INNOVATION IN HIGHER EDUCATION: THE INFLUENCE OF CLASSROOM DESIGN AND INSTRUCTIONAL TECHNOLOGY

By

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ABSTRACT

The current work seeks to explore University professors' perspectives on teaching and learning in an innovative classroom characterized by flexible design of space, furniture and technology. The study took place during the 2015-2016 academic year at Fairfield University, a Masters comprehensive university in the Northeastern United States. Qualitative research methods for data collection and analysis were used to gather and summarize professors' perspectives, with specific attention to their integration of technology for instruction and use of teaching strategies. Emergent themes revealed that professors redesigned course work and class time to utilize the innovative technology and space effectively. Results further demonstrated that professors actively integrated multiple types of technology into classroom instruction and used a variety of pedagogies to engage students. Additionally, professors expressed increased satisfaction and motivation for teaching related to ease of instructional technology and flexibility of classroom furniture. Future research is needed to examine how such changes in instructor perspectives might influence paradigm shifts in higher education and impact college student learning.

Keywords: Classroom Design, Instructional Technology, Active Learning, Innovative Pedagogy, Higher Education.

INTRODUCTION

Historically, the focus of teaching and learning has been on the delivery and recitation of content information. Termed the "banking model" (Freire, 1972) by some, or the "factory model" by others (Scott-Webber, 2012; Stedman, 1997), this approach to education places the teacher in the role of content knowledge expert and places students in the role of passive recipients. Since the time of the one-room school house, classrooms have been designed to promote this approach, with the teacher placed at the front of the room on a stage or behind a podium, and students in row by column seating facing the teacher (Scott-Webber, 2012). In this configuration, the instructor is the source of knowledge, and the primary actor in the classroom, promoting passivity among student learners. Early attempts to integrate technology into instruction likewise maintained this educational tradition (Goral, 2013; Selwyn, 2007). Teachers developed powerpoint slides to replace the chalk board notes that accompanied lectures, while students used word processing programs to prepare papers reciting their acquired knowledge.

In today's information-based, technology-driven society, however, content knowledge is rapidly generated and easily accessible. Employers world-wide expect today's high school and college graduates to not merely know information, but also be able to use that information to communicate in a variety of formats and solve problems across a variety of disciplines (Ananaidou, K., & Claro, M., 2009; Jones, E.A., 2002). In response, teaching must move beyond content delivery and learning must require more than recall and regurgitation. Shifting pedagogy from the traditional educational approach to create a teaching-learning environment that promotes critical reflection and student engagement can be challenging (Boyd, 2016). Innovative approaches to classroom design and educational technology can help facilitate this pedagogical shift to student-centered learning (Berrett, 2012; Hirumi, 2002), in which teachers are facilitators and students become the primary actors in their own learning. Prior research suggests that teacher concepts of his/her

role in the classroom and plans for classroom instruction influence the enactment of new pedagogies for educational reform (Siegel, 2005a; 2005b). Current research further demonstrates that, the built environment (e.g., classroom design) can also impact teaching behavior in the classroom (Scott-Webber, Strickland & Kapitula, 2013). This study explores the ways in which such design and technology innovations impacted University professors' experiences of teaching and learning.

1. Innovations in K-12 Education

Today's K-12 learners are digital natives (Prensky, 2001), members of the first generation born into a world where the use of technology, including computers and mobile devices, to access the Internet, e-mail, social media and video games is common place (Jukes, et. al, 2008; Sheets, 1991). As the articles and research reports in this journal attest, technology is rapidly becoming an essential tool to engage these digital natives as learners in the classroom (Min & Siegel, 2011). Indeed, the whole domain of educational technology literature is replete with examples of SMART Boards incorporated in elementary and secondary classrooms, flipped classrooms being used to enhance instruction, digital journalism sites supporting work with original sources, and e-portals being used as the primary communication channels between home and school (Finkel, 2012; Gilgore, 2015; Onder & Aydin, 2016; Tyner, 2010). In each case, the use of technology does not merely support instruction, but rather contributes to a changing dynamic of teaching and learning where students are becoming more actively engaged in their own learning processes.

In addition to this societal pressure toward more active learning, theories of learning within the fields of neuroscience, psychology and education acknowledge the connection between active student engagement and attainment of learning outcomes (Hirumi, 2002). Across these fields, student engagement, defined as student commitment to and investment in learning, has been identified as the primary factor in the learning process (Beeland, 2002; Bonwell & Eison, 1991; Glanvile & Wildhagen, 2007; Painter, Whitting & Wolters, 2005; Smith, Hardman & Higgins, 2006). Neuroscientists recognize that stimulating multiple senses, changing the type of activity, and providing opportunities for physical movement while learning increases oxygen flow to the areas of the brain responsible for focused attention, planning, and working memory (Byrnes, 2001; Lechak & Leber, 2012; Ratey & Loehr, 2011). Developmental psychologists recognize that, novel experiences and interactions with others promote learners to construct increasingly sophisticated ways of representing, organizing and employing information (Bruner, 1973, 1996; Piaget, 1972; Vygotsky, 1978). Educators know that, using a variety of pedagogies (i.e., instructional strategies) is an effective means to access these neurological pathways and development processes (Langer, 1997, 2000).

Contemporary K-12 educational frameworks, such as universal design for learning (Meyer, Rose & Gordon, 2014; Rose & Meyer, 2002) and student-centered, technology-rich learning environments (Hirumi, 2002), built on these theoretical foundations, incorporate the use of technology for instruction in ways that provide learners with multiple means of acquiring knowledge, multiple methods through which they can demonstrate their learning, and multiple ways to engage the curriculum. Such contemporary frameworks are becoming increasingly common in the elementary and secondary schools. Thus, the K-12 students enter college increasingly tech-savvy, familiar with active learning, and experienced in multiple flexible learning situations.

2. Bringing Innovation to Higher Education: Institutions, Designers & Educators

Situated between the K-12 experience of compulsory education and entry into the workforce for the traditional undergraduate students, higher education is uniquely positioned to help the young adult build on the knowledge and skills acquired in secondary school to meet the expectations of an increasingly demanding job market. Spurred by societal change, theoretical and scientific developments, and new educational practices, the evolution in the K-12 sector can and should push higher education to evaluate and reconsider its long-standing approach to teaching and learning. The expectations of employers that 21st century college graduates be able to

work collaboratively, communicate effectively, and solve novel problems can and should pull higher education toward its own construction and use of innovative approaches to teaching and learning. Considering from where today's college students are coming and toward where they are moving, the traditional approach to university teaching, namely the didactic lecture, may no longer be an effective strategy in higher education. According to Scott-Webber (2012), instituting change in higher education to a contemporary learning model will require the commitment of institutions, designers and educators.

2.1 Institutional Commitment to Innovation

In February 2014, Fairfield University embarked on a strategic planning process to guide decision making over the next five years. Continuous improvement and innovation were central themes of strategic planning, with task forces assigned to examine and make recommendations regarding all aspects of University functioning, including pedagogy.

In December 2014, conclusions from the Pedagogical Innovations Task Force report suggested that, professors were hindered from enacting effective teaching practices to promote active learning due to the physical and technological limitations of the 25+ year old classrooms. Classroom furniture that was set in rows and difficult to move, deterred professors from assigning in-class group work and promoted lecture-style instruction. Chalk boards that were difficult to erase and projection screens that covered white boards provided minimal writing space for students and instructors to connect with course content. Classroom technology that was outdated, in disrepair, and not user-friendly discouraged professors from incorporating dynamic resources in their instruction.

In response to these conclusions, Fairfield University began a multi-year project to upgrade the 90 general use classrooms on campus. Upgrades included improvements to space, furniture, and technology.

2.2 Designer Commitment to Innovation

This project to renovate Fairfield University's instructional spaces was the outgrowth of a unique collaboration between the divisions of Academics, Information Technology, and Facilities Management. Grounded in the belief that providing instructors increased flexibility would serve to promote their use of varied and innovative pedagogies, the classroom project team of Fairfield University worked together to identify solutions that would allow multiple options for the use of technology and furniture within a single classroom. They sought help in arriving at these solutions from two companies that could be characterized as designers committed to innovation in their fields - Apple Education and Steelcase Education.

In order to simplify technology in classrooms and untether the professor from an instructor station or lectern, the classroom project team replaced projection equipment and pull-down screens with Apple TV's, provided the entire full-time faculty with iPads, and upgraded the wireless connectivity so that professors and students bringing their own devices to the classroom could easily connect with Internet resources. Apple Education supported these technology upgrades by providing consultation and workshops to support the iPad rollout to the faculty and use of Apple TVs for instruction in the classroom.

In order to further increase flexibility in the classroom, the classroom project team replaced immovable row by column seating with mobile furniture that could be configured in a variety of formats – row by column, small groups, learning stations, large group U shape, and large group crescents. Guided by the consultations with Steelcase Education, the classroom project team furnished the classrooms with multiple writing surfaces – white-board painted walls, large portable white boards (e.g., Steelcase's Huddleboards 23" x 32"), and small portable white boards (e.g., Steelcase's Verb Boards 18" x 23") – and placed sound and visual displays (e.g., Apple TVs) in multiple locations creating flexibility in the location of the front and back of the classroom. Steelcase mobile instructor stations, 360-degree rotating student chairs (i.e., Node Chairs), and tables on wheels were used to optimize the furniture configuration options within the re-designed space.

2.3 Educator Commitment to Innovation

Institutional strategic planning and novel classroom design solutions are important contributors to innovation in higher

education. Pedagogical change, however, can only occur at the level of the instructor. Prior research suggests that, teacher concepts of his/her role in the classroom and plans for classroom instruction influence the enactment of new pedagogies for educational reform (Siegel, 2005a, 2005b). Current research further demonstrates that, the built environment (e.g., classroom design) can also impact teaching behavior in the classroom (Scott-Webber, Strickland & Kapitula, 2013).

3. Significance of Study

To date, however, little research across both K-12 and higher education settings has been conducted to examine the influence of the built environment, including classroom design and instructional technology, on teachers' perspectives on teaching and learning. As the landscape of higher education continues to evolve, institutions need to explore how their professors are utilizing available resources in their teaching pedagogy. Bringing together administrators, designers and educators to discover whether and how flexible classroom spaces, furniture, wireless technology and non-traditional active learning strategies impact the teaching and learning environment in the classroom can provide insight into the future of education.

4. Objective of the Study

This study explores Fairfield University professors' perspectives on teaching and learning in an innovative classroom characterized by the non-traditional design of space, flexible furniture solutions and upgraded technology. The purpose of the study was to explore how classroom space and available technology influence the experience of teaching for Fairfield University professors.

5. Methodology

5.1 Location

This study was conducted in the Active Learning Center (ALC) at Fairfield University, a Masters comprehensive institution in the Northeastern United States. The ALC was made possible by a grant award from Steelcase Education.

In late fall of 2014, coinciding with the commencement of the classroom upgrade project, Steelcase Education initiated a grant program, whereby secondary schools and institutions of higher education could be awarded the furniture and equipment necessary to build an Active Learning Center (e.g., innovative classroom space). In winter 2015, the classroom project team worked collaboratively to identify a classroom for renovation and submit a grant proposal. In spring 2015, they learned that Fairfield University was one of 12 awardees from 540 submissions to receive a Steelcase Active Learning Center grant.

Construction on the Active Learning Center (ALC) began in late spring 2015, and the ALC was ready for use at the start of the fall 2015 semester. Aligned with many of the classroom upgrades occurring across campus, the ALC includes two Apple TV's mounted in opposite corners of the classroom, two large white-board painted wall surfaces, multiple small individual white boards that can be displayed on easels or wall tracks, 36 student chairs that can rotate 360-degrees, 18 two-person tables on wheels that can be configured in a variety of formats, and one mobile instructor station. Thread, a new product from Steelcase, was installed to allow electrical power to run under the carpeting without the need for a subfloor, facilitating ease of charging mobile and other personal devices. Because the ALC was created as part of a learning grant program, and because it incorporated the most comprehensive upgrades of all classrooms on campus, it was served as the classroom location for the current study.

5.2 Participant Characteristics

During the 2015-2016 academic year, 30 full time and part time professors from a variety of disciplines, and across all of the academic units, including Arts and Sciences, Business, Nursing, Engineering, and Education, taught 43 different courses to almost 750 students in the Active Learning Center. Fourteen of the 30 professors were actively recruited to participate in the data collection for the current study and nine agreed. These nine professors, the final participant pool, included four Assistant professors, three Associate professors, one Instructor, and one part time professor. The professors taught a variety of academic subjects, including world history, composition, literature,

finance, and engineering to undergraduate students, and a variety of professional skills, including methods for teaching, counseling, nursing, and therapy to the Graduate Students.

5.3 Qualitative Data Inquiry

Drawing from academic traditions of anthropology and sociology, the researchers chose to use ethnographic inquiry to examine the influence of classroom design and technology on teaching and learning. Ethnographic inquiry is the study of explicit and tacit cultural knowledge, where culture refers to the acquired knowledge people use to interpret their experiences and generate new behavior (Spradley, & McCurdy, 1980). The researchers were specifically interested in the ways in which the "culture" of faculty who taught and learned in the ALC understood their experience and engaged in new behaviors in this innovative learning space. Using an ethnographic approach to data collection, the researchers sought to describe what people in the ALC say, what they do and what they create or make. Using qualitative methods, such as semi-structured interviews and artifact collection, the researchers explored the language that faculty used in the ALC, their descriptions of their behavior, and the products they created in or for the space. Corroboration of findings across these multiple data sources (e.g., interviews and artifacts) promotes confidence in the veracity of conclusions.

5.4 Artifacts

Participating professors submitted artifacts (e.g., course syllabi, scoring rubrics, lesson plans) generated during the semester they taught in the Active Learning Center. These artifacts were analyzed for evidence of innovative teaching to promote active learning. The researchers were specifically interested in the integration of technology with instruction, and the use of a variety of teaching methods during class time. Professor-generated artifacts that were collected, namely course syllabi, were considered to represent the goals professors had for learning and their plans for helping students achieve those goals. By analyzing professors' goals and plans, the researchers were able to explore whether teaching in the Active Learning Center impacted how courses were designed to maximize learning during class time through the use of technology and multiple teaching strategies.

5.5 Individual Interviews

Participating professors were interviewed twice during the spring 2016 semester. The second author, using a semi-structured format (shown in Appendix) designed to engage interviewees in conversation about their experience, conducted the interviews, which lasted approximately 30 minutes. Interviews were audio recorded and later transcribed for analysis. Interview transcripts were analyzed by both authors for evidence of use of a variety of teaching methods, the comfort level of integrating technology with instruction, and satisfaction and motivation for teaching.

5.6 Data Analysis

The standard in the analysis of qualitative data, NVIVO by QSR International, was used to reduce the qualitative data (e.g., interview transcripts) by identifying themes across participant perspectives. Professors also provided their syllabi or lesson plans for their course during the semesters taught in the Active Learning Classroom and these were analyzed using NVIVO for use of technology in the classroom and for evidence of engaging multiple methods of teaching.

6. Results

Analysis of interview transcripts and artifacts collected from the nine professors during the first year of implementing the ALC converged on four major themes: (a) classroom design did indeed influence professors' approaches to teaching, (b) professors used a variety of instructional strategies in the ALC, (c) among the strategies used, professors consistently and regularly integrated technology into their classroom-based lessons, and (d) professors who taught in the ALC demonstrated increased satisfaction with and motivation for teaching.

6.1 Classroom Design Influenced Pedagogy

Evidence across both the interview transcripts and syllabi artifacts revealed that, participating faculty redesigned course work and class time to maximize the opportunities they had in the ALC, including use of space, furniture, and upgraded technology. During interviews, professors shared their impressions of how the design of the ALC influenced

their approach to teaching:

- Many reflected on how they redesigned their courses for the semester, with one stating,

"I knew I was going to teach in [the Active Learning Center] so I thought how can I make use of this classroom, get the students the same content and skills but in a way that is manageable. I redesigned all of their assessment so that they were in groups for all of the semester".

- Another professor stated,

"knowing that I had [the Active Learning Center] for that class, I was like, okay this is going to work really well for group work, for students bringing their laptops in, for us watching videos on the screen, and so I took that into consideration as I restructured that class".

- A different professor discussed how teaching in the ALC influenced future teaching goals,

"I'm also thinking about offering the Shakespeare course as a service learning course in the future and the [Active Learning Center] has kind of helped me with that, just kind of thinking through that. I really like it and I imagine I could use it in all of my courses…I think its been really effective, there are so many ways that I can use that space you know, I don't think that the space is limited to any particular kind of course, I think anything can be taught in there".

6.2 Use of Multiple Teaching Strategies

Among the ways professors redesigned their courses, interview transcripts and syllabi artifacts revealed that professors employed multiple teaching strategies, sometimes within a single class session. Pedagogies described by the professors during their interviews, were also evident in their plans for the semester (artifact collection), and included whole-class discussion, partner and small group work, in-class writing and hands-on activities, powerpoint presentations, viewing of media and film clips, and use of mobile apps such as interactive polling during class. During one interview about the ALC, a professor stated,

"We used powerpoints on the screen, notes on the board, when we were doing hands-on activities, we made good use of the whiteboards, and I think for some of the discussions the ability to kind of create a smaller circle or have the students pair up to find their own spot in the room, that was helpful".

Another professor stated *"I would love to teach in there all the time,"* and added that she could continue to think of new ways to use the space as there are multiple possibilities to maximize its flexibility.

6.3 Integration of Technology

Included in the types of pedagogy they employed, professors consistently integrated the upgraded technology into their instruction to promote active learning. Artifact analysis revealed professors' goals to use technology to aid instruction, as well as professor expectations for students to use the wireless technology to project their own presentations. Interview transcripts supported these professors' plans and expectations, and further revealed professors' innovative use of low-tech options as well as challenges they encountered with technology.

6.3.1 Professor use of Technology

Among the technologies used by professors, the Apple TVs were most popular. Professors made use of the Apple TV's at both locations in the front and back of the room, allowing all students to choose to view content on the TV closest to them. The TVs had multiple source options, from wiring in a laptop or going wireless via use of the iPad. Many choose their iPads to wirelessly connect to the TV's, as one professor described,

"… it was nice and helped the feel of being a little bit more portable since I had it right there with me, and even if I wanted to pop to a website or something I could just swipe over to a different app or open up a you tube video or whatever we were needing just right from there as I walked around the classroom. And so I used that every single class, the wireless projection".

6.3.2 Student use of Technology

Integration of technology for instruction also included student use of technology during class time, as evident in both the syllabi and interview transcripts. For example, faculty mentioned using apps such as Poll Everywhere and Nearpod, to engage students in immediate interactive feedback as the class progressed. Students also used their

own devices, including laptops or smartphones, to take turns sharing content with the class via wireless projection. One professor noted *"we had students presenting and we were able to pretty smoothly flow from one projection source to another".*

This student use of technology was supported and made easier by the use of Thread, portable charging stations that were placed throughout the room.

"Thread was actually surprisingly helpful because I do have students who bring in their laptops for notes…they are always the students who are stuck against the wall because they need an outlet…just seeing one of those students walk in and discover Thread its like 'see you can be part of the circle!'"

6.3.3 Low-Tech Innovations

One of the most well-received "tech" innovations were the white boards, specifically the portable Verb boards, which provided multiple writing surfaces for professors and students. As one faculty member stated, *"the simplicity of the technology in the room [the ALC] was really good, I used that and I liked it."*

6.3.4 Technology Challenges

As with any technology innovation, there were also comments from professors that they encountered challenges with the upgrades.

- *"It was hit or miss, so there are days when the Apple TVs are not cycling together… so I always have a back up plan just in case my powerpoint doesn't project or my wireless isn't working."*
- *"I also learned that my laser pointer does not work on LCD screens, which you know I had to adapt to that a little bit."*
- *"There are things that don't work well with the Apple TV, like Netflicks for example. I show a lot of clips and I've had several frustrating moments with not being able to play them."*

6.4 Motivation and Satisfaction for Teaching

Analysis of interview transcripts revealed that, professors were motivated and satisfied with their teaching in the ALC. One professor stated, *"I think it opens up opportunities for me to teach differently. I think that's the big thing…I can do more of the group work, I can do more of the collaborative experiences that I've always wanted to provide."* Other professors discussed that, through using the technology and the furniture, their classes were more effective in the ALC,

"I remember we staged that from what would have been the side of the front of the room and it seemed normal to stand up and do it over there, I thought that would never have happened [in a different space] so that I thought was another effective class in that room…I tend to walk back and forth and I use the board at the front and I use the board at the back and sometimes they are both covered and they are using their [individual] boards and I think its really turned the traditional classroom on its head."

Professors enjoyed the space, discussed the feeling of comfort it provided, and 100% of those interviewed expressed interest in teaching in the ALC in a future semester.

Analysis of interview transcripts also elucidated professors' perspectives on student behavior in the ALC. *"I think [the students] learned more and that we had richer discussions this semester because of the space."* Another professor stated, *"I think it encourages conversation, it encourages participation, it encourages collaboration because they talk with one another."* Professors also expressed they saw increases in student engagement due to the variety of pedagogies employed by innovatively using the available technology; *"I definitely learned that the students' engagement does increase when they had something a little bit more physical…I felt like I was more connected to the students because no one was ever more than one student away when I walked by."*

Professors enjoyed teaching in the ALC, and as they structured their courses and the classes progressed, they recognized that, *"both pieces of the puzzle are key, the furniture is just as important as the technology and the technology is just as important as the furniture"* in promoting student engagement in class.

7. Discussion

Driven in part by rapid advances in technology, the focus of teaching and learning has been shifting over the past few decades from the traditional content delivery and

acquisition approach to innovative strategies that require students to apply, integrate and manipulate content knowledge for real world application (Bruner, 1996). As K-12 students continue to enter college with greater facility with learning technology and increased experience with flexible and multiple learning formats, and as employers increasingly expect college graduates to have more than content knowledge, the shift from solely lecturing to actively engaging students will continue to broaden their understanding of what can and should be done in college and university classrooms.

8. Limitations and Directions for Future Research

Exploratory in nature, the current study is one of the first to examine the interactions between classroom design, instructional technology, professor perspectives and innovative pedagogy. While this study helps to begin the conversation about these important constructs, further research is needed to examine how changes in instructor perspectives might influence paradigm shifts in higher education and impact college student learning.

One limitation of the current study was the sample size. Although qualitative studies often employ small and purposeful samples, the professors in this study represent only a fraction of the professors who teach in the ALC and a small percentage the full faculty at Fairfield University. Expanding the sample to include additional faculty at their institution could help to more fully explain the influence of classroom design and technology on teaching and learning.

Likewise, the study was limited to one classroom on Fairfield University's campus. Novelty or specialty associated with the ALC may have contributed to professors' enthusiasm toward their experience in the classroom. Interview and artifact data from professors who teach in upgraded, but not grant-winning, classrooms on campus may also help to provide a fuller picture.

Finally, although the study employed two data sources (interviews and artifacts), it was limited to information provided by the professors. Classroom observations of the participants teaching and learning in the ALC, as well as data capturing students' perspective could also help to support and further elucidate the findings.

Conclusion

This study demonstrated that innovative classroom design and upgraded instructional technology influences University professors' experiences and perspectives of teaching and learning in the classroom. When given the innovative space of the ALC, and the freedom to redesign or rethink their courses, faculty embraced a variety of pedagogies that promoted active learning. When provided with simplified equipment and wireless capability, faculty routinely integrated multiple types of technology into their instruction. The integration of technology alone might not be enough to engage students in class, but combining the current technology advances with innovative design using flexible furniture solutions allowed for greater collaborative work and active learning in class. Moreover, these pedagogical changes prompted by classroom design and technology upgrades, were accompanied by feelings of motivation for and satisfaction with teaching as well as new perspectives on student learning among the professors.

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References

[1]. Ananaidou, K., and Claro, (2009). "21st Century Skills and Competences for New Millennium Learners in OECD Countries". *OECD Education Working Papers,* No. 41, OECD Publishing. http://dx.doi.org/10.1787/218525261154

[2]. Beeland, W.D. (2002). "Student Engagement, Visual Learning and Technology: Can Interactive Whiteboards Help?" Retrieved from http://chiron.valdasta.edu/are/Artmanscript/vol11no1/beeland_am.pdf

[3]. Berrett, D. (2012). "How 'flipping' the Classroom can Improve the Traditional Lecture". *The Chronicle of Higher Education.* Retrieved from http://ctl.ok.ubc.ca/__shared/assets/_Flipping__The_Classroom45753.pdf

[4]. Bonwell, C.C., and Eison, J.A. (1991). "Active learning &

creating excitement in the classroom (ASHE-ERIC)". *Higher Education Reports,* (1), The George Washington University School of Education & Human Development.

[5]. Boyd, D. (2016). "What would Paulo Freire Think of Blackboard TM: Critical Pedagogy in an Age of Online Learning". *International Journal of Critical Pedagogy,* Vol. 7, No. 1, pp. 165-186.

[6]. Bruner, J. (1973). *Beyond the Information Given: Studies in the Psychology of Learning.* WW Norton & Company.

[7]. Bruner, J. (1996). *The Culture of Education.* Cambridge, MA: Harvard University Press.

[8]. Byrnes, J. (2001). *Minds, Brains and Learning: Understanding the Psychological and Educational Relevance of Neuroscientific Research.* New York, NY: Guilford.

[9]. Finkel, E. (2012). "Flipping the Script in k12". *District Administration,* Vol. 48, No. 10, pp. 28-34.

[10]. Freire, P. (1972). *Pedagogy of the Oppressed.* 1968. Trans. Myra Bergman Ramos. New York: Herder.

[11]. Gilgore, S. (2015). "Probing the Impact of Parent-Teacher Digital Communication". *Education Week,* Vol. 35, No. 4, pp. 1-16.

[12]. Glanvile, J.L., and Wildhagen, T. (2007). "The Measurement of School Engagement: Assessing Dimensionality and Measurement Invariance Across Race and Ethnicity". *Educational and Psychological Measurement,* Vol. 67, pp. 1019-1041.

[13]. Goral, T. (2013). "A Conversation with Tony Bates". *University Business,* Vol. 16, No. 2, pp. 44-45.

[14]. Hirumi, A. (2002). "Student-Centered, Technology-Rich Learning Environments (SCenTRLE): Operationalizing Constructivist Approaches to Teaching and Learning". *Journal of Technology and Teacher Education,* Vol. 10, No. 4, pp. 497-538.

[15]. Jones, E.A. (2002). "Transforming the Curriculum: Preparing Students for a Changing World". *ASHE-ERIC Higher Education Report,* Vol. 29, No. 3, pp. 1-101.

[16]. Jukes, I., McCain, T., and Crockett, (2008). *Understanding the Digital Generation: Teaching and Learning in the New Digital Landscape.* Vancouver BC Canada: Corwin A Sage Company.

[17]. Langer, (1997). *The Power of Mindful Learning.* Reading, MA: Lifelong Books.

[18]. Langer, (2000). "Mindful Learning". *Current Directions in Psychological Science,* Vol. 9, No. 6, pp. 220-223.

[19]. Lechak, J.R. and Leber, A.B. (2012). "Individual differences in distraction by motion predicted by neural activity in MT/V5". *Frontiers in Human Neuroscience,* Vol. 6, No. 12, pp. 1-10.

[20]. Meyer, A., Rose, D.H., and Gordon, D. (2014). *Universal Design for Learning: Theory and Practice.* Wakefield, MA: CAST.

[21]. Min, K., and Siegel, C. (2011). "Integration of Smart Board Technology And Effective Teaching". *i-manager's Journal on School Educational Technology,* 7(1), Jun-Aug 2011, Print ISSN: 0973-2217, E-ISSN: 2230-7133, pp. 38-47.

[22]. Onder, R. and Aydin, H. (2016). "Students' Views towards the Usage of Smart Board in Biology Lessons". *i-manager's Journal on School Educational Technology,* 11(3), Dec 2015-Feb 2016, Print ISSN: 0973-2217, E-ISSN: 2230-7133, pp.18-28.

[23]. Painter, D.D., Whitting, E.,and Wolters, B. (2005). "The Use of Interactive Whiteboard in Promoting Interactive Teaching and Learning". *VSTE Journal,* Vol. 19, No. 2, pp. 31-40.

[24]. Piaget, (1972). *To Understand is to Invent.* New York, NY: Viking Press, Inc.

[25]. Prensky, M. (2001). *Digital Natives, Digital Immigrants.* Retrieved from http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20- %20Part1.pdf

[26]. Ratey, J.J., and Loehr, J.E. (2011). "The Positive Impact of Physical Activity on Cognition During Adulthood: A Review of Underlying Mechanisms, Evidence and Recommendations". *Rev. Neurosci.,* Vol. 22, No. 2, pp. 171-185.

[27]. Rose, D.H., and Meyer, A. (2002). *Teaching Every Student in the Digital Age: Universal Design for Learning.* Alexandria, VA: ASCD.

[28]. Scott-Webber, L. (2012). "Institutions, Educators, and

Designers: Wake Up!: Current Teaching and Learning Places Along with Teaching Strategies are Obsolete-teaching Styles and Learning Spaces must Change for 21st-Century Needs". *Planning for Higher Education,* Vol. 41, No. 1, pp. 265.

[29]. Scott-Webber, L., Strickland, A., and Kapitula, L.R. (2013). "Built Environments Impact Behaviors: Results of an Active Learning Post-Occupancy Evaluation: The study shows that Rigorous Research Methods Embedded in the Design of Product(s) and Contextual Solutions Result in Measureable Improvements". *Planning for Higher Education Journal,* Vol. 42, No. 1, pp. 28-39.

[30]. Selwyn, N. (2007). "The Use of Computer Technology in University Teaching and Learning: A Critical Perspective". *Journal of Computer Assisted Learning,* Vol. 23, No. 2, pp. 83-94. DOI: 10.1111/j.1365-2729.2006.00204.x

[31]. Sheets, B. H. (1991). "Book Review of Growing up Digital: The Rise of the Net Generation". *Information Technology, Learning and Performance Journal,* Vol. 17, No. 2, pp. 53-56.

[32]. Siegel, C. (2005a). "An Ethnographic Inquiry of Cooperative Learning Implementation". *Journal of School Psychology,* Vol. 43, No. 1, pp. 319-329.

[33]. Siegel, C. (2005b). "Implementing a Research-based Model of Cooperative Learning". *Journal of Educational Research,* Vol. 98, No. 6, pp. 339-349.

[34]. Smith, F., Hardman, F., and Higgins, S. (2006). "The Impact of Interactive Whiteboards on Teacher-Pupil Interaction in the National Literacy and Numeracy Strategies". *British Educational Research Journal,* Vol. 32, No. 3, pp. 437-451.

[35]. Spradley, J.P., and McCurdy, D.W. (1980). *Anthropology, the Cultural Perspective.* John Wiley & Sons.

[36]. Stedman, L.C. (1997). "International Achievement Differences: An Assessment of a New Perspective". *Educ. Res.,* Vol. 26, No. 3, pp. 4-15.

[37]. Tyner, K. (2010). *Media Literacy: New Agendas in Communication.* New York, NY: Taylor & Francis.

[38]. Vygotsky, (1978). *Mind in Society.* Cambridge, MA: Harvard University Press.

Appendix

Interview Questions for Professors

Steelcase Active Learning Grant Canisius Room 9-Academic Year 2015-2016

1. What did you learn by teaching in this space this semester?
2. What class did you teach and what did you want your students to learn?
3. Do you feel you used this room to help your students meet your teaching goals?
4. Do you think your students learned more from being in this class in this space? How do you know?
5. Did teaching in this space allow you to teach differently than you have in the past in other spaces?
6. Could you discuss your satisfaction in teaching in this space this semester?
7. Any suggestions for future classroom designs?

ABOUT THE AUTHORS

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Dr. Jennifer Claydon is the Accreditation Coordinator for Fairfield University. She received a BS in Psychology from Fairfield University and obtained her Ph.D in Cognitive Psychology from the University of New Hampshire. Prior to joining Fairfield, Dr. Claydon worked at a private preparatory high school, Phillips Exeter Academy, teaching neuroscience, social psychology, and general psychology. Dr. Claydon worked as the Director of Disability Support Services at Fairfield University for 2.5 years supporting accessibility for all students. She currently adjuncts in the Psychology department teaching classes in general psychology and biological bases of behavior.