Built Environments Impact Behaviors

Results of an Active Learning Post-Occupancy Evaluation

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The study shows that rigorous research methods embedded in the design of product(s) and contextual solutions result in measurable improvements.

INTRODUCTION

THE SUCCESS OF A STUDENT IS INFLUENCED by a myriad of variables ranging from socioeconomic background to internal motivation; a variable often underemphasized is the role of the built environment. Studies show that factors in the built environment affect retention, attention, motivation, learning, and academic achievement (Blincoe 2008; Durán-Narucki 2008; Earthman 2004; Kumar, O'Malley, and Johnston 2008; Schneider 2002). What is missing in these studies is a post-occupancy evaluation that assesses whether or not an intentionally designed intervention had an effect on student outcomes in the classroom. This knowledge is important in designing evidence-based educational spaces that connect intentional learning behaviors and pedagogical practices.

In this study, Steelcase Education Solutions (SES) researchers focused on student engagement using a content analysis process to synthesize information from multiple sources including brain and learning sciences (Jensen 2005; Wolfe 2010), the National Survey of Student Engagement (2012), and one author's long-time research in this area (Scott-Webber, Marini, and Abraham 2000). The research team had three goals: (1) generate and test a post-occupancy evaluation instrument focused on student engagement, (2) ensure that the instrument was valid and reliable for future use, and (3) determine, through use of the instrument, if the evidence-based design solutions used as an intervention impacted student engagement. This article will discuss the background, methods, results, and implications for future initiatives of this study.

BACKGROUND

Research on student engagement and its effect on learning outcomes is not novel; multiple areas of research from numerous disciplines work to understand this particular phenomenon (Appleton, Christenson, and Furlong 2008; Jones 2008; Kahu 2011). What is new is an instrument connecting evidence-based spatial designs to student engagement factors. SES developed this instrument to understand how evidence-based, intentionally designed formal education spaces (i.e., the classroom) could perhaps impact and/or influence student engagement. The instrument was created by

- incorporating research on the impact of space in learning settings (Scott-Webber, Marini, and Abraham 2000) to guide the identification of student engagement factors;
- using a validated two-step decision model survey structure as a template (Baudouin et al. 2007; Hiebert 2012); and
- incorporating secondary research materials from the National Survey of Student Engagement (2012), brain science (Jensen 2005; Wolfe 2010), and brain-compatible classrooms (Erlauer 2003).

What is new is an instrument connecting evidence-based spatial designs to student engagement factors.

The result was an active learning post-occupancy evaluation (AL-POE, trademark in process) instrument that sought to measure the effect of evidence-based, intentionally designed solution intervention(s) on student engagement in the formal learning place. The AL-POE asked participants to compare their *old/pre* (row-by-column seating) environment with their new/post (SES's intentionally designed) environment on the basis of identified student engagement factors.

Engagement is a variable that inevitably dominates the conversation when exploring ways to cultivate passionate learners and successful students. It is a multidimensional metaconstruct identified as a predictor of academic performance (Appleton, Christenson, and Furlong 2008; National Survey of Student Engagement 2012). While comprehensive reviews elucidate slightly different definitions of what engagement is and how it should be measured, the literature generally identifies four components of engagement: cognitive, affective, behavioral, and academic (Appleton, Christenson, and Furlong 2008). In addition to these components, there are also varied perspectives through which student engagement is studied—behavioral, psychological, socio-cultural, and holistic—each of which places emphasis on a different facet of the metaconstruct (Kahu 2011). The use of brain science research (Jensen 2005; Wolfe 2010) and the National Survey of Student Engagement (2012) to guide the identification of student engagement factors positions this study within the behavioral perspective by placing an emphasis on student behaviors and teaching practices (Kahu 2011).

The root affirmation of environmental behaviorists is that environments impact behaviors (Altman 1970, 1975; Hall 1966; Sommer 1965, 1969). This foundational research asserts that the built environment impacts our personal behavior on multiple levels, including territoriality, crowding (Altman 1970, 1975), situational behavior (Hall 1966), and personal space (Sommer 1965, 1969). More recently, researchers have explored the ways in which the environment impacts students in an educational setting, determining that a number of variables within the learning environment affect how well a student learns (Earthman 2004). Various physical, social, and psychological dimensions of the learning environment have been shown to play a role in affecting students (Victorian Institute of Teaching n.d.). Recent research has begun to focus on how certain spaces affect student engagement, with one study showing that creative spaces featuring flexibility, a unique atmosphere, and inspiring aesthetics led to more engagement (Jankowska and Atlay 2007). In this study, the focus was on connecting a post-occupancy evaluation of an evidence-based, intentionally designed environment with student engagement. This was done for two reasons. First, SES designs evidence-based solutions specifically for active learning and student engagement and, second, engagement is shown to have a positive effect on student learning outcomes. An affirmation of a direct causal relationship between these new design solutions and student outcomes is incongruous with our holistic paradigm as we recognize that there are many factors that affect student achievement, with engagement a major one. However, in attempting to establish a relationship between the designed environment and the behavioral factors of student engagement, it is important to develop a body of evidence that establishes a foundation for the idea that the learning environment impacts student behaviors.

METHOD

SAMPLE

The sample was one of convenience, as three institutions of higher education in the United States that had installed SES' new/post evidence-based product solutions agreed to administer the AL-POE. The solutions for this study were three distinct active learning settings (node®, LearnLab®, and media:scape®) playing host to an array of diverse courses, with 130 students (n = 124 with any usable data) and 17 faculty members participating in the study. The class size varied among faculty. No professional development was given to educators.

INSTRUMENT STRUCTURE

The AL-POE instrument is a research tool administered once to concurrently assess the old/pre classroom environment against the new/post classroom environment (i.e., the current environment). The AL-POE is structured in four sections: (1) demographics and baseline information, (2) learning practices, (3) solutions, and (4) perception of outcomes.

» SECTION ONE: DEMOGRAPHICS AND BASELINE INFORMATION. The first section collected the education level of the student and the type of course in which the AL-POE was administered, the type of SES solution (the new/post) in place within the environment, the overall method of instruction, and the perceived overall level of engagement. In this section, participants were given an operationalized definition and sketch of an old/pre classroom structured in a row-by-column, forward-facing seating arrangement and an expected teaching practice of stand and deliver as the "control."

» SECTION TWO: LEARNING PRACTICES AND SECTION THREE: SOLUTIONS. The second (learning practices) and third (solutions) sections were identically formatted using the 12 identified student engagement factors (reflecting the synthesis done with previously mentioned secondary research). The factors were collaboration, focus, active involvement, opportunity to engage, repeated exposure to material through multiple means, in-class feedback, real-life scenarios, ability to engage ways of learning best, physical movement, stimulation, feeling comfortable to participate, and creation of enriching experience. The learning practices section sought to establish the presence of active learning practices in the classroom, while the solutions section sought to measure the impact of the SES solution on these learning practices. In order to concurrently evaluate the "old" and "new" environments, these two sections of the instrument followed a "post/pre" format. This means that participants concurrently evaluated the "post" condition (the "new" classroom environment) in one column and reflected back on the "pre" condition (the "old" classroom environment) in the adjacent column while experiencing the "post" condition (see figure 1). Looking back at a previous condition while in a current one allowed participants to more accurately compare the old and new situations. Thus, the data were reflective of that perceived change (Baudouin et al. 2007; Hiebert 2012); in other words, it was the evaluation of the effect of spatial design on students' engagement that was being measured.

To obtain accurate responses in these two sections, a scale based on a two-step decision model process was employed (Baudouin et al. 2007; Hiebert 2012). In step one of the process, the participant was asked to decide whether the statement (identified engagement factor) was/is not adequate (Not OK) or was/is adequate (OK). In step two, the participant assigned the appropriate rating: (0) not adequate; (1) not really adequate, but almost OK; (2) adequate, but just barely (still OK, otherwise it would be 0 or 1); (4) exceptional; or (3) somewhere between 2 (minimally OK) and 4 (exceptional). The number (3) was intentionally presented after the number (4) to cause the participant to pause and really think about the meaning of each number (see figure 1).

» SECTION FOUR: PERCEPTION OF OUTCOMES. In the fourth section, participants were asked how they believed, based on their experience in the new/post classroom, that this "new" classroom's layout contributed to their (1) engagement in class, (2) ability to achieve a higher grade, and (3) motivation to attend class. For this section only, a typical Likert scale was used to evaluate the outcomes perceptions. Open-ended comments were solicited at the end of the AL-POE.

Figure 1 **Partial Example of Section Two (Learning Practices) and the Two-Step Decision Model**

	Standard (OLD)					Current (NEW)				
	Not OK		OK			Not OK		OK		
The degree:	0	1	2	3	4	0	1	2	3	4
of emphasis on collaborative work.	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
to which you were/are able to stay focused.	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
of your active involvement in classroom activities.	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑

ADMINISTRATION

The final beta test administration of the AL-POE came after a series of previous tests evaluating the instrument and its methodology. The links (student and educator) to the AL-POE, hosted by the online tool Qualtrics, were sent to the established SES institutional contact. This institutional contact then sent two e-mails, one to students and one to educators, each containing the online link to the AL-POE. This process supported the separation of identifiable connections between the researchers and the students. The administration of the AL-POE took place six to eight weeks into the term so as to allow the students and educators to develop a rhythm of use within the space. Each institution kept the AL-POE open for at least two weeks to garner responses. The results of the study are presented next.

RESULTS

SECTION ONE: DEMOGRAPHICS AND BASELINE INFORMATION

Student results are for n = 124; however, note that sample sizes for individual variables ranged from n = 112 to n = 124 due to missing values.

Students came from three different universities (A = 56 percent, B = 28 percent, and C = 16 percent). Students were in Node Chairs (18 percent), LearnLab (46 percent), Media:scape class (10 percent), and a combined Media:scape LearnLab classroom (27 percent), as developed by Steelcase. Students were primarily undergraduates (freshman = 26 percent, sophomore = 14 percent, junior = 27 percent, senior = 28 percent, master's = 4 percent, and unknown or not applicable = 1 percent). Very few students indicated that their current class had only lecture (2 percent) or only student-to-student work (3 percent); the majority indicated that the instruction received was an even mix of lecture and student-to-student work (58 percent). The rest of the students sampled indicated that the classroom instruction was between only lecture and an even mix (8 percent) or between an even mix and only student-to-student work (28 percent). All students indicated that they were at least slightly engaged in the course, and 95 percent indicated that they were moderately engaged or better (slightly engaged = 5 percent, moderately engaged = 37 percent, very engaged = 41 percent, and extremely engaged = 17 percent).

SECTION TWO: LEARNING PRACTICES AND SECTION THREE: SOLUTIONS

RELIABILITY/VALIDITY

The analysis provided evidence that the AL-POE has validity and reliability. The reliability and item analysis was done on the pre- and post-test responses for learning practices items and solutions items separately. Each of these four conditions had 12 AL-POE items. Given that each item was measured on an ordinal scale, polychoric correlation between items was used in the analysis as suggested by Gadermann, Guhn, and Zumbo (2012). Reliability was measured using Cronbach's

alpha and Guttman's lambda 6 using the items for each of the four conditions. The resulting values were $\alpha = 0.91$, $\lambda = 0.92$ for the pre-practices condition, $\alpha = 0.93$, $\lambda = 0.95$ for the post-practices condition, $\alpha = 0.96$, $\lambda = 0.97$ for the pre-solutions condition, and $\alpha = 0.96$, $\lambda = 0.98$ for the post-solutions condition. To make sure that no individual item yielded results inconsistent from the other items, a hold-one-out analysis was also done which found that for none of the items did that item's deletion lead to a large change in overall reliability. *This indicated a high degree of internal item consistency for each of the four conditions.*

Construct validity was assessed through exploratory factor analysis (EFA) and individual item analysis on the polychoric correlation matrix. The EFA was done to see if the 12 items in each condition mapped to one underlying construct and if the loadings of the individual items were close in magnitude to one another with none close to zero. The results of each of the four sections' scree plots gave strong evidence that there was one underlying factor, and all of the loadings were greater than 0.5 for the individual items. These results gave support for creating composite variables for each condition: (1) a pre-practices composite variable, (2) a post-practices composite variable, (3) a pre-solutions composite variable, and (4) a post-solutions composite variable. The composite variables were formed by summing the individual responses for the 12 items in each condition to create a scale with a minimum value of zero and a maximum value of 48. Item analysis indicated that the degree of correlation between each individual item response in a condition and the composite score for that condition was greater than 0.6.

A measurement or survey instrument is said to have convergent validity if outcomes from the instrument correlate with other measures that are thought to measure the same or similar constructs. An instrument is said to have discriminant validity if it does not correlate with measures that are thought to measure unrelated constructs. If the composite score is a valid measure of engagement, then it would be expected that (1) the composite score for the new/post classroom condition would be positively correlated with the responses in the perception of outcomes section and (2) the composite score for the old/pre classroom condition would not be correlated or would be slightly negatively correlated with the responses in the perception of outcomes section. Thus, the correlation between the composite scores and items in the perception of outcomes section was calculated to assess convergent and discriminant validity. The post-practices and post-solutions composite scores were positively correlated with all three items in the perception of outcomes section, thus providing evidence of convergent validity. The pre-practices and pre-solutions composite scores had non-significant or very small negative correlation with the three items in the perception of outcomes section, thus providing evidence of discriminant validity (see figure 2).

Further evidence of discriminant and convergent validity was found in the correlation between the composite measures and the directly rated level of engagement in the current course

Figure 2 **Spearman Correlation Between Perception of Outcomes Items and Composite Scores**

Due to your experience in this new classroom layout, please indicate how you believe the "new" classroom layout contributed to an increase in:	**Correlation with Composite Score (*p < 0.05, ***p < 0.001)**			
	Post-practices	**Post-solutions**	**Pre-practices**	**Pre-solutions**
your engagement in this class.	0.63***	0.64***	-0.24*	-0.20*
your ability to achieve a higher grade.	0.56***	0.57***	-0.16	-0.07
your motivation to attend class.	0.67***	0.65***	-0.09	-0.05

(r = -0.03, p = 0.75 for pre-practices; r = 0.57, p < 0.0001 for post-practices; r = -0.11, p = 0.24 for pre-solutions; and r = 0.48, p < 0.0001 for post-solutions).

STUDENT DIFFERENCES IN COMPOSITE SCORES

Multivariate analysis of variance was used to test for any differences in mean composite scores for any of the four conditions between different universities, education levels, overall view of classroom instruction, or SES solution (node, media:scape). No statistically significant differences were found between the group means for the four composite measures using Pillai's trace statistic, F(8,200) = 1.42, p = 0.19; F(16,436) = 1.51, p = 0.091; F(16,436) = 1.66, p = 0.052; and F(12,324) = 1.49, p = 0.13 for pre-practices, post-practices, pre-solutions, and post-solutions respectively. Although the overall test was very close to statistically significant for the overall view of classroom instruction, none of the tests for the individual measures were close to statistically significant. Thus, there was no evidence that the average practices and solutions scores varied based on the institution, education level, perception of classroom instruction, or SES solution.

The first major finding was that the new/post classroom, using SES products, *provided adequate or better engagement and support of classroom practices* for the majority of students. As is illustrated in figure 3, individual items in the new/post classroom were rated as adequate or better by over 90 percent of students. In contrast, individual items were rated as adequate or better in the old/pre environment by a much smaller percentage of students (see figure 3).

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Also illustrated in figure 3 is the second major finding, that the majority of students rated the new/post classroom higher or better than the old/pre classroom on each of the factors. Furthermore, in both the learning practices and solutions sections the differences for *all of the items* between the old/pre and the new/post classrooms were *highly statistically significant* (all p-values < 0.0001) using Bonferroni adjusted Wilcoxen signed rank tests. This indicated improvement on all 12 identified engagement factors in the new/post classroom for both the learning practices and solutions sections.

The third prominent finding was a statistically significant difference in the mean learning practices composite score and the mean solutions composite score between the old/pre and new/post classrooms. The mean rose in the practices section from 21.6 (old/pre) to 36.3 (new/post) on a scale of 0 to 48, almost doubling (paired t(114) = 14.5, p < 0.0001). It rose in the solutions section from 19.4 (old/pre) to 36.4 (new/post) (paired t(115) = 17.1, p < 0.0001), again almost doubling (see figure 4). *This shows overall mean improvement in the learning practices that support engagement and overall mean improvement in the solutions that support engagement between the old/pre and the new/post classroom conditions.*

The fourth major finding, in the perception of outcomes section, was that students indicated that "due to their experience in the new/post classroom, [they] believed the new/post classroom layout contributed to" a moderate to exceptional increase in their engagement in class (90.32 percent), ability to achieve a higher grade (80.65 percent), and increase in motivation to attend class (78.04 percent) (see figure 5).

EDUCATOR RESULTS

As this was a beta test involving only three higher education institutions, there were not enough educators (n = 17) participating in the AL-POE to carry out a reliability analysis on the educator data. However, an analysis was done to look for differences between the old/pre and new/post conditions in the individual item and overall scores. Statistically significant differences were observed using Bonferroni adjusted Wilcoxen sign rank tests for six of the 12 practices

Figure 3 **Student Ratings of Individual Practices and Solutions Items for the Old/Pre and New/Post Classrooms**

	Standard Classroom (n = 116)		New Classroom (n = 124)		% New Rated Higher	Difference (New-Old)	
Factor	Adequate	Exceptional	Adequate	Exceptional		Mean	Median
Practices							
Collaboration	62.1%	6.0%	97.6%	36.3%	81.9%	1.47	2
Focus	75.0%	5.2%	92.7%	18.7%	59.6%	0.65	1
Active involvement	63.8%	4.3%	97.6%	29.0%	69.8%	1.23	1
Opportunity to engage	60.9%	4.3%	99.2%	43.1%	80.9%	1.54	2
Repeated exposure to material through multiple means	64.3%	1.7%	95.1%	30.1%	67.8%	1.23	1
In-class feedback	63.8%	5.2%	92.7%	28.2%	54.3%	0.97	1
Real-life scenarios	72.4%	9.5%	96.8%	33.1%	54.3%	0.97	1
Ability to engage ways of learning best	71.3%	5.2%	96.0%	33.9%	73.7%	1.19	1
Physical movement	33.9%	0.9%	90.3%	31.5%	82.6%	1.75	2
Stimulation	47.4%	0.9%	97.6%	36.3%	78.4%	1.65	2
Feeling comfortable to participate	62.3%	8.8%	92.7%	31.5%	59.3%	1.02	1
Creation of enriching experience	75.9%	6.9%	96.8%	42.7%	64.7%	1.13	1
Solutions							
Collaboration	46.6%	4.3%	99.2%	54.0%	87.9%	2.00	2
Focus	66.4%	7.8%	94.4%	25.0%	65.5%	0.97	1
Active involvement	56.6%	3.5%	100.0%	42.1%	84.1%	1.65	2
Opportunity to engage	48.3%	1.7%	99.2%	42.7%	87.1%	1.89	2
Repeated exposure to material through multiple means	50.9%	1.7%	97.6%	44.4%	82.8%	1.72	2
In-class feedback	65.5%	6.0%	92.7%	33.1%	62.1%	1.11	1
Real-life scenarios	58.3%	3.5%	95.1%	28.5%	72.8%	1.42	1
Ability to engage ways of learning best	66.4%	6.0%	94.4%	33.9%	68.1%	1.20	1
Physical movement	32.8%	0.9%	99.2%	44.4%	90.5%	2.14	2
Stimulation	53.4%	3.4%	96.7%	32.5%	73.0%	1.42	2
Feeling comfortable to participate	56.0%	6.0%	95.2%	30.6%	67.2%	1.29	1
Creation of enriching experience	69.8%	5.2%	96.0%	33.9%	71.6%	1.24	1

items: collaboration (p = 0.0005), active involvement (p = 0.0001), opportunity to engage (p = 0.0005), repeated exposure to material through multiple means (p = 0.0001), ability to engage ways of learning best (p = 0.0005), and physical movement (p = 0.0001). Statistically significant differences were found for eight of the 12 solutions items: collaboration (p = 0.0001), active involvement (p = 0.001), opportunity to engage (p = 0.0002), repeated exposure to material through multiple means (p = 0.0002), in-class feedback (p = 0.001), real-life scenarios (p = 0.002), ability to engage ways of learning best (p = 0.0005), and physical movement (p = 0.00006). All observed differences were in the direction of higher ratings for the new/post classroom. Furthermore, overall the mean rose in the practices section from 24.9 (old/pre) to 37.9 (new/post) (paired t(15) = 4.5, p = 0.0005), and it rose in the solutions section from 18.7 (old/pre) to 37.9 (new/post) (paired t(16) = 5.4, p < 0.0001) (see figure 6).

Even given the small number of educators who participated, there were indications of improved active learning practices and impact of solutions between old/pre and new/post classrooms that tracked in the same direction as the students' responses. This change occurred even though these educators were not provided with any professional development in the area of active learning.

LIMITATIONS AND POTENTIAL IMPROVEMENTS

As with any research study, there were limitations in the administration and instrument. Due to the manner in which the AL-POE was administered, one limitation was the inability to know which students were in the same classroom. Given this, the correlation between students in the same classroom could not be properly accounted for, and this might have resulted in some slight overestimation of p-values. However, given the magnitude of the differences, it would not be expected that this limitation would result in a change in conclusions. Future work will take into account the hierarchical structure of the data.

Figure 4 **Mean Student Learning Practices and Solutions Composite Scores for the Old/Pre and New/Post Classroom**

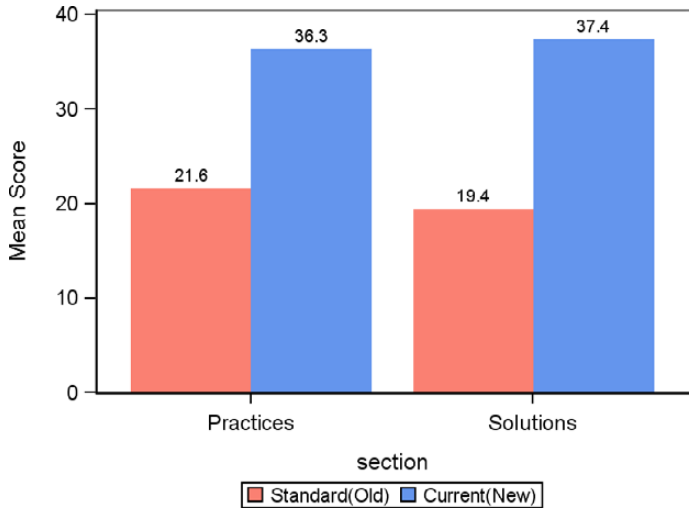


Figure 5 **Percentage of Students Who Attributed Moderate to Exceptional Increase in Factors to the New/Post Classroom**

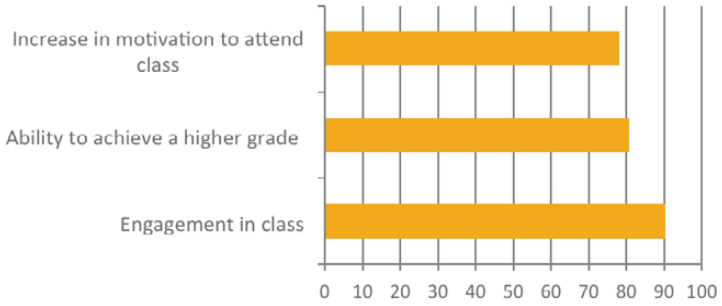
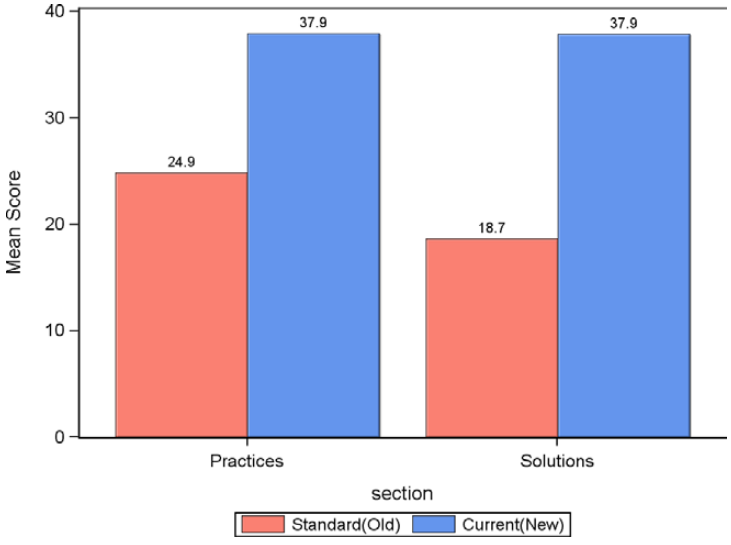


Figure 6 **Mean Instructor Overall Active Learning Practices and Solutions Scores for the Old/Pre and New/Post Classrooms**



An additional limitation of the instrument involved the potential for bias based on the use of color and position in the presentation of the AL-POE items. First, the scale for "OK — NOT OK" and the titles "old" and "new" were presented to participants in red and green. This potentially introduced bias since green indicated OK and new while red indicated NOT OK and old. However, this color coding was only used for the first box of the OK — NOT OK scale and not on the rest of the scale. This was edited for the next round of administration. Second, while positioning the old and new sections of the evaluation side-by-side aided in comparing the two, rating the old classroom before the new classroom may have introduced some bias in the new/post classroom ratings (see figure 1).

It is also recognized that by using an AL-POE instrument to understand the relationship between student engagement and the environment only a limited perspective on this relationship is captured. To capture a full understanding of how student engagement is impacted by the built environment, further research employing a greater diversity of data collection methods is needed.

IMPLICATIONS

The results of this study have some significant implications for educational institutions, the architectural and design communities, Steelcase Education Solutions as a research entity, and environmental and educational researchers.

» IMPLICATION ONE: THE STUDY DEMONSTRATES THE IMPACT OF INSTITUTIONAL INVESTMENTS AND NEW EVIDENCE-BASED, "FORMAL" LEARNING ENVIRONMENT DESIGNS. Educational institutions can be more assured that potential investments made in solutions intentionally designed to support active learning will create more effective classrooms and a higher likelihood of student engagement. Furthermore, although it is highly desirable to provide training and professional development to educators on active learning instructional practices, it would appear that these SES solutions encouraged or enabled educators to practice more active learning methods even without professional development or training. The architectural and design communities can feel more confident that research-supported, intentionally designed solutions impact student engagement. The results show *statistically significant differences on all 12 factors*, illustrating that a relationship exists between SES's evidence-based solutions and student engagement levels. This evidence allows for more confident predictions that these results can be replicated in future classroom projects.

» IMPLICATION TWO: THE STUDY SHOWS THAT RIGOROUS RESEARCH METHODS EMBEDDED IN THE DESIGN OF PRODUCT(S) AND CONTEXTUAL SOLUTIONS RESULT IN MEASURABLE IMPROVEMENTS. SES continues a rigorous research practice and embeds its research insights into the development of product(s) and application solutions. The *statistically significant ($p < 0.05$) ratings increases* demonstrated that this research protocol is critical. These new solutions were positively associated with student engagement and active learning practices.

» IMPLICATION THREE: THE STUDY PROVIDES ANOTHER EXAMPLE OF HOW THE ENVIRONMENT IMPACTS BEHAVIOR. Environmental and educational researchers will recognize that a reliable and valid instrument (AL-POE) was developed to measure the impact of environmental solutions on student engagement in the formal learning place, the classroom, that can also be used in a variety of formal learning places at the higher education level. *This study adds to the body of knowledge relative to how the formal learning space can impact student engagement behaviors.* Existing research indicates that environments impact behaviors (Scott-Webber 2004), and this focused study shows a more specific relationship between the built environment and student engagement. Further research

will build upon these findings to more fully understand the relationship between engagement and the learning environment.

These SES solutions encouraged or enabled educators to practice more active learning methods even without professional development or training.

CONCLUSION

An Active Learning Post-Occupancy Evaluation (AL-POE) tool was developed that synthesized student engagement factors from multiple research studies. A pre/post evaluation methodology was incorporated to connect an old/pre situation with a new/post situation using a two-step decision model process. Three institutions participated in this final beta test, which involved 124 students and 17 faculty members. Statistically significant improvements in student engagement between the old/pre classroom and the new/post classroom were found for all 12 factors, with reliability and validity evident in the instrument. These findings begin to demonstrate that a relational comparison can be made that describes the impact of the formal learning environment on student engagement. The study has positive implications for higher education institution decision makers, members of the architectural and design communities, educators, and students. Further research will offer a more complete understanding on how the active learning environment impacts student engagement and outcomes.

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