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Educational Design:
Does the Design of a Learning Environment Effect How a Student
Learns?

By
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A THESIS

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Educational Design:

Does the Design of a Learning Environment Effect How a Student Learns?

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University of Nebraska, 2022

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The Intent of this thesis is to review the role that the built environment plays in the educational process. Specifically, how the classroom furnishings support the newer pedagogy methods and how design of higher educational space can contribute to student success. The study done for this this thesis is based on the research of 21st Century methods of teaching and learning.

New 21st Century classroom layouts have evolved from the studies of several educational researchers and their findings over the past century. In conjunction with universities across the world, researchers developed progressive outlooks of what the built environment can offer to the newest generation of learners. Their studies have coined several terms such as Active Learning Classrooms (ALC), Student Centered Active Learning Environment for Undergraduate Programs (SCALE-UP) and Technology Enabled Active Learning (TEAL). These classroom models represent higher learning studies for more effective 21st century learning environments. Some of the models include a specific style of table and number of chairs, while other layouts favor mobile furniture options and a variation in furniture types. All have found a way to integrate the use of updated technology and whiteboards as well as used the methods of collaborative teaching

spaces for more student focused learning environments. This thesis will detail the specific research related to Active Learning Classrooms vs Traditional fixed seating classroom layouts.

Much of the evolution of the learning environment is attributed to newer technology and research developments offering a better delivery system for learning. 21st century classrooms encompass opportunities for learning through a greater use of shared content, collaborative learning, and more interactive facilitators. The desire is to benefit a larger range of the student population by understanding the learning needs and styles of 21st Century students. (Donovan, Green, & Mason, 2014) (Park & Choi, 2014)

Students of today have grown up in a technology-rich world, where learning and reference information is readily available. Classrooms of the 21st century are spaces that have laptops, projectors, monitors, (Donovan, Green, & Mason, 2014) and personal devices. Some classrooms are also furnished with specialized equipment such as 3D or laser printers. The development of rapid information gathering has conditioned students to learn in a different way than students twenty to thirty years ago. This allows today's students to have a new learning experience, one that provides more time for collaboration, where they can develop progressive critical thinking skills.

The pedagogy that has developed concurrently with technology reveals that students learn better when there is an exchange of ideas and when students can teach one another what they have learned. Students retain learning significantly better when they have a personal investment and interest in the subject matter. This has caused the shift in the newest pedagogy to be a more student driven and student focused teaching method where the teacher acts more as a facilitator than lecturer and where students are researching rather than regurgitating information. (Entwistle, 1991)

It is critical that the physical classroom environment is designed to support the mobility of the teacher as a facilitator. Providing flexible and mobile furniture options will help a classroom be rearranged quickly to support a large variety of functions and assist in the changing of activities required by the learning and collaboration of the student groups.

Keywords: Active Learning Classrooms, SCALE-UP, TEAL, Pedagogy, 21st Century Schools

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Educational Design: Does the Design of a Learning Environment Effect How a Student Learns?

Chapter 1: Introduction of the research study for the designed educational environment

1.1 Thesis overview and purpose of the study: Based on previous research from Elisa L. Park, Bo Keum Choi, David Bryan Zandvliet, Caitlin Pl DeClercq, Galen Cranz, Anne Taylor, and many other researchers outlined in this thesis, the built environment does contribute to the overall positive experience in the classroom and the overall student engagement and learning. This thesis will test the impact of mobile furnishings as a contributing factor in the student's learning experience. The mobile furnishings are part of the Active Learning Classroom (ALC) model. Movement in the classroom helps contribute to collaborative group discussion, quick break out activities, and the ability for a teacher to rotate within the class from group to group easier. Active Learning Classrooms can provide an atmosphere that will promote better learning and improve a student's overall engagement of subject matter.

This study was conducted to answer the question, "Does the design of a learning environment affect how a student learns?" Or more specifically to analyze whether college students benefitted from flexible seating options in Active Learning Classrooms. The intent of the thesis is to study the implications and difference between a traditional classroom and the Active Learning Classroom. ALC's objective is to support newer pedagogy by providing spaces where the teacher can affectively instruct in the classroom and transition to alternate activities more effectively; where traditional classroom spaces cater to lecture style teaching with less student interaction or group discussions.

The research and set-up for this thesis followed the pattern of colleges across the United States and other countries, who conducted similar studies. Many of the previous studies were qualitative in nature, based mostly on observations and surveys, Such as *The Impact of Learning Space on Teaching Behaviors* (Beery, Shell, Gillespie, Werdman) and *The Impact of the Classroom Built environment of Student Perceptions and Learning*, (Marchand, Nardi, Reynolds, Pamoukov). The qualitative research on the effects of design in educational environments showed that there is positive feedback from both educators and students when a space is designed to accommodate movement, variety and flexibility, technology, and collaboration. However, in the study for this thesis, both quantitative and qualitative research methods were used to evaluate collected data. The intent was to provide a statistical analysis of the findings for the benefit of the thesis and to help build the data for other higher learning institutions.

In the winter semester of 2017, BYU-Idaho permitted the research for this thesis to evaluate the benefits of Active Learning Classrooms on their campus. They desired quantitative results to understand statistically if the classrooms were making a difference in student learning outcomes. Previous studies up to this point at other universities showed positive qualitative feedback from teachers and students as to how they felt about the learning experience but did not have quantitative results showing a measurable performance benefit. This thesis will combine the quantitative and qualitative data in efforts to capture a broader picture of well-designed classrooms impact on students.

Before this study, BYU-Idaho had adopted a Student Learning Model that shifted the pedagogy of teaching and learning more toward the student driven experience. This model of instruction required that much of the reading and preparation happened before the scheduled class time, which provided that much of the class time was spent in group collaboration as well

as deeper learning and explanation. Active Learning Classrooms aligned with the BYU-Idaho Learning Model such that an Active Learning Classroom is designed with transitional spaces where discussion and break out activities can easily be accommodated.

1.2 Background of the study: During the early 2000s many colleges and universities as well as K-12 educational institutions began a transition from the traditional-style classrooms, where a lecture style format was standard, to more mobile or collaborative classroom layouts. Their interest was to discover if students and educators had a better experience in a classroom designed to promote group discussion and where the teacher acted more as the facilitator (Taylor 2009). Taylor outlines in her first chapter of *Linking Architecture and Education*, that the transition began with questioning how education needed to change and what was being done worldwide to improve the learning experience.

Education has a specialized need to both instruct and guide learning. Historically the educational system was structured around the “Ford model” of learning. This style of pedagogy is a routine teaching system designed to condition students to be future employees who would enter the work force groomed to have scheduled work, break, and meeting times. This was the result of factory driven societies back in the early 1900s, hence the coined phrase “Ford” model of learning. Today’s industry and thus its educational system is driven more by technology and collaboration. (Ramli, Shamsidar and Masri, Improving the Classroom Physical Environment: Classroom users' perception 2013)

Students of the 21st century are more successful in their learning if it is tailored to their interest or learning style. In the evolving educational model, a teacher’s role is to support, guide, and help assist in student learning but students drive their own education. This shift in pedagogy has necessitated a more cohesive classroom setting that encourages movement of the teacher

throughout the room to join in various group discussions. There is also a need to have the classroom quickly convert from instructional use to group break sessions.

1.3 Study outline and description: To determine if use of mobile furniture in a classroom versus traditional stationary classroom layouts affect how a student learns, this study focused its research in two higher educational classrooms at BYU-Idaho.

To explore these questions, the study at BYU-Idaho was designed to isolate the classroom as the only variable in the study. This was done by having the same professor teach two different sections of the same class in both the Active Learning Classroom and the traditional style classroom. The control of the study kept the subject and professor the same. Naturally the students would vary in both sections. To accommodate the difference, students attending each class were organized as a matched set with a student in the opposite class based on gender, grade point average, major, and year in school if needed. This left the classroom styles as the major variable of the study. The classrooms became the observable difference in the research.

The implications of this study can benefit the educators, architects and designers who design spaces for educational use. Results of the study might suggest best practices in the design and furniture used in classrooms to support 21st century teaching methods that enhance collaboration between students. Research and development in furniture, space layouts, environmental aspects, and technology will change the way educational spaces are developed and designed in the future.

1.4 Study set up: As previously noted, two classrooms were selected for the study, an Active Learning Classroom, and a traditional auditorium style classroom. The Active Learning Classroom had whiteboards on all the walls for student use. It was furnished with Steelcase Node chairs which are equipped with casters and individual desk surfaces. The tech station was

mounted to the wall allowing the teacher to have a mobile desk as well. A projector was in the room for content and instructional display. The entire space was designed for movement and flexible enough for quick activity change.

The traditional classroom was furnished with forward facing fixed seating. The teacher had a fixed podium to teach from which housed the tech station. There was a projector in the room to assist with teaching. The only whiteboards were located at the front of the room for teacher use. The side walls displayed one or two pieces of artwork that was not specific to the coursework. There was a bank of windows along the back wall.

Two sections of a Foundations of Religion class were taught by the same professor, on the same days but in the two different classroom types. The professor taught the class on Tuesdays and Thursdays each week. He taught in the Active Learning Classroom at 7:45-8:45am and then in the Traditional Classroom at 10:15-11:15.

At the beginning of the winter semester 2017 students in each class were asked for their consent to participate in the study. They were notified that it would not affect their grade and that their consent was voluntary. Students were informed that they could withdraw at any time. They were also told that this study would be used in a thesis paper and would benefit the investigation in learning environments for college students.

Since the study was set up to measure if students performed better in one classroom type than another, students grade point averages were the set quantitative factor of the study. The evaluation for the matched set was to assume that students who were comparable in Accumulative GPA would perform the same in either classroom environment. Meaning a student set with a matching GPA would be expected to receive an equal grade to their counterpart if they were attending in either classroom environment. At the end of the semester each paired student

was evaluated against their counterpart to see who fared better in their class. If one student received a higher grade in their class, it is assumed that there was a difference in the conditions in which the student learned in. Statistical information calculated the results of the pair and the entire class. Furthermore, the observations in the classroom explained how students and the teacher interacted and if the students seemed more engaged or disconnected in each space. The teacher taught in the same manner of pedagogy in each space and evaluations of the ability to teach were observed by the researcher.

This quantitative portion of the study was performed by the evaluation of student's grades which were obtained at the end of the semester from the registrar's office as previously outlined. The student's names and identifying information was removed before the researcher was given the information to protect the privacy of the students. After the matched sets were established, the grades they received in the class were compared. The comparison of grades between the matched sets were calculated to compare who did better in their respective classroom environment. A statistical evaluation, based on the null hypothesis that there would be no change in the student performance in either style of classroom was conducted. The results of this study are outlined in detail in Chapter 4.

The qualitative portion of the study was a two-part analysis based on classroom observation and at the end of the semester a digital questionnaire. The observations were done in each classroom 3 times during the semester for the entire class period of one hour. Observations were made as to how students and the teacher were responding to the classroom space based on the mobility of the furniture.

The survey was sent out through SurveyMonkey to all the students in each classroom. They were asked to rate their experience in their classroom for the appeal and aesthetics. They

also rated the room on whether they felt it promoted their engagement and learning. Ratings were averaged and evaluated based on their responses.

Chapter 2 – Background of the study, literature review, and the shaping of pedagogy

The framework for educational change can be traced back to research done by educational institutions and theorists who desired to comprehend student learning and the environments that supported better learning.

2.1 Educational Theorists: In the book, *Linking Architecture and Education, Sustainable Design of Learning Environments*, by Anne Taylor she outlines some of the well-known “Educational Theorists” who have attributed to the shaping of teaching pedagogy over time. She starts with John Dewey, who studied the inherent nature of children in 1916. In so doing, he discovered that children are active and learn from the stimulation of movement, suggesting that classroom and instruction should promote movements and discovery (Taylor 2009).

Dewey’s study was supported by Jean Piaget (1972) who felt that students developed in stages. Piaget claimed that children’s growth was enhanced by stages of exploration, discovery, and trial-and-error. Maria Montessori pioneered the concept of Montessori schools that were tailored to students not by age but by developmental stages. Her methods helped students to excel in the classroom space by providing open sensory-filled classroom spaces and appropriate learning methodology. Children in Montessori style schools could progress at their own pace with the guidance of a teacher (Taylor 2009).

The creative nature of students was recognized by Viktor Lowenfeld (1970), who understood that students could learn several self- identification elements by using art in the

teaching methods of the classroom. Art can motivate and help students in ways that traditional subjects cannot (Taylor 2009).

Lev Vygotsky (1978) studied the social learning that is evident from students in the classroom environment. This social and cultural study identified the need for adaptation in social environments. Benjamin Bloom desired to understand the concept of higher order thinking along the lines of “Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation” (Taylor 2009).

Howard Gardner developed and studied the theory that there were different ways students learned. He separated them into categories of “intelligences.” The ways he discovered that students learned he labeled as “Verbal/ Linguistic, Logical/Mathematical, Musical/ Rhythmic, Visual/ Spatial, Interpersonal, Intrapersonal, Bodily/ Kinesthetic and Naturalistic”. Knowing there is a difference in the way a student processes information can greatly help the way an educational space is built for students. Architects and designers must be aware of the space such that they are providing the correct stimuli or creative elements without being distractive to the focused needs of the space (Taylor 2009).

By linking subjects together and providing opportunities for Math, Sciences, English and so forth to work in conjunction with one another, Sandra N. Kaplan and Bette Gould realized that interdisciplinary subjects helped to “allow for in-depth learning”. In 1992, Spencer Kagan evaluated cooperative study in the classroom and found that by using this method it fortified the skills of management, class bonding and of course enhanced cooperation abilities. These skills are what the active learning spaces of the 21st century classroom is built on (Taylor 2009).

Taylor’s last “Educational Theorist” to review was herself, along with George Vlastos, who together focused on the physical environment that students learn in. Taylor and Vlastos felt

that the classroom space itself held responsibilities to the pedagogy and directed, in some ways, the curriculum and learning behavior of the students and teachers who used it (Taylor 2009).

Each study done by the “Educational Theorists” moved the advancement of understanding ahead to formulate our current pedagogy, of movement, student lead learning, and collaborative learning patterns (Taylor 2009). Previous studies helped determine student needs through teaching styles and learning spaces, this study takes a step forward to evaluate the correlation between the designed educational environment adapted for a 21st century teaching structure and student performance and learning.

2.2 Evolving Pedagogy: The previous section’s studies have led educational institutions to understand that there is room for improvement and evolution in the way information is taught and delivered to students. This transition from traditional learning and teaching techniques has given way to 21st century learning and teaching. The tools and techniques that have evolved over the last few years have been greatly affected by the introduction of new technology. Technology has allowed us to access information quicker and easier than ever before. This allows teachers to flip the teaching paradigm to a more student focused learning environment. Educators can lean more heavily on digital research and learning materials, thus making it available to students outside of class. This not only helps during the formal study years of students but also will teach students of 21st century learning to embrace technology that will be used in any student’s future career path. Use of technology in the classroom and learning the ability to collaborate will help to prepare students for new careers that require innovation and creativity. It is important to note as well, that educators understand that the previous pedagogy of “lecture and regurgitate” is not as affective for that preparation (Donovan, D. and Mason 2014).

21st Century learning pedagogy helps relate student learning to them personally. The format of class time has changed from a teacher lecturing during the hour to student's reading and preparing for class time on their own. Students then are prepared to come to class to discuss and collaborate on what they have learned. Sharing their thoughts and ideas is a key element in the effective learning. Engaging the students by breakout sessions and providing places where they can work through their ideas is the strategy of 21st Century classrooms. Technology is a key factor in the presentation and delivery of materials from educators and students alike. Many students and teachers agree that 21st Century Classrooms or Active Learning Classrooms, help with student motivation and most students were observed to do better in class assignments. (Miller and Metx 2014)

Differing opinions between students and faculty still exist when it comes to Active Learning Spaces. Surveys revealed that educators felt that a little less than a third of the time should be dedicated to Active Learning activities. But the students felt that forty percent of the time should be open to Active Learning pursuits. To support the student's viewpoint Miller and Metx state that "Educational research indicates that after 2 weeks, students tend to remember 20% of what they hear and 90% of what they say and do" (Miller and Metx 2014).

Research thus far, has developed four recommendations for classrooms moving forward. The first suggestion is that institutions of higher learning should understand the impact that classroom design can have on student performance. This includes design elements that promote a healthy learning space. The second recommendation is to make training available to the faculty using the Active Learning Classrooms so that they are aware of the benefits and capabilities of the space and how it can contribute to a better teaching model. Third, continued research should be done on the designed classroom and the integration of methods. These research studies should

be available for use to help advance classroom design. Fourth, post occupancy evaluations of the student's academic performance should be conducted to help map the effectiveness of the newer classroom design. Sharing the evaluations with the educational community as well as those in the field of architecture and educational design will help improve the educational experience in the future (Park and Choi 2014).

Forty years of previous learning research on classroom environments has produced undeniable evidence that the classroom as its own entity will influence student outcomes of “attitude, behaviors and cognition”. David Zandvliet in his journal article *PLACES and SPACES: Case Studies in the Evaluation of Post-Secondary, Place-Based Learning Environments*, stated that “Research in learning environments has provided convincing evidence that the quality of the classroom environment in schools is a significant determinate of student learning.” “Campus rooms and buildings have the potential to move beyond supporting our daily needs: they can enhance educational pedagogy in critical ways” (Zandvliet 2014).

2.3 Considerations of design elements: The learning environment does not solely include the taught subject matter or delivery method. It also includes the physical space that surrounds the student and how well that space supports the student's total educational experience. Zandvliet urges that the assessment of student success and learning has only been measured by letter grades and test scores, which cannot reveal the whole picture of the students experience in their learning environment. (Zandvliet 2014)

In the journal article, *The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis*, the authors have outlined three categories of elements that make up the built environment and influence the occupant's experience. They are: “Naturalness”- the element of incorporation of nature, use of light, temperature and ventilation, and the implication

of sound. “Individualism” within a space is defined as the ability to have ownership in the room. It is the sense of connection and the opportunity to change the space as needed to create an individualized environment. “Stimulation” was the third factor of this study, and it is the introduction of color and variety or complexity of the space (Barrett, et al. 2015).

Findings from Zandvliet’s *PLACES* study where students were given a “Learning and Constructive Environment Survey” indicated the following:

“Students preferred a learning environment that:

- (1) is open to students to speak their mind/ express themselves (Critical Voice)*
- (2) has a good group dynamic (Group Cohesiveness)*
- (3) Allows students the freedom to personalize their learning (Open-Endedness)*
- (4) Selects its experiential learning settings specifically to reinforce classroom-based learning (Relevance and Integration)*
- (5) provides opportunities for students to share and contrast alternative views of the learning content with one another (Student Negotiation)*
- (6) incorporates field activities into the curriculum (Environmental Interaction)*
- (7) allows students to actively participate in learning (Student Investigation)*
- (8) and lastly, allows students to share control, to some degree, what the teacher about what is to be learned (Shared Control)” (Zandvliet 2014).*

Zandvliet’s study also indicated that student rated the feeling of physical comfort above all other factors in the study. It is also noted that the students weren’t as concerned with the shared control of the learning as being able to personalize their learning experience. Subsequent case studies also valued the ability for a student to speak their mind and express themselves over the importance of shared control of content (Zandvliet 2014).

2.4 Movement and furniture, Perception of space: How students perceive a learning environment will contribute to how a student will learn in the space. It will be a factor in the overall teaching system that will have a direct impact on the quality of how the students learn (N. Entwistle 1991).

Researcher and psychologist David Bryan Zandvliet conducted a five-phase study to evaluate ideal learning environments for higher education. He started with an evaluation of a current learning environment, then adapted the environment's design to benefit the physical and psycho-social learning space, using previous studies' results as a guide to create the ideal (Zandvliet 2014).

Zandvliet's study denotes that research about human behavior has been debated since the early 1930s by scholars. They wrestled between the beliefs that people were influenced by their previous experiences, or they were influenced by their interaction with the environment, or perhaps a person's personal characteristics were the driving force of determining someone's experience. His research pointed to a report by Lewin in 1936 and the behavioral formula for $B=f(P,E)$ (the formula of Behavior as the function of the person and the environment) (Zandvliet 2014).

Zandvliet's study was conducted to help understand the reaction of students to their physical environment. He included elements of the designed space and its accommodation for the student's physical self and the learning activities performed in their classroom. Every element of the classroom environment was evaluated (Zandvliet 2014). (Findings from this study are outlined above at the end of section 2.3.)

Galen Cranz and Caitlin DeClercq's study, *Moving Beyond Seating-centered Learning Environments: Opportunities and Challenges Identified in Post-Occupancy Evaluation of a*

Campus Library, is focused on the sedentary life of school and sitting too long in academic spaces. DeClercq argued that the prolonged sitting is linked to as many health risks as that of people who smoke, are obese or elderly. The sedentary sitting position for several hours at a time has been linked to changes in skeletal muscle, blood cholesterol and lipid and glucose levels (DeClercq's reference Chastin & Skelton, 2012; Owen, Bauman, & Brown, 2009) (DeClercq and Cranz 2014).

DeClercq argued that schools should be designed in a way where sitting is not a standard practice. He stated that “our bodies are designed for movement thus, environments that invite movement and postural range are naturally therapeutic for the body and, in turn, the mind. Movement of all kinds is linked to cognitive function, creativity, learning, and memory as well as numerous health benefits across a range of mental and physical health outcomes.” (DeClercq and Cranz 2014).

Another key element in student learning is the involvement of students in the classroom environment. Active learning spaces encourage interaction and inclusion of the students by their very nature of design. This sense of belonging helps foster ownership in a student's own learning experience. Teachers feel they were getting more participation and reaching more students with the Active Learning format thus “producing richer discussions and more sophisticated questions.” (Walker, Brooks and Baepler 2011).

A successful classroom will be equipped with the tools and furnishings teachers and students will need to work and learn effectively. This will include furniture that will be mobile and adaptable for varying situations. Whiteboards are a tool that can provide a place to help the students and teacher convey understanding and work through solutions (Han, Leong and Nair 2014).

It was found that students would like to have flexibility built into the classrooms and more individual spaces for their belongings. Other desires from students are to have soft seating in the classroom, the ability to move the furniture around and have better access to technology, (Ramli, Shamsidar and Masri, Improving the Classroom Physical Environment: Classroom users' perception 2013).

Perception of a space can have an impact as much as the actual designed environment. For example, if it is perceived that care was taken in designing a learning space, it will reflect in the student's and teacher's performance in that space. Seating and arrangements have a role in the outcome of the learning process because of this perception (Ramli, Shamsidar and Masri, Improving the Classroom Physical Environment: Classroom users' perception 2013). In short if students and faculty understand they are using a space that was designed with their success in mind they will utilize the space in a way that amplifies that objective.

A sense of ownership is another key factor to helping students feel responsible for their setting and to also feel an engagement in the space. Ownership can come in the form of displays for their projects. It can also be emulated on the whiteboard that they used for class participation purposes (Barrett, et al. 2015). This feeling of belonging and inclusion can be inferred by giving identification to the students in their learning spaces.

Students and teachers alike had favorable views toward the ALC spaces. Teachers felt the desire for rearrangement of the classroom helped support the pedagogy of their preferred teaching style, while students looked for rearrangement to help create a fun and enjoyable classroom, when students are allowed to choose their desired classrooms 58% of the students selected a classroom with movable tables and chairs to help with groupwork. (Ramli, Shamsidar and Masri, Improving the Classroom Physical Environment: Classroom users' perception 2013).

2.5 Traditional classroom vs. Active Learning Classroom design: Traditionally

classrooms were oriented to direct the focus of the students to the front of the classroom. Each desk faced the teacher who would deliver information in a lecture style manner. For this type of learning format, students were arranged to have their eyes toward a single blackboard and a single presenter at the front of the room. The educational subject content was rehearsed and delivered to the class, with little variation or consideration of learning style, pace, or ability. The traditional classroom was the dominate way to design a learning environment until the integration of technology and the advancements in pedagogy began to take root.

Active Learning Classrooms are a space of movement. The facilitator or teacher moves freely around the room to join various student collaboration groups. The students are encouraged to move within the classroom for group or personal learning. This adds a degree of physical activity which helps with blood flow to activate the brain for deeper learning and engagement. Mobile furniture and the opportunity for quick reconfiguration are some of the elements that lead to the advancement of student-centered education, engagement activities, and student-lead discussions.

The introduction of technologically advanced tools began to play a major role in the delivery and access to information. Students were encouraged to use this technology for their learning. Equipment such as laptops, tablets and even personal cell phones are used to search for information that can lead to deeper subject discovery. The use of technology could help solve a problem, clarify subject matter, or complete a project. Delivery of school projects and learning are enhanced by the ability to present in a way that is relevant and engaging to the students, such as video presentations.

The necessity of educational change has been outlined well by Sir Ken Robinson, PhD, when he presented his TED talk, *Do Schools Kill Creativity?* Robinson advocates to change education from the dominate subject-matter teaching-method to a more holistic balance of whole mind and body. He argues that creativity should be as important as literature in the educational system. Robinson suggests that because of the rapid advancement of technology, the future occupation of students starting kindergarten today have not yet been created. For this reason, educators need to teach students how to creatively problem solve. Diversity in talent and ability from a student-to-student basis makes it almost impossible to justify the traditional one-size fits all educational pedagogy and with it the accompanying educational environment.

Studies noted that the use of an Active Learning space helped to engage the students and promoted more fluid question and answer sessions leading to notable increases in the depth and quality of the class learning environment. (DeBeck, Settlemeyer, et al. 2010)

Previous studies have shown that students improve almost half a standard deviation better in Active Learning Classrooms then they do with the traditional teacher driven lecture style classes. Furthermore, this same study showed that there was a failure rate of 33.8% in a traditional class as opposed to 21.8% in an active learning class. Overall students showed greater success in Active Learning Classrooms (Freeman, et al. 2014)

Other studies have observed that students who were timid to contribute at the beginning of the semester in the collaboration activities became increasingly more comfortable through the semester in sharing their ideas and to contribute to discussions. Observations noted that students understood their contribution to their assigned groups and felt a greater sense of belonging in the class (Horne, et al. 2014).

Studies done in 1977 found that during that time the opinion of educators did not believe the classroom environment was a factor in the education of the students and that the subject matter was the best way for students to learn. Educators of today realize that the physical environment does influence the student's learning and contributes to the activities, and health and well-being of the class. (Ramli, Shamsidar and Masri, Improving the Classroom Physical Environment: Classroom users' perception 2013)

Observed study results indicated that students in an Active Learning Classroom had a positive increase in performance when compared to peers in a traditional style classroom. Teachers agreed in active learning spaces they spent less time at the podium teaching and more time interacting with all the students in the classroom. Students when surveyed responded that the Active Learning Classroom helped them feel more engaged and they like the flexibility of the space. (Walker, Brooks and Baepler 2011)

Effects of the Active Learning Classroom seems to reach all students no matter their ability or academic ranking. Each student can benefit from the experience of learning in an active learning space (Walker, Brooks and Baepler 2011).

The ALC helped foster stronger ties between students and provides a sense of belonging which helps the students to be more engaged and motivates them to attend class. Most all students, regardless of their standard GPA reacted positively to the ALC environment (E. a. Park 2014).

2.6 Previous University studies of Active Learning Classroom types: Over the past twenty years various types of furniture and technology developments for classrooms have pioneered the Active Learning Classroom movement. North Carolina State University did a study with a collaborative space classroom they called “Student-Centered Active Learning

Environment for Undergraduate Programs” or “SCALE-UP”. Their classroom model was set up with 7-foot diameter round tables and seating for 9 students. Projectors are installed on opposite sides of the room and whiteboards are placed on all the walls.

Massachusetts Institute of Technology (MIT) built their model “Technology Enabled Active Learning” (TEAL) by increasing the use of technology in the room, including more personal directed computer-based learning. There was a significant increase in freshman success when they were taught in the TEAL classroom. The University of Minnesota combined the learning of both SCALE-UP and TEAL and created Active Learning Classrooms (ALC) which had a formula of 9 students per table or station and several areas where flat-panel displays were located to give students easy access to technology to work with each other and the teacher. (Not all classrooms that are termed Active Learning spaces are equip with the same formula.) McGill University researched their new classroom and coined it as the “Teaching and Learning Spaces Working Group” (TLSWG). The University of Pittsburgh set up the Brief Electricity and Magnetism Assessment (BEMA) which is a multiple-choice test to help evaluate how well the classroom is performing. Clemson University modeled a SCALE-UP class for multiple disciplines and found it overall to benefit a variety of subjects. The University of Iowa studied their own version called Transform, Interact, Learn and Engage (TILE). These classrooms had five-foot round tables that sat seven students. They studied students who were in TILE and non-TILE classrooms and found that there was a more positive outcome in the students that were taught in the TILE classroom (Park and Choi 2014).

Taylor’s University’s X- Space Learning Model: The Interactive Classroom Technologies model provides an “ideal learning and teaching environment for student and lecturers”. The focus of this space is to reach out to new ideas and technology for learning and to create a culture

of explanation that will allow students and teachers to facilitate their best educational experience with the aid of technology (Han, Leong and Nair 2014).

The X-Space Learning Model is built with eight key elements to be considered when designing classroom. They are the size and shape of the classroom, seating arrangement, furniture arrangement, technology system arrangement, interior lighting, thermal condition, color selection, and noise level (Han, Leong and Nair 2014).

North Carolina State University found that there were several themes that developed as they studied the use of the TILE classroom. They discovered that when given the active learning atmosphere, teachers adapted and worked well with the learning tools and technology that the classroom provided. They also found that if they had a way to help students stay on task and prepare early for the class with available materials before class time, that students were more apt to stay on task and participate in class activities while in the classroom. The third theme North Carolina noticed is that students did better in the classroom when teachers acted more as a facilitator and students had more opportunities to share their work (Horne, et al. 2014).

In teacher interviews about the TILE classroom advantages they stated that “they appreciated how easily they could move around the classroom and work one-to-one with students during discussions or group activities” (Horne, et al. 2014).

The advantage of an Active Learning or TILE classroom was that the classroom could transition ‘seamlessly’ from a lecture style classroom format to a student-centered activity, engaging the students with each other and with the available technology. The variety of learning formats benefits the students by obtaining new information and then working through deeper learning and investigation of that new information through discussion and discovery (Horne, et al. 2014).

Chapter 3 Methodology

3.1 Active Learning Classroom vs Traditional classroom BYU-Idaho study information:

All the studied formats from other universities, although different in some respects, had one common change implemented into their design scope. This common change was the use of furnishings to accomplish the desired grouping of students for collaboration. In some instances, the furnishings allowed groups to congregate around a technology source to share content yet was stationary in nature. In other instances, the furniture was specific to the design, for example the five-foot tables with seven chairs. For this study mobile furniture was considered to understand it's value to the students in the classroom.

As noted, before in Chapter one, two classrooms were selected for the study comparison, one with a traditional format (figures 6-10) and the other an Active Learning Classroom (figures 1-5). The traditional classroom had fixed auditorium seating and the Active Learning Classroom was furnished with Steelcase Node chairs that are mobile. One professor taught the same subject in both rooms. His teaching format matched the student lead learning model where students read and prepared for subject matter before class and were prepared to participate in collaboration and group discussions in class. The professor taught the same way for each section of the subject.

Accounting for the fact that the students would not be the same for the different sections, a matched set was created with the help of the registration office based on the student's gender and accumulative GPA. Where further correlations needed to be made the participants age, field of study, and/ or marital status were considered. Only the closest matches were used for the study.

The classrooms were inspected, and it was found that the section one classroom did match the description of an Active Learning space such that all furniture in the room was mobile, even the teaching table. Media and projection screens were available for use in a media center located on the wall in the room. All the walls were faced with whiteboards such that any student break out session would have easy access to them. The section six classroom was set up with fixed seating facing one direction and there was a clear front of the room. Side walls were mostly bare, except for a decorative picture or two. The only whiteboard and media location was at the front of the room. The teacher's podium was fixed at the front of the room.

The subject matter of each class was taught as close to the same format as possible given the spaces the classes were held. Observations were made in each classroom during class time to note the comfort of furniture, ability to teach as desired in the space, and the engagement of the students. The observations were used to analyze which space occupants favored as a learning environment. Both the students and the professor were observed and surveyed.

Benson Building Classroom- section 6 – Active Learning Classroom

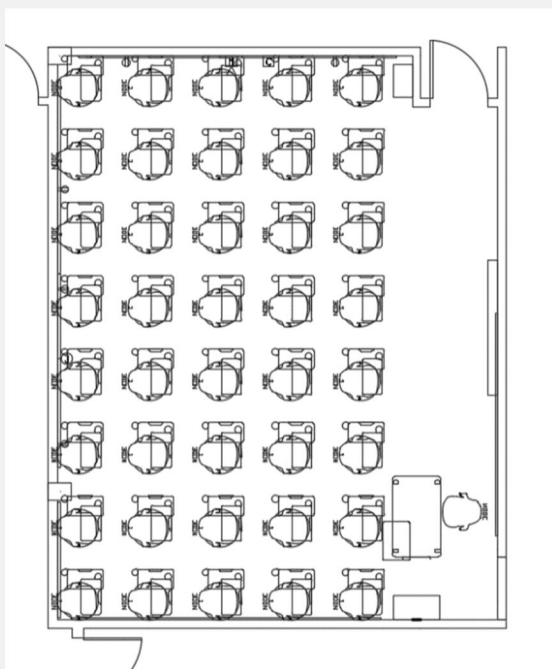


Figure 1: Active Learning Classroom floor plan

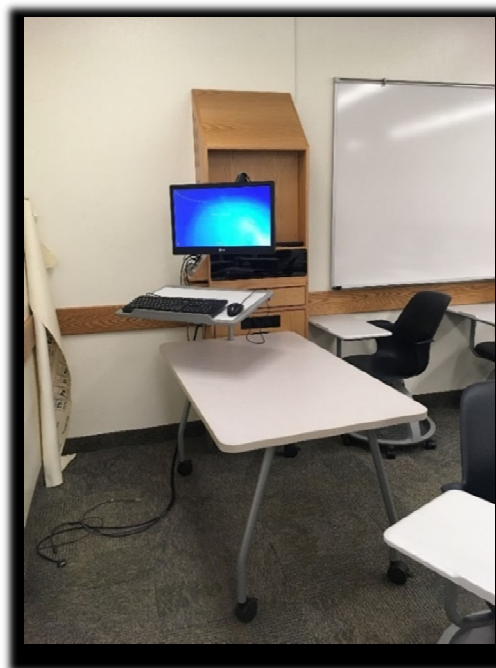


Figure 2: ALC- Teaching table and
tech station



Figure 3: ALC-West view from classroom

Figure 4: ALC-North view to back of classroom



Figure 5: ALC classroom view from doorway

Taylor Building Classroom – section 1- Traditional style classroom

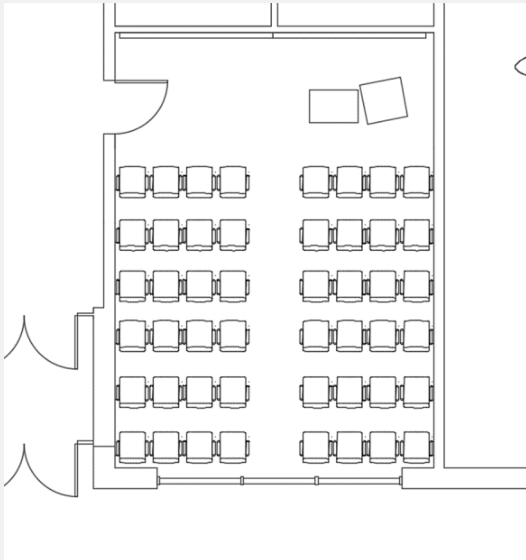


Figure 6: Traditional Classroom layout

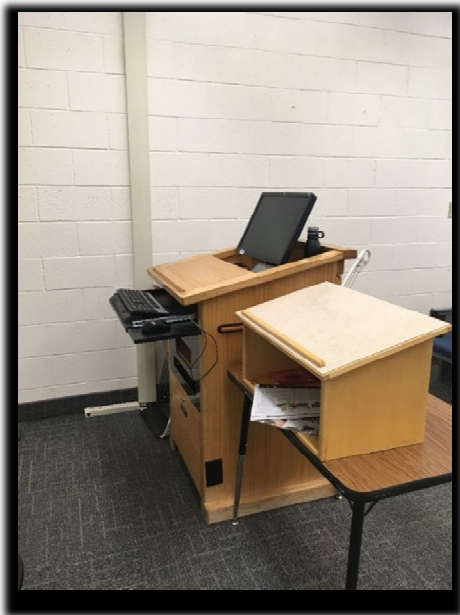


Figure 7: Traditional Class podium and teaching station



Figure 8: Traditional classroom- North view to front of classroom



Figure 9: Traditional Classroom: South view to class seating area



Figure 10: Traditional classroom: View into classroom from doorway

Of the 40 students in section six, the Active Learning Classroom and the 48 students in section one, the traditional style classroom, not all students were matched in each class. This was due to the sizes of the classes and the comparison of matching factors. 14 matched sets were made for females and 13 matched sets were made for males between the two classes. Only the closest matched student sets were used. If a student in one class did not closely match a student in the other class, that student was not selected for the study.

The next study parameter was to observe the classroom environments during class time. The researcher attended each class three times during the semester, once at the beginning, the middle and the end of the semester, for a total of 6 class periods of one hour each. The researcher sat in on the class with the students of each session to compare how students were being taught

and receiving the information. Observations were made by the researcher noting the atmosphere, general activities of the group, movement, student engagement, interaction with classmates, and how the professor was able to teach and facilitate in each of the spaces. Extensive notes were taken during each class hour. (Refer to Appendix D- Observation Notes)

3.2 Details of study survey: Lastly an electronic survey was sent out to all the students at the end of the semester to obtain feedback on five simple concepts of how they reacted to the room design. The response to this survey was smaller than had been hoped, however the intent was to have a 3-tiered research base. Explanations as to why this part of the research was not responded to as well as it might have been, is that it was given after the semester had concluded and perhaps students felt it unnecessary and were not reminded to fill it out during a class period. Another factor that may have led to its limited response is that it was done from an internet survey group that may have landed the email request in a junk mailbox. Three attempts were made to obtain a survey result.

The study was conducted in a Foundations of Religion class in the winter semester of 2017. Section six of the class was held in the Active Learning Classroom at 7:45 am on Tuesdays and Thursdays. The room could accommodate 40 students and there were 40 students enrolled in the class. Section one of this class was held in the traditional auditorium classroom on Tuesdays and Thursdays at 10:15. The room could accommodate 48 students and there were 48 students enrolled in the class.

The survey was answered by 13 students, 7 from the ALC class and 6 from the traditional classroom. The overall results of the survey are as follows: the first question asked was if they felt the classroom space affected their learning experience. 40% stated that they didn't pay

attention to the layout, and it didn't matter to them. 60% felt that they liked the layout and how it helped them connect with their teacher and other students in the class.

When asked if they felt their teacher was able to teach affectively in their classroom 90% said yes, that they felt he could move around easily and connect with them individually and in groups. 10% didn't notice any significance on how the teacher taught. The next question was How they felt they were able to complete group driven task and assignments. 70% said it was easy to break down into groups, 20% found it difficult and 10% didn't see a difference.

The last question asked students how important they felt collaborative assignments were in the class and if they were easier to accomplish when they faced other students in the group, 60% said they liked collaboration and felt valued when they could face the other students and 40% said they didn't have a preference as to what the teacher assigned them to do.

Broken down by class it was found that in the ALC, 100% of those who answered the survey liked the layout and felt it helped them connect with the teacher and their peers. 100% felt the teacher was able to move about the room easily and interact with the groups. 100% found it easy to break in to the collaborate group settings and 60% liked to do collaboration assignments and felt valued when they could face the others in the group. 40% didn't have a preference and would do whatever the teacher assigned.

In the traditional classroom the student response was more diverse. 80% responded that they didn't pay attention to the layout of the room and that it didn't matter to them. 20% said they liked the layout and it helped them connect with the teacher and others. 80% reported that they felt the teacher could move about and interact with the class, 20% said they couldn't see a difference. 40% felt it was easy to break out into groups, 40% felt it was difficult to break out into groups and 20% didn't really see a difference. Lastly 60% of the students liked to have

collaborative group assignment and felt valued when they could see peers face to face. 40% didn't have a preference and would do whatever the teacher assigned.

The results of the study in its entirety showed that the students who attended class in the Active Learning space felt more connected with the teacher and their peers, they appreciated the layout and the flexibility it gave them to perform collaborative work

Traditional classroom students were indifferent and split on their assessment of the classroom design, the work assigned and collaborative work. They still felt a connection with the teacher but seem less interested in the environment.

3.3 Observations: Observations showed that the structure of the class was set up in the same manner for both sections. The general format of the teacher's interaction and teaching of the students was a mixture of traditional style lecture and then discussion time for learning and collaboration. Technology was generally used for presentation of the professor's teaching materials, however students used electronic devices such as laptops, tablets, and phones to look up textbook materials and literature references. They were encouraged to do so by the professor.

The Steelcase Node chair furnished the Active Learning Classroom. The researcher noted the Node chairs were comfortable to sit in and easily adjusted to changes in posture. Students adjusted their writing surface differently for their personal use. These adjustments were altered throughout the class period as individual's desired and the chair was quiet as they moved. In the ALC space when the request for collaborative sessions was given, students quickly turned around and formed groups. When the time came to turn the attention back to the teacher, the same was true that they quickly adjusted and were facing toward him. Rows were not determined, in fact the class looked in somewhat of a disarray, but the teacher could move about freely and grab a chair to pull up to any one of the groups.

In the traditional- auditorium classroom the students were directed in similar ways to form groups and discuss a question. Since moving the chairs was impossible, many leaned forward or to the side of them to speak with other students. Few students turned backward to discuss topics with students behind them. Students in this class seemed to answer questions on their own and not bother with the difficulty. The professor would attempt to join group conversations but was only able to walk up the small aisle in the center of room and engage with a few students. He never sat down for discussion with a group.

Another interesting observation was that mid-semester the students in the traditional classroom seemed to still be introducing themselves to their few neighbors where the active learning class seemed to walk into the room knowing just about anyone. It was observed that friendships had formed easier in the Active Learning Classroom. It was also observed that in the traditional class little eye contact was made. Even in situations of discussions because they could not face each other the students mostly spoke facing forward while they had conversations. This likely led to some of the disengagement of the student interaction.

Observations of the professor showed that he was more comfortable in the Active Learning Classroom because of his ability to interact with the students. When he was in the traditional style class, he seemed to feel displaced when student discussion was happening and tended to return to the podium area while discussions were going on.

In the traditional classroom there was less personal room so students were confined to the single seat area and often students would not sit close together until the sitting started to become sparse. Back packs were tucked at the feet of the students. In the Active Learning Classroom students tended to grab which ever chair they wanted in the general area of where they wanted to sit and adjusted to a comfortable distance from each other. There were spaces under the mobile

seating for personal items and back packs. There seemed to be more comfort with distances and personal space in the ALC.

3.4 Matched set grade analysis: Outlined previously the matched sets were created to conduct the third part of the study to determine the performance difference of students in the two different environments, Active Learning vs. traditional classrooms. The study was conducted with the control of the same class subject and content being taught by the same professor but in two differing environments. Variations in students were minimized by creating matched set of students for the two sections.

When matched sets for the male and female groups were determined, students were assigned a number to represent the grade they obtained in the class. Numbers that were used were the standard grade point average numerical equivalent of the grade. They are as follows: A+ = 4.0, A = 3.7, A- = 3.3, B+ = 3.0, B = 2.7, B- = 2.3, C+ = 2.0, C = 1.7, C- = 1.3, D+ = 1.0, D = .7 and F did not receive a point value. The matched set information provided us with a representation that if a student was attending either class it could be assumed that they would have performed and received the grade that their counterpart received in the differing section of the class.

First the scores of all the students in the set that took the class in the Active Learning Classroom were compiled and averaged. Each score subtracted the average and then with this information the standard deviation was discovered. This was done for both sections and genders who attended the class. The standard deviation for females in the ALC was .31449 and traditional class was found to be .3676. Males in the ALC had a standard deviation of .27243 and traditional classroom was .2686.

A standard p-test calculated to discover if there was a significance of .05 between the matched sets of the two classes. The results for females were .4879 showing that there was not a significant difference for a female student between the ALC and traditional formats. The results for the male participant p- test was .13053 which showed a little closer significance for the male students; however, it still did not lie within the parameters of significance for this test.

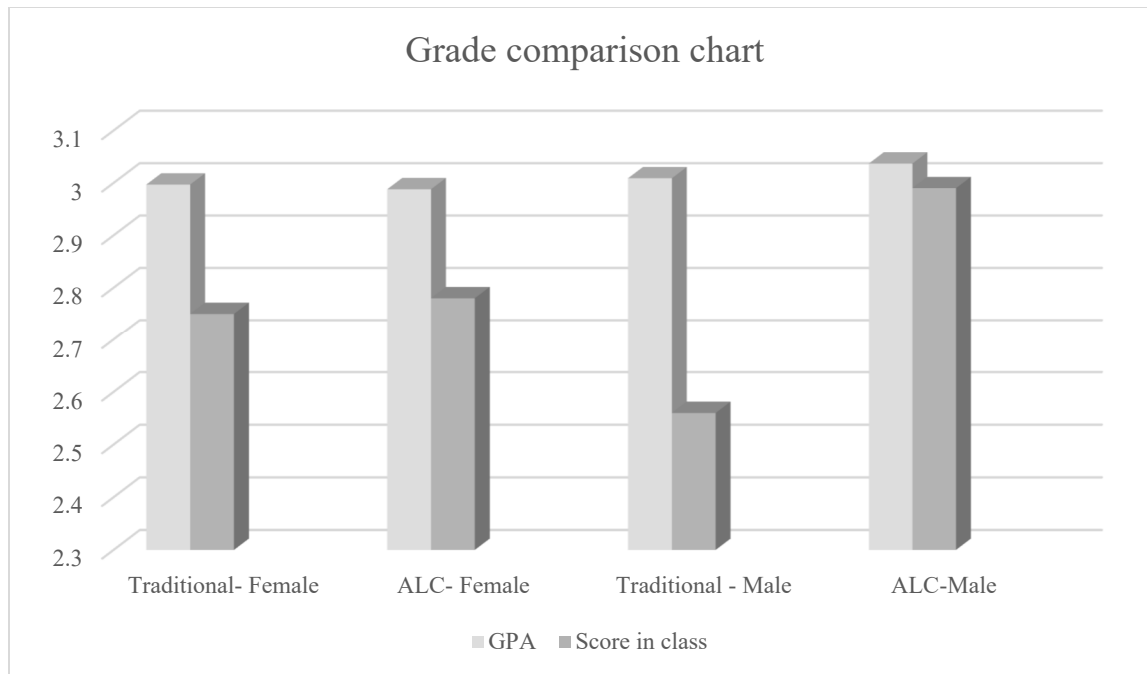


Figure 11: Bar graph for significance of grade improvement for Active Learning and Traditional classroom settings.

Figure 11 shows the comparison of accumulative GPA scores and the score for the class. It would be expected that students would receive a grade in the class that would closely match their GPA. As you can see there was no significant difference between females in either class. However male participants showed a significant difference and performed better in the ALC classroom space. ACL male participants were the group that performed closest to the assumed baseline and expectation of the results. Traditional classroom male participants showed the least association of

GPA to grade earned in the class. The graph shows that male participants had the greatest variance in response to their learning environments.

Chapter 4 Results of the study

4.1 Statistical conclusion:

The Null Hypothesis of the study is that the students in the Active Learning Classroom will perform the same as their matched set counterpart in the traditional classroom. The compared grades of matched students will not vary over a significance of more than .05. (Ho: M active learning class = no change) The Alternate Hypothesis is that the students who attended the class in the Active Learning Classroom would perform better than the students who attended the class in the traditional classroom setting. (H1: M active learning = change)

Level of significance is .05 one tailed, sample study to help determine predictions for the general population.

4.2 Explanation of calculated data: The P-tests for the classes revealed that there is no statistical significance to support that students do better in one classroom than another, thus we must fail to reject the null hypothesis. Although statistical data has shown that the students did not make a significant improvement in the class, the calculations in the research does show that students slightly improved in the Active Learning space. Observations concluded that students were more engaged in discussions and collaboration.

The professor who taught in both environments supported the Active Learning Classroom layout as it in turn supported his pedagogy of student lead learning.

Chapter 5 Summary and discussion

5.1 Summary: Providing students an appropriate and valuable educational experience has been the desire of many educators and theorists for over a hundred years. Studying the way students learn and behave has given educators the ability to experiment with classroom design and furnishings that support the learning styles of students. Educators have shown great interest in bringing the school system out of the last century where the teaching model was built from factory style expectations for both timed class hours and production-based learning. Research has progressed the expectations and pedagogy of 21st Century learning and teaching. With the advantage of technology, we can see that individual learning can happen outside of the classroom and that collaboration and deeper understanding can develop within the classroom.

The architecture and design of learning spaces can contribute and support collaboration and movement. Design considerations for the classroom to support various activities and quick transitions is a key element in design. Many other considerations help with student cognitive learning such as lighting, temperature, color, and noise reduction.

To build a classroom for 21st century learning that will be truly effective, technology and discussion spaces must be present. Typical technological elements would include at least one projector and screen where class content can be displayed. It would include whiteboards for groups to work through discussions visually and present discovered ideas to the entire class. Some 21st century classrooms are equipped with group tables where monitors are set up such that students can all connect in and display as desired to the group.

Most importantly for 21st Century learners a classroom must be configurable and able to be changed as needed for discussion and interaction. This is mainly because educational experts

have found that learning happens when students are engaged in collaborative discussion where ideas can be shared and built upon. This can happen by providing a well-designed environment.

5.2 Reflection: The study at BYU-Idaho gave us insight in how educators and students interacted differently in traditional and Active Learning Classrooms. The observations revealed that students were more comfortable with interactions with their peers and that they engaged in activities easily and effortlessly. The furniture provided them with opportunities to know more of their classmates and to feel invited to any location in the room. The traditional classroom kept students bound to a particular location and perhaps a routine of sitting in the same seat the entire semester. Students were not as willing or comfortable to meet people in the surrounding seats- especially if the seats were in front of or behind them where students had their backs to each other. Engagement in group activities was awkward and most students tended to answer for themselves instead of collaborating. This perhaps, hindered a sense of deeper learning because personal ideas were not comfortably shared and built upon.

The ease of transition and ability for the teacher to join in group discussions was apparent in the Active Learning Classroom. The fluid change for activities was effortless as students simply turned to each other or moved with their mobile desks to congregate. All students faced each other and with whiteboards on every wall, students felt comfortable standing and writing a thought for everyone to discuss. When the teacher interacted with the group neither the entering into the group or the leaving to participate in another group was hindered by furnishings. He could fluidly move around and sit at the student level. His participation became an aid to deeper thinking on a discussion the individual groups had already been debating, but his input was not directive or lecture based in nature. When moving to the next group he was able to guide and

participate on a differing train of thought. It was observed that the discussions lead students to a deeper, individualized learning experience.

In the traditional classroom the class was much quieter, which could lead to personal reflection and thought, however it seemed when a thought or idea was shared by a classmate it was considered but not developed and explored together. The hinderance of true discussion and facing each other was evident in the space. The general feeling of the room created by the close spacing of auditorium seating did not create a space of flow and comfort. Students were never observed standing at the whiteboard or truly facing each other during discussion time.

Although the statistical part of this research did not support the desired significance that Active Learning Classrooms made a difference in a student's grade in the class, it did show there was an improvement in their learning by a small degree. The observations in this study were the key factor in realization of better collaboration and engagement.

5.3 Relationship of BYU-Idaho study to prior research. How this study builds upon knowledge base for the educational community: Previous research done by various universities and learning institutions demonstrates a true desire to improve the student experience in the classroom. Observations of the advancement in technology and the learning styles of students at all ages has shown that what had been accepted as common practice for classroom design and pedagogy no longer needed to be the norm.

5.4 Recommendations for further research: It would be good to dive further into how a student learns in an environment and what triggers the growth of learning in the classroom. Studies that isolated elements of design individually and evaluated their effectiveness on student learning would be a fascinating research project. Rating such elements on its benefit would help

designers to create spaces that give the ultimate advantage to students in their classroom environments.

Since the study at BYU-Idaho many new developments have been considered for classroom spaces. Classroom have been suggested that provide furniture in mixed varieties of soft seating and movable tables and chairs all within one classroom environment. There are also the maker space classrooms where hands on learning is encouraged and promises to develop additional cognitive skills for students. There are many suggestions from the furniture industries and educational communities that would be beneficial to explore and study as to their benefit for students. Classes that encourage outdoor learning spaces or at the minimum the view of outdoor spaces from within the classroom provide their own realm of benefit to students and studies to support and understand their place in student learning would be interesting to educators.

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Figure 11: Bar graph for significance of grade improvements for Active learning and
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Include supporting material and instruments.

References

- Abdullah, N.A.G, S.C. Beh, A.I. Tahir, Che Ani, and N. M. Tawil. 2011. "Architecture design studio culture and learning spaces: a holistic approach to the design and planning of learning facilities." *Procedia Social and Behavioral Sciences* 27-32.
- Asiyai, Romina. 2014. "Students' perception of the condition of their classroom physical learning enviroment and its impact on their learning and motivation." *College Student Journal* 17 pages.
- Baepler, Paul, D.Christophe Brooks Brooks, and J.D. Walker. 2014. *Active Learning Spaces, New Directions for Teaching and Learning*. San Francisco: Jossey-Bass.
- Barrett, Peter, Fay Davies, Yufan Zhang, and Lucinda Barrett. 2015. "The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis." *Building and Environment* 89 118-133.
- Beery, Thersa A., Dustin Shell, Gordon Gillespie, and Eileen Werdman. 2013. "The impact of learning space on teaching behaviors." *Nurse Education in Practice* 13 382-387.
- Bey, Lee. 2014. "In the Loop." *Architectural Record* 82-87.
- Black, Susan. 2007. "Achievement by Design." *American School Board Journal* 39-41.
- Board, United States Access. 2002. "United States Access Board." September.
- Boys, Jos. 2011. *Towards Creative Learning Spaces; Re-Thinking the Architecture of Post-Compulsory Education*. New York: Routledge.
- Crestwell, John. 2015. *Educational Research Planning, Conducting, and Evaluating Quantitative and Qualitative Research*. New Jersey: Pearson Education, Inc.

- Cunningham, Cody. 2002. "Buildings that Teach: Incorporating the environment into school design can enhance the learning process. Here's how." *American School & University* 164-167.
- Dana Schwieger, Christine Ladwig, and Department of Accounting Southeast Missouri State University. 2018. "Reaching and Retaining the Next Generation: Adapting to the expectations of the Gen Z in the Classroom." *Information Systems Education Journal (ISEDJ)* 45-54.
- DeBeck, George, and Dedra Demaree. 2012. "Teaching assistant-student interactions in a modified SCALE-UP classroom." *AIP Conference Proceedings* 167-170.
- DeBeck, George, Sam Settelmeyer, Sissi Li, and Dedra Demaree. 2010. "TA Beliefs in a SCALE-UP Style Classroom." *AIP Conference Proceedings* . American Institute of Physics.
- DeClercq, Caitlin P., and Galen Cranz. 2014. "Moving Beyond Seating-Centered Learning Environments: Opportunities and Challenges Identified in POE of a Campus Library." *The Journal of Academic Librarianship* 40 574-584.
- Design, Cannon, VS Furniture, and Bruce Mau Design. 2010. *The Third Teacher; 79 Ways You Can Use Design To Transform Teaching & Learning*. New York: Abrams.
- Donovan, Loretta, Green Tim D., and Candice Mason. 2014. "Examining the 21st Century Classroom: Developing an innovation configuration map." *J. Education Computing Research* 161-178.
- Ellis, Tom. 2010. "Fit for Purpose." *www.Asumag.com* 45-47.

- Entwistle, N.J., J.H.F. Meyer, and Hilary Tait. 1991. "Student failure: desintergrated patterns of study strategies and perceptions of the learning environment." *Higher Education* 21 249-261.
- Entwistle, N.J. 1991. "Approaches to learning and perceptions of the learning environment." *Higher Education* 22 201-204.
- Freeman, Scott, Sarah L. Eddy, Miles McKonough, Michelle K. Smith, Nnadozie Okoroafor, Hannah Jordt, and Mary Pat Wenderoth. 2014. "Active learning increases student performance in science, engineering and mathematics." *PNAS* 8410-8415.
- Gestoltan. 2012. *Learning for Life: New Architecture for New Learning*. Berlin: Gestalten.
- Hakkinen, Paivi, and Raija Hamallinen. 2011. "Shared and personal learning spaces: Challenges for pedagogical design." *Elsevier Internet and Higher Education* 231-236.
- Han, Andrew Ng Yew, Lim Chee Leong, and Pradeep Kumar Nair. 2014. "X-Space model: Taylor's University's collaborative classroom design and process." *Procedia- Social and Behavioral Sciences* 123 272-279.
- Hanley, William. 2014. "Everything in Its Place." *Architectural Record* 96-101.
- Harrison, Andrew, and Les Hutton. 2014. *Design for the Changing Educational Landscape; Space, Place and the Future of Learning*. New York: Routledge.
- Hinchman, Mark. 2009. *History of furniture*. Fairchild Books.
- Horne, Sam Van, Cecilia Titiek Murniati, Kem Saichaie, Maggie Jesse, Jean C. Florman, and Beth F. Ingram. 2014. "Using Qualitative Research to Assess Teaching and Learning in the Technology-Infused TILE Classrooms." *New Directions for Teaching and Learning* DOI:10 17-26.

- Johnson, Amy M., Jacovia, Matthew E., Russell, Devin G., Soto, Christian M. n.d. "Challenges and solutions when using technologies in the classroom." (*Arizona State University*), for *Adaptive Educational Technologies for Literacy Instruction*.
- Kiefer, Amy. 2013. *The Learning Sweet Spot*. Kruger International, INC, 1-15.
- Kim, Paur, Suh, Esther, Song, Donggil. 2015. "Development of a design-based learning curriculum through design-based research for a technology-enabled science classroom." *Education Tech Reserach Dev* 63:575-602.
- Larsen, Justin, Olivia Shawl, and Jessica Whipple, interview by Terrie Larsen. 2018. *Improptu Student needs discussion* (March 31).
- Maillet, Julie O'Sullivan, Benise Baird Schwartz, and Mary Ellen Posthauer. 2013. "Position of the Academy of Nutrition and Dietetics: Ethical and Legal Issues in Feeding and Hydration." *Journal of the Academy of Nutrition and Dietetics* 828-833.
- Marchand, Gwen C., Nicholas M. Nardia, Douglas Reynolds, and Pamoukov. 2014. "The impact of the classroom built environment on student perceptions and learning." *Journal of Environmental Psychology* 187-197.
200. "Market Watch: AS&U's monthly update on trends, issues and legislation affecting education facilities and business." *www.asumag.com and www.schooldesigns.com* 3.
- McHugh, Sharon. 2014. "Learning by Design." *Architecutrual Record* 88-95.
- Metoyer, Sandra K, Scott T. Miller, Jennifer Mount, and Sandra L. Westmoreland. 2014. "Examples From the Trenches: Improving Student Learning in the Sciences Using Team-Based Learning." *Journal of College Science Teaching* 40-47.

- Michela Lenzi, Jill Sharkey, Michael J. Frlong, Ashley Mayworm, Kayleigh Hunnicutt and Alissio Vieno. 2017. "School Sense of Community, Teacher Support, and Students' School Safety Perceptions." *American Journal of Community Psychology* 527-537.
- Miller, Cynthia J., and Michael J. Metx. 2014. "A comparison of professional-level faculty and student perceptions of active learning: its current use, effectiveness, and barriers." *Advances in Physiology Education* 246-252.
- Mirviss, Laura. 2014. "View Master." *Architectural Record* 102-107.
- Nair, Prakash. 2014. *Blueprint for Tomorrow, Redesigning Schools for Student-Centered Learning*. Cambridge: Harvard Education Press.
- Nair, Prakash, Randall Fielding, and Jeffery Lackney. 2013. *The Language of School Design; Design Patterns for the 21st Century Schools*. USA: DesignShare.com.
- Park, Elisa and Choi, Bo Keum. 2014. "Transformation of classroom spaces:traditional versus active learning classroom in colleges." *Springer Science+ Business Media Dordrecht* 750-771.
- Park, Elisa L., and Bo Keum Choi. 2014. "Transformations of classroom spaces: traditional verses active learning classroom in colleges." *Springer Sceince + Business Media Dordrecht* 749-771.
- PEB Exchange - Organization for Economic Cooperation & Development. 2004. "Structures for Learning in New Zealand." *PEB Exchange* 7-8.
- Penton Media, Inc. 2011. "21st Century Learning." *American School & University (SchoolDesigns.com)* 203-213.
- n.d. *Quick History: Wicker Furniture*:. <http://www.apartmenttherapy.com/wicker-furniture-quick-history-121303>.

- Ramli, Nur Hidayatuljamilah, Ahmad Shamsidar, and Mawar Haji Masri. 2013. "Improving the Classroom Physical Environment: Classroom users' perception." *Elsevier, ScienceDirect* 221-229.
- Ramli, Nur Hidayatuljamilah, Shamsidar Ahamd, Mohd Zafrullah Taib Taib, and Mawar Masri. 2014. "Principals Perception on Classroom Physical Environment." *Elsevier ScienceDirect, Procedia- Social and Behavioral Sciences* 153 266-273.
- Raths, David. 2013. "Collaborative Technologies: Bringing Down the Wall." *t|h|e Journal* 39-42.
- Reif, Rita. January 19th 1992. "Antiques; At Home With a Zebra Table And a Skeleton Chair."
- Riley, Callie. 2013. "The Common Core, Aligned Assessments and the 21st- Century Classroom: Lessons Learned From Educators." *Techniques: Connecting Education & Careers (www.acteonline.org)* 24-28.
- Sassone, Adriana Boidi, Elisabetta Cozzi, Andrea Disertori, Massimo Griffo, Andreina Griseri, Anna M. Necchi Disertori, Alessandra Ponte, Gianni Carlo Sciolla, and Ornella Selvafolta. 1988. *Furniture From Rococo to Art Deco*. Evergreen.
- Strange, C. Carney, and James H. Banning. 2001. *Educating by Design*. San Francisco: Jossey-Bass.
- Tara L. Crowell, Elizabeth G Calamidas and Laura Engelmann. 2018. "Assessing school wellness trthough AtlantiCare healthy Schools-Healthy Children Grants." *Education and Health Vol. 36 No. 1* (Education and Health, Vol 36 No. 1) 11-25.
- Taylor, Anne. 2009. *Linking Architecture and Education, Sustainable Design of Learning Environments*. Albuquerque: University of New Mexico Press.
- Van Horne, Same, Cecilia Titiek Murniati, Kem Saichaie, Maggie Jesse, Jean C. Florman, and Beth F. Ingram. 2014. "Using Qualitative Research to Assess Teaching and Learning in

Technology- Infused TILE classrooms." *New Directions for Teaching and Learning* 17-24.

Walker, J.D, D. Christopher Brooks, and Paul Baepler. 2011. "Pedagogy and Space: Emperical Research on New Learning Environments." *EDUCAUSE Quarterly* 34.

Williams van Rooij, Shahron, and Kara Zirkle. 2015. *Balancing pedagogy, student readiness and accessibility: A case study in collaborative online course development*. Elsevier Inc.

Zandvliet, David Bryan. 2014. "PLACES and SPACES: Case Studies in the evaluation of post-secondary, place-based learning environments." *Studies in Educational Evaluation* 41 18-28.

Appendix A. Beginning of Study – Introduction to participants

Revised Beginning study script- Terrie Larsen-Project 16391

Students welcome to your new semester here at BYU-Idaho. My name is Terrie Larsen and as well as working at the University as an Interior Designer I am also a student at the University of Nebraska. For my graduate study and final thesis work, I would like to conduct a study on learning environments and their impact on student learning.

I am here today to ask you if you would be willing to participate in this study. If you choose to participate, I will ask for your consent to access your grades so that I can match you with a student who is similar to you in the other classroom I am evaluating. Don't worry I am not concerned or judgmental about your grades, in fact I will not even see what grade belongs to what student, they will be used only to match you up and note your progress. Information from this study will be kept securely in my possession for the required 3 years beyond the study. All identifiable information that links you specifically to the study will not be given to me but will be coded from the registrar's office before I see it.

In this study I will also ask you to complete a quick survey about how you felt about your learning experience in regards mostly to the classroom environment.

That is all that you are asked to do, other than that I will be visiting from time to time to observe things about interaction and classroom participation to see if we can work on providing the best type of classrooms for better learning at BYU-Idaho.

To participate in this study, I will be handing out a consent form for you to sign. Please remember that because of the study's voluntary nature you are free to be removed from the study at any time and that your participation in no way affects your grade in this class. This study is for the benefit of helping the designed classroom environment contribute positively to your future learning experience.

Thank you for your time and I hope you will consider helping in this study.

Appendix B Survey Monkey online survey questionnaire

4/26/22, 4:42 PM

[SURVEY PREVIEW MODE] Classroom learning environments Survey

Classroom learning environments

Student Learning experience

1. What time was your class held?

- ☐ Tuesday and Thursday at 7:45-8:45 am
- ☐ Tuesday and Thursday 10:15-11:15am

2. How did you think the classroom space affected your learning experience?

- ☐ I didn't pay attention to the layout, it didn't matter to me.
- ☐ I really liked the layout, I feel it helped me connect with my teacher and the students in the class.
- ☐ I felt the layout was disruptive or it restricted my learning experience.
- ☐ I did not like the layout and would have preferred something different
- ☐ Other (please specify)

3. Did you feel your teacher was able to teach well in your classroom space?

- ☐ Yes, he was able to move around easily and connect or answer questions we had individually or in groups.
- ☐ I didn't really notice a difference
- ☐ No, I felt he could not review or connect because of the classroom layout.

4. How do you feel you were able to complete group driven tasks and assignments?

- ☐ I found it easy to break into groups and collaborate on an assigned topic
- ☐ I found it difficult to be broken into groups to participate in an assigned topic

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1/2

4/26/22, 4:42 PM

[SURVEY PREVIEW MODE] Classroom learning environments Survey

☐ I didn't really see a difference

5. How important is it to you to collaborate on classroom work with other students during class time and do you feel more valued in the group when you can face each other?

- ☐ I like to collaborate and see what others are thinking and learning. I feel more value when I can face others in the group.
- ☐ I don't have a preference it is whatever the teacher assigns.
- ☐ I dislike collaboration and would rather face forward and learn from the teacher in that manner.

Powered by

See how easy it is to [create a survey](#).[Privacy & Cookie Notice](#)

Appendix C Study Consent form



IRB# 20161016391 EX
Date Approved: 10/24/2016
Valid Until: 10/24/2021

COLLEGE OF ARCHITECTURE
Architecture & Interior Design Programs

IRB# UNL project #16391
IRB# BYU-I project # 271-S16

Title: Educational Design: Does the design of a learning environment affect how well a student learns?

Purpose:

This research project will aim to review and evaluate the semester progress in fall 2016 of two congruent classes of similar nature but will be conducted in classrooms slightly different in furnishings as to study design and furniture effects on the student and their participation and learning in the classroom. You are invited to participate in this study because you are a BYU-Idaho student and have enrolled in one of the classes that are being held in a classroom that fits the requirements for this study. Your participation in this study is not mandatory and will not affect your grade in this course.

Procedures:

You will be asked to give your consent to allow the researcher to match your grades and ACT scores with a student in the congruent class, so that proper evaluations of progress and effects on learning can be assessed. You will also be asked to complete a short survey at the end of the semester to help the researcher understand your feelings and what you value in a learning environment. The procedures will last for the duration of the fall 2016 semester, and will be conducted at/in your current classroom. The researcher will be, from time to time, attending the class to observe specific behaviors and experiences the classroom environment is helping to encourage. This will be at random times throughout the semester and be limited to 4 at most.

Benefits:

There are no direct benefits to you as a research participant. However your participations will help to provide a resource to evaluate design of college classrooms to better the learning for students who attend this university

Risks and/or Discomforts:

There are no known risks or discomforts associated with this research. All identifiable information will be coded during the research and then destroyed at the end of the study.

Confidentiality:

Any information obtained during this study which could identify you will be kept strictly confidential. The data will be stored in a locked cabinet in the investigator's office and will only be seen by the investigator during the study and for 3 years after the study is complete. The information obtained in this study may be published in scientific journals or presented at scientific meetings but the data will be reported as aggregated data.

Opportunity to Ask Questions:

You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study. Or you may contact the investigator(s) at the phone numbers below. Please contact the University of Nebraska-Lincoln Institutional Review Board at (402) 472-6965 to voice concerns about the research or if you have any questions about your rights as a research participant.

Freedom to Withdraw:

Participation in this study is voluntary. You can refuse to participate or withdraw at any time without harming your relationship with the researchers or the University of Nebraska-Lincoln, BYU-Idaho or in any other way receive a penalty or loss of benefits to which you are otherwise entitled. It will not affect your grade in this course or standing at BYU-Idaho.

Consent, Right to Receive a Copy:

You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have decided to participate having read and understood the information presented. You will be given a copy of this consent form to keep.

Room 232 Architecture Hall / P.O. Box 880107 / Lincoln, NE 68588-0107 / (402) 472-9233 / FAX (402) 472-3806 / archweb.unl.edu

Participant Feedback Survey:

The University of Nebraska-Lincoln wants to know about your research experience. This 14 question, multiple-choice survey is anonymous; however, you can provide your contact information if you want someone to follow-up with you. This survey should be completed after your participation in this research. Please complete this optional online survey at:
https://ssp.qualtrics.com/SE/?SID=SV_aVvINCf0UJvse5n.

Signature of Participant:

 Signature of Research Participant

 Date

 Signature of Participant Parent (if under 18)

 Date
Name and Phone number of investigator(s)

Terrie Larsen, MA-student, Principal Investigator Cell: (208) 681-0255

Lindsey Bahe, Interim Interior Design Program Director, Secondary Investigator Office (402) 472-9003



IRB# 20161016391 EX
 Date Approved: 10/24/2016
 Valid Until: 10/24/2021

Appendix D Observation notes

Observation log

2-23-17 Active Learning room: This room was set up using individual Steelcase Node chairs for the students to sit in. Initially when entering the room, the Node chairs are in rows much like that of a traditional style classroom. There are whiteboards available on every wall. When students entered the room, they seem to organize themselves comfortably picking seats in the room as to where they are most comfortable. They also seemed to turn the seats slightly to see the teacher more clearly. The teacher begins the class discussion speaking and asking questions to engage the students. In the course of the class hour he asks the students to break out into groups of 5 or 6 and discuss the questions he has presented. Without much effort the students turn and roll to form the groups. The students seemed to feel free to openly discuss ideas and answers they have found. Everyone seemed friendly and as if they knew each other well. Technology in the form of personal devices and a projector were used to present class teaching material and research. When the teacher needed to have attention turned back to the front of the room it was done so in a quick manner and it seemed to connect and engage the students quickly.

2-23-17 Traditional style classroom: this room was set up with small auditorium style seating of 4 chairs on each side of the room. There is a definite front of the classroom with whiteboards only on the front wall. The set up did not encourage students to move around participate as much as the active learning room. Students were quieter when they entered the room and seemed more reserved. There seemed to be less interaction between students, and they seemed to struggle with making the space their own. Seating of course remained facing forward and rigid. Since the professor was the same for each class and the class was held on the same day, content of what was being taught was kept the same as well. The teacher's topic was

presented using a projector as it had been in the active learning space and the asked similar questions to his class. This time the engagement seemed to be much more traditional such that there were a few students who individually answered but it did not feel like the entire class was engaged. When the request was made to divide into groups the students could not move and restricted their discussions with those on their rows. Some of the students introduced themselves to the others on the row and the general feeling of the class was that they did not know each other well. When the teacher brought the attention back to the front of the room it lacked the change of activity and new focus the active learning class had demonstrated. It lacked the refreshing of activity differences. The professor had a difficult time really working with the individual groups because he could only walk from row to row to listen in and make himself available as in the active learning room he could sit with students and move from group to group. There were also some students that were sleeping in this classroom.

3-16-18 Active learning classroom: There is a substitute teacher teaching today, who is a retired professor asked to fill in. Though the course of his teaching it is evident that he is more accustomed to the traditional teaching methods of lecture style classes. Although he did ask questions and his teaching was interesting it was more traditional than active in the pedagogy. However it was noted that the students were able to sit in positions comfortable to them, some with legs extended and leaning back on their chairs and other leaning forward with arms resting on their desks. There was a comfort in the adjustment to the angle they were facing to the teacher. Most of the class seemed to focus on the teacher because they were in comfortable positions to do so.

3-16-18 Traditional classroom: The substitute teacher also taught this hour and the classroom layout seemed to fit more of his teaching style. He directed the class in more of a

lecture style and less interactive than in the classroom he taught in for the morning session. It was interesting to see the ease of slipping back to a format that he must have been more accustomed to in his years of teaching. The projector was used for the presentation and questions were asked of the class but the results were more individual in learning than collaborative and interactive.

Students were not able to create a comfortable space, individualize for them.

4-4-18 Active Learning classroom: Observations about space and how students are using remain the same. There was an observed freedom the students seemed to have when asking questions. Perhaps because of the environment feeling informal it seemed less ridged and students asked questions often. In the break-out session for students to work on questions and discussions the teacher moved about freely and almost disappeared into the class by sitting with various groups. Some kids entered the class late but seemed to jump in easily to group discussion. Once again when attention needed to focus on the teacher at the front of the room it was easily done by turning around in chairs. The room did not return to an orderly row by row nature, but it did shift easily to center on the teacher. The quiet nature of the chairs made it comfortable for students to move about.

4-4-18 Traditional style classroom: because of the observations of the active learning classroom this morning, the interest was to watch students enter the room and how they sat down. When someone came in they generally spaced themselves out from the person sitting next to them, however as more students entered the room they had to shift either where they choose to sit or stand so that someone could get by. This and the squeaking of the stadium style chairs were disruptive during the class. Likewise, it was observed again that the class was far less effective with group discussion break out time than the active learning space. The learning still seemed to

be very individualized and while some dug into the content being presented others seemed disconnected and busy with other things. Connections between students in the class did not seem to improve as a whole even though it is nearing the end of the semester.

Examples of journal entries

7

Students have the quiet moment. They do seem to be listening even of those who not verbal engagement. It doesn't seem like this is a point in lecture to respond. Students - 90% were looking to teacher so they seemed to be listening even though the discussion didn't lead to group or open discussion.

Most technology was ~~smart~~ phone. Some laptops. It was not really common. but in some cases, there was either work / distraction ~~together~~ because of the technology.

ease to turn to the teacher -

I think it was interesting to see the students being able to move or print personal seats to teacher.

I also saw one student that didn't move for their discussion circle to face the front and stayed oriented to the back of row slightly. it seemed like this individual did not want to be engaged.

Being larger the seats are not as comfortable for me. I like the ability to move - foot rest - moving the table top to where it is comfortable. Students seem to be comfortable.

Rotation of seat is easy & quiet - movement is very quiet. Sitting in chair seems to be distracting many could be moving and because you couldn't hear anything. It didn't distract from the class.

Arm rests were used. Not adjustable but easy to use. - helps with sound reduction.

Some movement was just for distraction/boredom.

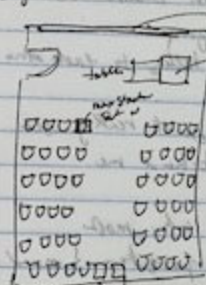
fit the space given to them

It's interesting to see that not very use desks

It is harder to report on the use of chairs, room
because not much movement seems to be going on at
room is not built as much

36 students

They definitely can speak more students into their
space than they could with a video camera
layer



conversation @ back of room

detachment students are facing forward -
topical classroom - helpful answer, some turned as

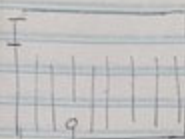
you can hear every moment

as before today there is a substitute teacher

more students check water bottles - no place to put them
but it looks like a video camera is not

4-4-2017 - 7:45 am class.

p1 12

what I
sat by* Need to get list of students
if serving.

Before class began rows are set up - little bit of disassemble/jumbling
our students sit down - didn't seem to bother anyone. what I
notice is that they adjust seating to face teacher.

Students seem to be more willing to add response/comment
not formally. They will call out answers. I feel like there
is a feeling of connects with entire class not just row
by row. But everyone.

Backpacks are sometimes placed in individual disk under
desk. Some are laid near chair/wall.

Students sit together but not engaged in conversation.

-Teacher asked group to turn to their neighbor. immediate
adjustment of seating by simple & quiet turn allowed
students to interact. Since the direction was given to
just turn to neighbor where people sat next to someone
they turned to each other. where there were breaks of 3.
that adjustment was made without incident & was quick
to adjust.

The assignment was to ask the neighbor to answer a
question that they had on the assignment. (student 1 question
is reading was given to student 2 to answer etc.)
Teacher was able to grab a chair near a group and
talk to them - immediately "disappearing" into class
discussion.