

Effects of Studio Space on Teaching and Learning: Preliminary Findings from Two Case Studies

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Abstract Recognizing that traditional classrooms do not facilitate active learning, colleges and universities are increasingly converting traditional classroom space into studio space. Research indicates positive effects on student learning when studio classroom space is combined with active learning pedagogy, but the research does not separate the effect of the space from the effect of the pedagogy or address the effect of the space on teaching. The case studies described in this article suggest that studio space can launch teachers into active learning pedagogy and can increase the positive effects of that pedagogy on learning. Teachers and students perceived direct effects of the space itself.

Key words classroom space · active learning · pedagogy · facilities

Mention of a college classroom may conjure up images of students sitting in rows of immovable desks or in a lecture hall, taking notes as a teacher talks behind a podium at the front of the room. Colleges and universities are now recognizing that these traditional classrooms do not facilitate active learning (Jamieson 2003). Active learning is widely understood as an effective pedagogy because it improves problem-solving, collaboration, and communication abilities as well as motivation to learn. Increasingly, colleges and universities are converting traditional classroom space into studio space that is designed to facilitate active learning pedagogies (Dittoe and Porter 2007).

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Studio Space and This Study

Studio classroom spaces are characterized by a combination of moveable furniture, tables that group students into learning teams, a centrally located or moveable teacher's station that does not create a "front" of the room, wireless laptops and computer projection, and wall spaces for writing or posting ideas. The goal is to create flexible spaces to support a flexible pedagogy (Ditoe and Porter 2007; Jamieson 2003; Monahan 2002). These spaces are typically used almost exclusively by science, math, and engineering courses.

The Studio Physics classrooms at Rensselaer Polytechnic Institute and the Student-Centered Activities for Large-Enrollment Undergraduate Programs (SCALE-UP) classrooms at North Carolina State University were some of the first innovative studio spaces. The SCALE-UP classrooms were designed to bring active learning pedagogy to large-enrollment classes by breaking classes into smaller groups around tables (Beichner 1999). Students in classes held in the SCALE-UP classrooms engage in collaborative problem-solving exercises facilitated by a computer-rich environment, whiteboards on the walls, and roaming instructors. Other institutions have adapted the studio classroom model to their purposes. For example, the Technology-Enabled Active Learning (TEAL) classrooms at the Massachusetts Institute of Technology (MIT) were designed to support the learning of physics by incorporating technology that enables interactive visualization of concepts. Grouped around tables that seat nine, students in TEAL classrooms experience a mix of lecture, individualized guidance from a faculty member and teaching assistants, table-top laboratory experiments, collaborative problem-solving activities, and interactive visualization or modeling on their laptops (Dori 2004). Similar flexible classroom space is now incorporated into MIT's new Stata Center, along with common spaces designed to encourage interdisciplinary chance meetings and collaborations of students and faculty outside of the classroom. A review of the *Special Report on Campus Architecture* appearing in the Chronicle of Higher Education (2006) indicates that the studio concept of common spaces is increasingly being incorporated into new academic buildings, including the Ford Motor Company Engineering Design Center at Northwestern University and the James H. Clark Center at Stanford University.

Research, primarily focused on learning in science, math, and engineering, indicates positive effects on student learning when studio classroom space like SCALE-UP and TEAL is combined with active learning pedagogy. Students in what I will call "studio classes," or classes held in studio space, seem to absorb the technical concepts more ably in that they create more complex schemas of their knowledge than do counterparts in classes held in non-studio spaces (Barak 2004; Beichner et al. 1999; Dori 2004). Students make gains in problem-solving abilities (Beichner et al. 1999), and they develop abilities to represent their knowledge in multiple ways and provide more in-depth answers (Barak 2004). Students' attitudes and interest in the subject matter also improve (Foulds et al. 2003). Barak (2004) suggested that these learning gains derive from students' engagement, within the studio classroom setting, in hands-on problem-solving and extensive interaction among students and between students and faculty. Learning, in these settings, is social.

Even as the effects of studio classes become more recognized and the spaces become more common, questions remain. First, the existing research does not separate the effect of the space from the effect of the active learning pedagogy that is an integral part of classes in models such as SCALE-UP and TEAL. Research has shown that active learning pedagogy alone produces improved learning gains (Dori 2004). To what extent, however, does the use of studio space increase or decrease the improvements? It seems reasonable to speculate that the space itself would have an effect. According to the theory of architectural

probabilism, space affects behavior by making some behaviors more likely than others (Strange and Banning 2001). Anecdotal evidence suggests that comfortable surroundings can encourage learning behaviors (Bartlett 2003). Learning theory indicates that the greatest learning occurs in unfamiliar settings because learners confronting the unfamiliar tend to question assumptions and develop new questions (Dilworth 2004). Studio spaces are still unfamiliar territory for many students, and the flexibility of the space means that it can be frequently reconfigured to create new learning settings even when the students have learned in studio spaces in the past. But while these theories and anecdotes point towards an effect of studio spaces, we have little data on how students and faculty actually perceive and interact within studio classroom spaces. Investigating students' and faculty members' perceptions and actions can help us begin to understand the importance of the space itself.

Second, most research has focused on effects on learning. What are the effects of studio space on teaching? Research indicates that teachers tend to reconfigure their classroom space, when possible, to meet their needs and pedagogical styles (Lackney and Jacobs 2006). When teachers have more options for ways to configure a classroom space, how is their pedagogy affected? Perhaps most importantly, if a faculty member does not intend to use active learning pedagogy in a class that meets in a studio space, does the space encourage the adoption of such an approach? If studio spaces become common in colleges, universities, and even grade schools, they are likely to be used by faculty who already believe in and use active learning pedagogies as well as those who do not. It is important to determine whether the space itself can prompt changes in the faculty's pedagogy.

This study begins to answer these questions by examining two science classes taught in a new studio space (called here "the Studio") at a mid-sized land-grant university. The Studio features light-weight, moveable tables and chairs, interactive and traditional whiteboards, tackboards, a muted blue and green color scheme (unlike any other spaces in its building), and corporate-like quality of furnishings and construction (such as the use of non-cinder-block walls). The classes studied provided ideal settings for investigation for two reasons. First, the two faculty members, neither of whom had taught in the Studio before, brought different pedagogical approaches, allowing study of the effect of the space on multiple ways of teaching and learning. Second, both of the classes were "introduction to the major" courses designed to engage students in building conceptual and professional knowledge rather than specific content knowledge, allowing study of perceptions of the effect of the space on learning of the sort that is supposed to be facilitated by studio-based classes.

Methodology

This study focused on two science classes taught during the same semester in the Studio. Each semester a call for proposals to teach in the Studio is issued. In the semester when this study was conducted, seven classes met in the Studio. Two of these classes were selected at random from among the classes not taught by English faculty. (English classes were excluded because English faculty operate the Studio and study its effects; therefore, they do not represent typical users of the space.)

The two classes selected were Astronomy 105 (Physics of the Universe) and Genetics 805 (Issues in Research). Both classes were "introduction to the major" courses designed to engage students in building abilities that will be needed during their degree programs. The astronomy course, intended for freshman entering the physics major, focused on building problem-solving, conceptual skills. Twenty-five students were enrolled in the class. The

genetics course, intended for new graduate students entering the genetics and biochemistry program, focused on developing communication, ethics, and professional skills. Nine students were enrolled. Both classes held all class meetings in the Studio. The undergraduate astronomy course met twice each week and the graduate course met once each week. Given the clear difference between the first-year undergraduate and graduate levels, it is important to note that this study does not purport to compare the two classes. Rather, it presents the two classes as case studies that illuminate ways that the studio space affects the teaching and learning of classes of various kinds.

Neither of the faculty members had taught in the Studio before. Both are tenure-line faculty who have participated in University initiatives designed to help faculty integrate humanities training into their courses (ethics in the case of the genetics professor and writing in the case of the astronomy professor). Here, the genetics professor will be called Jenny, and the astronomy professor will be called Jim.

I interviewed each faculty member four times and surveyed each class four times as well. Prior to the beginning of the semester, I interviewed each faculty member about his or her expectations about teaching in the Studio. I interviewed them again each month during the semester, including a final interview after the end of the semester. In each interview I collected information about the faculty members' uses of the Studio and their impressions of the effect of the space. In total, I collected and transcribed about five-and-a-half hours of taped interviews.

The four student surveys were also evenly spaced during the semester, beginning with a survey during the first week of class and ending with a survey during the last week of class. Each student survey included some general questions seeking overall impressions as well as some specific questions about uses and effects of particular features of the Studio. These specific questions changed from survey to survey during the semester. In total, I collected 125 surveys. All faculty and students involved in the study signed consent forms, and all human subject guidelines were followed. This study had been approved by the institution's human subjects review board.

Effects of Studio Space on Teaching

Jenny and Jim brought substantially different approaches and expectations to their teaching experience in the Studio. Like most subjects of research on the effects of studio space, Jim aspired to use active learning. He applied to teach in the Studio because he felt the space would facilitate the change in his teaching. Jenny, on the other hand, did not aspire to use active learning and applied to teach in the Studio simply because she felt it would be "convenient" based on its location and available technology. Importantly, both faculty members adopted active learning pedagogy once they began teaching in the Studio, although the degree of adoption differed.

Jim: The Eager Experimenter

Before the semester began, Jim expected to modify his teaching of the astronomy class so that it would become more collaborative. He planned to encourage student-to-student communication, especially active problem-solving in teams. He felt that the Studio is conducive to collaborative work due to its moveable furniture, "aura" of openness, and (for the faculty member) ease of walking among the students. However, Jim was apprehensive about using collaborative, active learning because his past attempts had resulted in resistant

students and negative course evaluations which had been noted at the dean's level during performance reviews.

Once he began teaching in the Studio, Jim found that “the Studio changes my teaching style.” Whereas the traditional classroom “puts faculty into focus,” he said, “in the Studio, we are not the center.” When lecturing in traditional classroom spaces, Jim typically used PowerPoint presentations, delivering them non-stop from beginning to end. Jim realized that he could not lecture effectively in the Studio for an entire class period due to the de-centering effect of the space. When he tried to lecture in the Studio, he found that students asked more questions than usual, thus breaking up the lecture, lengthening the amount of class time needed for explanation of a concept and often re-directing the discussion to a different topic. During lecture and discussion, Jim began using the interactive whiteboard, which projects a computer image and allows the user to “write” digitally on the image, to further encourage his students' desire for active learning. He displayed astronomical images on the whiteboard and then annotated them based on lecture points or on issues brought up by students through questions. In other words, even Jim's lecture became fluid and interactive, rather than “canned” as he described the PowerPoint presentations he had used previously.

The majority of class time, however, was spent in collaborative, problem-solving activities. Importantly, Jim said that these activities were “not just group work but *collaboration*,” which meant to him that the tasks were meaningful and that the students actually thought together rather than simply talking together while completing a task. The Studio, Jim said, “forced me to change how I teach.” He found that he planned for class differently:

Before, I'd spend a lot of time preparing lectures. Now, it's just different. What problems do you want them to do? What cases do you want them to research? How do you want them to interact? It changes the way you teach.

Jim was asking different questions while planning his classes. When asked to pinpoint the reason for this change, Jim explained that “the seating and furniture drive everything.” When he saw a room full of students sitting in rolling chairs, clustered at small rolling tables, Jim saw the possibilities for student-to-student interaction and student movement during class. He also wanted to move among the students himself because the room does not offer a “front” for the teacher; in fact, its elongated shape encourages the teacher to position himself in the center of the space rather than at one end. During the middle of the semester, Jim even decided that he was circulating too much during class. He felt he was distracting the students from their collaborative work and actually “impeding progress.” He “felt guilty, but went back and sat down” at his table. As a result of the intense and productive student-to-student communication during the class, Jim says that there may have been less teacher-to-student communication in the studio-based class than in a regular class; but he felt the teacher-to-student communication during his roaming from team to team was more effective than the usual lecture and occasional answer to a question.

Jim had hoped the Studio space would allow him to make these sorts of changes in his teaching. Other changes, though, were unexpected. Jim began to develop new teaching techniques driven by the Studio space. For example, he saw a poster about visual rhetoric on the tackboards in the Studio and altered his lesson somewhat that day in order to talk with his students about data graphics and ask them to read the poster that explained strategies for visual design. He also decided “I'm going to experiment” with collaborative writing, even though “I know nothing about it.” He assigned student teams to write a brief pro or con argument about an astronomy issue, then print their arguments on the Studio

printer. Pro teams exchanged papers with con teams and offered feedback. The teams then revised their arguments based on their peers' responses. This activity took about 45 minutes following about 30 minutes of lecture and discussion of relevant astronomy issues. After trying the activity once, Jim began incorporating it into more and more classes. "I've really enjoyed," he said, "seeing them learn in front of me and develop new ideas." Jim felt this activity "could not be done in a traditional classroom" because traditional rooms are too rigid, do not facilitate printing, and do not allow the students to "gather round" into tight teams for collaboration.

Jim developed so many new teaching ideas during his semester in the Studio that he said "it was overwhelming." Although he wanted to enact all of the plans, he was not able to find time to have his students write astrophysics haiku and take accompanying digital photographs that would be posted on the Studio tackboards, for example. He also wanted to have his students use the mindmapping software in the Studio to create maps of concepts learned in class. Jim signed up to teach in the Studio in the following semester and hoped to implement more new techniques.

Jenny: The Surprise Adopter

Jenny did not expect to use active learning pedagogy in the Studio. Instead, she expected that the space would facilitate her top-down teaching style. She planned to critique student work in front of the class (at the interactive whiteboard), thus allowing "all students to benefit from what I say to the other students." She would help the students learn to "identify what is right or wrong" about research posters, for example.

Once she started teaching in the Studio, however, Jenny's approach began to change. Whereas she used to stand at the front of her class in a conference room, now she sat with them at a group of tables clustered around the interactive whiteboard. She became "part of the table" and found that "I don't have to stand up all the time." She described the change in this way:

It's less of me talking to them and more of me talking *with* them. Usually, when I'm teaching, I'm talking at the board, and it's like I'm far away. But here it's much more like people sitting in a room talking than standing on high pontificating to the masses. It's much more like talking than lecturing. I just don't know of another way to describe it.

Jenny is explaining a substantial shift from a top-down pedagogical approach to a more egalitarian approach. While her class may not have become fully student-centered, it nevertheless moved strongly in that direction. For example, much of the class time was spent in discussions during which Jenny "sat down in the circle with the students" and asked them for their comments on issues or fellow students' work. In an interview during the middle of the semester, Jenny said "A student would say something, and I'd say 'I agree' or 'I hadn't thought of that,' and then I'd ask another student for response." This comment indicated that, during the middle of the semester, Jenny still controlled the flow of activities and the discussions revolved around her input, even though she was now encouraging the students to become more involved in discussion and feedback.

Later in the semester, however, Jenny began talking about feedback "as a class," referring to a shift in control of feedback from her to the class of students as a whole. She repeatedly emphasized in interviews that she was surprised by how students would "go back and forth" during discussion. The students were beginning to respond to each others' comments without Jenny's intervention, a phenomenon that Jenny attributed to the round,

clustered tables that “let them see each other and feel close together.” She also found that “we transition right into discussion” from her lectures “because we’re already in a circle.” She indicated that the students began taking some control of the discussion, pointing to words or images on the interactive whiteboard and even operating it at times. Jenny praised this shift towards active learning and equality because it mirrored the professionalization that the course is supposed to develop in students. “We’re coming to the same level,” she said, both literally (in the seating arrangement) and figuratively (in the students’ entry into the profession as graduate students).

By the end of the semester, Jenny was focused on teaching in order to “get at the better answers as opposed to the worse answers, not the right answer,” which stands in sharp contrast to her comments before the beginning of the semester in the Studio. Jenny felt the Studio was responsible for this change in her pedagogical approach, saying “this is not the kind of thing that lends itself well to a classroom because it’s much better done in a circle.” She also indicated that she began to enjoy teaching more, feeling more relaxed and having “more fun.”

Like Jim, Jenny developed more ideas for new teaching approaches than she was able to carry out during her first semester in the Studio; and, also like Jim, she wants to return to the Studio the next time she teaches the class. Next time, she hopes to have students revise a research paper together using the interactive whiteboard. She also wants to bring pieces of a poster (title, various sections, images, and so forth) to class and have students “actually make a poster together by rearranging the parts on the tackboard and talking about the position and placement of the parts.”

Jenny’s story, then, is different from Jim’s but reflects the same trend. Both teachers found the Studio generative of ideas for active learning activities. Both found themselves incorporating more active learning techniques than expected. Most importantly, however, Jenny’s experience indicates that even teachers who are not inclined towards active learning pedagogy can be enticed by studio space to incorporate such pedagogy into their classes.

Effect of Studio Space on Learning

Like most teachers in Studio spaces, Jim and Jenny incorporated active pedagogies that are known to improve learning. One purpose of this study was to attempt to separate the effect of the Studio space on learning from the effect of the pedagogies. To this end, students were asked to provide their impressions of the effects of the space. It is important to note that the data reflects student perceptions, not external assessment of learning. Nevertheless, the students’ responses indicate that they felt that the less structured environment provided by the space itself had positive effects on their learning. In addition, their teachers were asked to comment on their perceptions of changes in the students’ learning, as well.

Effects on Knowledge Gains

In the undergraduate astronomy class, 68% of the 25 students felt the Studio had a direct, positive effect on their knowledge gains. Twenty-four percent felt the Studio had no effect; and 8 percent, or two students, felt it had a negative effect due to distractions. Students who felt the Studio had a positive effect said they learned more from the collaborative activities than from a traditional class. However, rather than indicating simply that the active pedagogy improved their learning, the students also indicated that the Studio space itself impacted the knowledge they gained from collaborative activities. For example, they cited

the ease of forming and reforming groups. “We can get people from other tables to join us to explain things,” one student said. Another student commented, “it’s an open environment where we can move chairs around to talk and work with classmates to understand.” They noted that the round tables create better discussion and “seem more collaborative” because “you can look at people and their work easier.” Several students mentioned that they can “get more done” due to the logistics of the space and the “fluid structure” that “does not limit to working with one table.” These comments indicate that simply facilitating collaboration with moveable furniture and plenty of space allows students to take better advantage of collaborative opportunities to increase their learning. Whereas most collaborative exercises in classes, even active learning classes, involve students in working within unchanging teams, the students in the Studio remixed teams to accumulate the expertise and approaches they needed. These students were using more complex strategies of collaboration than we normally see even in active learning environments. The remixing of teams exposes students to more ways of thinking and solving problems and thus improves their learning experience.

Many of the undergraduate students also identified the “more relaxed environment” of the Studio as helpful in facilitating learning. Being comfortable, students said, “makes it easier to learn” and “allows me to think.” Another student said, “because I feel better about my surroundings, I learn better.” Many students mentioned that the class felt like “an after-class study group” with the “freedom to talk freely and move around.” One student put it most succinctly: “I come to class.” Quite simply, meeting in the Studio seemed to help the undergraduate students engage in the course material.

The graduate students also reported positive effects of the Studio on learning. In fact, all nine of the students responded that the Studio had a direct, positive effect. For these students, the effects were largely due to the interactive whiteboard technology that provides an “easy and fun way to present information” and “eliminates common problems with visibility and volume.” Students said they could follow the teacher’s lectures more easily because of the quality of the technology and because they were sitting closer to the teacher and the screen. Some of the graduate students also mentioned the “relaxed,” “comfortable” atmosphere as an aid to learning. They noted that the space “breaks the barrier of ‘teacher in front, students listen,’” which improves communication with the teacher and thus improves learning.

Jenny was also convinced that the Studio caused positive learning effects. “They’re learning differently, more intensely,” she said. Jenny also noted that students tended to pick up on even small points brought up in class and use them again in later classes or even outside of class, a phenomenon that she found positive and unusual. She attributed the changes directly to the “shape of the table and the fact that we’re all so close to each other and to the interactive whiteboard.” These features of the Studio meant that the students “have to interact and can’t hide.” In other words, the physical features of the Studio, according to Jenny, led to greater engagement in the course and thus improved learning. As learning became more social, it was enhanced.

Effects on Communication

A crucial element of learning in an active learning class is communication—both between teacher and students and among students themselves. The students in the undergraduate class were evenly split on the question of whether they communicated more or about the same amount with the teacher in the studio-based class as in a traditional class. Those who indicated that they communicated more with the teacher said the environment made them

“more comfortable asking questions” and caused the teacher to “wander around and be involved, not just a figurehead at the front.” Jim felt that the students asked more questions because he was better able to respond to their questions “on the fly” due to the interactive whiteboard technology and his “wandering” around the room. The result, Jim said, was “pretty interesting little tangents” that taught the students information they would not otherwise have gained from the class and that engaged their attention. Students who indicated that the communication level was similar said that their teachers also move around the room in other classes.

About three-quarters of the undergraduates felt they communicated more with their fellow students in the studio-based class than in traditional classes, and they attributed the difference to the Studio environment. In particular, they noted that communication was improved by “getting closer around tables” rather than sitting at separate desks, being able to “move around more,” and being able to “manipulate the space.” Jim noticed that his students communicated with each other more during class and that they were also becoming a cohesive unit outside of class at physics student events, which he said had not happened with previous first-year classes. At one point, he realized from reading students’ journals that students had been peer-reviewing each others’ work during group sessions in the Studio, even though this activity had not been assigned, reinforcing his view that the Studio space causes students to “naturally work together.” Jim noted that the collaborative interactions in the Studio were more focused than those in other classes he had taught and that, whereas students sometimes worked alone even during announced collaborative activities in other classes, “this never happened in the Studio.”

The graduate students mentioned many of the same ideas, noting that they talked more with their teacher because “she sits at the same height with everyone facing each other” and more with their fellow students because of the “arrangement of tables and chairs” in a tight group. About half of the graduate students felt that they communicated more with their teacher and fellow students in the Studio. Many of the students in the graduate class speak English as a second language, and these students in particular seemed to feel that the Studio was a more forgiving environment for communicating. The other half of the students felt their in-class communication is never affected by the room in which the class is held, making statements such as “if I have something to say, I say it” and “I am here to work during class” that reflect a diligence perhaps tied to their role as graduate students.

Jenny noticed a difference in communication in her class, saying that the tight circular grouping of students “forced some of them to participate more than they would have” because they could see others’ faces and felt a part of a group. The students who felt an effect emphasized the “less serious” atmosphere that “seems open to what I feel” and gives students “more chances to connect to each other.” Jenny noted that the students developed more camaraderie than usual, “interacting with each other before class” and even talking with her between classes about conversations they had with other students about course material. “They are not islands,” she said, “whereas they always used to be separate islands in class.”

Effects on Enjoyment

Enjoyment of learning can improve learning because it improves motivation and engagement. Nearly all of the undergraduate students said the Studio had a direct, positive effect on their enjoyment of the astronomy class. The most common reason for the positive effect was the physical comfort of the space and the less restrictive atmosphere. Students described the Studio as “grown-up,” “cool,” “good natured,” and “a much-needed change.”

Those who did not feel the Studio had a positive effect on enjoyment said that they actually felt uncomfortable in the non-traditional space. One student indicated that he or she “would prefer the room to look the same from day to day,” and another student said that “it bothers me a little that there is no front of the room and the Studio is not set up for lecture.” Interestingly, then, even the students who did not enjoy the Studio were reacting to its flexibility and student-centered design.

Jim noticed that his students were enjoying his class. He overheard a student telling another student that one of the collaborative problem-solving activities “was really fun” and that the student “couldn’t wait until the next one.” Jim said he had never heard a student say that before about one of his classes, and he said, “I think the Studio is responsible for that” because of the “environment and furniture and layout.” He noted that the students “enjoy learning from each other.” This enjoyment helped them engage with the course material and encouraged Jim to continue to invent new active learning approaches that would maintain the positive spirit.

The graduate students had similar responses, with about two-thirds indicating that the Studio caused them to enjoy class more and about one-third indicating that they were not affected by the space. (For example, one student said that “the space doesn’t affect how much I enjoy the course *material*.”) Those who reported a positive effect reacted mainly to the atmosphere, describing the space as “relaxed and convivial,” “comfortable and inviting,” “less boring,” and “more like a living room than a classroom.” They even noted the “soothing” colors. Overall, the graduate students connected these enjoyable aspects of the Studio to improved communication, saying that they “felt free” to talk with both the teacher and their classmates.

Conclusion

These case studies suggest that studio space can launch teachers into active learning pedagogy and can increase that pedagogy’s positive effects on learning. The teachers and most of the students in this study perceived a direct effect of the space itself, rather than simply an effect of the pedagogical approaches. They tended to enjoy the class more than usual, and the teachers were inspired to create new active pedagogical approaches. Student-to-student communication tended to increase significantly, and the teachers believed their students learned more as a result. These differences were widely attributed, by students and teachers, to the flexibility and comfort of the Studio space.

More research is needed to verify these results on a larger scale. In particular, controlled studies could be conducted to confirm effects of space on learning. For example, how does the remixing of teams, and the resulting complexity and fluidity of collaborative work, contribute to learning? Are student engagement and attendance actually better in the studio environment? How does a more social approach to teaching and learning affect knowledge gains? And, importantly, how can teachers best address the concerns of the minority of students who find the less structured studio classroom disconcerting?

Although more research is needed, even the initial results of this study indicate that much is to be gained from creating studio spaces for higher education classes. There is also apparently little to be lost. Some students in the surveyed classes felt unaffected by the space, and a few students said that the Studio was distracting due to its unstructured environment. If studio spaces became more common, the students who felt negatively affected may react more positively as they became accustomed to the spaces. The spaces could also become less affecting due to their prevalence, but this result seems less likely.

The students who reported no effects of the space tended to indicate that they are never affected by space or that they were simply focused on the course material. These views were not held by most students, so it would seem that most students would continue to enjoy positive effects from studio learning even if all of their classes were held in studio spaces, rather than becoming immune to the effects.

There also seems to be little to lose and much to gain for faculty. In fact, this study suggests that institutions should consider encouraging faculty who are not incorporating active learning pedagogy to teach in studio spaces as a way to reinvigorate their teaching. It is important to note as well that the study indicates that teachers like Jim can be very successful with active learning pedagogy in a studio setting even when they had not been successful in a non-studio setting. More research is needed to determine whether changes in teaching techniques transfer back to a traditional classroom setting. While the nature of the studio space itself seems to have an important effect on teaching and learning, it is possible that teachers who have experience teaching in studio spaces could replicate some of the positive effects in traditional spaces, thus allowing institutions to maximize effects by rotating faculty and classes through studio environments rather than transforming all classrooms into studios.

Responses from the students in this study indicated that designers of studio space should be sure to incorporate (1) moveable furniture, (2) relatively small tables, (3) comfortable and unusual chairs, (4) plenty of space not occupied by tables or chairs, (5) a room shape that does not suggest a “front,” and (5) interactive whiteboards. It also seems important to minimize rules and maximize students’ freedom to rearrange the space in order to create the open and inviting atmosphere that students felt was conducive to learning. While studio classrooms such as SCALE-UP and TEAL incorporate some of these features, they tend to use small rolling chairs and large immobile tables, which do not facilitate remixing of teams or student-initiated rearrangement of the space. More research is needed to identify the elements of studio space that are most important for learning and teaching.

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