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Intentional Process for Intentional Space: Higher Education Classroom Spaces for Learning

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This chapter addresses the confluence of theory and practice in developing and using "flexible" classrooms for student learning. A large classroom building renovation will be described, in terms of how collaboration and co-creation of value led to early success of the renovated space. Co-creation of value for staff and faculty can help overcome initial resistance to change, bridge understanding, and drive a successful change from lecture-based teaching to growing use of active learning pedagogies. At the University of Tennessee, Knoxville, co-creation was central to planning, conducting, and sustaining a renovation of space into flexible, technology-enhanced classrooms and changing classroom pedagogy.

Matching Learning Spaces and University Pedagogies

What impact does the configuration of classroom space have on teaching and learning? What difference does space make? We know a great deal about both student preferences, particularly for the millennials (Tapscott, 2008) and student learning through collaborative, active learning (Bransford *et al*., 2000; Hattie, 2008; Svinicki and McKeachie, 2011). We know that students today want to engage with and collaborate with their peers, they want immediate feedback and communication with others (including their professors), and they want to be considered as individuals as opposed to a mass of students (Tapscott, 2008). We know from decades of educational research that student learning occurs in the context of past learning, including inaccurate understandings, and that learning must go deep rather than stay at the surface if we want to see results in learning outcomes and learning that will be transferred to other contexts. Transfer is more likely to happen when the foundations are strong and students have the opportunity to readily apply these foundations (Bransford *et al*., 2000). Students need time to learn and often require a reason to reach deeper understandings. As Bransford *et al*. (2000) stress, factors that influence learning for transfer include the context of that learning and how students are invested in and can control their own learning. This point is emphasized as well in the Hattie (2008) meta-analysis that revealed students need to be active learners who understand their own learning processes and engage in self-monitoring behaviors. This foundational understanding of student motivation as well as engagement in learning which is supported by classrooms that are "learner-centered" has led to consideration of how physical environments impact student learning.

One key challenge today is conveying to disciplinary-focused higher education faculty the current knowledge of learning, including connections to issues of physical space and how space can impact student learning. For some faculty, learning spaces matter (e.g., English composition, foreign languages, engineering). Pedagogies recommended for teaching in these disciplines require alternative, often flexible, spaces, where students can meet in groups and move around to accomplish active learning tasks. Numerous case studies of innovative projects (TEAL classrooms and SCALE-UP rooms, for instance) support the use of active learning spaces which are configured differently than the traditional model (Nielsen, 2011; Brooks, 2012). Spatial configurations of classrooms are understood differently, however, when disciplines have adopted the lecture as the primary pedagogy—and seating in fixed rows with clear visibility, facing a speaker who is audible, is seen as most efficient for delivery of the content. Current research into active, engaged learning supports the "flat and flexible" model of classroom design, because multiple pedagogies can be accommodated, including lecture as needed (Chism, 2006; Steelcase, 2010; Whiteside *et al*,. 2005, 2010; Lizzio *et al*., 2002; Walker *et al*., 2011).

The HSS Renovation Project at UTK

Research about learning spaces became particularly relevant to the University of Tennessee, Knoxville (UTK) when the opportunity arose to renovate one of the largest

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classroom buildings on campus: the Humanities and Social Sciences building, or HSS as it is known on campus. HSS is the only dedicated classroom building on the University of Tennessee campus, hosting between 20 and 25% of undergraduate credit hours including a large proportion of general education courses. Beyond classroom technology installations and HVAC upgrades, the building has received little attention since the 1960s. By the 2012 fall semester, 34 classrooms with capacities from 35 to 75 students were refurbished as "flexible classrooms," with each room containing movable "node chairs," a movable table in place of a fixed podium, multiple white boards mounted on available wall surfaces, and a wall-mounted interactive "smart board" with a ceiling projector.

The "before and after" images below of the HSS building show how a building that was once avoided on campus tours is now a highlight of such tours; teaching faculty and students are delighted with the space (as will be addressed later). Previously, the building interior resembled a rundown high school. Illustration 1 shows a typical HSS classroom before renovation (note: the chalkboards and tablet armchairs) and Illustration 2 shows the crowded and dull hallways.

Illustration 1. HSS classroom

Illustration 2. HSS hallway

Now, the building space has a more modern, open "feel" with hallways that are useful (with seating and electric outlets) and classrooms that are flexible, with plenty of whiteboards, movable furniture, and a smart board in each room (see illustrations 3 and 4).

Illustration 3. HSS renovated hallway

Illustration 4. HSS renovated classroom

At UTK, a large team of faculty, staff, and administrators drew on the theory and practice of the importance of flexible spaces to students learning together. To build this conversation with stakeholders, research into student learning and education about innovative classroom space projects in higher education provided grounds for conceptualizing this major building renovation on campus. The national conversation about learning spaces served as a benchmark for faculty success in teaching in new spaces on campus, and this experience of renovation has influenced the university community's approaches to subsequent current building projects.

This chapter will elaborate on the process of changing the conversation about classroom space through collaboration among interest groups, under the guidance of the Classroom Upgrade Committee, supported by the Provost's office, and with collaborative support of faculty teaching by the Tennessee Teaching and Learning Center (Tennessee TLC).

Conceptualizing Learning Spaces: A Review of Relevant Theory

A confluence of theories of learning and approaches to learning spaces supported the infusion of innovative thought and action during the HSS project. Research and theory about active learning pedagogies and student engagement in learning—as intersecting with theories of learning spaces—were brought to bear in a co-creative process. Figure 1 presents the influences of theory and research on the process.

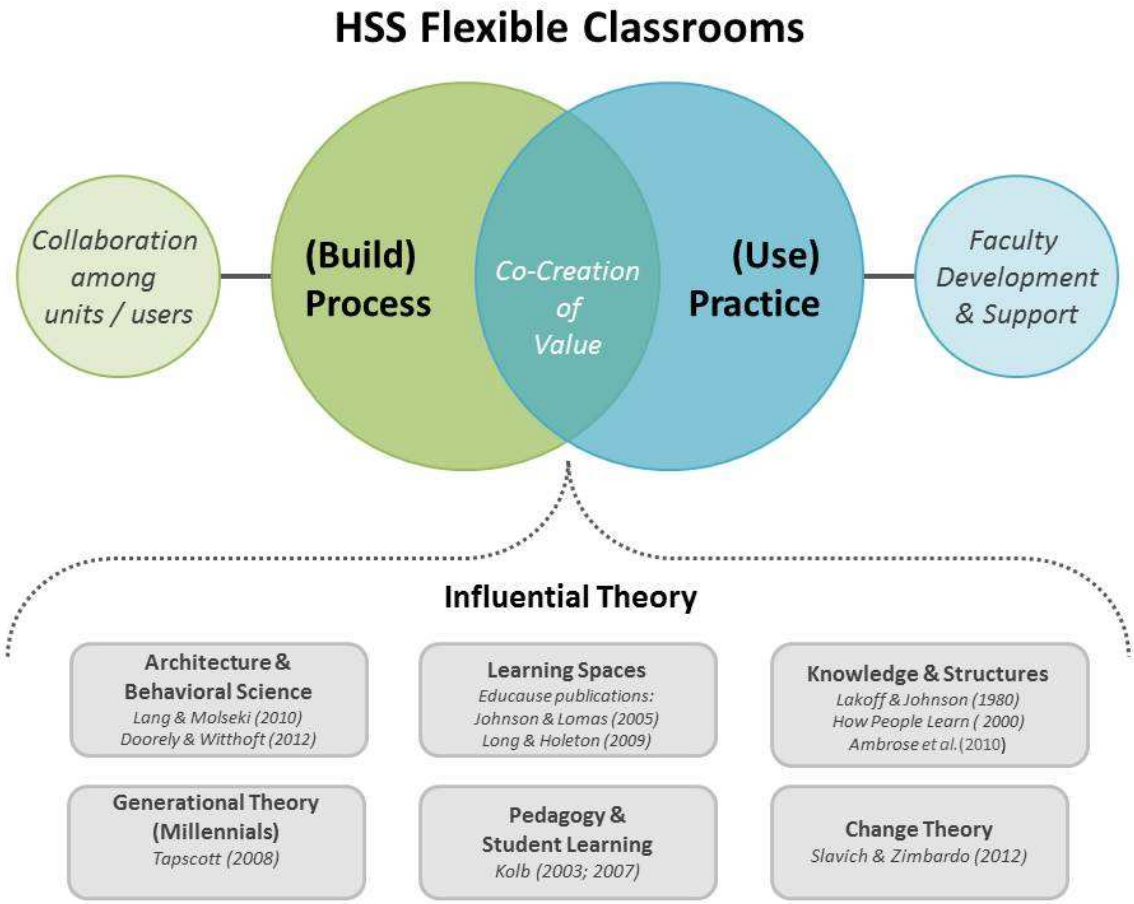

Figure 1. HSS flexible classrooms model

One of the first questions addressed by the committee and stakeholders was "why does space matter?" In the research, this question is asked repeatedly but is answered differently depending on the discipline. One focus in architectural theory is on human behaviors in space and how behavior contributes to architectural design; this coincides today in interesting ways with studies of the millennial generation of students and a large (and growing) body of studies on student learning. Architectural behaviorism laid the groundwork for thinking about human behavior in designed spaces (Lang, 1974; Lang and Moleski, 2010). Behaviorism in architecture draws attention to how people use built spaces—such as the patterns of movement in a building or the relationships among people that are developed through the built space. As Lang and Moleski (2010: 13) point out, it is an "unrealistic model" that assumes the architectural space can shape human activity, in terms of "social behavior, self-esteem, and, more generally, quality of life." Instead, they assert, a building design can offer *opportunities* of which people may or may not take advantage. This question of the use of space became a discussion focal point for the HSS renovation project; what was desired in terms of behavioral change was expressed as well as predictions of what change would actually take place. Would faculty change pedagogical practices? Would students change patterns of interaction and study in the learning spaces provided in the building? The intention of the project was to provide access to positive learning spaces and to educate consumers of the space. In essence, a classroom is a space where behavior is an important indicator of learning, and therefore architecture has a cognitive function and should create

places that provide "opportunities for continual learning" (Lang and Moleski, 2010: 243).

In the ongoing campus discussion, the confluence of spatial planning and cognitive theories of learning became apparent. In an active learning situation, movement and behaviors in space may have significant impact on opportunities to learn. The questions unfold from here. What configuration of tables and chairs and white boards and screens can be created to facilitate learning? How well can the teacher move around the room in order to assist students? Can students see each other and sit in groups, in order to form connections with peers? Will the classroom configuration only permit a delivery model of instruction or can dialogue, critical and creative thinking, and problem-solving be possible—both individually and in groups? Bransford *et al*. (2000) emphasizes the importance of these questions. It provides a touchstone for discussions of the research about student learning and the importance of encouraging active learning, metacognition, and time for cognitive processing. Theories of teaching and learning, particularly constructivist approaches such as Kolb's model of experiential learning (1976), have at the same time offered ways of putting our knowledge of learning in higher education into better methods of practice. In the campus context, the functions of education at a land grant institution, and the understanding of educational spaces as special places, as democratic places for negotiations of power and social function, brought a sense of to the planning discussions (Foucault, 1986; Lefebvre, 1992, 1974; Soja, 1996). For the HSS renovation, conversations rotated around and emerged out of this confluence of architectural theory, understanding of cognition and ways of learning, and space as a place for citizenship. These rich conversations among students, faculty, designers, facilities services staff, and administrators (through focus groups with students and faculty and meetings with committees and bodies such as student government) influenced planning and implementation, faculty development, and assessment practices.

An important lesson learned from experiences with flexible spaces is that not all faculty and student will embrace changes in learning spaces, in part because of the implications mentioned above. Faculty and students might react negatively at first because of the recognition that changes in pedagogy and learning will take time and work—and the reasons for making this effort may not be evident to them. It is up to those who are initiating changes to make clear arguments for change and to outline drivers of change and potential benefits. Faculty developer and author Connie Schroeder (2010) explains that often those of us who are in support organizations (faculty development, instructional design, and those who are early adapters among faculty and administrators) must think through a strategic approach to initiating and sustaining cultural change. Her research shows that faculty developers hope that grassroots methods ("word of mouth") will accomplish this change, without realizing that it may be unlikely in and of itself. In the case of HSS, vocal support for the Classroom Upgrade Committee was given by the Vice Provost for Academic Affairs: with a goal that renovation of an entire building devoted only to classroom space could bring about corresponding changes in thinking about and enacting pedagogy that engages students. Enacting this change proves an ongoing challenge, since "transformational teaching" is a complex undertaking (Slavich & Zimbardo, 2012).

Despite initial "starts and stops" typical to a large project, co-creation of value for staff and faculty helped bridge divergent understanding of university goals and drive a successful change. Co-creation is a term used to describe the engagement of producers and consumers of production, to draw all concerned into an iterative process of creation. In higher education, use of this theory draws particularly on an emphasis on valuing participation, on drawing broadly from expert knowledge, and of placing importance on measures of success that value the quality of knowledge and ethical use of knowledge (Diaz-Mendez, 2011; Schumann *et al*., 2013). In order to bring knowledge into a coherent conversation, not only is representation a key issue, but giving voice to those representatives is equally important. Allowing everyone to listen and contribute to the conversation in a way that honors knowledge and creative and critical thinking, more so than position, is a condition of co-creation. At UTK, co-creation was central to plan, conduct, and sustain the renovation of the HSS building.

Theory to Practice: Creating Flexible Classrooms

Attention to process through careful planning, ongoing assessment, and continuous support has also driven early success. Student feedback has been overwhelmingly positive of the redesigned learning spaces, and teachers have either extended already flexible pedagogies or begun to restructure learning through pedagogies suited to active learning and engagement. This feedback loop fit into an iterative process (for an overview of the components of the process, see Figure 2).

The process began with focus groups and faculty interviews that indicated widespread dissatisfaction with the building's aesthetics and classroom teaching and learning functionality. Informed by teaching and learning research, the Classroom Upgrade Committee initiated a

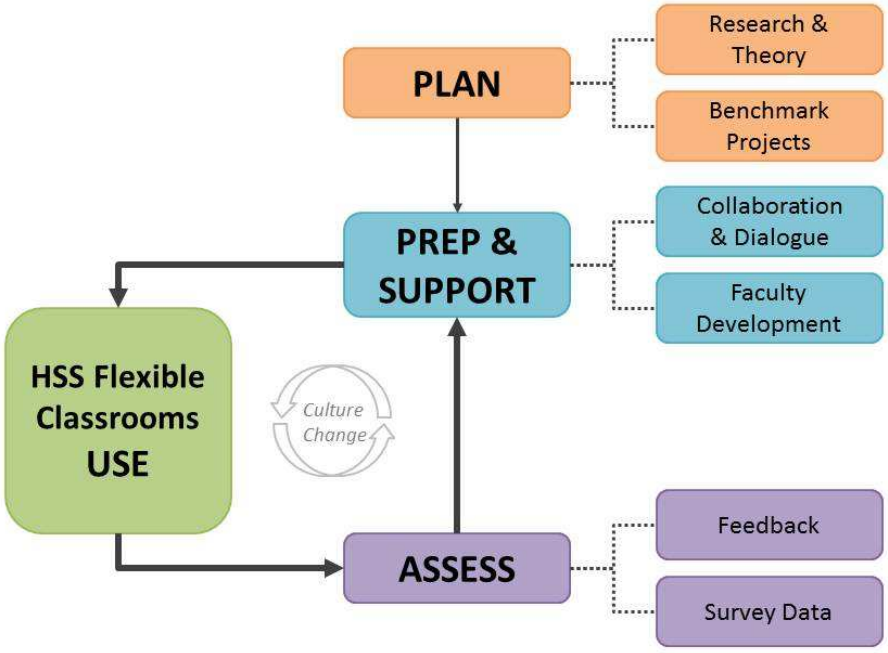

Figure 2. Planning process components

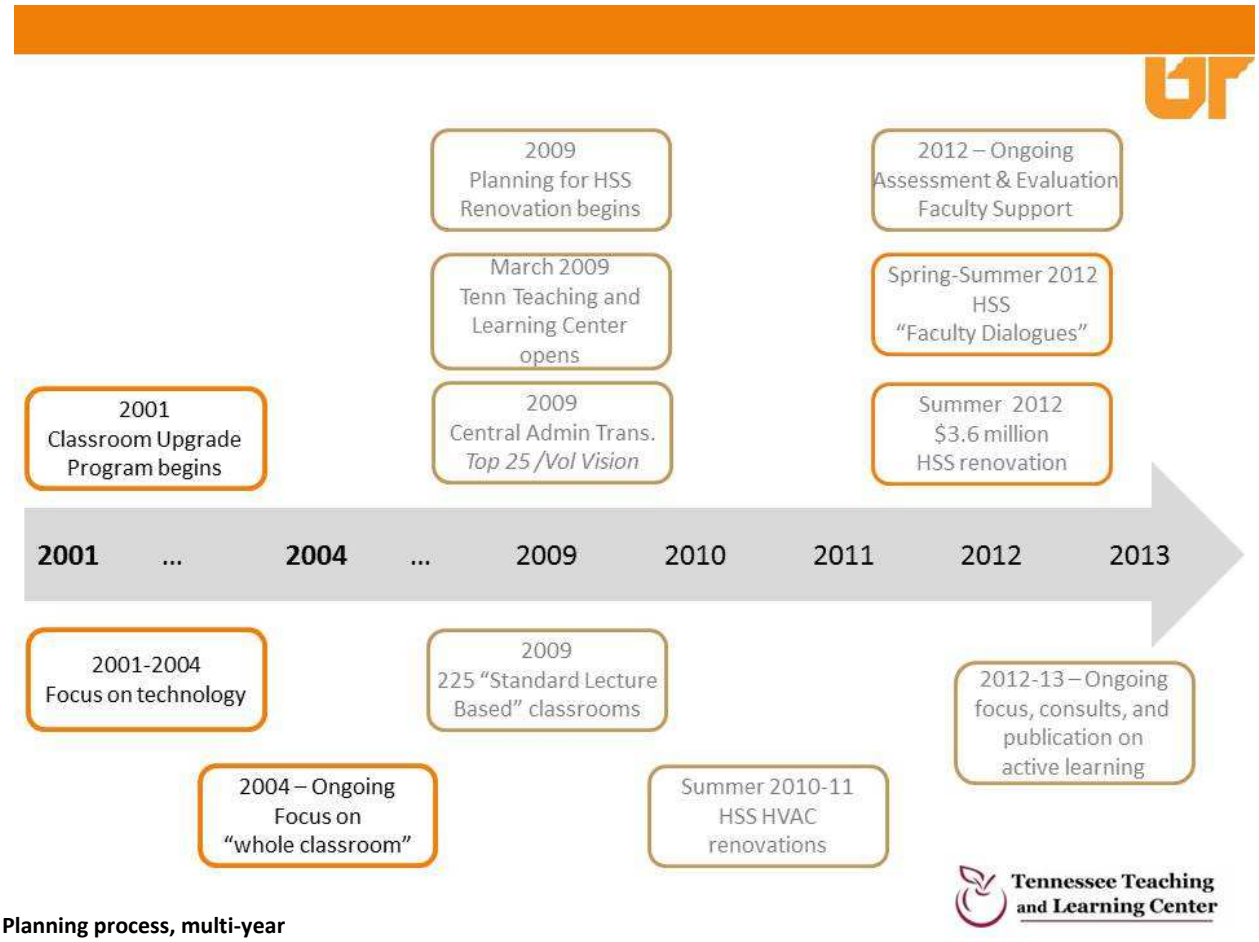

Figure 3. Planning process, multi-year

renovation of HSS to make it more welcoming and aesthetically pleasing, and the classrooms more conducive to active and collaborative learning. The intent of the configuration was then assessed during the year following the renovation. Surveys, interviews, and classroom observations are being used currently to assess faculty and student perceptions and satisfaction. This section will include analysis of data collected so far. This was a multi-year project, as Figure 3 reflects.

As indicated in this timeline, the UTK community had already engaged in significant steps before the start of the renovation. The focus on classroom upgrades started at the same time as a focus on technology and teaching. Indeed, the classroom upgrades are funded through student fees. In March of 2009, the Tennessee Teaching and Learning Center (Tenn TLC) opened its doors. Shortly after that date, central administration initiated a strategic plan focusing on reaching the "Top 25" public institutions in key areas, one of which is undergraduate education, with metrics including retention and graduation rates. As the conversation about classrooms grew, smaller scale projects such as the establishment of "scale up" rooms and "teal" classrooms gave faculty, staff, and administration opportunities to "pilot" alternative spaces. Dr. Robert Beichner (2014), who provides leadership for "Scale-Up" classrooms, spoke on campus and his research provides a great deal of data on large, nontraditional rooms (Scale-Up rooms are flat, furnished with round tables for nine students each, and designed to work with an active learning pedagogy). In his research, it is notable that gains in learning are high for minority and female students in physics (statistics are cited in studies and presented in summary form on the Scale-Up website at http://scaleup.ncsu.edu). After gaining access to his research, these results were studied by key members of the classroom upgrade committee.

TEAL (technology-enhanced active learning) rooms were also established on campus, in a Communications classroom and in CASNR, the College of Agricultural Science and Natural Resources. Faculty member Dr. Joanne Logan worked with both instructional technologists and the staff of the Tenn TLC to adjust her pedagogy for a TEAL classroom, designing activities for groups of students who had computers at their tables with ability to project the results of their research and problem-solving tasks.

While student and faculty use of classroom spaces is in some ways entirely different from the use of library common spaces, staff at UTK's Hodges Library experimented with flexible furniture and open spaces for several years before the HSS renovation. Flexible furniture of various kinds was in use on the "Commons" floor of the library and in the library classrooms. Using student feedback and observations from library staff, librarian Dr. Theresa Walker was able to contribute collected data to conversations about student use of flexible spaces and flexible furniture.

Because of experiences such as these with new classrooms and flexible spaces, a core group of people (Classroom Upgrade Committee members, the Vice Provost, faculty, and support staff) had first-hand experience with the use of innovative spaces by faculty and students. Several points were clear to this core group. Best practices rather than traditional models in creating learning spaces were important. Conversations with architects—particularly the School of Architecture at UTK—and with contractors and suppliers, key financial staff, and administrators were needed. Most of all, guiding principles had to be set by the Classroom Upgrade Committee and administration. The process of creating a new type of space required new thinking and communication, with research about student learning at the core of these discussions. These experiences not only fed into the planning process but into the preparation and support for use of the HSS classrooms.

In previous projects (for TEAL and SCALE UP rooms), faculty and staff had reported on the detailed work in the layout of the room and installation of technology, and they could also speak to the amount of time spent by to redesign a course for a new space. These experiences drove home the point that after an old space is evaluated, redesigned, and retrofitted for new layout and lighting, technology, and furniture, the work is far from complete. Adaption of a course, particularly in disciplines where the lecture pedagogy is valued and uniformly practiced, presents challenges to faculty members. The challenge extended to students as well, who have to adjust to new expectations after semesters of college work which have trained them to succeed with a standard pedagogy, primarily. A clear lesson learned by support staff was that in order to be successful, the faculty member needs support in rethinking the course structure and progression. Given new types of spaces, time is needed to plan—and this planning includes deciding how time and space is used during and after class to support student learning. Planning can involve not only broad conceptions of the course, but building activities and assignments (and finding resources to do so).

When delivering a redesigned course in a renovated space, faculty members were more successful when they gave students clear rationales for major changes in the physical space and corresponding changes in pedagogy. For instance, soliciting formative feedback regularly from students in class was essential to having a conversation about how to best use the active learning approach in the TEAL classroom. In the case of Dr. Logan, she was supported by a year-long grant and found that it took two semesters to work out "bugs" in both technology and lesson planning. She was supported in her project by both faculty

developers and technology support staff. When other faculty were assigned to the new room, advertising her success was essential to educating others in the use of the room; having support in active learning pedagogies from the Dean of the College was crucial. In this case, the Dean held an annual faculty development day on topics such as best practices in assessment (formative and summative) and the use of experiential learning pedagogies. These experiences laid the groundwork for the renovation of HSS.

Flexible Faculty Development for Flexible Space

While studies abound that support the efficacy and importance of active learning pedagogies' impact on student learning outcomes, studies also emphasize the need to train faculty to use such pedagogies intentionally and in ways that are well-designed. In other words, just adding "group work" to one's repertoire without connecting the activity to learning outcomes will not necessarily result in better student learning (Mathews *et al*., 2011). Once trained and having reflected upon what activity would be most useful, a teacher's effort is much more likely to be successful. Thus, the community that is built around new learning spaces and continually supported is part of the success of the project.

How faculty development is enacted and sustained can affect ways that faculty envision teaching and learning in new classroom configurations. The HSS flexible classrooms with movable furniture, lots of board space, and various levels of technology options poses opportunities which can be challenging to teaching faculty. With faculty members who already engage in active learning pedagogies, the jump is not as sudden; for others, the room itself poses challenges: first, a faculty member needs to know the rationale for including active learning (and may need rationales for different types of active learning, in detail; second, faculty decide whether or not to include more active learning as a pedagogical approach; third, faculty may need to decide what kind of active learning will best support student learning and when various pedagogical approaches should be implemented. The move to include more active learning can be quite challenging.

In order to help faculty make informed decisions, as the university undertook this large installation of flexible classrooms, the Tenn TLC provided training to over 380 teachers. To familiarize faculty with the teaching and learning potential of flexible classrooms, Tenn TLC staff, with assistance from faculty facilitators and instructional technologists, facilitated 28 small-group workshops during April-May and August (the building opened a few weeks before the start of fall classes). Rather than offer a "one size fits all," the teaching and learning center offered "dialogues" for faculty and invited faculty collaborators in various disciplines into the planning and delivery of these dialogues (see figure 4). Teaching faculty were encouraged to sign up

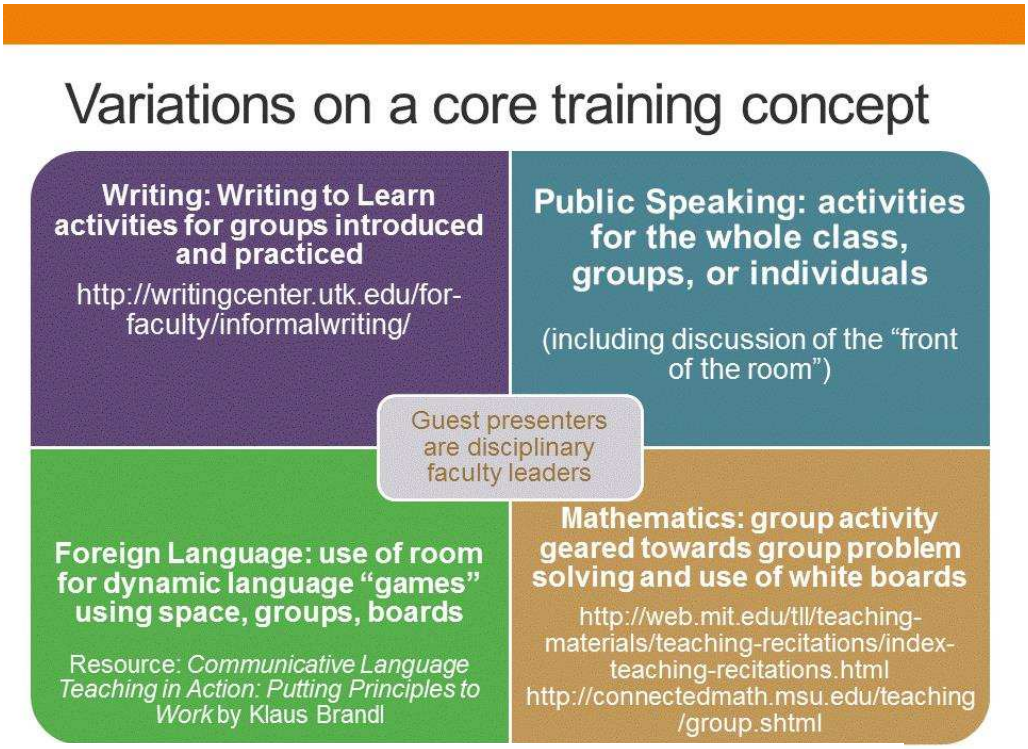

Figure 4. Core training concept

for an appropriate workshop: with focuses on writing, public speaking, foreign language instruction, and mathematics. Faculty members from key departments were involved in the planning and delivery of these workshops—and consequently, departmental support was clearly presented to participants.

The workshop development process began with the use of a logic model for a reflective and collaborative team approach to workshop development with faculty collaborators, including addressing differences in disciplinary approaches. A mock training classroom identical to the HSS rooms was set up in the library. In order to model the use of the room, active learning pedagogy was employed intentionally in the dialogues so that faculty experienced the flexible classroom as engaged participants. Surveys, interviews, and classroom observations were used and are still being used to assess pedagogical uses and rate of change. At the core of these dialogues were key outcomes and activities. The three outcomes were that participants will:

- Discuss potential uses of the flexible classroom
- Evaluate major types of group work
- Create a learning activity that uses the flexible classroom

After a short introduction to the HSS project, participants moved into groups and were involved in an introductory group conversation, preceded by "free writing" responses to the room; comments from groups were recorded on the smart board; participants were introduced to various configurations of student groups, and finally each group used white board space to design a learning activity (which was photographed and emailed using their phones). Participants left with a sample rubric (listing criteria for group participation), sample self- and peer-assessment sheets for use with students, instructions on creating team folders and group roles, and a description of suggested group activities and group configurations. Each conversation ended with the same activity (see illustration 5). Faculty, in groups of four, would go to the whiteboards and design an activity for a class session in a course. They had to answer the following questions: 1.What is the learning objective of your activity? 2. How will the learning be assessed?

Workshop evaluation consisted of a standard satisfaction survey, including the question "I will be able to apply at least some of the elements from this session to my teaching" (indicated on a scale of 1-5, with 1 being strongly disagree and 5 being strongly agree). The average response for all workshops for this question was 4.47. What is more telling is that surveys of faculty use in the classrooms showed application of these methods. Although data from 2011 and 2012 are still being analyzed, initial findings show that faculty are employing collaborative learning techniques. A faculty survey of classrooms, adopted with permission from the University of Minnesota, was used, with the following results (Whiteside, Brooks, & Walker, 2010):

Scale 1-6, 1=strongly agree; 5=strongly disagree; 6=no experience

(62 faculty responses)

1. Classroom facilitates multiple types of learning activities:
   1.99 average (2 as singular mode)
2. Classroom encourages my students active participation:
   2.33 average (2 as singular mode)
3. Classroom enriches my own learning:
   2.85 average (2 as singular mode)
4. This classroom is an appropriate space in which to hold this particular course:
   1.77 average (1 as singular mode)

Illustration 5. Faculty conversation

Open-ended comments were also permitted. Some of the typical responses were as follows:

"The use of these classrooms has helped me to revisit the way I teach, and I have been able to include different activities that were not possible before."

"Makes teaching so much better and, in my opinion, more effective."

"I absolutely love the new HSS. I think it has allowed me options in the classroom that have resulted in me being a more effective teacher."

"I love the classroom. The flexibility of class arrangement and the great tech resources are ideal for my composition course."

"The changes in HSS really reflect the commitment the university has in innovating student learning. It updates the facility and brings it into the 21st century."

Overall satisfaction of the project adds to these findings. In the same survey, faculty (N= 55), students (N = 109), and staff and graduate students (N=26) indicated high levels of satisfaction, as demonstrated in tables 1 and 2.

As might be expected in such a large project, there are detractor and contradictory evidence. Open-ended comments indicated some negative impacts from the project, as seen in the following comments:

"The current classroom setup is awkward, not conducive to learning, and very much in the way."

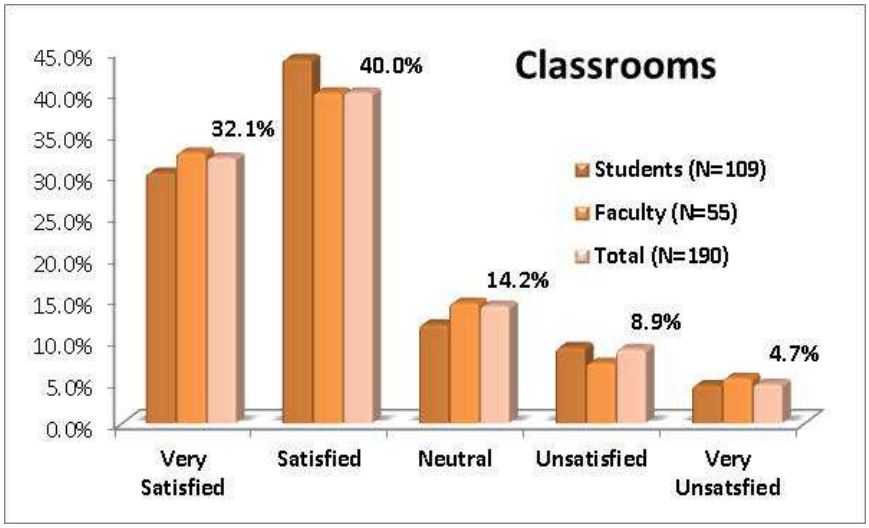

Table 1. HSS classrooms

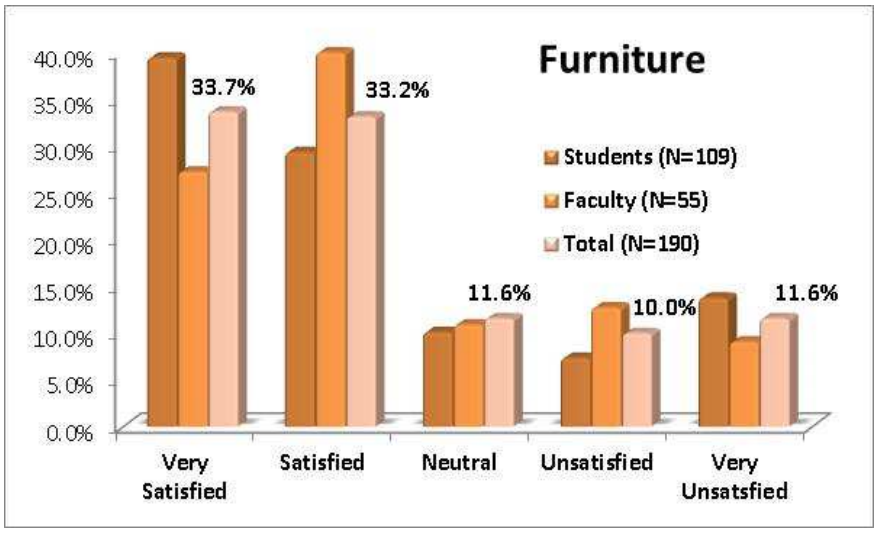

Table 2. HSS classroom furniture

"The chairs are distracting and detract from order in a classroom."

"The new classroom aesthetics are such a blatant display of putting appearances over quality and of mismanaging money. The desks are an absolute nightmare. I do not understand why you would spend money on plastic, circular, colorful rolling desks that seem likely to break and that are distracting to a learning environment."

"It doesn't give off an academic feel at all and the desks are always out of order, it's chaotic."

The initial quantitative data also reveals that more work is needed in supporting diverse pedagogies and sustaining change. In this first year of assessment, the initial indications are that there is not a statistically significant difference between faculty who were involved in the dialogues and received this faculty development and faculty who did not. This begs the issue of developing and sustaining change over time, of affecting wholesale cultural change as a longer term strategy. Faculty development efforts continue to focus on technology training and faculty development through initiatives such as a weekly "teaching tip" aimed at those faculty who are currently teaching in HSS. Focused support in the form of outreach, practical ideas, pedagogical discussions, availability of faculty consultation, and other methods remain in place, and in this case, targeted toward faculty who teach in the flexible classrooms.

Consequences of the Project

Can classroom redesign for active learning stimulate course redesign for active learning—and change the culture of teaching and learning? As we know from architectural and behavioral theory, space cannot change behavior; it can only give us options for behaviors. When considered in the light of change theory, we also know that sustaining motivation for change and providing support for change is a lengthy process. Certainly, this project highlights the importance of asking questions, of gathering qualitative as well as quantitative data, of continuing contact with faculty and providing ongoing faculty

development. This need for clear models that result in reliable data emerges from some recent studies. Long and Holeton (2009: 47) ask important questions in their matrix for guiding design decisions about learning spaces, such as what is the motivation for the project, and what types of "learning and teaching are we trying to foster" as an outcome? However, these questions do not go far enough in terms of connecting student learning and pedagogy in specific ways. Yet as the study by Brooks (2011), on the University of Minnesota's active learning classrooms, shows, it can be difficult to separate the design process and resultant features from changes in pedagogy to produce reliable data. In evaluating a large-scale project, what approach is best? To focus on faculty development and encourage changes in pedagogy, thus supporting potential cultural change? Or focus on the effects on student learning in new versus traditional classrooms? As possible, both aspects should be addressed, although assessment needs to be developed carefully within this complexity.

One conclusion that can be reached is that the implementation of new learning spaces on traditional campuses can involve a complex set of issues and opportunities. In this project, the initial hurdles of educating key leaders on campus and involving the campus in a larger discussion of learning spaces have been addressed through co-creation of value. One of the most important results is that now new projects involve more of these discussions leading to plans to introduce further innovative learning spaces to the University of Tennessee campus, as with two new science buildings under construction. This reflects a cultural change in the making, one that requires patience matched with the courage to act.

References

Beichner, R. J. (2014). History and Evolution of Active Learning Spaces. *New Directions for Teaching and Learning*, *137*(Spring), 9–16. doi:10.1002/tl

Bransford, J. D., Brown, A. L., & R. R. Cocking. (2000). *How People Learn: Brain, Mind, Experience, and School*. Washington, DC: National Academy Press.Brooks, D. C. (2011). Space matters: The impact of formal learning environments on student learning. *British Journal of Educational Technology, 42* (5), 719-726.

Brooks, D. C. (2012). Space and Consequences : The Impact of Different Formal Learning Spaces on Instructor and Student Behavior. *Journal of Learning Spaces*, *1*(2), np.

Chism, N. (2006). Challenging Traditional Assumptions and Rethinking Learning Spaces. In Oblinger (Ed.). *Learning Spaces*. EDUCAUSE. Retrieved from: http://www.educause.edu/research-and-publications/books/learning-spaces

Diaz-Mendez, M. (1995). Value Co-Creation and University Teaching Quality: Consequence for the European Higher Education Area. *Journal of Service Management, 23* (4), Emerald Publishing Group.

Foucault, M. (1986). Of Other Spaces. Trans. Jay Miskowiec. *Diacritics, 16, (1),* 22-27.

Hattie, John (2008). *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. NY: Routledge.

Kolb, D. A. (1976). Management and the Learning Process. California Management Review, 18(3), 21-31.

Lang, J. (1974). *Designing For Human Behavior: Architecture and the Behavioral Sciences*. Ed. Stroudsburg, PA: Dowden, Hutchinson & Ross.

Lang, J. & Moleski, W. (2010). *Functionalism Revisited: Architectural Theory and Practice and the Behavioral Sciences*. Surray, England: Ashgate.

Lefebvre H. (1992). *The Production of Space*, (original, 1974), Trans. Donald Nicholson-Smith. NY: Wiley-Blackwell.

Lizzio, A. L. F., Wilson, K., & R. Simons (2002). University Students' Perceptions of the Learning Environment and Academic Outcomes : Implications for Theory and Practice. *Studies in Higher Education, 27*, (1), 37–41. Retrieved from: http://reforma.fen.uchile.cl/Papers/Learning%20Environment%20and%20Academic%20Outcomes%20-%20Lizzio%20Wilson%20Simons.pdf

Long, J. & R. Holeton (2009). Signposts of the Revolution? What We Talk about When We Talk about Learning Spaces. *EDUCAUSE Review, 44* (2), 36–49. Retrieved from: http://www.educause.edu/ero/article/signposts-revolution-what-we-talk-about-when-we-talk-about-learning-spaces

Matthews, K.E., Andrews, V. & P. Adams. (2011). Social Learning Spaces and Student Engagement. *Higher Education Research and Development, 30* (2), 105-120.Nielsen, N., et al. (2011). *Promising Practices in Undergraduate Science, Technology, Engineering, and*

Mathematics Education: A Summary of Two Workshops. National Academies Press. doi:10.17226/13099.

Schroeder, C. (2010). *Coming In from the Margins: Faculty Development's Emerging Organizational Development Role in Institutional Change.* Sterling, VA: Stylus.

Schumann, D., Peters, J. & T. Olsen. (2013). Co-creating Value in Teaching and Learning Centers. *New Directions for Teaching and Learning, Spring* (133), 21-32.

Slavich, G. & P. Zimbardo. (2012). Transformational Teaching: Theoretical Underpinnings, Basic Principles, and Core Methods. *Educational Psychology Review, 24* (4), 569-608.

Soja, E.W. (1996). *Thirdspace: Journeys to Los Angeles and Other Real-and-Imagined Places*. Oxford: Basil Blackwell.

Steelcase. (2010). node : Keeping pace with active learning: Pre- and post-installation studies at the University of Michigan confirms node transforms the traditional classroom. 360Steelcase.com. Retrieved from: http://www.steelcase.com/content/uploads/2015/01/Steelcase_node-and-U-M_case_study.pdf

Svinivki, M., & McKeachie, W. J. (2011). *McKeachie's teaching tips: Strategies, research, and theory for college and university teachers* (Thirteenth ed.). Wadsworth: Belmont, CA.

Tapscott, D. (2008). *Grown up Digital How the Net Generation is Changing Your World*. NY: McGraw-Hill.

Taylor, S. S. (2008). Effects of Studio Space on Teaching and Learning: Preliminary Findings from Two Case Studies. *Innovative Higher Education, 33* (4), 217–228.

Walker, B. J. D., Brooks, D. C., & P. Baepler (2011). Pedagogy and Space : Empirical Research on New Learning Environments. *Educause Quarterly, 34* (4), np. Retrieved from: http://z.umn.edu/lsreq2

Whiteside, A., Ph, D., & S. Fitzgerald (2005). Designing Spaces for Active Learning. Implications. *Implications, 7* (1), np. Informe Design, University of Minnesota. Retrieved from: http://www.informedesign.org/_news/jan_v07r-pr.2.pdf

Whiteside, B. A. L., Brooks, D. C., & J. D. Walker (2010). Making the Case for Space: Three Years of Empirical Research on Learning Environments, *EDUCAUSE Review*, (September, 2010). Retrieved from: http://www.educause.edu/ero/article/making-case-space-three-years-empirical-research-learning-environments