and courses in this study were Athletic Training, Exercise and Sports Science, Public Health, and Recreation. Participating department faculty received a six-hour professional development program in active learning instruction (Knudson & Meaney, 2018) from the university instructional technology specialists from the Office of Distance Learning and formed a faculty learning community and mentoring program.



**Figure 1.** *Two active learning classroom designs*

Left panel: Active learning classroom with mobile desks (classroom MD). Right panel: Active learning classroom with mobile tables and chairs (classroom MT). Both classrooms included two projectors with screens on two different classroom walls, wall-mounted whiteboards, and mobile whiteboards (visible in photos) to support collaboration.

Two of several traditional classrooms that were renovated into low-tech ALCs were the focus of this study. Briefly, the renovated ALCs included installation of multiple projection units, mobile white boards, and electrical power to support active learning instruction. The teacher station was off to the side in both classrooms, so the primary difference between the classroom designs (Figure 1) were replacing stationary desks with either mobile tables and chairs (classroom MT) or mobile desks (classroom MD).

Informed consent for faculty and students was obtained using procedures approved by the institutional review board. Twenty faculty members were invited from those scheduled in these two ALCs during the fall of 2019 and fourteen faculty participated. Students invited to participate in this study ( $N = 466$ ) were enrolled in 19 courses taught by these fourteen instructors. These courses in athletic training, exercise and sports science, public health, and recreation all had faculty who had completed the active learning faculty development and committed to using active learning techniques in their course. The courses where faculty volunteered represented all levels within the academic programs (Table 1), although most (76%) were from upper

level and graduate courses so the student mean (SD) age was 22.4 (4.5) years. There were 438 students who initially began the study with 413 completing their courses and both study surveys. Students were ethnically diverse (Table 1) from this Hispanic Serving Institution, however the vast majority (90%) of students' first or native language was English.

### *Data Collection*

Faculty and student perception of engagement were captured at two time points by written surveys, at the beginning and the end of the semester. One of the investigators or research assistant visited each course during the second week of the term to describe the study, obtain informed consent, and give the first survey. Faculty were excused from the classroom and blinded to student participation in the study. Faculty gave consent and took the survey individually the same week as the students. During the 13<sup>th</sup> week (before Thanksgiving) of the 15-week term, students and faculty were again given their respective survey.

Table 1: Student Characteristics Reported at Second Week Survey	
Variable	Percentage
<b>Sex</b>	
Female	63
Male	36
<b>Race/Ethnicity</b>	
Asian	5
Black or African American	10
Hispanic or Latino	34
Native Hawaiian or Pacific Islander	<1
White	43
Mixed	8
<b>Classification</b>	
Freshman	3
Sophomore	21
Junior	30
Senior	31
Graduate (masters)	15
<b>Major</b>	
Athletic Training	5
Exercise and Sports Science	51
Public Health	14
Recreation	14
Other	15
<i>Note: Percentages may not total to 100 because of rounding error or students selecting "prefer not to respond."</i>	

### Student and Instructor Surveys

The research questions were explored using previously validated engagement inventories for ALCs adapted to this study. These instruments had question wording slightly adjusted to accommodate the study of ALC designs and faculty or student role. For example, the wording "typical classroom" was used early in the semester and "this classroom" for the ALC design comparison at the end of term. Instructors answered the 25-question Social Context and Learning Environments (SCALE) instrument that has been used in several studies (de Bora et al., 2019; Mui et al., 2019; Sawers et al., 2016; Walker & Baepler, 2017). Students answered questions from the Engaged Learning Index [ELI] (Schreiner & Louis, 2011) and the updated SCALE version 6.1 to take advantage of more questions (27) and the updated factor structure of the instrument (University of Minnesota,

2021). Students also provided responses to six demographic questions to document their major, classification, age, sex, race/ethnicity, and native language. A graduate assistant transferred faculty and student written responses to Excel files and these raw data verified by another student. These raw data were imported to JMP Pro 14.0 (SAS Institute, Cary NC) for statistical analysis.

### Dependent Variables and Data Analysis

The question of student and faculty perception of engagement from previous experience in traditional classrooms was tested by calculating the mean of all SCALE questions using the five-point scale coded (5 Strongly Agree, 4 Agree, 3 Neither Agree nor Disagree, 2 Disagree, 1 Strongly Disagree). Higher mean scores of all scales represented more favorable perceptions of engagement in class activities and potential learning. Descriptive statistics and 95% confidence intervals were calculated to compare overall perceptions of engagement by faculty and students of "typical university classrooms." The question of difference in perception of engagement between the two ALC designs was examined with two t-tests of mean SCALE scores, one for faculty and one for students. Student perception between the ALC designs were analyzed in greater depth by examining factors or dimensions previously validated from the ELI and updated SCALE instruments. The ELI uses a 6-point Likert scale (6 Strongly Agree, 5 Somewhat Agree, 4 Agree, 3 Disagree, 2 Somewhat Disagree, 1 Strongly Disagree) and has three dimensions: Meaningful processing, focused attention, and active participation (Schreiner & Louis, 2011). The most recent SCALE has four dimensions: Student-student general relations, student-instructor formal relations, student-instructor informal relations, and student as instructor. All comparisons were based on a type I error rate of  $p < 0.05$ . The size of mean differences was documented by effect size ( $d$ ) calculated using the mean standard deviation of groups being compared.

## Results

### Instructor and Student Perceptions of ALCs

Initial faculty perceptions of engagement in traditional classrooms from the 5-point SCALE instrument were primarily neutral ( $M = 3.4$ ,  $SD = 0.7$ , 95% CI: 3.0. to 3.8). Instructor perception of engagement in both ALC designs at the end of the semester was significantly more positive ( $M = 3.9$ ,  $SD = 1.1$ ) than their perceptions of traditional classrooms. Student initial perceptions of traditional classrooms were also neutral ( $M = 3.6$ ,  $SD = 0.5$ , 95% CI: 3.5 to 3.7). Student perception of engagement in both ALC designs was also significantly more positive ( $M = 4.2$ ,  $SD = 0.4$ ) than their perceptions of traditional classrooms

*Perceptions Between ALC Designs*

Mean faculty perceptions were not significantly different ( $t = 0.93, p = 0.378$ ) between ACL designs. Mean (SD) faculty perception of engagement in the MT and MD designs were 4.1 (1.1) and 3.5 (1.2), respectively. Student perceptions of the MT design approached statistical significance ( $t_{411} = 1.9, p = 0.058$ ) of potentially greater perceptions of the MT design ( $M = 4.2, SD = 0.4$ ) over the MD design ( $M = 4.1, SD = 0.5$ ).

Exploration of the seven engagement dimensions from the SCALE and ELI instruments between the ALC designs showed inconsistent results: Five nonsignificant differences ( $0.142 < p < 0.987$ ) and two dimensions with differences favoring opposite designs. Mean student perception from the START questions of the “student-student general relations” dimension of engagement was significantly ( $t = 3.0, p = 0.003$ ) higher for the MT design than the MD design. In contrast, mean student perception of the “meaningful processing” dimension questions from the ELI was significantly ( $t = -2.1, p = 0.036$ ) higher for the MD design than the MT design.

**Discussion**

The hypothesis of more positive perceptions of engagement the two ALC designs compared traditional classrooms was supported. Both students and faculty from diverse areas of a Health and Human Performance department had more positive perceptions of engagement

from overall SCALE scores for the ALC designs than their experience with traditional classrooms. This was a medium to large effect ( $d = 0.6$  and  $1.7$ ) and was consistent with previous research on ALCs (Brooks, 2012; Holec & Maryninski, 2020; Talbert & Mor-Avi, 2019; Zimmermann et al., 2018).

The hypothesis of higher faculty and student perceptions of engagement in the MT design than the MD classroom design was not supported by the data. There was a trend ( $d = 0.51$ ) of faculty favoring the MT design over the MD design that was consistent with strong faculty opinion and student engagement measures reported in previous case study (Odum et al., 2021). Also consistent with the Odum and coworkers (2021) study was qualitatively lower student perceptions of the MT design compared to faculty. There was smaller trend ( $d = 0.22$ ) of students favoring the MT design over the MD ALC design. The sample of students in this study had moderate statistical power ( $1-\beta = 0.57$ ) for this effect size. More research with larger (about 800) numbers of students might clarify the if students perceive a small ( $d = 0.2$ ) difference in engagement between desk or chair design in ALCs. It is also possible that the hypothesized benefits of MT over MD could be too small to be of much pragmatic value, which is consistent with the Odum and coworkers (2021) study that reported STROBE observations of student-to student engagement 8% larger and student-to-instructor 6.5% smaller in the MT classroom than in the MD classroom. Harvey and Kenyon (2013) also reported nonsignificant

<b>Table 2: Student Perceptions of Dimensions of Engagement in the Two Active Learning Classroom Designs</b>				
	MD		MT	
	M	SD	M	SD
<b>Engaged Learning Index (ELI)</b>				
Meaningful Processing	4.8*	0.8	4.7	0.8
Focused Attention	3.3	1.2	3.2	1.1
Active Participation	4.7	1.0	4.7	1.0
<b>Social Context and Learning Environments (SCALE)</b>				
Student-Student General Relations	4.6	0.6	4.8*	0.5
Student-Instructor Formal Relations	3.9	0.5	4.0	0.4
Student-Instructor Informal Relations	4.1	0.7	4.2	0.7
Student as Instructor	4.1	0.6	4.1	0.6
<p><i>Note.</i> Self-perception of engagement scores from 1 to 5 from SCALE version 6.1 (Walker &amp; Baepler, 2017; University of Minnesota, 2021) and 1 to 6 from the ELI (Schreiner &amp; Louis, 2011) instruments. MD = ALC with mobile desks group; MT = ALC with mobile tables group.</p> <p>* Significantly (<math>p &lt; 0.05</math>) larger than the other ALC design.</p>				

differences in student perception between modern mobile chair (like MD) and tables with chairs on casters (like MT).

These equivocal results in the hypothesized difference in the MD and MT design was also confirmed in the additional analysis of the dimensions of engagement within the SCALE and ELI instruments used. Five of seven dimensions were not significantly different and the two dimensions that were favored opposite ACL designs. Taken together the current results did not support the hypothesis of greater engagement in the MT design over the MD design from a previous study controlling for instructor and subject matter (Odum et al., 2021). It is clear that both MT and MD ALC designs were perceived positively by the current diverse sample of faculty and students in this study. The current data indicate that given the likely similarity of the two ALC designs, departments might emphasize initial cost, maintenance, and space issues in ALC furniture decisions.

Early ALC designs like SCALE-UP (Beichner et al., 2007), given their reported benefits for student learning, have become models for classroom configuration to facilitate student engagement and collaboration. However, these designs are not within reach of all educational institutions with initial costs easily reaching hundreds of thousands of dollars (Eickholt et al., 2021; Park & Choi, 2014; Soderdahl, 2011). Future research exploring student engagement and learning outcomes in lower-cost ALCs may help identify a more economical model of classroom design. Indeed, a qualitative study observed that low-cost features like mobile chairs and whiteboards were perceived and the most important for engagement and learning (Rands & Gansemer-Topf, 2017). While their study did not include student engagement measures, Eickholt et al. (2021) recently reported no statistically significant differences in final exam or final course scores in a state-of-the-art ALC compared to a more economic version. Further exploring the cost benefit of constructing or reconfiguring ALCs, both initial costs and long-term costs (e.g., reduced seats as compared to a traditional lecture hall) will help inform classroom design decisions.

Some imitations of this study should be considered in interpreting the results. Comparisons across ALC design could also be influenced by differences in instructors, subject matter, and student characteristics. The small sample of faculty participating decreased the statistical power of comparisons between ALC designs. While there was a large sample of students that could detect small differences, there were no consistent trends other than positive perception of both ALC designs. This also study did not control for inflation the type I error rate given the testing of eleven perception of engagement dependent variables. This is not likely a problem given the small number of statistically significant effects observed.

## Conclusion

This study confirmed positive perceptions of engagement in two ALC designs over traditional classroom designs by a diverse group of faculty and students from Health and Human Performance fields. The data did not support differences in perception of engagement between the two ALC designs. It is likely that there are not meaningful differences between MT and MD designs, so departments may want to make decisions on ALC furniture based on cost, maintenance, and other issues.

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