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Reforming the Environment: The Influence of the Roundtable Classroom Design on Interactive Learning

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This study investigated the influence of physical and virtual learning spaces on interactive learning in a college and university setting. Qualitative analysis of an undergraduate liberal arts program that employs the use of roundtable classrooms was conducted. Interview and focus group data from students and faculty, along with classroom observations, resulted in the finding that the roundtable classroom encouraged interactive learning, face-to-face accountability, and verbal immediacy, along with a "cohort effect" and "fidget factor." Virtual learning spaces influenced interactive learning, and their effectiveness was heavily moderated by instructors and by the frequency and use of educational technology. Recommendations and suggestions for future research are provided.

Introduction

Reform the environment. Do not try to reform humanity. (Fuller, 1966, p. 70).

Half a century ago, design futurist Buckminster Fuller aptly described how the intentional design of an environment allows its users to be thoughtful and productive citizens of society. Learning spaces are environments in which users create meaning from the silent messages all around them. Orr (1993) posited that campus designs possess their own hidden curriculum and Edwards (2000) contended that university buildings are silent teachers on a college campus. Clearly, learning spaces communicate messages to their users.

As geographical locations designed to support, facilitate, stimulate, or enhance learning and teaching (*Journal of Learning Spaces*, 2011), learning spaces are found in classrooms, lecture halls, or common areas and are regularly blended with virtual learning spaces. With the recent and rapid changes in technology, teaching, learning, and classroom design, researchers and practitioners have begun addressing the need for learning spaces that intentionally promote interactive learning and student engagement.

Rands and Gansemer-Topf (2017) have called for research on how learning spaces can improve student engagement. Oblinger (2006) and Fisher and Newton (2014) suggested a reconceptualization of learning spaces that center on student needs and the student learning experience. Research on learning spaces and student engagement up to this point has been fairly limited and thus deserves further study.

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This study investigated the influence of learning spaces on interactive learning in the roundtable classroom and its surrounding learning spaces. In order to explore how learning spaces can promote interactive learning on modern college and university campuses today, this article will describe: 1) relevant literature about learning spaces and interactive learning, 2) the methodology used in this study, 3) results, and 4) discussion.

Interactive Learning

Social development theory (Vygotsky, 1978) posited that social interaction is necessary for cognitive development. As opposed to the transmissionist model, which places central emphasis on the instructor, self-authorship through social interaction empowers students to take charge of their own learning (Baxter-Magolda, 1999; Kegan, 1994; King, 2003). Claiming an internal locus of control allows students to engage actively in their own cognitive development. A shared connection, wherein a group of relative strangers perceive that they are in a supportive community atmosphere, can result in high levels of academic performance (Kuh, 2000; Kuh, Kinzie, Schuh, & Whitt, 2005) and student persistence (Tinto, 1997). Because social and interactive engagement is integral to cognitive development, the learning spaces that are most conducive to interactive learning should be investigated.

Learning Space Design and Interactive Learning

Active classroom designs that facilitate interaction between faculty and students have been successful in improving student learning outcomes (Cox, 2011). Experimental classroom designs that feature innovative use of furniture, such as swivel chairs and tables on gliders

(Rands & Gansemer-Topf, 2017), tablet desks on gliders (Henshaw & Reubens, 2014), and swivel seat desks (Henshaw, Edwards, & Bagley, 2011) have shown to increase classroom participation and engagement by allowing students to form small groups. McArthur (2015) found that classrooms featuring swivel chairs and tables on gliders, while heavily moderated by the instructor, substantially influence student learning. Author (2016) found that roundtable classrooms facilitate dialogue and community building among students.

Variations on Beichner's (2008) Student-Centered Active Learning Environment for Undergraduate Programs (SCALE-UP) classroom design, which features multiple round tables with chairs, no teaching podium, laptop connections at every seat, and projection screens at multiple points in the room, have shown successful results in faculty and student interaction and favorable student outcomes (Beichner, 2014; Brooks, 2012; Van Horne, Murniati, & Saichaie, 2012). The SCALE-UP classroom demonstrates not only the usefulness of the circular seating design as an alternative the traditional classroom where the front row engages more than anyone else (Park & Choi, 2014), but also the usefulness of educational technology when it is intentionally integrated into the classroom.

Jamieson and Fisher (2000) suggested that the upcoming generations of students will experience a campus through diverse virtual technologies and that planners and designers should reconsider learning spaces from both an on-campus and digital-campus perspective. Fisher, Gilding, Jamieson, Taylor, and Trevitt (2000) contended that the growing online teaching presence should prompt a thoughtful redesign of existing built environments along with judicious management of educational resources with evolving student learning needs in mind.

Harvey and Kenyon (2013) argued that learning space planning is central for the success of higher education institutions. Studies of new classroom designs are producing helpful evidence that intentionally designed learning spaces improve classroom participation and learning outcomes. To address the need for more research, this study sought to describe experiences in an active learning, roundtable classroom in order to determine whether students and/or faculty perceive that they are effective in promoting interactive learning.

Methodology

The next section of this article will address the methodology and tools for analysis of the roundtable classroom and surrounding spaces in an undergraduate liberal arts community. Specifically, this section will describe: 1) research questions, 2) the site and participants, 3) data collection and artifacts, and 4) analysis and coding.

In light of recent literature and current gaps in our understanding about the influence of learning spaces on interactive learning, this study asked the following research questions:

RQ1: In what ways do physical, built learning spaces influence interactive learning?

RQ2: In what ways do virtual learning spaces influence interactive learning?

The Site

The site for this study is an undergraduate liberal arts learning initiative designed to promote innovation and creativity at a large, public southeastern university. As part of the program, students complete two 100-level seminar foundation courses, then take 300-level thematic seminars, and complete their experience in the program with a 400-level capstone course. The capstone course integrates prior coursework into each student's development of an individual worldview.

At the time of the study, about 250 students were enrolled in the program. Fourteen instructors, called senior fellows, were teaching in the program. Teaching assistants, called junior fellows, who are graduates of the program, assisted in teaching and facilitating the classes. According to its promotional materials, the program provides the unique nature of a small liberal arts college within a major university. Learning outcomes of the program include: 1) developing intellectual breadth in the liberal arts, 2) critical reading and writing skills, 3) problem solving skills, research and analytical skills in the Arts and Sciences, 4) debate and discussion skills, and 5) a sense of community among freshmen who live together.

The Academic Buildings. The program offers exclusive use of two academic buildings, both of which are located on the central quadrangle of campus. Students may access these buildings at any time during the day or night. Both buildings house classrooms for upper-level seminars, common study spaces, a computer and printing lab, and office space for program faculty and administrators.

The Classrooms. The classrooms utilized for this study were roundtable classrooms, emphasizing face-to-face communication in small groups. The freshman seminar class took place in a large seminar room that consisted of multiple, semi-round tables connected into a full-circle in the middle of the room, surrounded by 15 to 20 standard chairs and windows on one side of the room. This freshman participants in this study, ten of them, met in the program's living-learning residence hall classroom (see Figure 1) on Tuesdays and Thursdays from 9:30 to 10:45 a.m.

Upper-level classes took place in one of the program's academic houses, located on the main quadrangle of campus. The 400-level senior capstone class utilized in this

study took place in a small seminar room (see Figure 2) on Tuesdays from 2:00 to 4:30 p.m. and was composed of eight students. The seminar room consisted of a large conference table in the middle of the room, surrounded by ten to 15 standard chairs, with a projector on the ceiling, and windows around the perimeter of the room.

***Figure 1*: Classroom in the program's residence hall**

***Figure 2:* Classroom in one of the program's academic buildings**

Participants

Freshmen and seniors enrolled in the liberal arts undergraduate initiative were the focus of this study. The 18 students interviewed for this study ranged in age from 18 to 22 years of age. Each student was currently enrolled as an undergraduate student in either the freshman seminar class or in the senior capstone seminar. Of the ten freshmen, seven of them were female and three were male. Of the eight students enrolled in the senior seminar class, all of them were seniors; four of them were female and four were male. Overall, 11 of the 18 students interviewed in this study were female (61%), and seven students were male (39%).

The students in this study came from a variety of backgrounds, though most grew up in southeastern states and described their socioeconomic backgrounds as middle class. Almost all of the participants were Caucasian; one student was African American. Among the 18 students participating in the study, 21 majors were represented.

The primary instructor who was observed during this study has an academic home in the History department and also serves as a senior teaching fellow in the program. An assistant instructor who was also observed during this study completed the program while he was an undergraduate student and later became an assistant instructor while enrolled in graduate school. The third instructor interviewed for this study has taught the freshman and senior seminar classes study in this program for over a decade.

All participants were provided with a description of the nature of the study and received a copy of an Institutional Research Board (IRB) information sheet, which they were asked to sign. They were informed that their identities would be protected and that all data would be used only for purposes of the project and destroyed after use.

Data Collection and Artifacts

Data was collected in the proposed site from both a freshman seminar course and a senior capstone course. Artifacts included interviews, focus groups, audio-recorded classroom observations, and reflection journals. Before the first classroom observation, photographs, sketches, and notes on the unoccupied physical space were also collected.

Interviews. Interviews with both faculty and students were based on participants' experience of the learning spaces, especially the instances of interactive learning and discussion that they observed and/or experienced there. Interviews included such questions as: How has the layout of this classroom (e.g., the desks, chairs, board, projector, lab computers, spatial orientation) influenced you/your students' ability to engage in interactive learning? How would you compare the use of technology (or lack thereof) in this program to other experiences you have had on campus? To gather information about how the classroom compared to other classrooms, they were asked what aspects of the classroom made it more enjoyable or less enjoyable than other classrooms they had experienced.

Classroom Observations. The first classroom observation took place during the fourth or fifth week of the semester and continued until near the end of the semester. Audio-

recorded footage was collected and later transcribed and analyzed.

Focus Groups. Students were invited to participate in a focus group that met in the classroom space. They met in groups of five to eight students at a time. During the focus group, students were asked about how the layout of the classroom influenced their ability to engage in interactive learning. Any necessary follow-up to these focus group discussions and/or member checking took place during the last two weeks of the semester.

Journals. During this study, students and instructors were asked to keep reflection journals, in which they described their experiences and reactions to learning spaces.

Analysis and Coding

Using Glaser and Strauss' (1967) grounded theory approach, this analysis coded for categories that emerged as relevant themes in reference to the research questions. Grounded theory refers to an inductive process of uncovering theories and central concepts that are grounded in the information provided by participants (Strauss & Corbin, 2008). As key concepts emerged from the data collected and analyzed during the study (Kvale & Brinkmann, 2015; Stake, 1995), participant perceptions of the learning spaces were assessed inductively. Following this grounded theoretical approach, and the methodological strategies of Charmaz (2014), initial coding strategies included word-by-word and line-by-line coding of each incident as it happened.

The use of this coding method sought patterns and themes that emerged from the interviews, focus groups, classroom observations, reflection journals, fieldnotes about the space itself, and audio recordings of classroom proceedings collected during the study. Analysis of these initial codes led to a systematic coding structure. Nvivo software was also utilized to create memos that summarized key themes into clusters. Clustering is a method of coding in which the researcher groups the emergent themes into meaningful categories and systems (Marshall & Rossman, 2015). Following Emerson, Fretz, and Shaw's (2011) instructions for writing ethnographic fieldnotes, the researcher in this study developed jottings into detailed notes of analysis, which were then open-coded, clustered, and thematized.

Results

Throughout the semester, the roundtable classroom provided opportunities for students to speak and interact with each other and with their instructor. Overall, both students and faculty provided evidence that the roundtable classroom provided more opportunities for interactive learning than do most traditional classrooms. This section presents the primary themes and findings from all relevant artifacts collected in the study.

The roundtable classroom promotes interactive learning through consistent face-to-face communication.

Both students and instructors in this study described how face-to-face communication is essential to interactive learning and that the desire for face-to-face communication is one of the features that attracted them to the program. They described how the roundtable discussions allowed them to achieve the eye contact, hand gestures, other forms of nonverbal communication that are necessary components of immediacy in the classroom.

Students described how the immediate sharing of feedback with classmates was a particularly interactive feature of the roundtable classroom. A senior in the program, who admitted he was woefully afraid of public speaking, described how the roundtable classroom allowed him to practice his speeches while sitting in the circle and to receive immediate feedback about his performance from his peers. A freshman in the program described how the roundtable classroom, which employed the use of peer writing circles, allowed her to receive immediate feedback about written essays from her peers. She stated,

> *We sit in the circular, round shape set up. We'll take our papers and pass them…to the left…and the person to the left will review the first paragraph. Then, the instructor says "pass." Then, the next person will review the second paragraph. You review paragraphs pretty much until it gets back to you. A new person in the circle reviews different paragraphs of your essay.*

Students described how sharing their work in this small circle of classmates allowed them to build confidence and to openly discuss their work so that they could make future positive changes. Giving and receiving this immediate feedback was described as a primary benefit of the roundtable classroom.

While several students reported that they enjoyed these active learning circles, others expressed how they sometimes wished to "melt away" or "fade away" into the background. One senior described how "there were times where it was just nice to be able to go and sit in the lecture halls and just let the professor do their thing." On more than one occasion, students were observed engaging in distracted behaviors such as doodling, sketching, or fidgeting (e.g., fidget spinners). Students who did very little of the talking in class were observed to fidget more than students who consistently did most of the talking in class. Fidgeting behavior was observed immediately following discussions

in which one person was dominating the discussion, or during discussions that had gone on longer than usual.

The roundtable classroom promotes interactive learning through a system of accountability.

In this study, students described how the roundtable classroom created a system of accountability where all students were expected to participate. All students were expected to be alert and have read the material for the day. When asked how the roundtable classroom format compares to other classrooms, a freshman described how the roundtable classroom is "a lot more beneficial. You may want to fade away into the background, but then you think about how much you're paying to go to college and how much of a waste it is to not be engaged." Another freshman reported that the roundtable classroom helped her to stay awake and that, "when you fall asleep, it's really embarrassing." Another freshman stated, "You can't fade in the background here…everyone is looking at you." This system of accountability occasionally resulted in the policing of classroom behavior. One freshman commented that she could detect when her classmates had not prepared for class, because they were not prepared to answer questions from the instructor. She observed, "[Kassie] does that. Whenever [the instructor] points her out, she is like, 'I'm trying to formulate my thoughts.' And I'm like, 'You didn't read that.'" Particularly during the freshmen year, students described how important it was to have read the material and to be alert and willing to answer or ask questions during class.

The roundtable classroom promotes interactive learning by allowing students to regulate the flow of classroom discussion.

Students described how, during classroom proceedings, they shared the floor and actively regulated the flow and turn-taking of classroom discussions. A senior described how the roundtable classroom facilitated an egalitarian exchange of information during classroom discourse. She stated, "Having a round table is a really good way to do a discussion that's not awkward, like, 'teacher-student-teacher-student.' It is more like, 'teacher-students-students-students-teacher.'" A freshman described how classroom discourse was regulated in this way: "The way we discuss with each other is…like, after 'the big question,' and then a story, then we all start talking to each other." She described how the real discussion got started after students decided on the direction they would like to go with the original question or idea.

Students reported that they saw their professor as a "shepherd" or "mediator" during classroom discussion, but that students clearly regulated most classroom discussions. One senior described how, "We get these profound lessons from our professors but as a whole, I think our peers' points of view and their experiences are usually more relevant." The teaching assistant, who stayed after class in the lobby for an hour each week, described "something important comes out of each classroom discussion" and that "everything that we talk about…extends outside of the classroom." He further reported that students regularly get together to "just sit and talk about Descartes" long after a class has adjourned.

Active learning classrooms were generally described as more conducive to interactive learning than traditional classrooms with desks in rows. The following table (see Table 1) displays student and faculty comparisons of traditional classrooms and the active learning classrooms.

	Traditional Classroom (desks in rows)	**Active Learning Classroom** (roundtable or other non-traditional)
Students	• Instructor-centered • Isolating • Restrictive • Intimidating	• Student-centered • Interactive • Engaging • Open
Faculty	• Instructor-centered • Efficient, if arranged properly	• Student-centered • Interactive • Conducive to learning • Useful for small group discussion

Table 1. **Student and Faculty Comparisons of Traditional and Active Learning Classrooms**

Transcripts of classroom proceedings corroborated much of what students and faculty shared in their journals and interviews. While they reported that many traditional classrooms were adaptable and did not impede their learning, most students described at least one traditional classroom in which they felt that their interactive learning was hindered by a lack of comfort and/or enjoyment.

Virtual learning spaces influence interactive learning and their effectiveness is heavily moderated by whether the frequency and use of educational technology.

Participants interviewed for this study described how virtual learning spaces, when designed and implemented thoughtfully, have had a mostly positive influence on their ability to engage in interactive learning. However, its

frequency and use strongly influences whether students will engage in interactive learning.

Each student in this study had taken a class in both a *technology light* classroom that employs minimal to no use of media platforms and in a *technology rich* classroom that employs the use of one or more media platforms and applications inside and/or outside of the physical, built classroom. Participants in the study reported a clear preference for technology light classrooms because they are more conducive to verbal immediacy, eye contact, hand gestures, and overall student engagement (see Table 1). A freshman described how students rarely checked their smart phones during class, but if someone did, everyone else in the room sighed with frustration. In her words, "your mind is here." Seniors in the program emphasized that smart phones hinder the discussion and that "we use our minds more than technology." Students described how meaningful discussions occur in technology light classrooms, and classroom observations testified to the interactive learning that occurs there.

In stark contrast, participants in this study described how technology rich classrooms offer very little opportunity for interaction. They reported that technology rich learning spaces, while useful for disseminating information and viewing slides in large lecture halls, tend to impede interactive discussion. They described how using educational technologies in the classroom has occasionally deterred their learning and social interaction with peers.

Virtual technology was generally described by both faculty and students as a distraction to small group discussion. The following table (see Table 2) displays student and faculty comparisons of technology light classrooms and technology rich classrooms in this study.

	Technology Light Classrooms (minimal use of media platforms)	**Technology Rich Classrooms** (frequent use of media platforms)
Students	• Assists interactive learning. • Effective for small group discussion, verbal immediacy. • Fewer distractions.	• Impedes interactive learning. • Effective for larger class lectures, when properly integrated. • Frustrating when misused.
Faculty	• Assists interactive learning. • Effective for small group discussion. • Fewer distractions.	• Impedes interactive learning. • Effective for larger class lectures, when properly adapted.

***Table 2*. Student and Faculty Comparisons of Technology Light and Technology Rich Classrooms**

Participants' descriptions of the distracting nature of technology supports the idea that students and faculty in this particular program do not believe that technology is necessary in order for them to engage in interactive learning. However, they noted that the 24-hour computing facilities provided by the program were essential and convenient for writing and printing papers.

Virtual learning spaces influence interactive learning and their effectiveness is heavily moderated by the instructor.

Faculty and students in this study described how using technology changes the level of interactive discussion in the learning space and therefore needs to be thoughtfully moderated by the instructor. This suggestion was corroborated during classroom observations. For example, during one classroom observation, a student spontaneously instigated the viewing of a short media clip on her laptop and her classmates remained thoughtfully engaged during the viewing and during a subsequent lively discussion of the clip. However, during a separate classroom observation, when the instructor instigated the viewing of a lengthy film on the projection screen, students disengaged by doodling, sketching, or fidgeting.

Students described, in particular, how more instruction and guidance on the use of technology in the classroom would help them to understand its role and purpose. For example, in-class use of technology for group use (e.g., screens or monitors to show slides, websites, or short film clips) or individual use (e.g., laptops, mobile devices) can promote student engagement when it is clearly integrated. Instructors can also help students utilize technology outside of classroom meeting times (e.g., course management systems, media platforms) by clearly explaining their function and use.

Discussion and Conclusions

The next section of this article includes a discussion of the findings about learning spaces and interactive learning in this undergraduate liberal arts community. In particular, this section includes: 1) a discussion of findings, 2) recommendations for policy and practice, and 3) limitations and suggestions for future research.

Discussion of Findings

Research Question One: Influence of Physical Learning Spaces on Interactive Learning

RQ1 asked in what ways physical, built learning spaces influence interactive learning. Designed to support, facilitate, stimulate, or enhance learning and teaching,

physical learning spaces can be formal (e.g., classrooms, offices) or informal (e.g., hallways, common areas, residential study areas) (*Journal of Learning Spaces*, 2011). Psychologist Lev Vygotsky's (1978) concept of social development and interactive learning guided the investigation of this research question.

The primary finding in this study is that the physical learning spaces have a positive influence on interactive learning, as described by both students and instructors. Participants reported that the roundtable classrooms and the informal gathering areas not only promoted face-to-face social interaction and student accountability, the learning spaces also facilitated students' ability to regulate the flow of classroom proceedings and small group discussions. Participants described how face-to-face communication (e.g., eye contact, hand gestures) and verbal immediacy (e.g., vocal volume, use of pause, invitation to interaction) is essential during social interaction and that the desire for it attracted them to the program's roundtable seminars. Immediacy, heavily moderated by the instructor, has the potential to improve cognitive and affective learning for students (Frymier, 1994; LeFebvre and Allen, 2014). Face-to-face communication allows students to interact more in the classroom, to enjoy the experience, and thus to learn more. Students and faculty described how the roundtable classroom in this study certainly qualified as an active learning classroom and its surrounding spaces were sites for social engagement as well.

What was surprising about the findings in this study is that the learning spaces promoted enough social interaction to produce a cohort effect and a "fidget factor" among the students. Do and Schallert (2004) found that students who take several courses together quickly form habitual ways of responding to one another during the first few weeks of class, producing a "cohort effect" (p. 626) of predictable behavior among their peers. This effect was observed during classroom proceedings, which were typically lively with some students consistently talking more than others. These lively discussions among the cohort sometimes produced a "fidget factor," wherein some students were observed using fidget spinners, doodling, drawing, and sketching during class. Students who did very little of the talking in class were observed to fidget more than others and they reported that facing the same people every day was difficult and sometimes made them want to hide or fade away. Do and Schallert (2004) found that students disengage in classroom discussion in order to protect themselves from the frustration and boredom they sometimes experience while speaking and/or listening to others in the classroom. Carver and Scheier (1999) described how students periodically tune out in order to regain the emotional energy to rejoin a discussion.

Anthropologist Francis Galton (1885) contended that all humans occasionally experience the need to fidget when bored and Psychologist Théodule-Armand Ribot (1890) claimed that humans fidget in order to maintain an appropriate state of attentive consciousness. Tuning out by doodling, fidgeting, or sketching may help students to stay alert, and to reconcile any negative emotional triggers before then tuning back in to the conversation. Future research should explore students' and instructors' perceptions about why students tune out of discussion and whether or not the desire to disengage is unique to the learning spaces in this study. Future research should also investigate learning spaces located in other majors and disciplines in order to confirm or disconfirm whether the influence of physical learning spaces on interactive learning in this study was unique to its cohort of participants.

This study supports past findings that the circular classroom design is conducive to interactive learning. Variations on Beichner's (2008) SCALE-UP classroom design, for example, have been successful in generating desired student outcomes (Van Horne, et al., 2012; Brooks, 2012) that are not likely to occur when the teacher only interacts with the first few rows of students (Park & Choi, 2014). Classroom designs that allow rearrangement of classroom furniture into a circle has shown to enhance several desired student outcomes (Rands & Gansemer-Topf, 2017; Parsons, 2016; McArthur, 2015; Henshaw & Reubens, 2014; Henshaw, Edwards, & Bagley, 2011). Clearly, learning spaces that allow small group discussion circles hold tremendous potential to promote desired student outcomes and thus needs to be explored more in the future.

Research Question Two: Influence of Virtual Learning Spaces on Interactive Learning

RQ2 asked in what ways virtual learning spaces influence interactive learning. Designed to support, facilitate, stimulate, or enhance learning and teaching, virtual learning spaces include all forms of technology (e.g., learning management systems, online virtual environments) used in a learning space (*Journal of Learning Spaces*, 2011). Vygotsky's (1978) theory of social development and interactive learning guided the investigation of this research question.

The primary finding in this study is that virtual learning spaces influence interactive learning and their effectiveness is heavily moderated by whether they are technology rich or technology light. For instance, students reported that "there is no need for technology" in the roundtable classroom where eye contact and hand gestures are essential for communication. However, they described how technology rich learning spaces, while not conducive to group discussion, can be useful for large lecture halls and dissemination of information. In light of the favorable

student outcomes that classrooms such as Beichner's (2008) SCALE-UP have produced (Van Horne, et al., 2012; Brooks, 2012), future studies should investigate the best practices for promoting interactive learning in classrooms that blend physical and virtual learning spaces. Because the site utilized in this study relied very little on technology, future research should also investigate virtual learning spaces located in other disciplines along with other class sizes in order to confirm or disconfirm the idea that virtual learning spaces can influence interactive learning. Future research on the best uses and applications of instructional technology (e.g., laptops, mobile devices, clickers, PowerPoint) would also help to further understand the best practices for promoting interactive learning in classrooms that blend physical and virtual learning spaces.

This study also found overwhelming support for the idea that virtual learning spaces influence interactive learning, and that their effectiveness is heavily moderated by the instructor. Findings suggested that using technology in the classroom can cause distractions and deter student interaction, especially when the role and purpose of instructional technology has not been clearly communicated by the instructor. Past studies have shown that technology can limit interaction in the classroom (Kolleny, 2003; Okojie & Olinzock, 2006; Venezky, 2004; Jamieson, 2003) and that the use of mobile devices in the classroom has potentially damaging effects on student achievement (Kuznekoff & Titsworth, 2013; Kraushaar & Novak, 2010; Wei, Wang, & Klausner, 2012). However, a skillful instructor who effectively integrates technology into the classroom can achieve just as much interaction as that of a traditional classroom. Bitner and Bitner (2002) wrote that "an often-overlooked but crucial determinant of whether technology succeeds or fails in the classroom is a less than obvious one…the teacher" (p. 95). The way that an instructor uses transitions to move between instructional modes helps students to understand the purpose and use of technology in the classroom (Arlin, 1979). By using thoughtful transitions between face-to-face discussion and the group viewing of a screen, for instance, an instructor allows students to adjust their attention spans appropriately. Future research on the best practices for transitioning between instructional modes during classroom proceedings in an era of educational technology be helpful.

Recommendations for Policy and Practice

Learning spaces that are intentionally designed promote interactive engagement, creativity, social interaction, and thoughtful innovation between faculty and students. To make informed decisions about future classroom design, administrators should seek feedback from user councils composed of other administrators, industry professionals, custodial staff, instructors, and students, to generate ideas about users' experience of a space (McArthur, 2011). The flexibility and fluidity of a built environment holds tremendous potential to promote student interaction and engagement (Monahan, 2002). In order to promote interactive learning in a physical, built learning space:

- Materials necessary for interaction (e.g., whiteboards) should be easy to find and use.
- Furniture should be adaptable to rearrangement.
- Formal learning spaces should be close to informal ones (e.g., lobbies, faculty offices, study rooms).
- Various disciplines and majors should be assigned to the same physical space.
- Instructors should intentionally design and explain their chosen modes of instruction (e.g., lecture, small group discussion, screen use) within a learning space.
- User councils should receive training on active learning strategies before making decisions regarding classroom design.
- User councils should regularly conduct space audits and implement changes accordingly.

To promote interactive learning in virtual learning spaces:

- Laptops, screens, and monitors should be adaptable to rearrangement.
- Digital materials necessary for interaction (e.g., computer software, wireless access) should be easy to find and use.
- Instructors should thoughtfully integrate educational technologies (e.g., laptops, screens, monitors, learning management systems, online virtual environments).
- User councils should receive training on educational technologies and active learning strategies before making decisions regarding virtual learning spaces.
- User councils should conduct strategic virtual space audits and implement changes accordingly.
- User councils should respond to student and faculty needs for technology support.

Revisions to a traditional classroom need not consist of a complete overhaul of the room. Lee and Tan (2013) have suggested that, because of the substantial cost and risk associated with redesigning classrooms, evidence and stakeholder input is necessary before making changes. User councils can suggest inexpensive, thoughtful adaptations that will improve the quality of each classroom on an annual basis. Simple changes such as replacing older chairs, replacing light fixtures, removing naps or snags in the carpet, repairing thermostats, removing clutter, and buffering noise distractions with acoustic pads can greatly improve the comfort and enjoyment of a classroom. Exemplary instructors who regularly use the classrooms and learning spaces in a building are a valuable asset and should be consulted by user councils.

Limitations and Suggestions for Future Research

A potential limitation of this study lies within its generalizability and reliability. This study focused on one learning community, limiting access to a broader representation of undergraduate student participants. Students in this program selected to participate in it, and its demographic composition may not represent the entire student body. Future research could survey and/or interview a larger sample of students and faculty at a variety of other institutions or among a wider variety of living-learning communities, residence halls, and classrooms.

A second potential limitation of this study was that data were collected during only one semester with two particular sets of students at one particular university. The same study conducted at a different time of year, at a different hour during the same semester, or at different institutions may yield richer data in the future. Longitudinal analysis of the space would also be useful in confirming or contradicting the patterns that were identified in this particular study.

Concluding Remarks

While this study emphasized the influence that a roundtable classroom can have on student learning, visualizing what the active learning classroom looks like in other learning spaces will require more extensive research and testing. Future experimentation will help to identify which types of active learning classrooms are most effective.

Diane Oblinger and others have called for more active and participatory learning spaces that focus squarely on learner needs. To echo the words of Buckminster Fuller, if we reform the environment, we improve students' ability to be thoughtful, productive, and engaged in interactive learning.

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