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The Combined Effect of Learning Space and Faculty Self-Efficacy to use Student-Centered Practices on Teaching Experiences and Student Engagement

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Research on pedagogy and learning spaces often assumes that active learning spaces enhance faculty's ability to implement student-centered practices; it also relies on student perspectives. In this study faculty completed surveys that assessed their self-efficacy for student-centered pedagogy, teaching experiences, and student engagement when teaching in active and traditional learning spaces. Self-efficacy positively predicted teaching experiences and student engagement within the same space, but negatively across spaces. Only self-efficacy in active learning spaces positively predicted student-centered strategy use. Findings challenge the assumption that skilled faculty will feel successful in any space necessitating the development of policies and trainings that consider pedagogy and space.

Introduction

In addition to core subject knowledge, the Partnership for 21st Century Skills calls for opportunities for students to develop innovation (e.g., critical thinking), information, media, technology (e.g., media and information literacy), life and career (e.g., leadership and social skills), and other 21st century skills (e.g., global awareness and financial literacy) (Brandt, 2010). Students need to be skilled problem solvers, communicators, creative thinkers, and collaborators who effectively leverage new technologies (Pearlman, 2010). However, traditional pedagogies and classrooms can limit the integration of these skills into the curriculum. For example, an instructor who relies on lecturing may limit student independent thinking, problem solving, access to other sources of information outside the classroom, and autonomous use of technology (Oblinger, 2006; Petersen & Gorman, 2014). Further, a classroom that consists of rows of students facing a podium also limits opportunities for collaborative thinking, social connections with peers, and personal attention from the instructor (Oblinger, 2006; Uduku, 2015). To accommodate this shift in thinking and practice, institutions of higher education are redesigning classroom spaces to help students strengthen the skills required to be competitive in both national and international job markets (Beichner, 2014; Brandt, 2010; Oblinger, 2006; Pearlman, 2010).

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Student centered practices

The changing needs of students in the classroom and aims of the 21st Century Skills framework (Brandt, 2010) align with the concept of student-centered pedagogy (Beckers et al., 2015; Jonassen & Land, 2012; Savery, 2015). Student-centered pedagogy emphasizes that learning is enabled through strong social relationships and collaboration with fellow students and their instructor, in addition to problem-based, hands on learning (Beckers et al., 2015; Oblinger, 2005; Wilson, 2004). With this type of pedagogy students are significantly involved in the classroom and become

increasingly responsible for their own learning, while faculty transition to serving as guides and facilitators (e.g., Beckers et al., 2015; Wilson, 2004). Research shows that the implementation of student-centered practices improves student test scores, learning, attendance, attitudes, engagement and connectedness to others, as well as ownership of their learning (Armbruster, Patel, Johnson, & Weiss, 2009; Beichner et al., 2007; Brooks, 2011; Brooks & Solheim, 2014; Freeman, 2014; Hains & Smith, 2012; Hunley & Schaller, 2009; Mason et al., 2013; Weiman, 2014). Further, student-centered practices reduce failure rates (Freeman et al., 2014; Weiman, 2014). Although student-centered practices have clear benefits for students, the physical space in traditional classrooms limit the ability of instructors to effectively apply these strategies (Beichner, 2014; Hannafin & Land, 1997; Jessop, 2012; Oblinger, 2006). In order to maximize the application of student-centered practices in the classroom universities are changing learning spaces.

Active learning spaces

Traditional learning spaces are not conducive to student-centered practices as desks are fixed, student attention is forward, teacher movement is restricted, and access to technology is prohibitive (e.g., few power outlets and small desks) (Petersen, 2014). In contrast, active learning spaces often include reconfigurable tables and chairs, space for instructors to move about the room, internet connectivity, power outlet access and workspace to use computers comfortably, and multiple screens to project media (Beichner, 2007; Brooks, 2014; Hannafin & Land, 1997; Uduku, 2015). The use of active learning spaces is associated with improved student test scores and grade point averages, engagement, conceptual understanding, enriching experiences, and reduced failure rates of students considered to be at risk (Brooks, 2011 & 2012; Baepler, Walker, & Driessen, 2014; Dori & Belcher, 2007; Gaffney, 2009). Although some research conceptualizes active learning spaces as independent and direct predictors of desirable student outcomes, it is more probable that the concurrent use of active learning spaces and student-centered teaching practices yield the greatest benefit for students (Baepler et al., 2014; Brooks, 2014; Folkins, Friberg, & Cesarini, 2015; Walczak & Van Wylen, 2013; Walker et al., 2011).

To demonstrate the concurrent effect of student-centered pedagogy and active learning space in promoting positive outcomes in students, Walker and colleagues (2011) manipulated instructor behavior across course sections taught in the same active learning space. After teaching the first section, the instructor attended a teacher development training designed to enhance the use of student-centered strategies. Students had similar perceptions of engagement, enrichment, and flexibility across these two sections but students reported greater active participation and, on average, had final grades more than five percentage points higher in the second section. Brooks (2014) also demonstrated that the integration of student-centered pedagogy in an active learning space was associated with improved student grades compared to students who took the same course, in the same space, but with an instructor who used more traditional teaching pedagogy. Improvements in student grades and classroom experiences (e.g., academic confidence, use of the learning space, and engagement) have also been reported in other studies that examined the combined effects of student-centered practices and active learning spaces (e.g, Baepler et al., 2014; Deslauriers, Schelew, & Wieman, 2011).

The growing evidence for the combined benefits of active learning spaces and student-centered practices has relied on student self-reported measures and their academic performance. When instructor perceptions are included the focus is often on their perceptions of the physical learning space, their students, and reported use of teaching strategies (e.g., Lage et al., 2000), rather than how active learning spaces support their use of student-centered strategies. Overall, this work leads researchers and practitioners to understand that courses taught in active learning spaces is associated with improved student outcomes, however, the mechanisms that link learning spaces (the context) and pedagogy (behavior) remain relatively unexplored.

Social cognitive theory

According to social cognitive theory (Bandura, 1977), one of the determinants of behavior and perceptions of experiences is self-efficacy, the belief that one can successfully execute the behavior required to produce a certain outcome. Research indicates that an instructor's self-efficacy to support student learning is a consistent, positive predictor of student academic achievement and adaptive classroom experiences (e.g., Bandura, 1993; Caprara, Barbaranelli, Steca, & Malone, 2006; Klassen, Tze, Betts, & Gordon, 2011). However, social cognitive theory also identifies that self-efficacy and experiences, as well as behavior are influenced by the greater environment (i.e., time, place, and task) (Bandura, 1977). When student-centered interactions and learning spaces are couched in this framework an instructor's self-efficacy to implement student-centered practices, their classroom experiences, and behaviors are contingent on a number of environmental factors, such as the physical features of the classroom space (see Figure 1 for a conceptual model).

Ways in which physical space influences how individuals behave as information gleaned from the environment conveys the intended purpose of the space include: how the

space supports an individual's work and how individuals should interact with others (Strange & Banning, 2001; Jamieson, 2003; Langley & Guzey, 2014). Even though faculty preferences for classroom space aligns with many common characteristics of active learning spaces, such as favoring rooms with comfortable, flexible, and group-oriented seating, (Douglas & Gifford, 2001; Walczak & Van Wylen) the use of active learning spaces is not always associated with improved student learning (McArthur, 2015). Examining the combined effects of faculty self-efficacy and learning space could provide evidence that self-efficacy is learning-space dependent, which would help explain why the use of active learning spaces is not always associated with improved student outcomes.

McArthur's (2015) work hints at the potential role of learning-space contingent self-efficacy as a mechanism of change in teaching practices. McArthur's study compares student academic outcomes when courses were taught in a traditional learning space and then an active learning space. However, faculty whose journals described feelings of decreased comfort and perceptions of ability to teach in an active learning space had students whose academic performance suffered in the active learning spaces. Although this work does not directly assess faculty self-efficacy for student-centered practices it does provide an initial, descriptive insight to the potential for learning-space dependent self-efficacy.

Faculty self-efficacy contextualized to learning space

The literature describes some close approximations of self-efficacy to apply student-centered practices, contextualized to learning space. For example, faculty who are uncomfortable with new pedagogical practices are more likely to reorganize furniture when they teach in an active learning space to mimic a more traditional classroom floor plan (Hunley & Schaller, 2009). Such faculty also report that the layout of the room in active learning spaces negatively influences their perceived ability to teach effectively (Langley & Guzey, 2014; Michael, 2007; Petersen, 2014). Instructors who use student-centered practices in a traditional classroom space may feel less capable of integrating those same practices in an active learning space (Beichner, 2007; Cotner, et al., 2013). These findings are important to the continued use of active learning spaces, as increased discomfort and anxiety, and decreased perceptions of ability are the most commonly reported barriers to using an active learning space (Bonwell et al., 1991; Walker et al., 2011).

The current body of research provides preliminary evidence that instructors' self-efficacy for student-centered practices may depend on the physical learning space. However, most of this work is descriptive, not couched in theory, and focuses on perceptions of ability to use student-centered strategies within a single space, not across both traditional and active learning spaces. Further, most research on the use and consequences of student-centered practices and learning spaces includes a few, handpicked instructors who often have previous training in student-centered pedagogy (Andrews et al., 2011) and relies on student perspectives and outcomes. Previous research (e.g., Beichner, 2007; McArthur, 2015) and theory support (Bandura, 1997) self-efficacy for student-centered practices as context dependent, but self-efficacy to apply student-centered practices in both active and traditional spaces has not been examined. Further, the theoretical and practical implications of context-dependent self-efficacy for student-centered practices has not been assessed.

Purpose and hypotheses

The purpose of this study was to: (1) examine faculty self-efficacy to use student-centered practices in active learning and traditional spaces and (2) test the degree to which self-efficacy predicts faculty perceptions that the learning space supports student centeredness, engaged behaviors of students, satisfaction with their teaching, and use of student-centered practices. Due to the context dependent nature of self-efficacy (Bandura, 1977) we hypothesize that the associations between faculty self-efficacy to use student-centered practices, student centeredness, use of student-centered practices, teaching satisfaction, and engaged student behaviors will be contingent upon learning space. Specifically, faculty self-efficacy to use student-centered practices in a learning space should positively predict their perceptions of student centeredness, engaged student behaviors, and teaching satisfaction in the same type of space. As greater self-efficacy for a skill positively predicts behavior (Bandura, 1977) we also hypothesize that faculty self-efficacy to use student-centered practices in active learning and traditional spaces should positively predict their reported use of student-centered practices overall.

As more active learning spaces are available faculty may have opportunities to teach courses in active and traditional learning spaces. However, there is a paucity of research examining faculty experiences in both active and traditional learning spaces and how these experiences influence their self-efficacy to use evidence-based pedagogies in these spaces. To address this gap, this research tests the degree to which faculty self-efficacy to use student-centered strategies in traditional and active learning spaces predicts perceptions of student centeredness, engaged student behaviors, and teaching satisfaction across learning spaces.

Method

Context

Researchers across multiple units of the university collaborated to collect survey data regarding faculty perceptions of the role of classroom space on teaching practice. Traditional classrooms were described as lecture-style rooms with seating arranged in rows while active learning spaces were described as classrooms with seating that is arranged to easily facilitate collaboration or group work.

Procedures and participants

After receiving exempt status by Institutional Review Board, a list of instructors who taught in an active learning space at least once during the 2014 and 2015 academic years and were still employed by the university in the spring of 2015 was obtained from the University's Institutional Research Office. The research team contacted faculty (N = 582) by email and invited them to participate in the study. Participants completed an online Qualtrics survey that took less than 20 minutes.

158 faculty completed the online survey. Some faculty (n = 10) started but completed less than 25% of the survey and were excluded from all analyses. In the final sample (N = 148) any missing data was replaced using person mean imputation, as little data was missing (< .5% or 26 items). Faculty had a range of teaching experience, with 6% teaching less than two years, 6% teaching for three to five years, 20% teaching for five to ten years, and 68% teaching for more than ten years.

Some faculty (n = 57 or 39%) participated in a campus-wide course transformation faculty learning community that focuses on the redesign of large enrollment courses. This program uses an evidence-based approach to redesign courses to create student-centered learning environments. It is a semester long program where faculty attend thirteen, 75-minute sessions and work in guided cohorts to integrate student-centered pedagogy, active learning strategies, and technology to improve student learning (Purdue University, 2014). The program has driven the demand for more active learning spaces since summer 2012 resulting in a total of 41 active learning spaces on campus at the time of this study. Although the purpose of this study was not to test the effectiveness of the program, we controlled for the potential influence of this training in all analyses.

Measures

New measures were developed to assess faculty self-efficacy in applying student-centered practices, student centeredness, use of student-centered practices, satisfaction with teaching, and engaged student behaviors in both learning spaces. Measures and items were developed drawing from social cognitive theory (Bandura, 1977), active learning and student- centered pedagogies (Beckers et al., 2015; Jonassen & Land, 2012; Savery, 2015), and modeled from measures that assess student perceptions of the degree to which faculty implement student-centered practices in the classroom (Morris et al., 2014). Ultimately, parallel items were developed for active learning and traditional classroom spaces that contextualized study variables to each type of learning space. Faculty responded on a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) for all items.

Self-efficacy to use student-centered practices was assessed using 22 parallel items contextualized to traditional spaces (11 items; α = .87) and active learning spaces (11 items; α = .89) (see Table 1). Items indicated the degree to which traditional spaces and active learning spaces facilitated their ability to apply student-centered practices (e.g., engaging students in group work, discussions, and peer assessment).

Faculty perceptions of student centeredness were assessed by ten parallel items contextualized to traditional spaces (5 items; α = .89) and active learning spaces (5 items; α = .90) (see Table 1). Again, items measured how each space either facilitated or inhibited faculty-student interactions that exemplify student-centered practices (e.g., developing positive relationship with students and adapting to student needs).

Faculty perceptions of satisfaction with teaching were assessed with four parallel items. Faculty indicated their agreement with two statements contextualized to each learning space: "I am satisfied with my teaching" and "I am satisfied with my ability to use technology."

Faculty perceptions of engaged student behaviors were assessed with six parallel items. Faculty indicated their agreement with three statements contextualized to each learning space: "students are actively engaged in class," "students engage with each other to work on learning course material," and "students come to class prepared."

Faculty perceptions of their implementation of student-centered practices was assessed with one item. As the concept of student-centered practices is less well-known and there is conceptual overlap between student-centered pedagogy and active learning pedagogy (e.g., Oblinger, 2006), faculty were asked to report their degree of agreement with "*I try to use active learning strategies in my classrooms as frequently as possible*".

Faculty participation in the course transformation learning community and years teaching were assessed with one item each. Faculty indicated (*No* = 0; *Yes* = 1) whether they participated in learning community and reported years of

teaching experience on a four point scale where: *0-2 years* = 1, *3-5 years* = 2, *5-10 years* = 3, and *more than 10 years* = 4.

Data Analysis

Screening for multivariate assumptions (Tabachik & Fidell, 2007) and preliminary analyses including descriptive statistics and correlations for all variables was completed in SPSS 22 (IBM, 2013). To assess the performance of the new measures for faculty self-efficacy and student centeredness a confirmatory factor analysis (CFA) was conducted in AMOS 21 (IBM, 2012). Item loadings were evaluated and overall model fit assessment was based on the following thresholds of fit statistics: root mean square error of approximation (RMSEA) ≤ .08, 90% CI ≤ .60; test of close fit (CFit) non-significant at $p \leq .05$, comparative fit index (CFI) ≥ .90; and Tucker-Lewis index (TLI) ≥ .90 (Hu & Bentler, 1999; Little, 2013).

Structural equation modeling was used to test the study hypotheses, as this approach permits, when appropriate, the representation of unobserved variables as latent variables, includes measurement error, and allows the examination of associations among predictors and multiple dependent variables (Schreiber et al., 2006). Three models were tested. In each model we controlled for faculty participation in the learning community and number of years teaching by entering each control variable as a predictor of all other variables in the model. In model one we entered self-efficacy to use student-centered practices in active learning spaces and traditional learning spaces as a predictor of student centeredness in active learning spaces and traditional learning spaces. Model two tested the associations among self-efficacy to use student-centered practices in active learning spaces and traditional learning spaces, satisfaction with teaching and satisfaction with technology in active learning spaces and traditional spaces, and use of student-centered practices. Model three tested the associations among self-efficacy to use student-centered practices in active learning spaces and traditional learning spaces and student classroom engagement, peer engagement, and preparation for class. Model fit as indicated above, path coefficients, and variance explained were considered in model evaluation and hypothesis testing.

Results

Descriptive statistics and correlations for study variables are reported in Table 2 and correlations are further depicted in Table 3. All faculty perceptions had significant, positive correlations with variables contextualized to the same learning space. Faculty self-efficacy in active learning spaces was not correlated with self-efficacy in traditional learning spaces. Any significant correlations across active and traditional learning spaces were weak to moderate in strength and negative, except the positive correlations between satisfaction with use of technology and student preparation across the two spaces. Last, faculty reported use of student-centered practices was positively correlated with each variable contextualized to active learning spaces and only had significant, negative correlations with teaching satisfaction and peer engagement in traditional spaces. Overall, average values for faculty perceptions in active learning spaces were greater than the average values in traditional learning spaces and, with the exception of the use of technology in traditional spaces, averages were at or above the midpoint of the scales. Faculty reported relative high use of student-centered practices (M = 6.02).

The CFAs for the measurement of faculty self-efficacy to use student-centered practices and student centeredness in traditional spaces and active learning spaces support the hypothesized one-factor models (see Table 1). The self-efficacy models both demonstrated adequate fit and completely standardized item loadings ranged from .41-.88. The student centeredness models both demonstrated adequate fit as well (see Table 1) and completely standardized item loadings ranged from .68-.88.

Results for models 1-3 indicate a consistent pattern of associations among faculty self-efficacy for student-centered practices, perceptions of student centeredness, teaching satisfaction, and engaged student behaviors in traditional and active learning spaces (see Figures 1-3). Overall, all paths between self-efficacy and outcome variables contextualized to the same learning space were positive and significant. Significant associations between self-efficacy and outcome variables contextualized to different learning spaces were negative. In each model, faculty teaching experience had a significant association with self-efficacy in traditional spaces but not active learning spaces or any other dependent variable.

Model 1: Hypothesis supported

Controlling for participation in the course transformation learning community and teaching experience, self-efficacy in traditional spaces positively predicted student centeredness in traditional spaces and self-efficacy in active learning spaces positively predicted student centeredness in active learning spaces (see Figure 2). There were no significant associations between self-efficacy and student centeredness contextualized to different learning spaces. Overall, the model explained 49% and 57% of the variance in student centeredness in traditional spaces and active learning spaces, respectively. Participation in the course transformation learning community was not a significant predictor.

Model 2: Hypothesis partially supported

Controlling for participation in the course transformation learning community and teaching experience, self-efficacy in traditional spaces positively predicted satisfaction with teaching and use of technology in traditional spaces and was not significantly associated with use of student-centered practices (see Figure 3). Self-efficacy in active learning spaces positively predicted satisfaction with teaching and use of technology in active learning spaces and use of student-centered practices. There were also significant negative associations between self-efficacy in traditional spaces and satisfaction with teaching in active learning spaces as well as self-efficacy in active learning spaces and satisfaction with teaching in traditional spaces. Overall, the model explained 54% and 49% of the variance in teaching satisfaction and 30% and 31% of the variance in satisfaction with use of technology in traditional and active learning spaces respectively, and 16% in use of student-centered practices. Participation in the course transformation faculty learning community positively predicted ($\beta = .18$, $p < .05$) use of student-centered practices only.

Model 3: Hypothesis supported

Controlling for participation in the course transformation learning community and teaching experience, self-efficacy in traditional spaces positively predicted student engagement, peer engagement, and student preparation in traditional spaces (see Figure 4). Self-efficacy in active learning spaces positively predicted student engagement, peer engagement, and student preparation in active learning spaces. There were also significant negative associations between self-efficacy in traditional spaces and student engagement and peer engagement in active learning spaces as well as self-efficacy in active learning spaces and peer engagement and student preparation in traditional spaces. Overall, the model explained 51% and 43% of the variance in student engagement, 20% and 25% of the variance in peer engagement, and 25% and 13% of the variance in student preparation in traditional and active learning spaces, respectively. Participation in the course transformation learning community positively predicted perceptions of student preparation in traditional spaces ($\beta = .21$, $p < .05$) and student engagement in active learning spaces ($\beta = .13$, $p < .05$).

Discussion

The purpose of this study was to examine the combined effect of learning spaces and faculty space specific self-efficacy on faculty and student experiences in the classroom. Results of our study support our hypotheses, framed in social cognitive theory (Bandura, 1977), that faculty self-efficacy for student-centered practices are contingent on learning space and that self-efficacy in traditional and active learning spaces positively predict faculty and student experiences within the same learning space. Contrary to our hypotheses, faculty self-efficacy for student-centered practices positively predicted reported use of student-centered practices only in active learning spaces. Our exploration of potential cross learning-space associations indicated that learning-space specific self-efficacy was negatively associated with teaching and student experiences across learning spaces.

Learning space contingent self-efficacy

Our findings support social cognitive theory (Bandura, 1977) where self-efficacy for the same skill can differ across contexts. The lack of a significant association between self-efficacy in active and traditional learning spaces suggests that instructors' perceptions of capability to use student-centered practices is contingent upon learning space. This finding counters the common assumptions of previous research – that instructors who feel effective implementing student-centered practices in traditional learning spaces will feel just as or even more effective in active learning spaces (Beichner, 2014; Hannafin & Land, 1997; Jessop, 2012; McArthur, 2015; Oblinger, 2006). Instead, there is no consistent pattern of associations between self-efficacy in active and traditional learning spaces. Prior research demonstrates that faculty training programs can increase the use of student-centered practices in active and traditional learning spaces. However, the mechanisms through which instructors feel capable of applying these practices is relatively unexplored (e.g., Brooks, 2014; Walker, 2011). Guided by social cognitive theory (Bandura, 1977) new training programs should recognize that faculty may feel equally, more, or less capable across learning spaces and provide faculty with strategies for enacting student-centered practices in all types of learning spaces. As the number of active learning spaces increases on campuses, such training could help instructors maximize the use of all learning spaces and better prepare instructors to support positive student learning experiences in all learning spaces.

Within learning space associations

Also, in line with social cognitive theory (Bandura, 1977), faculty self-efficacy positively predicted faculty perceptions of student centeredness, engaged student behaviors, and teaching satisfaction within the same learning space. As faculty feel increasingly able to use student-centered practices, they create environments that enable student learning by developing positive relationships with their

students, facilitating students' independent learning, enabling students to learn from one another, and considering their students' needs (Beckers et al., 2015; Oblinger, 2005; Wilson, 2004). The current study extends these findings by demonstrating that, as faculty perceptions of capability to use student-centered practices increases, their perceptions that they interact effectively with students, their students are prepared and are capable, and their teaching satisfaction also increases.

Learning space research often relies on student academic achievement as the primary indicator of the effectiveness of active learning spaces and ignores potential mechanisms that may explain how active learning spaces support student learning. Therefore, it is difficult to explain why courses taught in active learning spaces do not always lead to improved student outcomes (e.g., McArthur, 2015). The current findings tested faculty self-efficacy as an underlying mechanism of the effectiveness of learning spaces and demonstrated that faculty benefit from implementing student-centered practices as well (Armbruster, Patel, Johnson, & Weiss, 2009; Freeman, 2014; Weiman, 2014). Future research should continue to test how learning-space specific self-efficacy fosters positive faculty teaching experiences and explore the role of greater faculty self-efficacy in improving student learning experiences and academic achievement. As it can be challenging to foster interest and excitement for instructor training in higher education (Bonwell & Tanner, 2012; Michael, 2007), new evidence-based trainings focused on how to build self-efficacy for student-centered practices could emphasize that participants may improve both their students' learning experiences and their own teaching experiences.

Reported use of student-centered practices

Although faculty reported relatively high self-efficacy for student-centered practices in both learning spaces (M_{ALS} = 4.44; M_{TS} = 5.67), self-efficacy positively predicted the reported overall use of student-centered practices only in active learning spaces. The examination of self-efficacy in both learning contexts made it possible to address a common assumption in the learning spaces literature; that active learning spaces enable, while traditional learning spaces frustrate, faculty use of best teaching practices (e.g., Beichner, 2014; Oblinger, 2006). Our findings partially support this assumption, but as not all faculty have opportunities to teach consistently in active learning spaces, training programs should be designed that equip instructors to creatively apply student-centered practices in traditional learning spaces as well. For example, the resourceful use of traditional learning spaces, such as having students leave desks empty and sit in a U-shape when teaching in a learning space with fixed desks (Folkins, Friberg, & Cesarini, 2015) can create new opportunities to use student-centered practices in traditional learning spaces.

Exploration of cross learning spaces associations

Two closely related variables, self-efficacy for student-centered practices and perceptions of student centeredness, were not associated across learning spaces. However, these perceptions were positively associated within the same learning space. Although previous research emphasizes that active learning spaces enable positive student-instructor exchanges by supporting one-on-one interactions, feedback, and individualized attention (Beckers et al., 2015; Oblinger, 2005; Wilson, 2004), the current finding suggests that the association between learning-spaces and student centeredness is more nuanced. Faculty with greater self-efficacy in active learning spaces, but not in traditional learning spaces, reported more student centeredness in active learning spaces.

The presence and influence of space specific self-efficacy is also evident in the negative, cross learning-space associations between self-efficacy and teaching satisfaction, student engagement, peer engagement, and student preparation. These negative associations further challenge the assumption that active learning spaces are the ubiquitous solution to improvement in teaching practices and student learning experiences (Beichner, 2014; Hannafin & Land, 1997; Jessop, 2012; McArthur, 2015; Oblinger, 2006). On the contrary, they indicate that the effects of faculty perceptions of their ability to use student-centered practices are not analogous between spaces. Instead, as faculty perceptions of capability increases in one learning space, their perceptions of their teaching and student engagement decrease in another learning space.

Increased self-efficacy to use student-centered strategies in active or traditional learning spaces negatively predicted teaching satisfaction across learning spaces. As physical space strongly influences how we perceive ourselves and others (Strange & Banning, 2001; Jamieson, 2003) it seems reasonable that instructors who feel more capable using student-centered practices in a particular space would be less satisfied with their teaching in a different learning space (e.g., Bonwell et al., 1991; Walker et al., 2011). Such negative affective and behavioral experiences may contribute to decrements in teaching satisfaction when conducting a course in a learning space that constrains faculty perceptions of efficacy to use student-centered practices.

Similarly, faculty who reported greater self-efficacy for student centered practices in one learning space perceived that their students were less engaged with their peers across learning spaces. Further, faculty who reported greater self-efficacy in traditional learning spaces perceived that their students were less engaged in active learning spaces. As

indicated in the findings of this paper, active and traditional learning spaces place different demands on faculty that may either enable or constrain their ability to use student-centered practices. Faculty who feel more capable to use student-centered practices in traditional learning spaces may perceive that students are more attentive when they quietly sit in rows, may prefer commanding attention from the front of the room, may favor instructing students to ask questions, request help, and interact with their peers at specific times during the lecture (Michael, 2007). In contrast, faculty who feel more capable to use student-centered practices in active learning spaces may perceive that students are more attentive when they are conversing among themselves, seeking help when they need it, completing projects independently, and moving about the space (Beichner, 2007; Brooks, 2014; Hannafin & Land, 1997; Hunley & Schaller, 2009; Uduku, 2015). Training that 1) targets self-efficacy for student-centered practices in both spaces and 2) demonstrates how individual student and peer engagement may be manifested differently across spaces could help reduce negative perceptions of student engagement behavior in learning spaces where faculty feel less comfortable.

Faculty self-efficacy in active learning spaces negatively predicted their perceptions of student preparedness in traditional learning spaces. To effectively implement student-centered strategies, students must be prepared to apply and extend their knowledge during class. Previous research supports this need, as faculty report that a primary barrier to implementing student-centered strategies is that students are not prepared to serve as active participants in their own learning (Michael, 2007). The current paper builds upon this finding by integrating the role of learning space in faculty perceptions of student preparedness. In traditional learning-spaces, students may assume a more passive learning role as the space itself is less conducive to student-centered strategies and communicates a more transactional and uni-directional learning process (Oblinger, 2006; Petersen, 2014; Uduku, 2015). To implement student-centered strategies, faculty may need to overcome the conventional role of students by clearly communicating their teaching philosophy and expectations. These efforts may be especially important to faculty who feel capable of using student-centered strategies in active learning spaces. The affordances (e.g., integration of technology, flexible seating) of these innovative spaces are not present to the same degree in traditional learning spaces and faculty must work to motivate students to be prepared to facilitate their own learning and counter the entrenched, passive role of students in traditional learning spaces.

It is important to consider the negative cross learning space associations as faculty transition into active learning spaces. Social cognitive theory (Bandura, 1977) posits that negative experiences in a context (e.g., inability to master a skill, negative interpersonal interactions, and affective states) compel individuals to seek out new contexts and skills where they can experience success. As experienced faculty are more likely to feel capable in traditional-spaces, they are at risk for negative teaching experiences in active learning spaces. Without adequate support, moving the most experienced and competent faculty to active learning spaces could lead to undesirable consequences for both students and faculty (Caprara, 2006). A common barrier to encouraging faculty to move into active learning spaces and incorporate student-centered practices is the time and effort it takes to redesign their teaching and course (Bronwell & Tanner, 2012; Michael, 2007). Coupled with decreased satisfaction with their teaching, it may become increasingly difficult to encourage faculty to persist in these innovative spaces. Previous research does not highlight the potential negative consequences of moving faculty into active learning spaces; the current findings underscore the need for training that prepares faculty to effectively instruct in active learning spaces.

In the current paper we extended previous learning-spaces research by framing our research questions in social cognitive theory (including faculty with a range of teaching experience) and assessing faculty perceptions of their teaching practices and students in both active- and traditional- learning spaces. The interplay between self-efficacy and learning spaces could be further described by research that included faculty report of how certain physical characteristics of learning spaces (e.g., available technology and flexibility of seating) and course demographics (e.g., course content, number of students, and student classification) influence how they instruct and interact with students. Although the current work did not include observed faculty behaviors or student perceptions and experiences, these variables could help researchers and practitioners comprehensively examine how learning spaces ultimately influence student outcomes. The current findings indicate that learning space dependent self-efficacy is an important mechanism of faculty teaching experiences. Future research should continue to include the combined effect of pedagogy and space to develop, implement, and evaluate new faculty trainings designed to improve learning space specific self-efficacy and to target the four sources of efficacy beliefs (i.e., mastery experiences, vicarious experiences, verbal persuasion, and interpretation of physiological and affective states) as identified in Bandura's (1997) work.

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Table 1. Completely standardized factor loadings from the CFA models for faculty self-efficacy to use student centered practices and student centeredness contextualized to traditional and active learning spaces

	Traditional spaces	Active learning spaces
Self-efficacy to use student-centered practices (It's easy to…)		
Engage students in group work	.49	.48
Have students give presentations	.41	.64
Hold whole class discussions	.55	.73
Use technology in my teaching	.41	.66
Engage students with course materials	.85	.88
Receive student feedback during class	.67	.81
Use real-life problems to demonstrate course material	.69	.70
Involve students in peer assessment of work during class	.56	.44
Develop student's critical thinking skills	.75	.69
Support student learning	.86	.78
Student centeredness		
I feel confident in my ability to create positive relationship with my students	.73	.85
I feel able to create a learning environment in which students learn from each other	.70	.76
I feel comfortable in my role of facilitator during class	.68	.75
I have the ability to flexibly adapt to students' needs	.88	.87
I have the ability to adapt my teaching to students' prior experiences	.87	.78

Note: Each measure demonstrated adequate fit: self-efficacy in traditional spaces (RMSEA = .06 (90% CI = .01-.09, CFit = .34) CFI = .97; TLI = .96), self-efficacy in active learning spaces (RMSEA = .06 (90% CI = .03-.10, CFit = .24) CFI = .97; TLI = .96), student centeredness in traditional spaces (RMSEA = .07 (90% CI = .001 - .17, CFit = .29) CFI = .99; TLI = .98) and student-centered interactions in active learning spaces (RMSEA = .05 (90% CI = .001-.13, CFit = .42) CFI = .99; TLI = .99).
$p < .001$ for all loadings.

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Table 2. Descriptive statistics and correlations

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. TS self-efficacy															
2. TS student centeredness	.60**														
3. TS teaching satisfaction	.60**	.63**													
4. TS technology use satisfaction	.54**	.64**	.51**												
5. TS student engagement behavior	.60**	.65**	.67**	.39**											
6. TS peer engagement	.37**	.46**	.44**	.31**	.46**										
7. TS student preparation	.35**	.52**	.41**	.30**	.61**	.26**									
8. ALS self-efficacy	-.00	-.08	-.20*	-.05	-.12	-.19*	-.05								
9. ALS student centeredness	-.13	.07	-.28**	-.04	-.11	-.12	-.04	.65**							
10. ALS teaching satisfaction	-.22**	-.16	-.29**	-.12	-.24**	-.27**	-.15	.60**	.63**						
11. ALS technology use satisfaction	-.03	.09	-.14	.25**	-.10	-.09	.04	.49**	.56**	.51**					
12. ALS student engagement behaviors	-.21*	-.14	-.32**	-.13	-.11	-.19*	-.02	.56**	.63**	.56**	.39**				
13. ALS peer engagement	-.26**	-.13	-.27**	-.13	-.15	-.05	.01	.37**	.49**	.40**	.29**	.68**			
14. ALS student preparation	-.08	.01	-.06	-.03	.11	.07	.37**	.30**	.33**	.16*	.20*	.45**	.31**		
15. Use of student centered practices	-.12	.03	-.24**	.05	-.13	-.18*	.05	.26**	.43**	.43**	.28**	.46**	.38**	.27**	
M	4.44	4.84	4.09	5.01	3.72	3.22	3.72	5.67	5.77	5.42	5.46	5.35	5.75	4.30	6.02
SD	.92	1.30	1.93	1.59	1.44	1.49	1.41	.79	1.05	1.48	1.35	1.34	1.09	1.39	1.22

Note: TS = traditional spaces, ALS = active learning spaces. All items were measured on scale from 1-7.
*p < .05, **p < .01

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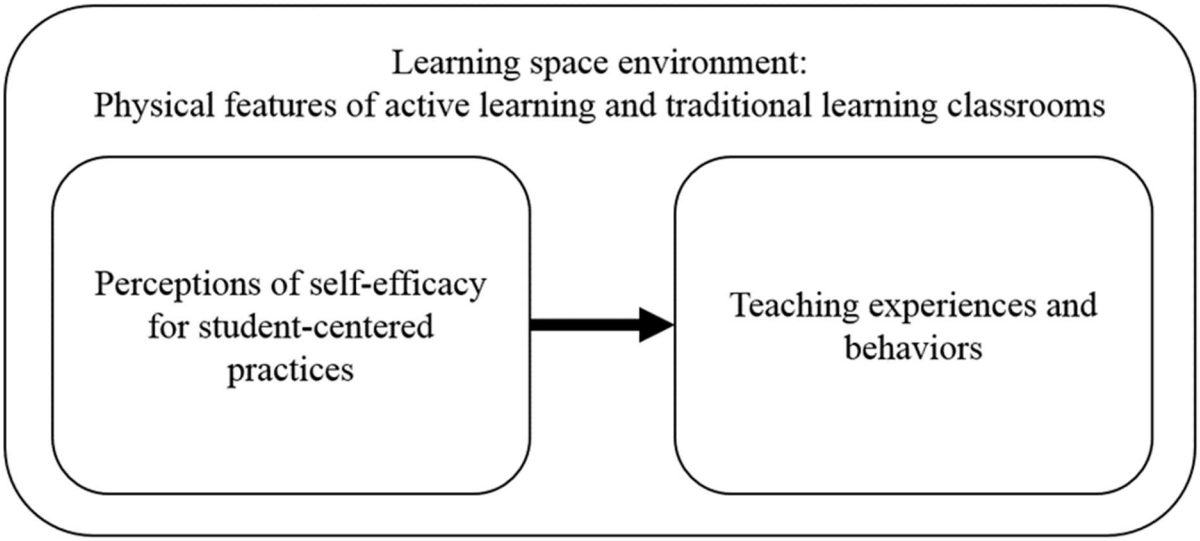

Figure 1. Conceptual model of the associations among student-centered practices, learning space, and teaching experiences and behaviors couched in social cognitive theory.

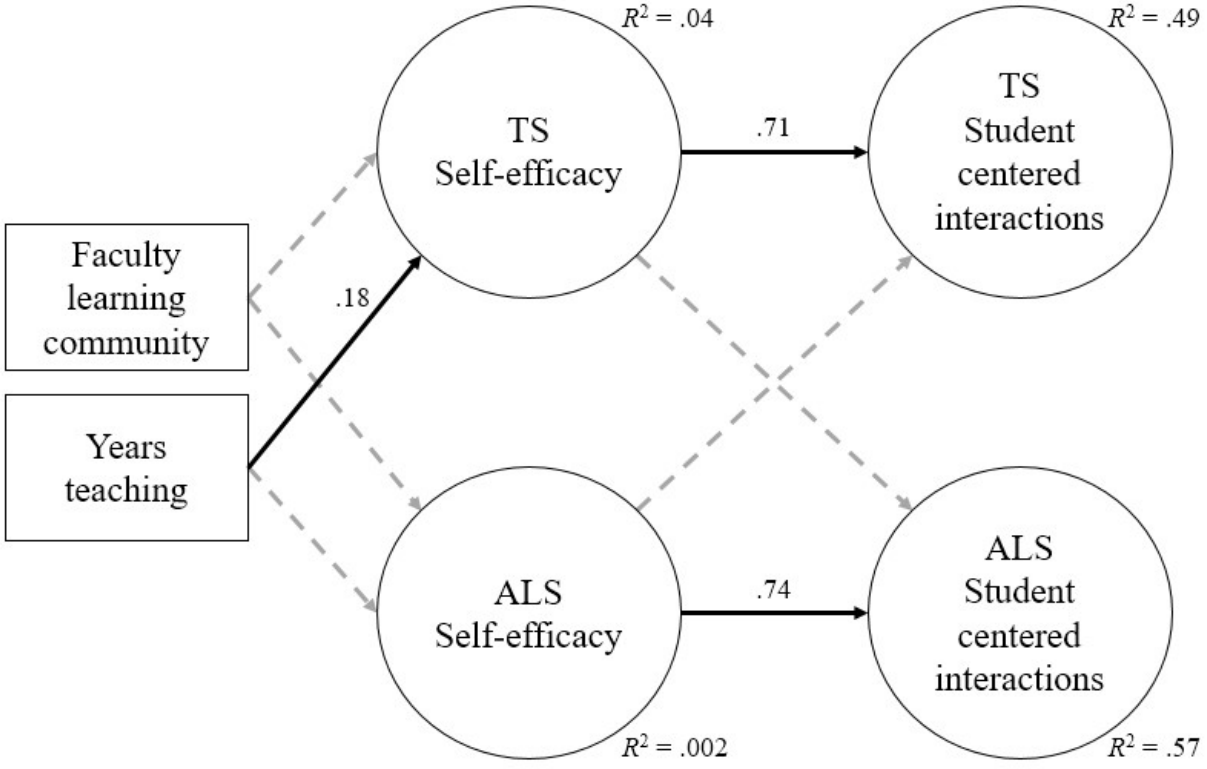

Figure 2. Results of Student Centeredness Model. Participation in the course transformation faculty learning community and years teaching were also entered as predictors of student centeredness but were not depicted for clarity. Significant paths (p < .05) represented by solid lines and non-significant paths represented by dashed lines. TS = traditional spaces, ALS = active learning spaces, R^2 = variance explained. RMSEA = .05 (90% CI = .04 -.06, CFit = .23) CFI = .93; TLI = .91.

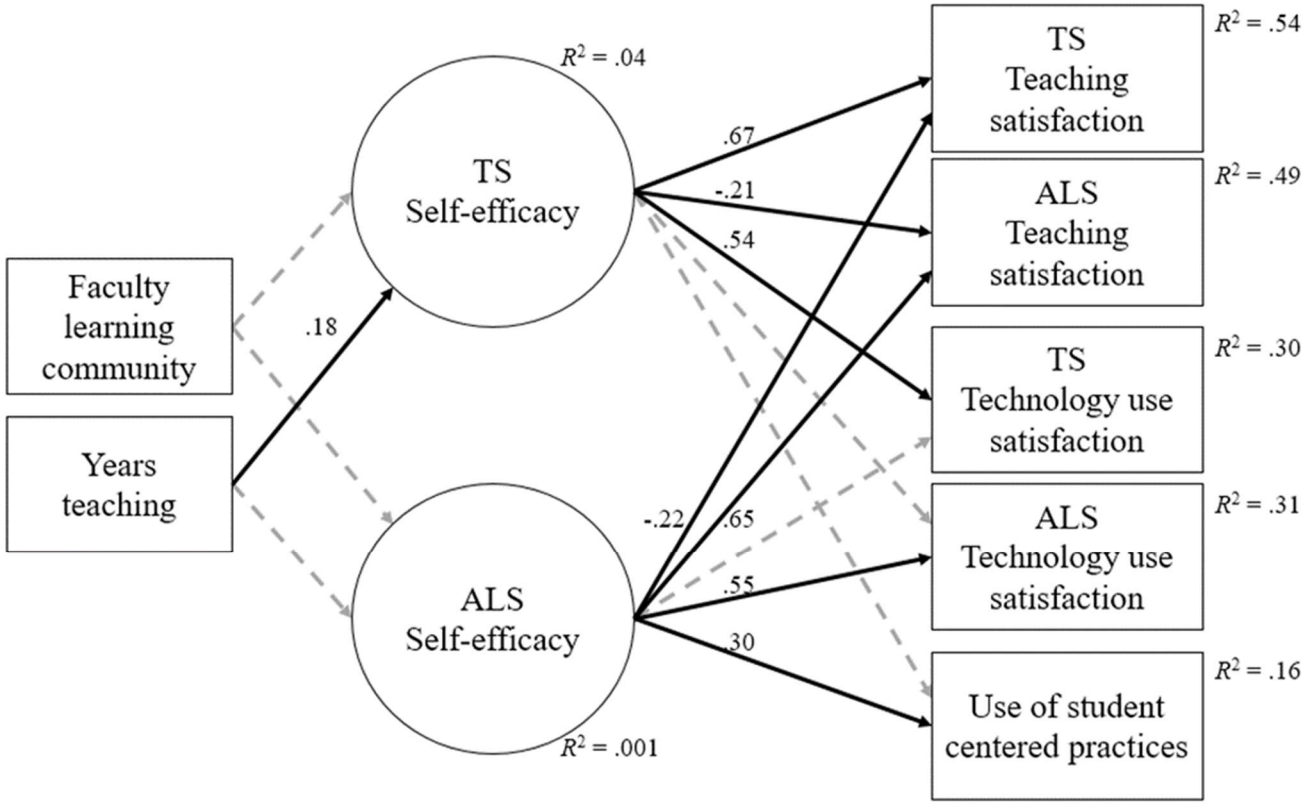

Figure 3. Results of Teaching Satisfaction and Use of Student Centered Practices Model. Participation in the course transformation faculty learning community and years teaching were also entered as predictors of faculty satisfaction and reported use of student centered practices but were not depicted for clarity. Significant paths (p < .05) represented by solid lines and non-significant paths represented by dashed lines. TS = traditional spaces, ALS = active learning spaces, R2 = variance explained. RMSEA = .06 (90% CI = .05-.07, CFit = .06) CFI = .92; TLI = .89.

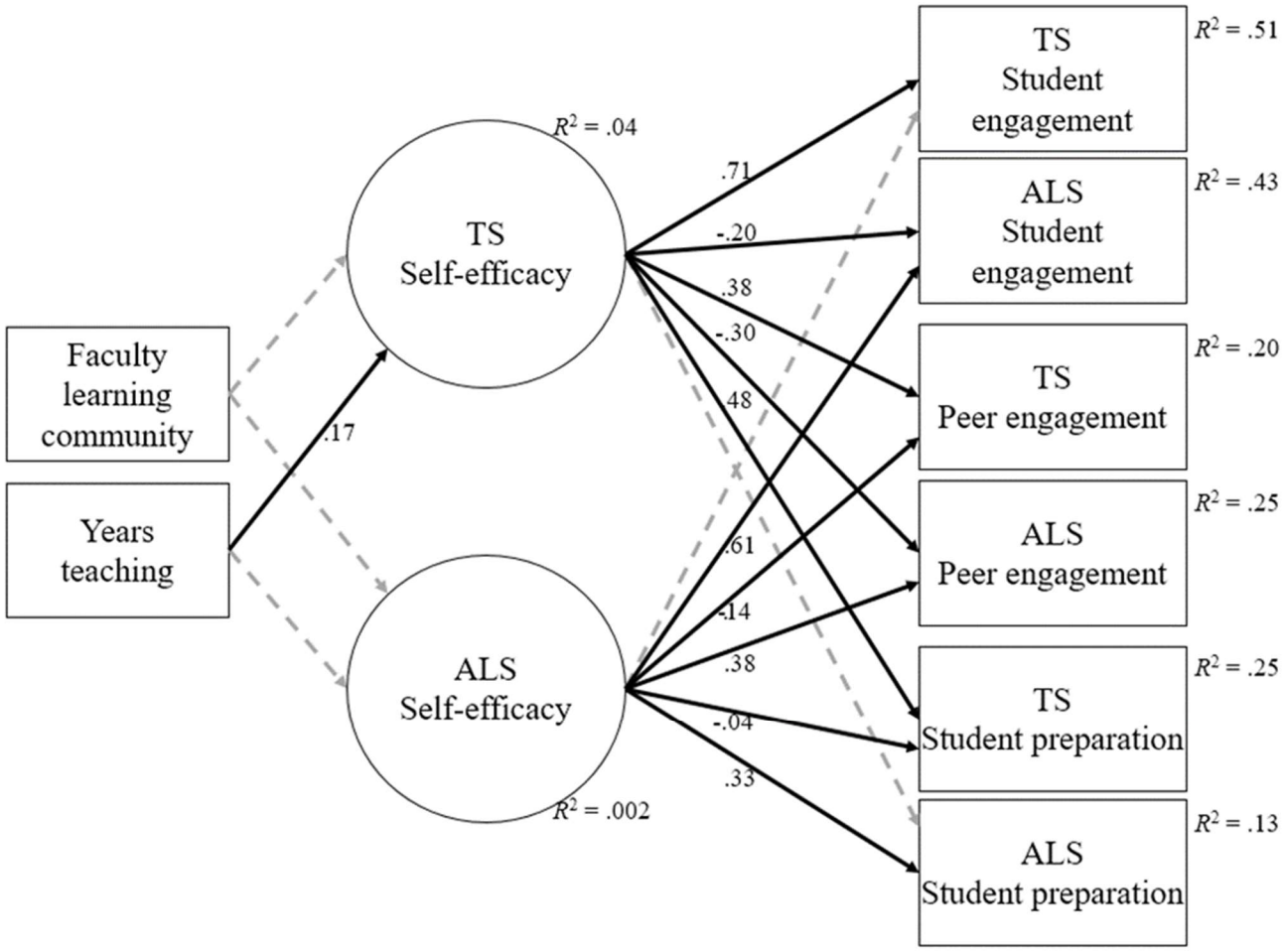

Figure 4. Results of Perceptions of Students Model: Participation in the course transformation faculty learning community and years teaching were also entered as predictors of faculty perceptions of students but were not depicted for clarity. Significant paths ($p < .05$) represented by solid lines and non-significant paths represented by dashed lines. TS = traditional spaces, ALS = active learning spaces, R2 = variance explained. RMSEA = .06 (90% CI = .05-.07, CFit = .15) CFI = .92; TLI = .90.

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