Increasing Student Achievement Through Constructive Play

An approach towards game environment art for designers, programmers and artists

A Thesis Submitted to the Faculty of the Interactive Design and Game Development in Partial Fulfillment of the Requirements for the Degree of Master of Fine Arts in Interactive Design and Game Development

at

Savannah College of Art and Design

Daniel Paul Triplett

eLearning

Aram Cookson, Committee Chair

David Meyers, Committee Member

Dr. David Whittinghill, Committee Member

Acknowledgements

Thesis Chair Aram Cookson

Thesis Committee

David Meyers

Dr. David Whittinghill

Survey Participants

CGT 490 Fall 2016

Table of Contents

List of Figures

Increasing Student Achievement Through Constructive Play

Daniel Paul Triplett

Abstract

Typical approaches to game environment art studies incorporate many long hours of modeling and texturing, followed by construction of a virtual space. Environment art studies that begin with construction of an environment first, in the form of constructive play, may lead to early success by helping to see results immediately. The purpose of this study is to show that by adding *constructive play* to game environment art curriculum, students in game studies will perform better in the *mastery experiences* that will lead to greater success in exercises.

Keywords: constructive play, mastery experience, game environment art, curriculum, modeling

Introduction

"As to their STUDIES, it would be well if they could be taught everything that is useful, and everything that is ornamental: But art is long, and their time is short. It is therefore proposed that they learn those things that are likely to be most useful and most ornamental."

- Benjamin Franklin

Exploring the possibilities of improving environment art instruction started in an experimental classroom setting within the Computer Graphics Technology department (CGT) at Purdue University in West Lafayette, Indiana. The process began with a number of brainstorming sessions where the problem was approached; how might artistically challenged students be helped in improving the level of visual aesthetics in their portfolios? Dr. David Whittinghill, Associate Professor of Games Studies at Purdue Polytechnics Institute, and Daniel Triplett, a six-year video game industry veteran, met to discuss a variety of approaches to solve this challenge. While the goal of the initial question was vocationally driven: Students need to get noticed and to get jobs. Constructing an engaging, achievable and creative curriculum for those who typically would not describe themselves as "artists" was at the forefront of our discussion. It was hypothesized that adding constructive play (CP) to environment art studies would help to keep the interest of students better and increase their performance. Research led to gaining a clear understanding of CP, where it has been used and to what ends. As investigation of CP for adults began, it was also sensible to investigate approaches towards creative studies for non-artists. Through talking with other academics about engaging non-artists, the name "David Kelley" and the "IDEO" School at Stanford arose. David Kelley is from the IDEO or "D" school who works with people from all disciplines focusing on unlocking their creativity and creative

confidence (Kelley and Kelley 117). In their book *Creative Confidence: Unleashing the Creative Potential Within Us All* David and his brother Tom Kelley speak of a great influence on the their work is the author and Psychologist Albert Bandura. Albert Bandura used a term "self-efficacy" to describe confidence in ability (Bandura vi). Albert Bandura's suggests that the most powerful approach towards confidence is built by what he calls "mastery experiences" (Bandura 80). In essence a mastery experience is what most academics strive to help their students achieve: mastery of part or all of a subject (Khan, "Teach for Mastery"). Researching mastery experiences became a guide in curriculum building.

Using CP for environment creation drove research into the architecture that might effectively be represented using little more than the blocks. Purdue CGT's game curriculum uses Unreal Engine 4 (UE4) as the typical solution to house final presentations for games studies. While UE4 allows for primitives and binary surface partitions in engine, these tools are limited in their ability to modify certain parameters like beveling an edge or adjusting UVs. The desired approach was the fastest method. Working primarily in the game engine to aid in immersive constructive play was favored, eliminating valuable time typically used jumping back and forth from a digital content creation application (DCC) to the engine. Research found procedural tools became an attractive alternative to the many imports and exports involved in the traditional workflow (*Sidefx Houdini* Engine). With some training in procedural techniques, one could learn to create a box builder that could be interactively updated within the game engine with no need to jump back and forth between applications. This procedural asset could be beveled and resized within a few seconds and could have dynamic UVs that automatically updated with any adjusted parameters. Houdini FX, a procedural DCC application, produced a method for creating what they call a "Houdini Digital Asset" (HDA) (*Sidefx Houdini Engine*). The HDA can be imported

into UE4 once, and then duplicated, manipulated into many sizes based on parameters created and promoted in Houdini.

The blocks made through Houdini do not come textured. Using photo source textures, Allegorithmic's "Bitmap 2 Material" (B2M), part of the Substance Suite, became a starting place for physically-based shaders (PBS). The advantage of generating textures with B2M is the speed at which the program allows one to take a photograph, tile the texture to a power of two, and export it to UE4. Where B2M failed to give enough control, Photoshop became the alternative.

The study then took on two stages: one, add constructive play to a mastery experience for part of a semester and examine the grades against grades from the second part of the semester where similar assignments were given, but no CP was involved and two, create a visual component to research the effectiveness of environment creation using largely constructive play techniques, e.g., building with blocks.

Literature Review

For more than a hundred years theorists have studied CP and child development, but far less research can be found in relation to adult learners and constructive play. In order to acquire previous works done on the topic of CP in adults education, and a consultation with Purdue Professor Judy Nixon aided in a search for relevant literature. Five databases were searched: MEDLINE, ERIC, Education Source, PsycINFO, and Google. The following keywords were investigated: "constructive play" adults, "constructive play" undergraduates, "constructive play" adolescence. From the search only 13 results were found using "constructive play" adults, but all of the thirteen articles were addressing how adults might help facilitate CP in children. Finally, a

query was made within dissertations with one result: "Facilitating Creativity in Adult Learners" by Kuan Chen Tsai. Tsai experienced similar shortcomings in research done over the last twenty years on facilitating creativity in adults. Tsai claimed that most research is focused on children (TSAI 8). The need for more understanding on how constructive play can affect adults is woefully inadequate and beckons more consideration. Because searches for adult studies in CP were unsuccessful, much of the following literature has roots in the studies done on children and on play in general.

What is constructive play? Psychologist and author Peter Gray defines constructive play as "the playful building of something" (Gray, par. 14). Gray further refines his definition: "constructive play (the playful building of something) is always directed toward the goal of creating the object that the player has in mind" (Gray, par. 14). Gray's interpretation of CP is the definition this study utilizes. It is important to note that in its essence game environment art carries with it a sense of "construction" already. For this study "play" was considered the central part of the concept. While most people understand play at an experiential level, a deeper look into the concept of play to understand why it takes place was undertaken.

Play

Why do we play? Psychologist Karl Groos studied and theorized about the reason animals engage in play. Groos first view is that play is physiological, partly caused by excess energy (Groos, "Play of Animals" 1). Could excess energy lead one towards spending more time on a subject that is fun thereby learning the subject better? This question beckons thought: why do some seem to excel and thrive in a particular activity and others do not? ScienceNordic, a news outlet for scientific studies, reported findings on a similar question as it relates to sports:

"Certain children demonstrate a remarkable talent in sports at an early age. Why do some of them fade away, while others rise to the big leagues" (Stranden)? ScienceNordic's study offers three leading factors for success in this area. The top factor is self-practice done on their own and in organized settings (Stranden). The study goes further to suggest: " ... training should be fun ...This play does not have to directly relate to the sport the child will excel in" (Stranden). Through these observations there seems to be a relationship between play and practice. It has commonly been said "practice makes perfect". Those who wish to attain a higher level in any skill need to put forth the time to refine their abilities. Looking to play as a motivator for improvement has long been studied with a focus on children. Many children object to doing mundane tasks, but a task that is fun yields an enthusiastic participant. Adults, like children may also need added practice at work or in academia. One study on practice within an adult demographic shows that even after the physical body is accustomed to an activity one can still benefit from practice. Professor Alaa Ahmed of Colorado University studied the physiological reaction of practicing beyond perfection (Huang, Kram, and Ahmed). In the study, tests were measured gathering metabolic and muscular activity rates while learning a "novel" task of moving a robotic arm using a keyboard (Huang, Kram, and Ahmed). The study notes: "Interestingly, metabolic power reductions continued to occur late in motor learning...whereas muscle activity decreases were only detected during initial motor learning." Here we see that although little to no muscle changes occurs after a certain amount of practice (the motor skills were efficient), yet the metabolic rate still drops. "Ahmed theorizes that even after participants had fine-tuned their muscle movements, the neural processes controlling the movements continued to grow more efficient" (Paul, par. 8). Efficiency is therefore a result of practice. It could be deduced that there is a biological necessity for play as it relates to survival of our

species. Playing, seeing a task as fun, and in response repeating said task often may help humans fine-tune themselves to reach higher standards.

Groos goes on to challenge the exclusivity of his first thoughts on play, suggesting that instinct has a part in play too: "instinct is a power in itself which does not need special accumulated stores of energy to bring it into activity" (Groos, "Play of Animals" 19). Play then acts as a preparatory agent, and involves imitation many times, allowing the learner to become familiar with the activities (Groos, "Play of Animals" 7). Most have witnessed this in playful simulations: young children take part in pretending to go to school, having a tea party, or cooking an imaginary meal. "Constructive Movement-Play" is play that "demanded an external result of our instinctive movement" (Groos, *Play of Man* 99). Groos describes constructive movement play: "Pleasure in the work of our own hands ... here becomes positive creation, instinct for building, for uniting scattered elements into a new whole" (Groos, *Play of Man* 99). While few develop a sense of accomplishment or mastery in developing "scattered elements into a new whole", at one time or another most have played in the sand, built cities with blocks or created some kind of virtual space to their fancy. This observation led to the hypothesis that adding play to further studies is something that is natural, instinctual, and intuitive. Adding CP to game environment studies early, before the demands of modeling, is expected to fulfill a natural longing to build. Interest and drive were also considered: could CP help generate curiosity that would pay off later during modeling and texturing stages of environment art studies?

Origins of Constructive Play

Looking into the origins of CP in education was an important step in understanding previous approaches. CP in formal education can be traced back to Fredrich Froebel, the pioneer who invented Kindergarten with a focus on "play" (*StateUniversity*). Froebel's "Kindergarten

Curriculum" consisted of direct forms of CP in a series of "gifts" (*StateUniversity*). Those fundamental concepts represented by Froebel's gifts included blocks "that children could use to create geometrical and architectural designs" (*StateUniversity*, par. 13). The influence of Froebel's blocks in the life and work of Frank Lloyd Wright is well known to those familiar with the master architect. In 1991 Wright was recognized by American Institute of Architects in a national survey as "the greatest American Architect of all time" (Brewster, par. 15). His mother gave Wright a set of Froebel's blocks in his youth (Fowler 1). In a quotation from his autobiography Wright recalls the influence the Froebel's blocks had: "The maple wood blocks ... are in my fingers to this day" and "these primary forms and figures were the secret of all effects" (*froebelweb*, par. 1). With knowledge of block building as a fundamental approach towards creating geometry and architecture, and its influence on great designers like Wright, it seemed logical that environment art learners could benefit as well.

Fig. 1. Froebel's Blocks

Caroline Pratt, another pioneer in early education, was influenced by Froebel's ideas (*FroebelWeb*, par. 1). During the late 1800s, Pratt saw the inadequacies in the American educational system where rote exercises led to skills acquired but without tangible outcomes

(Pratt, ch. 2). Pratt expanded on Froebel's method by creating Unit Blocks. Unit Blocks are common to many children's classrooms in America and were used in this study.

Fig. 2. Pratt's Unit Blocks

Through facilitating constructive play, it is expected that not only will common benefits occur like spatial reasoning and increased math skills (Oostermeijer, Boonen, and Jolles), but also through the process of playing early within their studies, students would have fun while gaining familiarity with the common tools needed for game environment building. CP would help immerse them in their studies. The hypothesis driving this study posits that using environment pieces that are professionally created may lead students to: one, learn what a good asset looks like, and, two, help students gain familiarity with important technical details such as file structures, patterns for naming conventions, UV layouts and other practices common to environment artists. While it is expected that exposure to professional-level pieces will advance these students ability to see quality aesthetics, Kelley's theories take into account that exposing non-artists to incredibly complex models might intimidate or discourage students rather than drive their efforts forward. David Kelley suggests “Non-artists need reassurance…the kind of

supportive culture that ignores the quality of their sketches and focuses on the quality of their ideas." (Kelley and Kelley 860). For this reason students were introduced to CP pieces that represented real architecture, but in its most refined form.

Constraints in Constructive Play

Constructive play, while intended to be fun and not seem like work, does not come without confines. As Gray suggests, constructive play, regardless of the chosen medium, must have a goal in mind: "You don't just pile up blocks randomly; you arrange them deliberately in accordance with your mental image of what you are trying to make" (Gray, par. 18). Tom and David Kelley, in their book on creative confidence, suggest that we use constraint to fuel creativity (Kelley and Kelley 1654). They go on to explain that while it sounds like an oxymoron to have "creative constraint" that it is this very constraint that fuels creative innovation (Kelley and Kelley 1654). *Forbes Magazine* found after surveying 1.7 million corporate award winners that a trend was established "that people who create new value on the job are often inspired by constraints" (Sturt). The *Forbes* article highlighted Frank Gehry, world famous architect, who designed the Guggenheim Museum in Bilbao, Spain and the Disney Concert Hall in Los Angeles. Gehry is quoted: "I think we turn those constraints into action" (Sturt).

Plays Effects on Intrinsic Motivation

Creating an atmosphere of play adds intrinsic motivation towards the goal, an atmosphere where "players do not necessarily look for the easiest routes to achieving the ends" (Gray, par. 14). Maria Montessori, an innovator in facilitating learning environments, states: "So we found that education is not what teachers give; education is a natural process spontaneously carried out by the human individual" (Montessori 7). Maria suggests that humans learn; it is what we do.

Yet Gray explains why play offers a motivation to learn that goes beyond just achieving the ends of a study:

> "When we are not playing, we typically opt for the shortest, least effortful means of achieving our goal. The non-playful, goal-oriented college student, for example, does the least studying in each course that she can in order to get the "A" that she desires, and her studying is focused directly on the goal of doing well on the tests. Any learning not related to that goal is, for her, wasted effort" (Gray, par. 12).

For building a readied mind for learning, we need students who see their endeavors as play and, in play, the activity is "conducted primarily for its own sake" (Gray, par. 34).

Constructive play then readies the mindset for learning. Gray observes: "... if play has been established, we can expect an alert but unstressed state that is ideal for learning a new skill" (Gray, par. 34). This fertile ground for learning and unlocking creativity was another basis for using constructive play in this study: setting up the environment where a mastery experience can then start to take place at a deeper, more meaningful level.

Mastery Experiences

Researching mastery experiences helped to better understand how one might raise the confidence and ability in another person. Mastery experiences could be described as incremental accomplishments. Through Bandura's studies, he found mastery experiences are the single greatest key for success in building self-efficacy or confidence in ability (Bandura 80). We see this in athletic training. For any major sporting event, the typical approach is to start training with small incremental goals. Hal Higdon, world champion runner and trainer of marathon runners, uses a system of incrementally raising the length a runner achieves over a period of

fifteen weeks. In the final three weeks of training the runners run a bit less to allow their bodies rest for the final test of the marathon (Higdon). This type of incremental approach works to gain the strength and stamina for novice runners to complete a larger goal. Likewise Bandura's approach to mastery experiences uses similar techniques to allow people not only to accomplish sought after goals, but to reduce anxiety. People who go through Bandura's guided mastery process "... ended up having less anxiety about other things in their lives. They tried harder, they persevered longer, and they were more resilient in the face of obstacles and failure" (Kelley and Kelley 563). If successes are gained early in the process of learning, one's confidence tends to increase, while failure early has the reverse effect (Bandura 80). Steps early on should be easy to accomplish, but as time goes on Bandura suggests overcoming bigger obstacles requiring perseverant efforts will become more important to build a resilient sense of efficacy (Bandura 80). This pattern of raising difficulty as mastery is in progress is important while building curriculum. Incorporating the simplicity of CP allowed early, tangible results, for immediate confidence building. Later more challenging lessons were introduced.

Facilitating Mastery Experiences

Facilitating a mastery experience, whether uncomplicated or advanced, is accomplished by breaking down complex skills into "easily mastered sub-skills and organizing them hierarchically" (Bandura 80). In typical classroom environments, a conventional approach towards subjects consists of a lecture given to students, as notes would be taken to help retain information explained in class (Deslauriers, Schelew, and Wieman). Currently, advances in screen-capture technology and broadband are readily available. Rather than the traditional lecture, game environment creation skills can be recorded allowing organized repetitious learning to occur: "Recordings can save valuable class time, engage students in online courses,

and provide an archive of important information that students can view multiple times, especially for hard-to-grasp concepts" (Ashwat, par. 2). One institution using screen-capture technology as a foundation for teaching is Kahn Academy. Kahn Academy, an online resource for learning, was built on the premise of concept mastery (Khan, "Teach for Mastery" 00:00:00-00:01:00). In its infancy, Khan Academy was a mathematics course to aid in founder Sal Kahn's cousins' studies (Kahn, *One World Schoolhouse* 7). Kahn explained that as he tutored his cousin, it became clear that she preferred working with the video lessons rather than direct lectures (Kahn, "reinvent education", 00:02:00-00:03:00). The advantage to recording lessons allowed the student to stop and repeat parts of the lesson in the event a concept was not comprehended (Kahn 10). In his consideration of complete subject mastery, Kahn argues for a paradigm shift:

> "In a traditional academic model, the time allotted to learn something is fixed while the comprehension of the concept is variable...What should be fixed is a high level of comprehension and what should be variable is the amount of time students have to understand a concept" (Kahn, *One World Schoolhouse* 39).

Using readily available video training replicates the intended lesson, bringing education closer to Kahn's vision.

Testing the results of Kahn Academy's approach occurred first in a few schools in Los Altos, California. Teachers noted: "Students who traditionally struggled with the material were more confident and engaged" ("Is Khan Academy effective?," par. 10). The figure below shows a shift from class results before the use of Khan Academy and after its use:

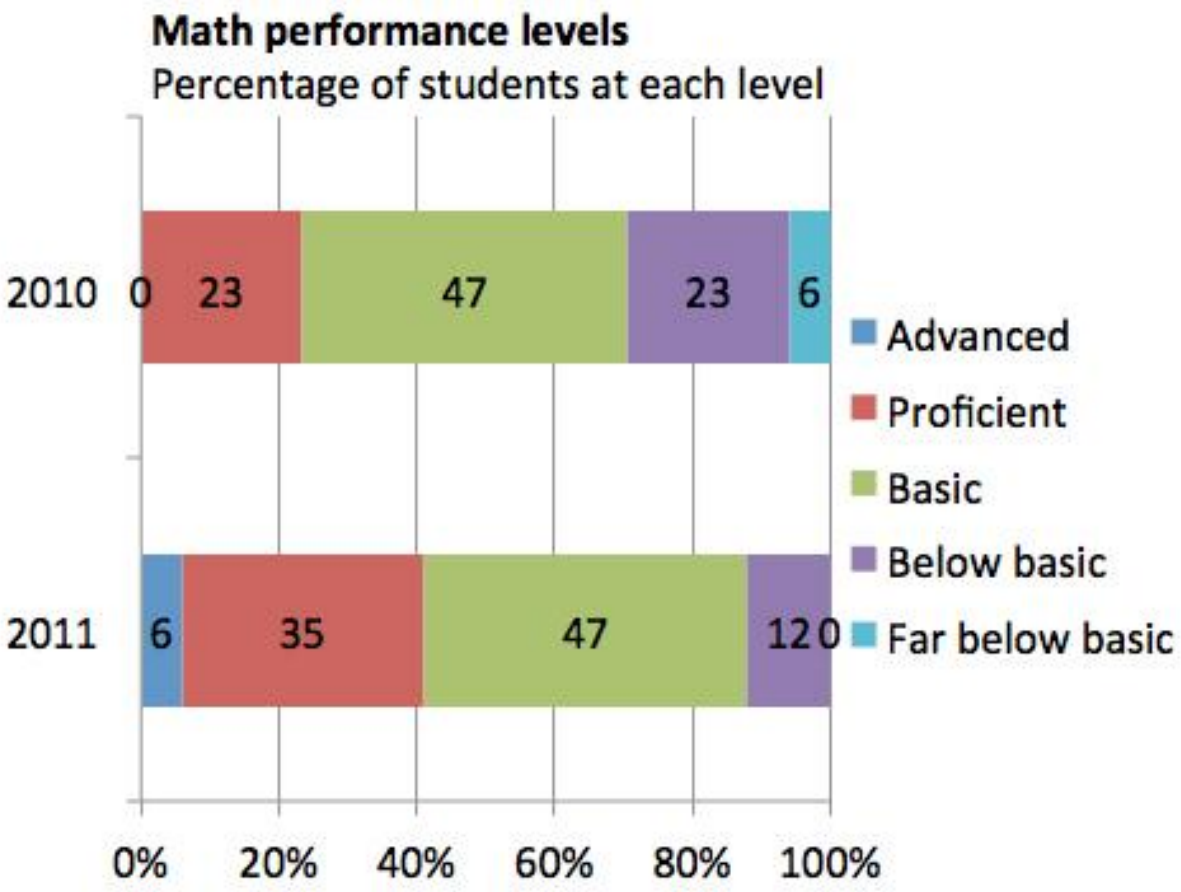


Fig. 3. Khan Academy pilot platform results from schools in Los Altos, California

While the chart above does not indicate a radical elimination of below average scores, the scores for "far below average" are completely gone; instead there are now "advanced" students. As this thesis set out to engage and educate, Kahn's and Bandura's theories influenced the course material as they had the same goal of mastery. As a result, CP coupled with standard environment art studies were broken down into orderly steps and provided in video format.

Minimal Architecture

The need of a beginners' mastery experience in environment art called for research into a viable environment style that could be built by basic pieces. Many architectural styles examined starting from ancient Egypt to modern structures supplied extensive possibilities. However,

Minimal Architecture stood out as a style that seemed achievable. Minimalism began as an American art movement during the 1960s: " ...the use of simple geometric forms, the modular principle, and an industrial look are attributed to this art style" (Ruby, Ruby, Sachs, and Ursprung 6). In game environment building, terms like "geometric forms" and "modular" are common as well. While there is no official definition for minimal architecture (Ruby, Ruby, Sachs, and Ursprung 10), many sources describe similar settings as this quotation proposes: "In minimalist architecture, design elements strive to convey the message of simplicity. The basic geometric forms, elements without decoration, simple materials and the repetitions of structures represent a sense of order and essential quality" (Pawson 8).

One artist/architect whose work embodies the minimal style is Tadao Ando. Ando is "one of the first to enter the field of architectural minimalism" (Ruby, Ruby, Sachs, and Ursprung 30).

Fig. 4. Tadao Ando 2004

"Even photographs cannot restrain the fact that these buildings effectively make room for the ineffable. This is architecture at its best" (Daelemans, par. 2). Referring to "Church of Light" in Osaka, Japan, Daelemans speaks boldly about the impact a minimal piece of architecture can have. Not alone in his opinions, in 1995 Ando won the Pritzker Architecture Prize, considered by some to be "the most prestigious award in architecture" (Pollard, par. 1). It is clear that minimal

work can be highly regarded as impactful in architectural circles.

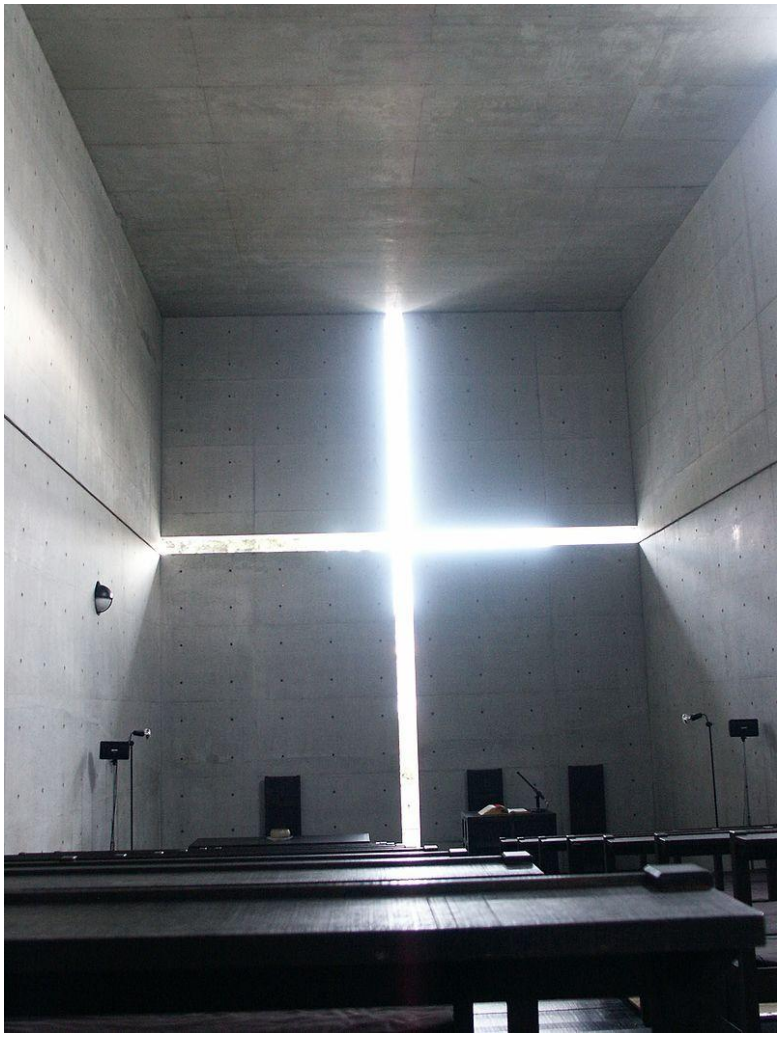


Fig. 5. Interior of the Church of the Light, designed by Tadao Ando, in Ibaraki, Osaka Prefecture.

The Church of Light's layout and materials are simple concrete (Kroll). Yet "the seams and joints of the concrete are built with precision and care by master Japanese carpenters, along with Ando, that have worked to create an immaculately smooth surface and accurately aligned joints" (Kroll, par. 5). This kind of thoughtful consideration to surfacing is the desired end of

building minimally rather than cheap gray box levels, but instead refined, thoughtful spaces, like Ando has achieved.

Can minimalism achieve the same accolades in a virtual world? One YouTube video using UE4s modern-graphics technology posted shortly after the game engine released in August 2014, caught the attention of many. Created to highlight UE4's lighting ability, this video displayed environment art and architectural visualization and became a much-watched demonstration at 895,416 views (Koooolalala). Koooolalala is revered as a "rendering expert" and creates "environments that are virtually impossible to tell apart from real life" (Keskeys, par. 2). The style Koooolalala created for this particular video was minimal, and was even compared to Tadao Ando in regards to the concrete walls (Keskeys, par. 3).

Fig. 6. Koooolalala, UE4 Archviz / Lighting 4

The importance of Koooolalala's video to this thesis is that it shows that simple environments can draw high accolades getting work noticed. While this study focuses on CP to

enhance studies, a fundamental motivator for this study was to improve the aesthetic qualities within student portfolios. In his quintessential book *The Animators Survival Kit,* Richard Williams gives advice for those who wish to advance their studies in art:

> "The thing you are going to build on must be basic. Everyone wants to decorate their house with interesting pieces before putting in the corner-stones and supports. Everyone wants to jump ahead to the sophisticated bit-glossing over the dull, old support work. But it's the thorough understanding of the basics that produces real sophistication" (Williams 46).

Using CP with minimal environment art as a starting point to game environment creation follows the principal Williams puts forth.

Frank Lloyd Wright mentioned earlier, trends towards minimal architecture: " ...simplification of the interior he called it the elimination of the insignificant, a lesson he learned from the Japanese: the ideals of simplification, order and natural material" ("Americas Castles Frank Lloyd Wright," 8:56-9:00). Clearly influenced by Froebel's blocks, as stated earlier, Wright's professional journey began with designing buildings, but evolved into designing an entire architectural experience down to the very furnishings placed within his structures ("Americas Castles Frank Lloyd Wright" 12:50-13:15). In *Fig. 7* Wright's design for light fixtures and trim possesses simple geometric forms of spheres and cuboids making intricate patterns that appear more than the sum of their parts. Wright is an example of how CP can influence and become a foundation for works that are considered by many to be at the pinnacle of design.

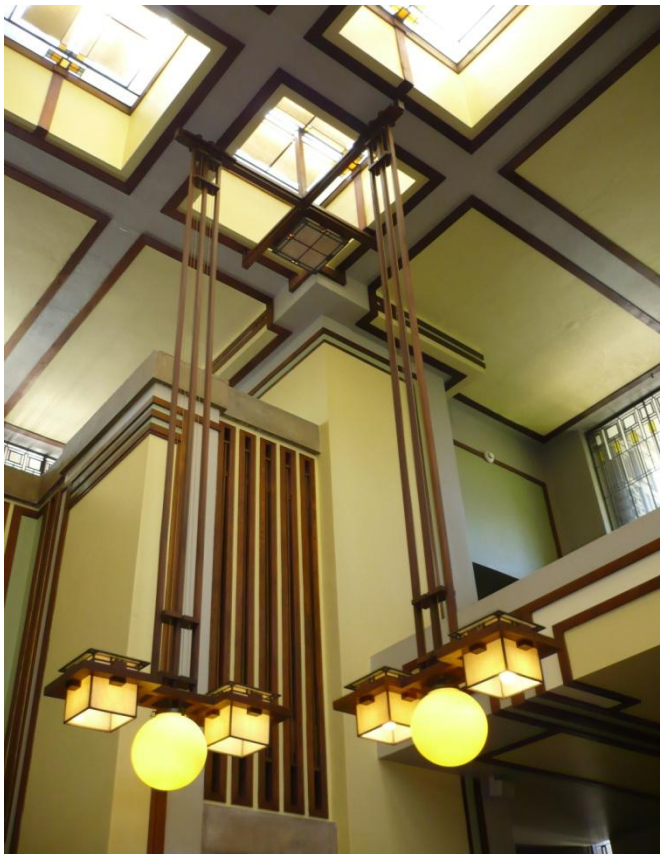


Fig. 7. Architourist2day Unity Temple - Oak Park, Frank Lloyd Wright, 1910

Research has established CP as a valid addition to studies within children, but little knowledge about CPs affect on a mature audience indicates an area to study. The following approach adds CP to a game environment art curriculum and looks for graded results as an indication towards CPs validity.

Overview of the Project

This project focused on facilitating and training traditional game environment subject matter as dictated by industry professionals, but with CP introduced before common topics of modeling and texturing began. Students spent part of the semester working with professionally created environment pieces, learning to lay out spaces, light, post process and troubleshoot problems, while learning typical environment skills also trickled into the curriculum. Later in the

semester, CP was completely pulled from the curriculum, yet usual subject matter continued. It was hypothesized that the addition of constructive play into game environment art undergraduate studies would engage students and yield higher scores in assigned activities.

Class Curriculum Part 1: Game Environment Art Studies with Constructive Play

Week 1: 08/22/2016

Upon entering the classroom, students found Pratt's unit blocks and Lego's sitting on the tables within the lab. Students did not hesitate but played with the items while introductions, syllabus review and any other formalities commenced. David and Tom Kelley suggest, "dedicate a separate space for innovation" (Kelley and Kelley 3189). By setting up youthful tangible objects, CP began within the first minutes of class.

Creativity is inherent in art creation. Ror this reason, facilitating creativity led to innovators in the field. David and Tom Kelley claim that to be more creative, "the first step is to decide you want to make it happen" (985). The Kelleys suggest, regardless of uninformed steps that may be required, it is essential for one to begin to make a decision toward creativity. With this in mind, at the close of class introductions, a motivational speech about setting forth one's mind and efforts towards the direction of environment art studies was delivered. One focus of the discussion proclaimed that effort and application to environment studies yields results. This verbal persuasion exhibits Bandura's claim that "it is easier to sustain ... if significant others express faith in one's capabilities" (Bandura 101).

During the first class session students were given a survey which asked a multitude of questions set forth to determine the level of experience students had with the subject matter. The

multiple choice survey was for the benefit of the instructor during the outset of the class. The questions and answers were kept informal, and one answer for each question was notably whimsical. For instance, question two read: I have at some point in my life built a simulated space with blocks, sand, couch cushions and/or bed sheets, snow, Lego's, diorama materials (cardboard, Styrofoam), playing cards, etc.? The possible answers to this question were:

(1) Never

(2) When I was a kid, but not recently

(3) Recently for a school project

(4) Recently for fun

(5) I'd be building one right now if I wasn't doing this questionnaire

Each question posed was to determine a level of experience with the subject matter, but also to establish the students' interest in the subject matter. The nature of choice five in each question was to establish a fun, playful, lighthearted attitude. It was believed a survey in this tone would convey a playful, pleasurable, and relaxed classroom atmosphere versus a mundane, rote one. Research has been shown "that when the joy and comfort are scrubbed from the classroom and replaced with homogeneity, and when spontaneity is replaced with conformity, students' brains are distanced from effective information processing and long-term memory storage" (Briggs, par. 12).

In order to begin with a fresh, playful mindset the class discussed their favorite game environments and explained why these environments were influential to them. "One important aspect of unlocking creativity is to approach subjects with a beginner's mindset" (Kelley and

Kelley 1049). All of the students were passionate about games and this discussion seemed to get the students talking from an excited and vigorous perspective.

Bandura writes: "Ambiguity about task demands adds an element of uncertainty in the appraisal of personal efficacy from enactive experiences" (83). All assignments during the semester came with an accompanying assignment sheet to avoid uncertainty. Students found documents for each assignment, accessible through Blackboard Learning (BBL). The assignment document included the name of the assignment, how many points it is worth, explicit guidelines on the format it should be finished in and, in some cases, an example of a finished piece. BBL carried the details about when it was due.

Keeping in line with lessons from industry professionals and leading academic sources, fundamental interactive world building approaches, like reference collection, were incorporated and refined into early lessons. Senior environmental artist Judd Roy explains that collecting images for reference helps to generate ideas to overcome artist block (Roy). Based on this, an assignment on reference collection was given to the class. Students were directed to go outside of class and deconstruct an environment through photography. Part of the logic backing this lesson takes root in learning to observe: “Careful observation of evidence is the heart of modern scientific method; photography has always been valued as an objective technique of observation” (*Science Photography*, par. 3). While this study is focused on art, scientific and objective approaches towards reference collection leaves students with skills that would transfer to other game practices like photogrammetry (Hamilton and Brown). Students are asked to use forensic-like photography techniques; "it is better to have too many than not enough images" (Crime Scene Photography 5).

To aid in CP, students began by learning the fundamentals of UE4. As suggested by Kahn, videos were used to instruct all of the technical skills needed to work within the game engine. It was taken into account that some enrollees had never used UE4. In this case tutorials from World of Level Design's (WoLD) website were acquired that taught the utmost beginnings of UE4. Even the software installation process was explained (*WoLD*). The *UE4 Fundamentals* from WoLD incorporated CP through Binary Surface Partitions (BSP) and used starter content included with the free download of UE4. Students learned how to navigate the user interface, populate levels with BSPs and meshes, apply and adjust materials, place special effects, basic lighting and testing their environment by navigating through it.

Week 2: 08/29/2016

It was important to create an idea of beautiful environments. A discussion that studied major architectural movements highlighted many periods with famous buildings and environments. Students did their own short research project promoting a period they found beautiful and inspiring. In an article on neuroaesthetics, Moheb Costandi notes that while "an object's beauty may not be universal, ... the neural basis for appreciating beauty probably is" (Costandi, par. 1). Students looked at and recorded three architectural periods or movements they found interesting. Instructed to write one of three examples on the board, students choose their subject matter, making sure that no one had already picked that topic. Lectures given by the students during week four presented a plethora of architectural styles. In her book *The Not so Big House*, architect and teacher Sarah Susanka explains how she leads students to identify beauty: "Notice what constitutes the spaces that feel good to you. Try to determine if they appeal on an emotional level or in a physical way. And try to articulate why" (Susanka and Obolensky 18). For Susanka, acknowledging and articulating what is beautiful and why is a step towards

understanding one's personal taste in aesthetics. Choosing architectural styles that appeal to students and writing about them puts forth the same goal.

Week 3: 09/05/2016

Labor Day fell on Monday week three; no class was in session. Students were to continue progress on *The Corridor Project.*

Week 4: 09/12/2016

During week four students continued working on *The Corridor Project*, incorporating CP. Students also presented their research on inspirational architectural movements. While students were already piecing together a minimal environment, a formal lecture introducing and inspecting minimalism, as an approach to learning environment art, ensued. Concepts like "less is more", a phrase attributed to Ludwig Mies van der Rohe, one of the twentieth century's most influential architects (Stott, par. 1), became a basis for the conversation.

After week four's lecture was finished, students engaged in lab time. Like Higdon's marathon training, it became important to create a rest period where no new concepts beyond CP were presented. The lab time allowed students to come to class, work and ask questions. Bandura suggests that external assistance carries little efficacy value because the student is likely to credit their success to external aids rather than personal capabilities (83). Video instruction allowed students to work through lessons and try to master topics themselves. If students asked questions where the answer existed in the recorded lesson or from prerequisite subject matter, the instructor would direct them back to the resources. If the knowledge the student wished to acquire was completely new to them and was a familiar subject to the instructor, then a brief overview was discussed. The instructor then directed students where further resources existed.

An example of this was a student who wished to dive into Zbrush. The student was given a quick one-on-one tutorial and then directed to Zbrush Central's ZClassroom where covered topics could be watched free of charge. This method of self-reliance puts the power to learn and accomplish back into the hands of the students, avoiding extensive external assistance. A deep-held conviction to never turn away a student in need drove the instructor's conscience, but students were encouraged to become self-sufficient learners.

Week 5: 09/19/2016

In week five, specific topics of Photoshop's basic tools and how to mask parts of textures was demonstrated. Each student with a photograph of a leaf, followed along with a lectures instructions. Referencing professional texture authoring methods helped facilitate training presented to the class. Many texturing techniques, learned from seven-year game environment art veteran and creator of *Eat3D.com* Riki Babington, were presented. Babington's video *Next-Gen Texturing Techniques* informed efficient workflow for subjects like tiling textures, masking and opacity (Babington).

In order to complete later assignments students needed introductory environment modeling skills. *WoLD 3D Game Environment Modeling/Uving Foundation* added basic custom modeling to the curriculum during week five. These videos complemented *The Corridor Project* as the pieces used in CP could be created using the information therein.

Week 6: 09/26/2016

While watching videos for guiding CP, it was necessary to model target behavior, in front of students (Bandura 87). The training from Babington passed on to and was recorded in front of students, demonstrating asset creation in real time. The screen recordings posted to BBL for

further referencing. Students worked with un-tiled brick photographs taken by the instructor. All of the bricks were unique in order to promote individuality. Students then started using the skills learned through early WoLD videos to create their own BSPs in UE4 and test their textures.

Week 7: 10/03/2016

During week seven, concepts of texturing continued. Students by this time had assembled the entire scene of *The Corridor Project* and were putting on final touches to their environments.

Building on texturing concepts, students became familiar with Bitmap 2 Material (B2M) and how to create a tiled brick texture in Substance Designer. Allegorithmic's own YouTube channel provided many videos which guided instruction and translated to fit current assignments.

Week 8: 10/10/2016

Week eight fell on a day Purdue observes October Break; no class was held.

Week 9: 10/17/2016

To test constructive play's effect on student achievement, it needed to be removed from the curriculum. During week nine, students were introduced to the last assignment that incorporated CP. The assignment required the texturing and modeling skills learned in class thus far. Students took the environment arranged after *The Corridor Project* and added their own textures. Students were encouraged to create new models to add to the environment as they worked further through the WoLD modeling foundations.

Week 10: 10/24/2016

Given as a lab week, students worked on re-skinning, rearranging, and adding pieces to *The Corridor Project.* The re-skin was completed by the end of class week ten.

Class Curriculum Part 2: Game Environment Art Studies without Constructive Play

Without student knowledge, in week eleven CP went missing from the curriculum. Students were informed that the remainder of the time would consist of creating more game assets in a fashion that modeled the game industry. The instructor assigned students assets to create. Students then had to hand off the completed asset to the instructor the same way a junior environment artist or a prop artist might in an industry setting (Mon, par. 7).

Week 11: 10/31/2016

Lessons included using the plant textures created earlier in the semester to form an organic piece. Paul Liaw, one of the industry's top modelers, created a lesson on building plants in his *CG Pro Secrets of Success* (Liaw project 4, lecture 4). Liaw's lesson was recreated and then broken down into a step-by-step process in video format by the instructor.

Students continued to work through WoLD 3D modeling fundamentals in addition to the plant assignment.

Week 12: 11/07/2016

Zbrush, often considered difficult to utilize for first time users, was not originally part of the curriculum. Still, students showed interest in Zbrush early on in the semester. An introductory lesson and small assignment seemed appropriate to fuel the curiosity within the class. Introduction to Zbrush was approached in a playful way. Instead of demanding students create anything specific at first, they followed the instructor through the interface and the quintessential tools. The learners then were allowed to play around for over an hour asking questions as they came up. The instructors experience began with Zbrush 2 in 2005 learning

from Gnomon DVDs by Meats Meier and Aaron Sims. More recently, Liaw's organic environment training on rock sculpting became a specific reference for this class (Liaw, project 4, lecture 9).

The Zbrush assignment given was to create a rock. Because rocks come in a plethora of shapes and sizes, it was theorized that it would allow for early success. The students received pre-recorded videos made by the instructor that walked them through the entire pipeline of sculpting all the way through texturing with Substance Painter.

Week 13: 11/14/2016

The final assignment was a culmination of most of the lessons learned through the modeling and texturing portion of the class. Each student sat with the instructor and talked about what they liked working on and what they felt they were their capabilities. As mentioned, the final assignment mimicked the process an entry-level prop artist or junior environment artist in the game industry typically fills. Prop artists typically hand off individual pieces of an environment for an environment artist to place (Mon, par. 7). Concepts created by the instructor or references of ideas gave examples of the pieces to be modeled and textured. In some cases, students showed particular interest in texturing and opted for a procedural texturing assignment.

Week 14: 11/21/2016

Week fourteen served as a lab week to allow students to ask questions, and get help where needed.

Week 15: 11/28/2016

Finals were submitted.

Visual Component

The visual component aimed at providing proving grounds for the methods taught in the class. One important advancement added to the process aimed at future goals for furthering this study. If CP creates more engagement for students, especially among the non-artists, then finding ways to increase the time spent in CP may yield better results in later trials. This theory drove research. A method that allowed more time in game engine, with more versatile block building was sought. While a custom program, written specifically for block building in game engine, could be built, limitations were considered. Mainly, artists and designers as well as inexperienced programmers might find such tasks difficult and outside of the scope of an environment art class. One method of approach allowed achievement of goals without having to know how to program or script. SideFX, a software company, has focused on procedural asset creation and visual effects in the software Houdini FX. In recent years, SideFX focused on an engine that plugs into other popular programs such as Maya, 3D Studio Max, and game engines like Unity and UE4. Houdini Engine allows the user to control assets created in Houdini within a host application. In the case of this study, a simple box builder was created that allows users to manipulate a box's parameters, with procedurally updated UVs right inside UE4. This allows CP to happen with little interruption. The addition of Houdini Engine became the only method which was not taught by the class curriculum.

References:

Following lesson one in the curriculum, the project started with scouting the environment to recreate. Searching for minimal environments, a lobby in downtown Chicago, Illinois became the focus: The Burnham Center, 111 W Washington St., 60601.

Acquiring photographs took place early in the morning before patrons were present in the lobby. Various angles captured architecture and allowed recreation of the scene through observation. Texture reference pictures taken perpendicular to walls and floors aimed at providing undistorted color maps.

Modeling:

Three box builders were created in Houdini with parameters like beveling and procedural UVs. A decision was made that three box builders were needed to aid in optimization. From the three box builders almost the entire lobby of the Burnham Center was modeled. The parameters built into the box builder allowed for increase in the box dimension's in X, Y or Z axis, and beveling. In certain cases custom models or UVs were needed to create specific shapes: lamps, exit signs, door handles, and small details needed specific, albeit simple modeling.

Texturing:

Photographs were fed into B2M processing marble, brass and wood. For custom textures, Photoshop served as the software of choice. Materials set up in the engine used basic parameters like color, roughness, metallic and normal maps.

Materials:

After importing the three block builders into UE4, simple materials were crafted to place on the blocks. Materials representing three marbles (floor, pillars and green trim) were crafted first. To avoid repetition, an additional marble was created for the floor and green trim. Materials representing drywall were next, one eggshell white and one tan. Bronze, wood and glass filled in the rest of the materials created with B2M. The materials just discussed populated most of the environment. Where models and textures needed to be specific, the materials followed in suite.

Constructive Play:

After the blocks and material had been established, CP began to take place. A majority of the time spent building included duplication of blocks, tweaking their size and placing them to match reference.

Optimization:

The environment was not particularly high in polygon count, but following standard practices, major sections of the environment were exported to a DCC application and the unseen block faces were deleted for optimal performance (Lohikoski and Ruden 8).

Lighting and Post-processing:

Lighting techniques explained in *The Corridor Project* guided the lighting in the virtual Burnham Center. Simple spot lights for the light scones pointed upwards, while point lights created fill lighting. IES profiles added complexity to the spot light shape to mimic the original lighting seen in the reference. On the ceiling, elongated point lights mimicked the hidden recessed lighting.

Final Renders:

Establishing cameras and composition screen captures showed the final results.

Methodology

Testing was conducted within the CGT program at Purdue University. A class of 16 senior-level students, games career oriented students, eager to learn to make beautiful environments, were selected to be the focus of research.

Fig. 8. Students of CGT 490 Fall 2016

Lessons learned from top industry professionals, broken down into simple how to lectures and video tutorials, created a basis for an introductory game environment art class. Before typical environment art curriculum began, students took part in lessons incorporating CP. As students progressed through the semester, the independent variable, texture authoring and model creation, facilitated common environment art studies. CP, being the dependent variable, ceased after week ten. In order to avoid subjectivity, student scores were based solely on completion of assignments. Teaching Assistant (TA), Casey Chastain graded all assignments. The TA enforced a rubric based on two points off for each unfinished facet of the assignment sheets' instructions.

Results

The data shows only fifteen students as one student dropped the course halfway through the semester. Two charts represent data from scores, the first corporately and the second individually.

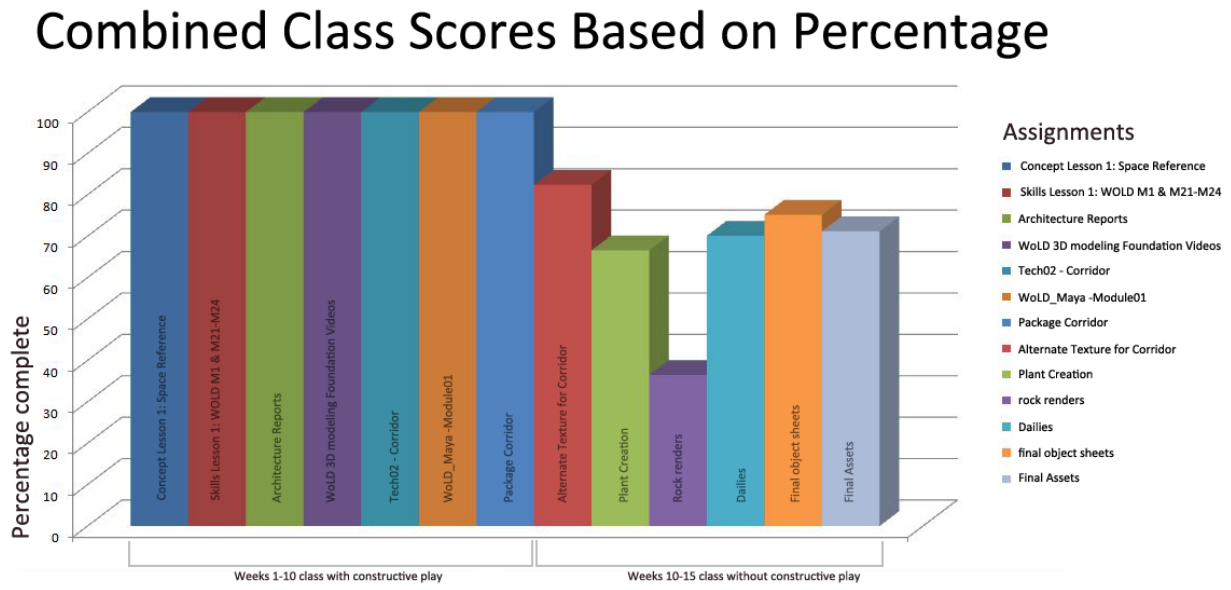


Fig. 9. Graph of student performance

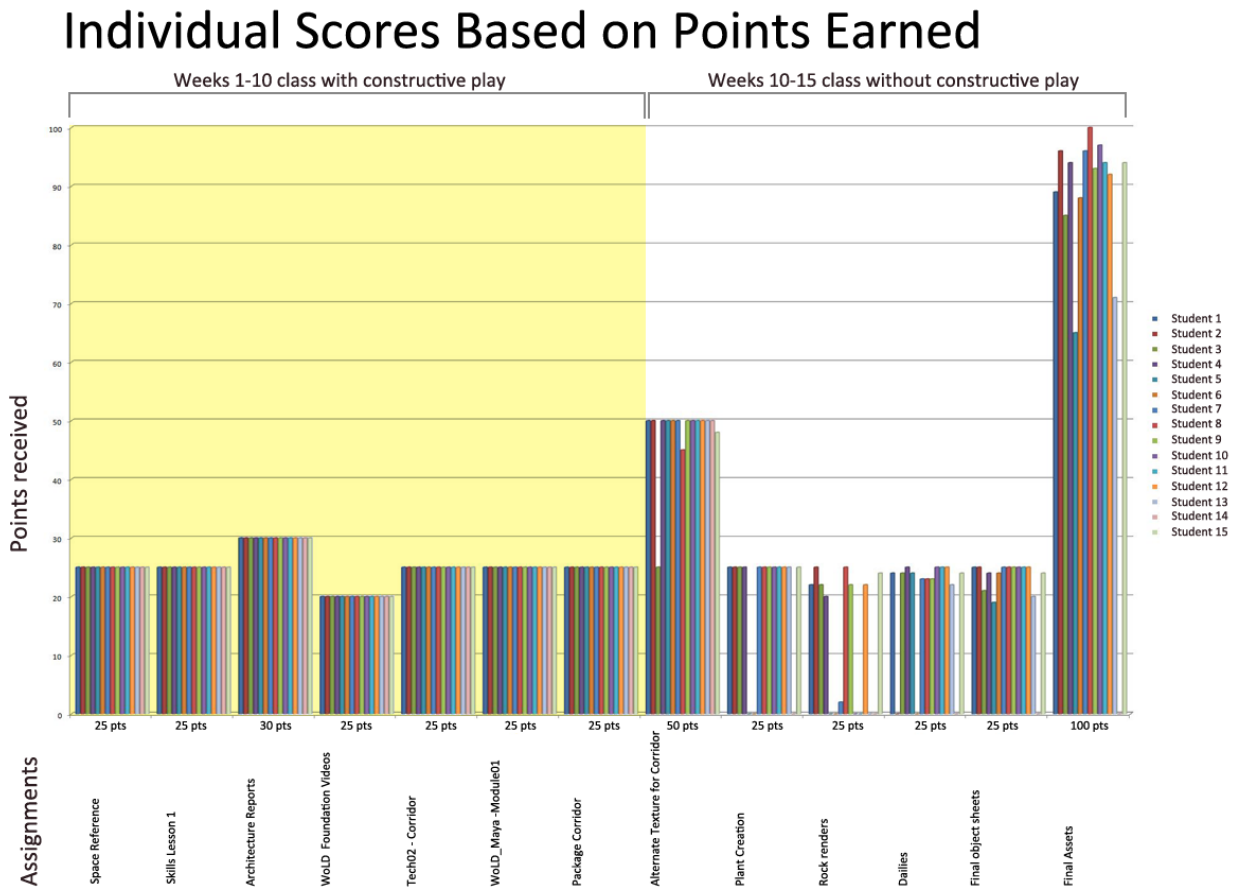


Fig. 10. Graph based on individual points earned

Analysis

It seems remarkable that students showed perfect scores all the way until week ten when constructive play ended. The data shows a clear decline in grades as CP dropped out of the curriculum. Many factors could have affected these results. For instance, what was the class load for other classes? If students did so well in assignments before week ten and then other classes became more intense, perhaps students felt they could miss assignments or put environment art studies as a lesser priority causing underachievement. Another factor to consider is the nature of the assignments given after the change in curriculum. One assignment that likely represents data

tainted by a lack of preparation is the Zbrush rock. While the Zbrush videos showed clear steps towards completion, students commonly identify Zbrush as a challenging program to pickup and frustrating. Since Zbrush lessons were originally unplanned for this curriculum (but added as much of the class showed interest), it is perhaps a subject that should be left off at a beginners level environment art class, or at the very least, not graded. Even if the Zbrush assignment was left off, there still exists a drop in performance. One possible reason for this is the interest of the class as it pertains to the subject matter. Students who sign up for this class may not realize the process involved in creating environment assets, and then find it to be tedious, boring or misaligned with their goals. The addition of CP may help those students because they get to do what they really signed up for right away, which of course is making environments. For students that are game design or game programming oriented, it is unlikely they have goals that focus on art asset creation and may have other intentions for learning how to create game environments, specifically for building spaces to house tech demos or innovative level designs. For these non-artists it seems fitting to keep CP as a central role throughout the entire environment art process.

Conclusion

This study showed that while CP was part of the curriculum, even when additional modeling and texturing homework was assigned, students completed all of their work. CP helped students get into building environments and seeing results immediately. Understanding that play helps students establish a state of mind where building becomes a pleasure, may help to explain why one would feel a deep connection to their work and persevere through more of it. There is still much to learn about constructive play in adult studies. While constructive play aided in stronger involvement within the demographic of this class, does its inclusion in more advanced

environment art studies produce similar results? If constructive play expanded into other studies, a playful approach towards work in general, perhaps training the mind to see tasks as play and fun will open the door to more practice, and in turn higher levels of mastery.

APPENDIX A: Visual Component

Download Level for Windows (0.5 GB): Burnham Center Lobby.

Directions: Unzip folder, look for "MFA_Thesis.exe" and open. Standard first person shooter controls for navigation: W A S D keys, combined with mouse for turning.

References:

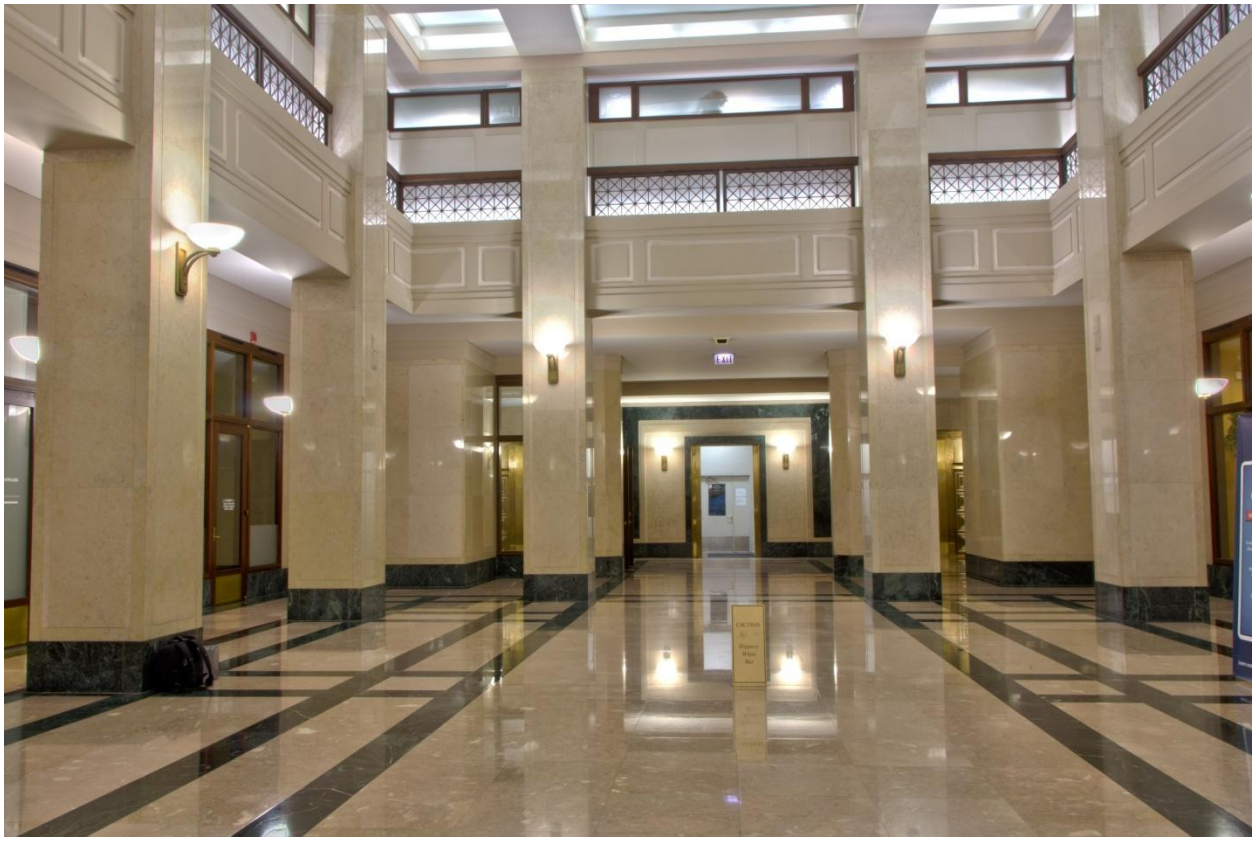


Fig. 11. Burnham Center Lobby

Fig. 12. Burnham Center Elevators

Fig. 13. Burnham Center Ceiling

Final Renders from Unreal 4:

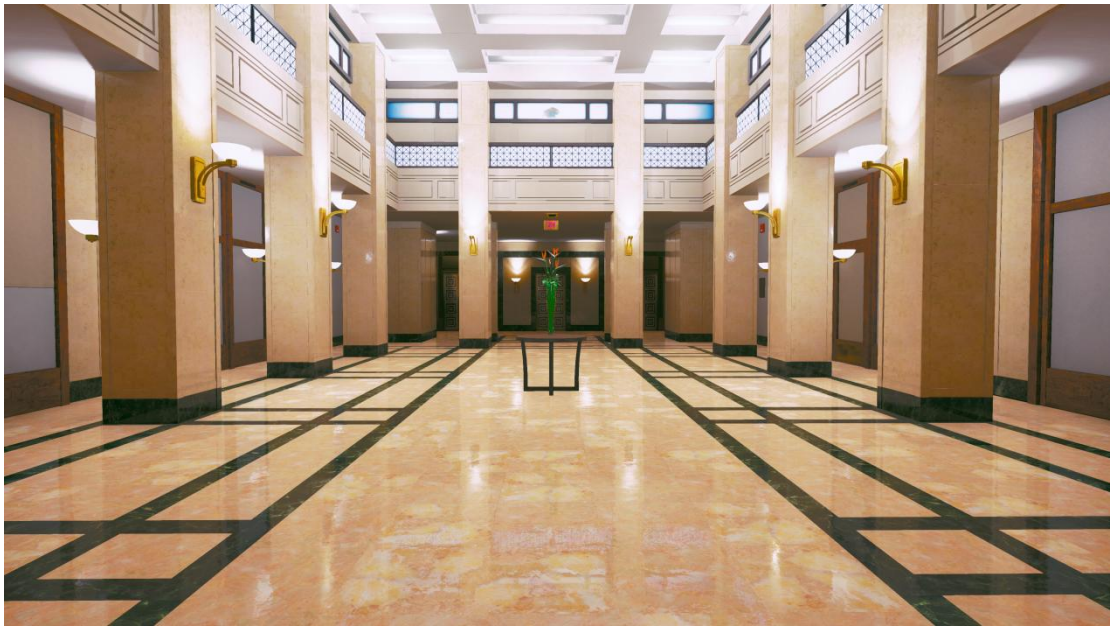


Fig. 14. Lobby

Fig. 15. Ceiling

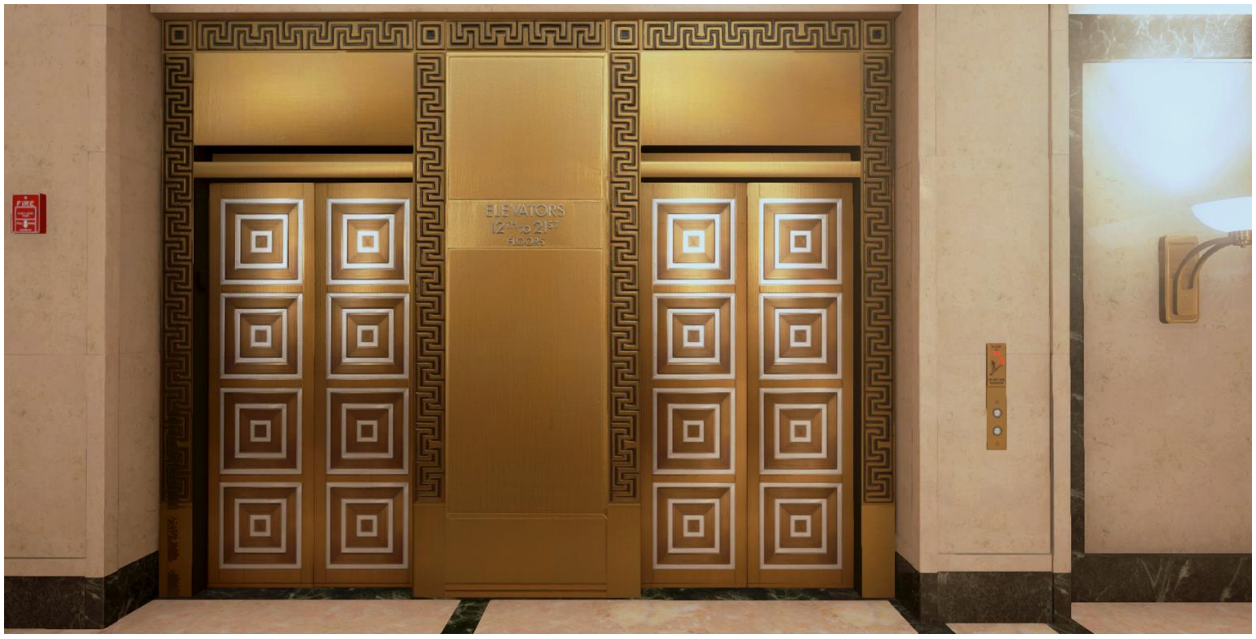


Fig. 16. Elevators

Fig. 17. Hall

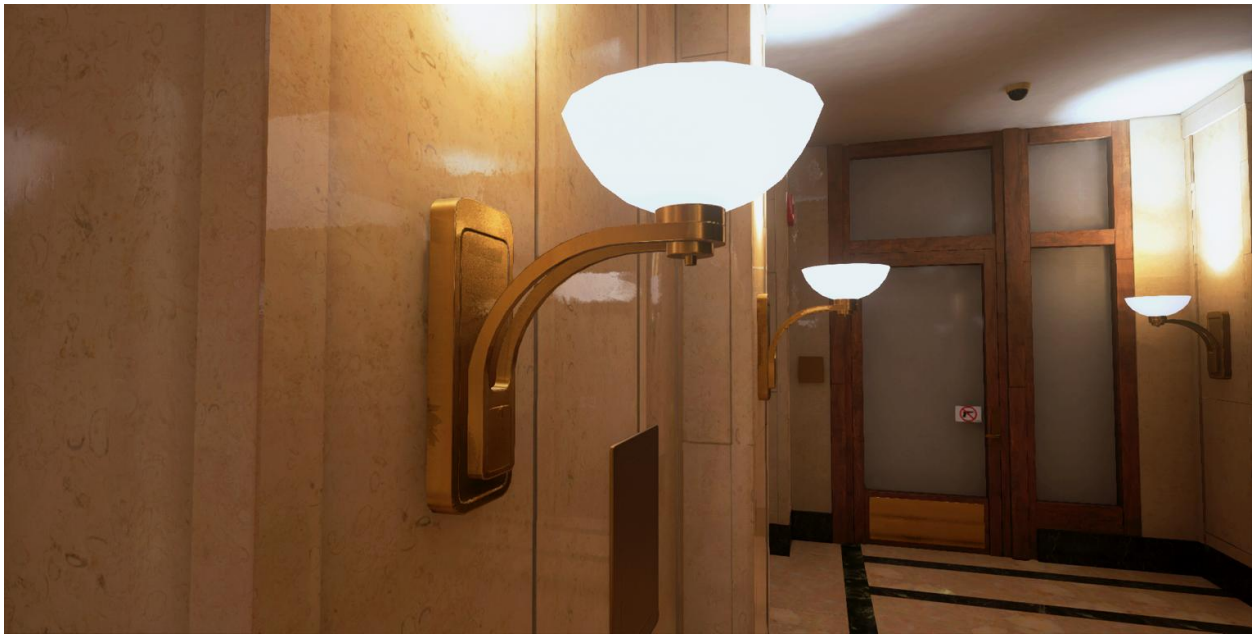


Fig. 18. Wall Lamps

Fig. 19. Lobby B

Box Builder:

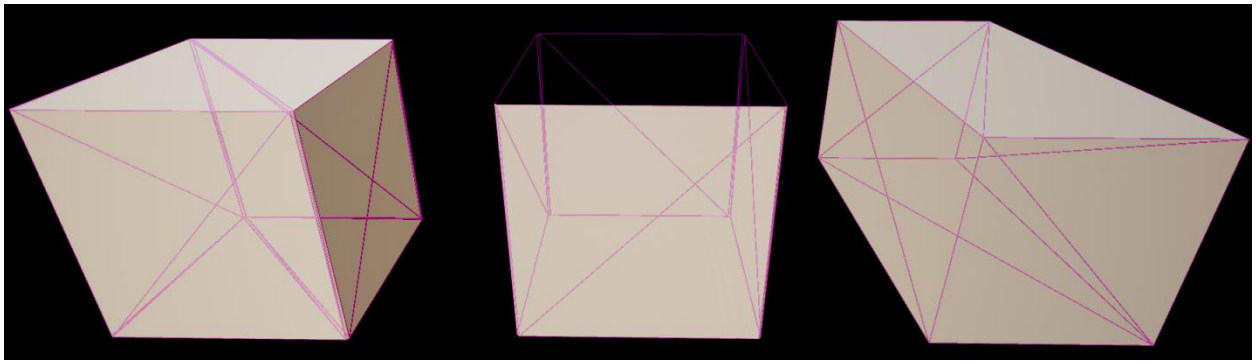


Fig. 20. Three Box Builders

Fig. 21. Box Builder Parameters

APPENDIX B: Supplemental Videos

Instructor Video Links:

Plant Textures 1- 2: Plant01, Plant02, Plant03, Plant04

Brick Tiled Texture 1- 4: Brick01, Brick02, Brick03, Brick04

Procedural Brick Texture: Procedural Brick01, Procedural Brick02

Plant Modeling: Plant Model01, Plant Model02, Plant Model03

Zbrush Rock: Rock01, Rock02, Rock03, Rock04, Rock05, Rock06, Rock07, Rock08, Rock09

World of Level Design: http://worldofleveldesign.com/

How to Create a Box Builder in Houdini: http://www.dantrip.com/prototype.html

Fig. 22. World of Level Design Training

APPENDIX C: Student Work Examples

Corridor examples where students added to the environment on their own volition:

Fig. 23. Corridor, Charel Kucharzak

Fig. 24. Corridor, Jordyn Lukomski

Examples of Corridor Project Results:

Fig. 25. Corridor, Ben Ahlbrand

Fig. 26. Corridor, Eric Huang

Examples of Alternate Corridors:

Fig. 27. Alternate Corridor, Jordyn Lukomski

Fig. 28. Alternate Corridor, Amanda Luginbuhl

Space Reference Assignment:

Fig. 29. Space Reference, Madison Holliday

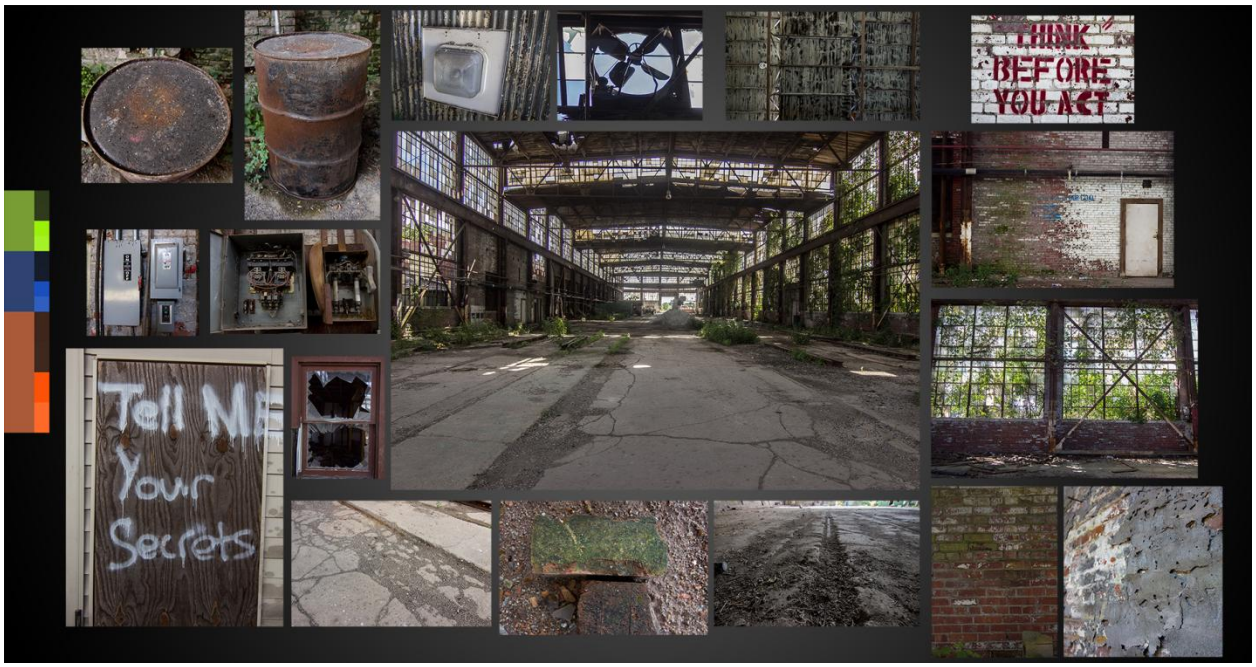


Fig. 30. Space Reference, Drew Sumner

Examples of Leaf Texture and Finished Plants:

Fig. 31. Leaf, Jordyn Lukomski

Fig. 32. Plant, Jordyn Lukomski

Fig. 33. Leaf, Joshua Woodard

Fig. 34. Plant, Joshua Woodard

Example of Tiled Brick:

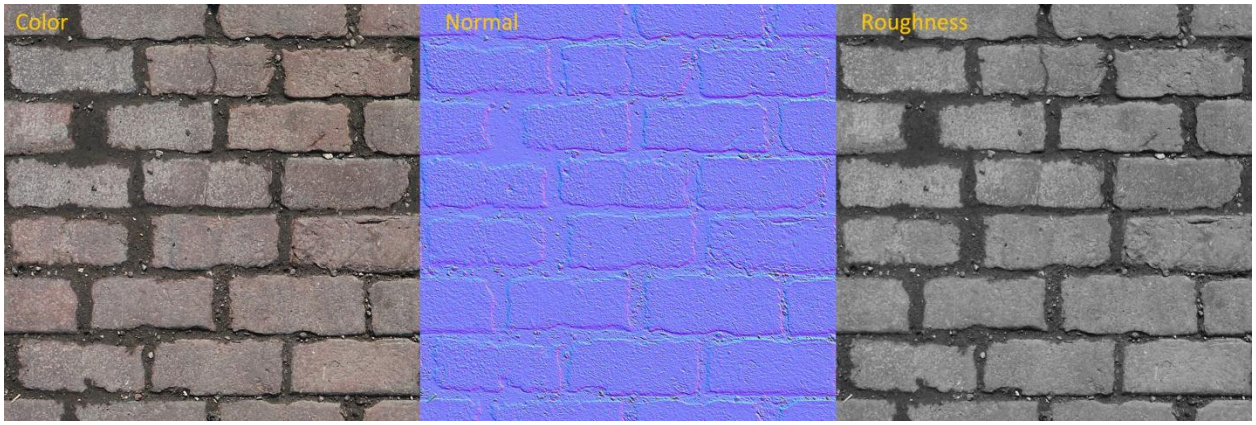


Fig. 35. Brick Tiled, Jonathan Simonson

Procedural Texture Example:

Fig. 36. Procedural texture in Substance Designer, Ben Ahlbrand

Rock Examples:

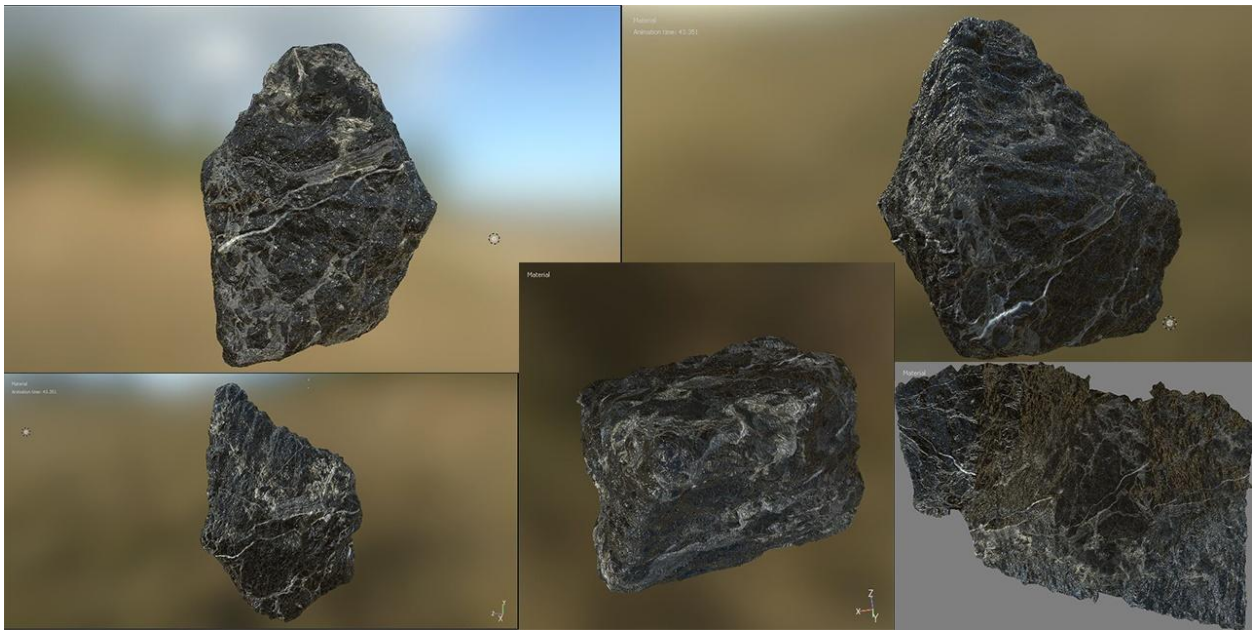


Fig. 37. Rock, Michael Chang

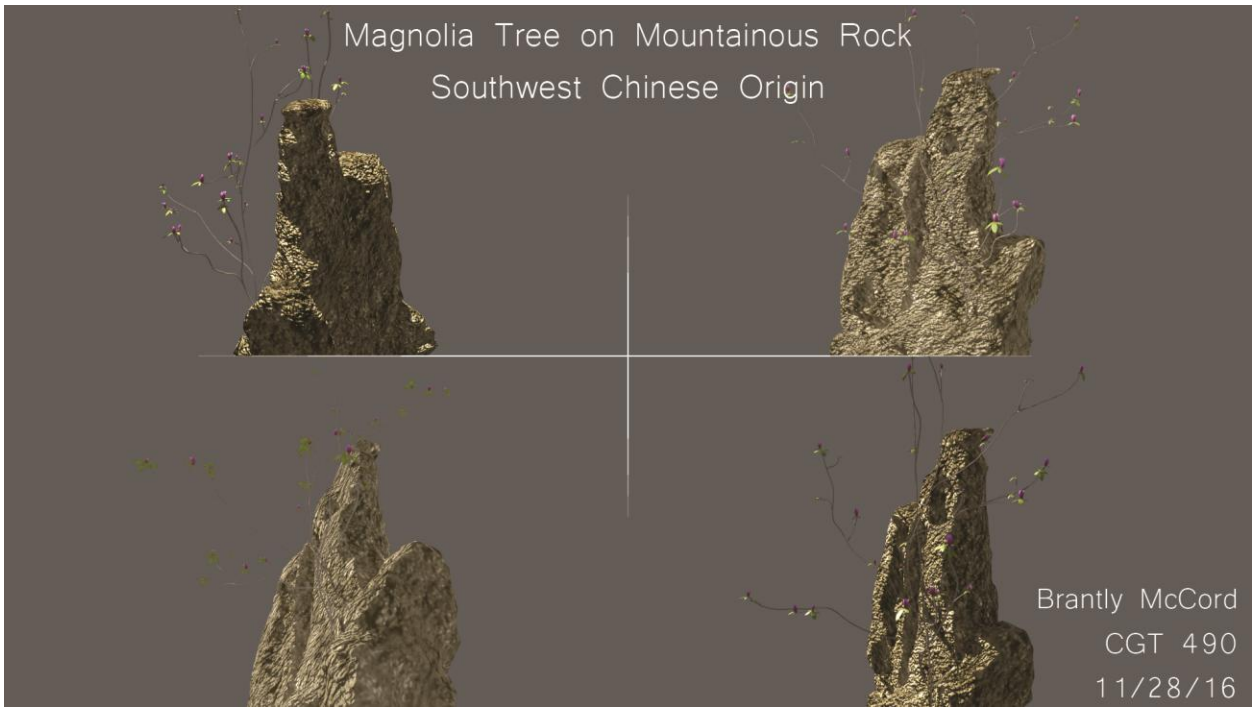


Fig. 38. Rock and Plant, Brantley McCord

Final Asset Examples:

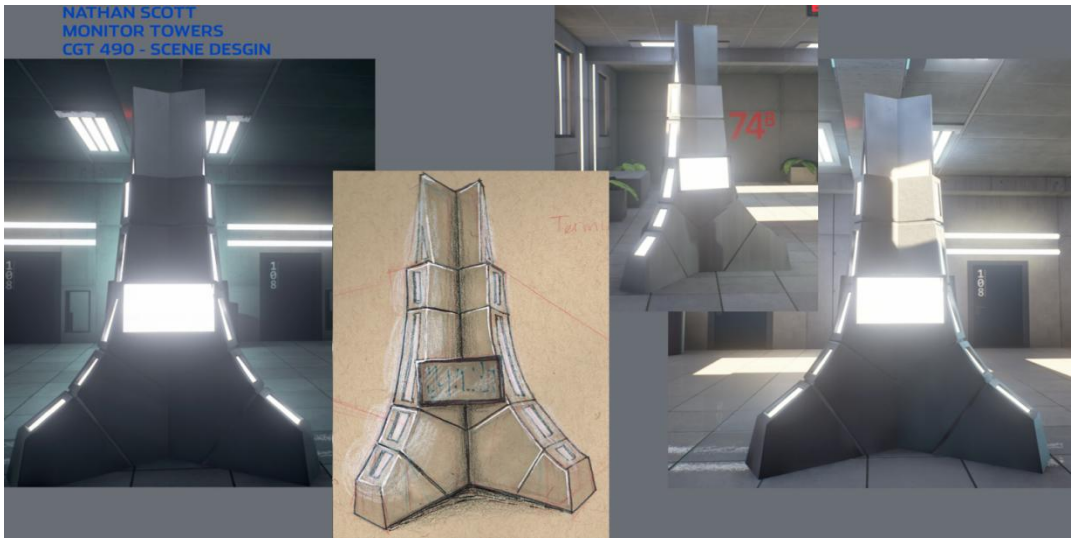


Fig. 39. Lamp Model, Nathan Scott. Concept, Daniel Triplett

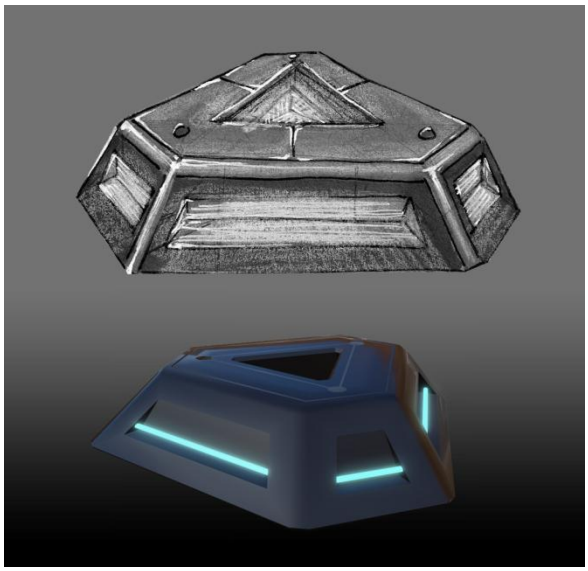


Fig. 40. Floor Light Model, Madison Holliday. Concept, Daniel Triplett

APPENDIX D: Thesis Project Curriculum Outline, Assignment Sheets, and Surveys

Curriculum:

Lectures are in purple

Assignments given are in green and are hyperlinked to documents or videos

Assignments Due are in red*

*Note that some assignments while marked "**DUE**" were combined into other assignments and do not show up on the graphs.

Class Curriculum:

WEEK1: Introduction to the class

(Lecture part 1) Content area philosophy, choosing creativity:

a. Setting your mind to something
b. Approaching environment creation with high expectations

(Lecture part 2) Observation: learning to observe

c. Approaching photography like a scientist
d. Using forensic photography techniques
e. Transcending beyond looks; examining feelings
f. **Concept Lesson 1:** Space Reference students create a reference sheet of a real space they find interesting; reference sheet template is given

(Lecture part 3) Building an environment through constructive play.

g. **Skills Lesson 1: WOLD M1 & M21-M24:** World of Level Design Tutorials: *UE4 Fundamentals* and *UE4 The Corridor*

WEEK2 : Building an understanding of aesthetics, an approach and explanation

DUE: Reference Sheet assignment

(Lecture part 1) What is Beauty (or Aesthetics)

a. Scientific research on beauty
b. Empirical physical reaction to beauty
c. Identifying beauty through emotional responses

(Lecture part 2) Architectural Periods: looking at environments

d. **(In Class Assignment):** Students form visual images of a place that is beautiful to them, referencing game environments they felt immersing

e. **(In Class Assignment):** Students pick 3 favorite pieces of architecture for a study
f. **(In Class Assignment):** Students pull up examples of their beautiful space
g. **(In Class Assignment):** Assignment: Students talk about their beautiful place, and present their pick of an architectural period (making sure all periods are unique)
h. **Architecture Reports:** Students research and write about an architecture period they find interesting, which they will report on next class
i. **WoLD 3D modeling Foundation Videos:** World of Level Design Tutorials: *UE4 Fundamentals* and *UE4 The Corridor*

Week3:

DUE: Present Architecture report

(Lecture 1) Minimalistic Approach

a. Minimalistic approach
b. introduces constraints
c. **Tech02 - Corridor:** World of Level Design Tutorials: *UE4 Fundamentals* and *UE4 The Corridor Project*

WEEK4: Lab day where they can work on finishing the first stage of constructive play, having the instructor help each student individually

DUE: WoLD ue4 the corridor project-part 1of2

a. **Tech02 Corridor (Continued):** World of Level Design Tutorials: *UE4 Fundamentals* and *UE4 The Corridor*

WEEK 5: Begin Modeling and continue texturing

DUE: WoLD ue4 the corridor project-part 2of2

Students are introduced to creating their own blocks in Maya. For some Maya is new, so fundamentals are covered

a. **WoLD_Maya Module01:** Work through the video's listed in document
b. **Texturing-masking leaf:** Complete working through introduction to texturing in Photoshop tutorials

WEEK 6: Coming back to texturing in Photoshop again, students are guided through creating a tiled texture

DUE: Leaf alpha texture, example scene of completed Maya tutorial

a. **Tiling textures:** Create a tiled brick texture in Photoshop

b. Assignment: Create a level in Unreal apply brick texture to BSP or Primitive (This information is covered in UE4 Fundamentals)

WEEK 7: A Procedural approach: Texturing in Bitmap 2 Material and Substance Designer

h. **Texture bump leaf:** Watch and follow "How To" create a bump map for the Lilly Pad
i. **Texture output leaf:** Watch and follow "How To" use Bitmap 2 Material to output leaf textures
j. **Intro to Substance Designer:** Watch and follow "How To" intro to Substance Designer
k. **Texture tiling textures:** Watch and follow "how to" create a brick texture procedurally in Substance Designer

WEEK 8: Minimalistic Modeling I

DUE: Finished leaf texture from B2M, Finished Procedural Brick

a. **WoLD_Maya Module02:** Maya Foundations: Working with objects, Arched Doorway
b. **Package Corridor as an executable for Windows**

WEEK 9: Culmination of early learning: Alternate Texture Set for Corridor Pieces

DUE: Maya Foundations: Working with objects, Arched Doorway

a. **Application of tiled textures and level building:** Alternate Texture Set for Corridor Pieces

WEEK 10: Minimalistic Modeling II

LAB-**DUE (at end of class):** Alternate Texture Set for Corridor Pieces

a. **WoLD_Maya Module03:** This week go through World of Level Design Videos: 3DEnvMdlFoundationMayaLT-Module03-1of2

WEEK 11: Building a Simple Plant

we revisit the cube and the plant texture and add curves and planes to create and entire plant

a. **Plant creation:** Students will create a Plant from a cube and curves, plus adding their plant texture to cards for foliage

WEEK 12: ZBrush Play, then Rock

DUE: Maya WoLD videos: Module03 2 of 2

(In Class Assignment) Students are encouraged to open Zbrush and given simple guidance into the interface and "how to" use fundamental brushes on a subdivided mesh

a. drawing a primitive to canvas
b. brushes are introduced (including stroke type and alphas)
c. adding and Subtracting
d. masking
e. subdividing mesh
f. mirroring and radial array
g. subtools

Create a simple rock in Zbrush: This assignment walks the student through a complete asset workflow

WEEK 13: Introduction to Group Project: ARK

DUE: Finished Plants

a. **Final:** Take assigned concept art or reference and begin building pieces for final

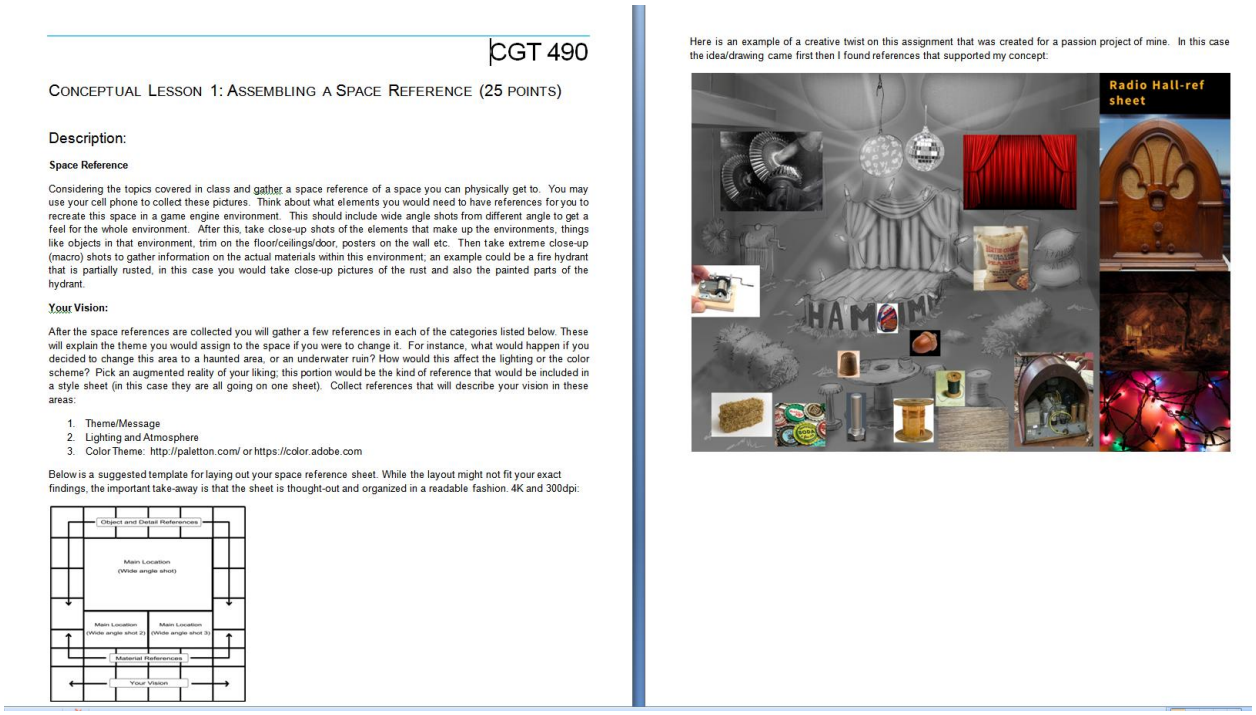
WEEK 14: LAB

DUE: Sculpted Rock

WEEK 15: Final Presentations of ARK assets

DUE: Final Presentation of custom simple ARK assets

Assignment Sheet Example:



CGT 490

CONCEPTUAL LESSON 1: ASSEMBLING A SPACE REFERENCE (25 POINTS)

Description:

Space Reference

Considering the topics covered in class and gather a space reference of a space you can physically get to. You may use your cell phone to collect these pictures. Think about what elements you would need to have references for you to recreate this space in a game engine environment. This should include wide angle shots from different angle to get a feel for the whole environment. After this, take close-up shots of the elements that make up the environments, things like objects in that environment, trim on the floor/ceilings/door, posters on the wall etc. Then take extreme close-up (macro) shots to gather information on the actual materials within this environment; an example could be a fire hydrant that is partially rusted, in this case you would take close-up pictures of the rust and also the painted parts of the hydrant.

Your Vision:

After the space references are collected you will gather a few references in each of the categories listed below. These will explain the theme you would assign to the space if you were to change it. For instance, what would happen if you decided to change this area to a haunted area, or an underwater ruin? How would this affect the lighting or the color scheme? Pick an augmented reality of your liking; this portion would be the kind of reference that would be included in a style sheet (in this case they are all going on one sheet). Collect references that will describe your vision in these areas:

1. Theme/Message
2. Lighting and Atmosphere
3. Color Theme: http://paletton.com/ or https://color.adobe.com

Below is a suggested template for laying out your space reference sheet. While the layout might not fit your exact findings, the important take-away is that the sheet is thought-out and organized in a readable fashion. 4K and 300dpi:

Here is an example of a creative twist on this assignment that was created for a passion project of mine. In this case the idea/drawing came first then I found references that supported my concept:

Fig. 41. Lesson 1 - Reference

Link to Assignment Sheets:

Week01: Concept01, Tech01

Week02: Concept02, Tech02

Week04: Tech04

Week05: Tech05, Tech05b

Week06: Tech06

Week07: Tech07

Week08: Tech08

Week09: Tech09a, Tech09b

Week10: Tech10

Week11: Tech11

Week12: Tech12a, Tech12b

Week13: Tech13

Intro Survey: Experience with subject matter

Name_____

Questionnaire –Please answer all of the questions using choices 1-4

I understand and have practiced photography

(1) not really
(2) only leisurely
(3) I have sought out some training
(4) I have extensive experience
(5) Ansel Adams calls me for advice

I have at some point in my life built a simulated space with blocks, sand, couch cushions and/or bed sheets, snow, Lego's, diorama materials (cardboard, Styrofoam), playing cards, etc.

(1) Never
(2) When I was a kid, but not recently
(3) Recently for a school project
(4) Recently for fun
(5) I'd be building one right now if I wasn't doing this questionnaire

I have learned and practiced 3D polygonal modeling in a program like Maya, Modo, 3Ds Max, Cinema 4D, Houdini, Blender

(1) Never

(2) I have a bit of experience, but am still very much a beginner
(3) I have modeled at least a year
(4) I've been modeling in an entertainment suite, like before mentioned, for over two years and have experience in hard surface and organic modeling
(5) Naughty Dog is beating my door down, but Mom says I gotta finish college first

Which, if any, 3D software do you model in

Maya Modo 3Ds Max Cinema 4D Houdini Blender Other_____

I am familiar with Photoshop

(1) Never used it
(2) Dabble a little bit (beginner with some knowledge)
(3) I know my way around it pretty well
(4) I have used PS extensively (over 4 years experience)
(5) I live in the Creative Cloud

I know how to UV unwrap a 3D model in any 3D software package (except Zbrush)

(1) What are UV's?
(2) Basic knowledge
(3) I have done a moderate amount on school or personal projects
(4) I have extensive experience in organic and hard surface unwrapping
(5) UDIM's are my life.

I have used Zbrush or Mudbox for highpoly sculpting

(1) Z what and Mud who?
(2) I have tried one of them
(3) I have been learning to highpoly sculpt for a bit now
(4) I have a strong grasp of creating forms using highpoly sculpting methods
(5) I am the curator of the gallery on Zbrush central

If you have highpoly sculpted please circle one: Zbrush Mudbox Other_____

I have used Substance Designer

(1) Never
(2) I created a texture or two
(3) I have completed a whole project that integrated Substance Designer
(4) I have used Substance Designer for two years of more
(5) They call me Mr. Allegorithmic

Have you used any of the other substance products: B2M or Substance Painter

I have a computer that can run Unreal 4 (without struggling/dying) Yes No

Lighting affects my mood

(1) Never
(2) I open the drapes occasionally
(3) I consider lighting in most of my spaces
(4) I sculpt spaces with light

I have spent time thinking about the reflective differences between rusted and non-rusted metal

(1) No, and you're crazy if you do
(2) I textured something old metal once, so yes it has crossed my mind
(3) I have done material creation for a project so I consider material complexities
(4) I contemplate the history that is told through material weathering often

I have done visual conceptualization on paper or in a simulated environment in some form before (I have created concept art or designs)

(1) Concept what?
(2) I have drawn a thing or two for a project before, but I am no artist
(3) I have enjoyed sketching out things like floor plans or characters or storyboarding etc.
(4) I not only enjoy conceptualizing, I practice it often.
(5) They call me the Android Jones of West Lafayette

Survey Results:

student name	I understand and have practiced Photography?	I have at some point in my life built a simulated space with blocks, sand, couch cushions and/or bed sheets, snow, Lego's, diorama materials (cardboard, Styrofoam), playing cards etc.?	I have learned and practiced 3D polygonal modeling in a program like Maya, Modo, 3Ds Max, Cinema 4D, Houdini, Blender?	I am familiar with Photoshop?	I know how to UV unwrap a 3D model in any 3D software package (except Zbrush)	I have used Zbrush or Mudbox for highpoly sculpting?	I have used Substance Designer?	Lighting affects my mood?	I have spent time thinking about the reflective differences between rusted and non-rusted metal?	I have done visual conceptualization on paper or in a simulated environment in some form before (I have created concept art or designs?)	Total
Student 1	2	4	2	3	2	2	1	4	1	2	23
Student 2	2	4	3	2	2	2	1	1	4	3	24
No Data											
Dropped											
Student 3	2	4	4	4	4	2	1	3	3	3	30
Student 4	1	3	3	3	2	1	1	3	2	2	21
Student 5	2	4	3	3	3	3	1	2	2	2	25
Student 6	2	3	4	4	4	3	1	2	2	4	29
Student 7	3	3	4	4	3	2	1	3	3	3	29
Student 8	2	3	2	4	3	1	1	3	2	3	24
Student 9	2	4	2	4	2	1	1	3	3	3	25
No Data											
Student 10	2	2	2	2	2	1	1	3	2	2	19
Student 11	4	2	4	3	3	2	1	2	2	3	26
Student 12	4	4	3	4	2	2	3	3	3	3	31
Student 13	2	2	3	2	3	2	1	3	3	2	23

Fig. 42. Survey Results

Works Cited

"Americas Castles Frank Lloyd Wright." Video file. *https://youtu.be/fX3sXDZ34AI*. N.p., 01/12/2017. Web. 07/22/2017.

Ashwat, Anu. "Engaging Students with Video Screen Capture Technology." *http://teaching.pitt.edu*. Pitt University Center for Teaching and Learning, 09/12/2013. Web. 07/07/2017.

Babington, Riki. "Next-Gen Texturing Techniques." Video file. *http://eat3d.com/texturing*. N.p., n.d. Web. 06/02/2016.

Bandura, Albert. *Self-Efficacy The Exercise of Control*. New York: W.H. Freeman and Company, 1997. Print.

Brewster, Mike. "Frank Lloyd Wright: America's Architect." *web.archive.org*. N.p., 07/28/2004. Web. 07/22/2017.

Briggs, Saga. "Refuse to Be a Boring Teacher: 15 Ways to Have More Fun." *http://www.opencolleges.edu.au/informed/features/refuse-to-be-a-boring-teacher/*. http://www.opencolleges.edu.au, 10/10/2015. Web. 07/26/2017.

Costandi, Moheb. "NEUROAESTHETICS PROMISES TO REINVIGORATE SCIENCE'S SEARCH FOR A THEORY OF BEAUTY." *http://seedmagazine.com/content/article/beauty_and_the_brain/*. N.p., 09/16/2008. Web. 06/11/2017.

Daelemans, Bert. "Ando's Cross." *http://faithandform.com*. N.p., June 23, 2014. Web. 07/10/2017.

Deslauriers, Louis, Ellen Schelew, and Carl Wieman. "Improved Learning in a Large-EnrollmentPhysics Class." *www.info.maths.ed.ac.uk*. N.p., 12/22/2010. Web. 07/08/2017.

Fowler, Penny. *Frank Lloyd Wright: Graphic Artist*. Rohnert Park: Pomegranate Communications, Inc., 2002. *books.google.com*. Web. 07/22/2017.

Gray, Peter. "The Value of Play I: The Definition of Play Gives Insights." *https://www.psychologytoday.com*. 1. N.p., 10/19/2008. Web. April 17th 2017.

Groos, Karl. "The Play of Animals." *https://archive.org/details/playofanimals00groouoft*. N.p., 1898. Web. 07/13/2017.

---. *The Play of Man*. New York: Appleton, 1901. EPUB.

Hamilton, Andrew, and Kenneth Brown. "Photogrammetry and Star Wars Battlefront." Video file. *www.gdcvault.com*. N.p., n.d. Web. 06/13/2017.

Higdon, Hal. "Marathon Training Guide - Novice 1." *http://www.halhigdon.com*. N.p., n.d. Web. 07/01/2017.

http://education.stateuniversity.com/pages/1999/Froebel-Friedrich-1782-1852.html. stateuniversity.com, n.d. Web. 07/19/2017.

http://worldofleveldesign.com/. N.p, n.d. Web. 08/15/2016. <http://worldofleveldesign.com/>.

http://www.froebelweb.org. N.p, n.d. Web. 07/22/2017.

http://www.froebelweb.org/web2027.html. N.p, n.d. Web. 07/19/2017.

https://www.nature.com/scitable/spotlight/science-photography-10285104. Scitable by NatureEducation, n.d. Web. 05/10/2017.

https://www.sidefx.com/community/houdini-engine-for-ue4/. SideFX, n.d. Web. 01/10/2017.

Huang, Helen J., Rodger Kram, and Alaa A. Ahmed. "Reduction of Metabolic Cost during Motor Learning of Arm Reaching Dynamics." *http://www.jneurosci.org*. Society for Neuroscience, 02/08/2012. Web. 07/14/2017.

"Is Khan Academy effective? How is it different than other resources available?" *https://khanacademy.zendesk.com/hc/en-us*. N.p., n.d. Web. 07/07/2017.

Kahn, Sal. "Let's use video to reinvent education." Video file. *https://www.ted.com*. N.p., March 2011. Web. 04/05/2017.

---. *The One World Schoolhouse: Education Reimagined*. New York: Twelve, 2012. Kindle.

Kelley, David, and Tom Kelley. *Creative Confidence: Unleashing the Creative Potential Within Us All*. New York: William Collins, 2015. Kindle.

Keskeys, Paul. "The Art of Rendering: 7 Magical Demonstrations of Hyper-Real Environments." *https://architizer.com/blog/the-art-of-rendering-unreal-engine/*. www.architizer.com, 07/06/2016. Web. 07/19/2017.

Khan, Sal. "Let's teach for mastery — not test scores." Video File. *https://www.ted.com*. N.p., November 2015. Web. 03/02/2017.

Koooolalala. "UE4 Archviz / Lighting 4." Video file. *https://youtu.be/UwEuSxAEXPA*. Lighting 4. www.youtube.com, 08/18/2014. Web. 01/15/2016.

Kroll, Andrew. "AD Classics: Church of the Light / Tadao Ando Architect & Associates." *http://www.archdaily.com/101260/ad-classics-church-of-the-light-tadao-ando*. http://www.archdaily.com, 01/06/2011. Web. 07/19/2017.

Liaw, Paul. "CG Pro Secrets of Success." Video file. *https://www.uartsy.com/course/cg-pro-secrets-of-success#lecture-15451*. N.p., 07/25/2015. Web. 07/26/2015.

Lohikoski, Laura, and Elin Ruden. "Optimization of 3D Game Models." *https://www.diva-portal.org/smash/get/diva2:708048/FULLTEXT01.pdf*. N.p., n.d. Web. 08/02/2017.

Mon, Sierra. “Everything You Need to Know to Become a Game Environment Artist.” *https://magazine.artstation.com/2017/03/game-environment-artist/*. N.p., 03/17/2017. Web. 07/29/2017.

Montessori, Maria. *The Absorbent Mind*. adyar: Theosophical Publishing House, 1949. *https://archive.org/details/absorbentmind031961mbp*. Web. 07/08/2017.

Oostermeijer, Meike, Anton J. H. Boonen, and Jelle Jolles. “The relation between children’s constructive play activities, spatial ability, and mathematical word problem-solving performance: a mediation analysis in sixth-grade students.” *https://www.ncbi.nlm.nih.gov*. Front Psychol, 2014 July 17. Web. April 07, 2017.

Paul, Annie Murphy. “The Neurological Benefits Of Practice.” *http://www.teachthought.com*. N.p., n.d. Web. 07/15/2017.

Pawson, John. *Minimum*. London: Phaidon Press Limited, 1996. Print.

Pollard, Lawrence. “Swiss architect wins top honour.” *http://news.bbc.co.uk*. N.p., April 13, 2009. Web. 07/10/2017.

Pratt, Caroline. “I Learn from Children: An Adventure in Progressive Education.” *I Learn from Children: An Adventure in Progressive Education*. New York: Grove/Atlantic Inc., 06/16/2014. N. pag. EPUB.

Roy, Judd. “Methods of Collecting References.” Video file. *https://www.lynda.com/3ds-Max-tutorials/Methods-collecting-references/420012/476125-4.html*. www.lynda.com, n.d. Web. 07/26/2017.

Ruby, Ilka, Andreas Ruby, Angeli Sachs, and Philip Ursprung. *Minimal Architecture*. New York: Prestel, 2003. Print.

"A Simplified Guide To Crime Scene Photography." *www.forensicsciencesimplified.org*. N.p., n.d. Web. 05/14/2017.

Stott, Rory. "Spotlight: Mies van der Rohe." *http://www.archdaily.com/350573/happy-127th-birthday-mies-van-der-rohe*. http://www.archdaily.com, 03/27/2017. Web. 05/16/2017.

Stranden, Anne Lise. "How do kids who excel in sports become real stars?" *http://sciencenordic.com*. N.p., 10/29/2014. Web. 07/14/2017.

Sturt, David. "Creativity: How Constraints Drive Genius." *www.forbes.com*. N.p., JULY 12, 2013. Web. 07/06/2017.

Susanka, Sarah, and Kira Obolensky. *The Not So Big House: A Blueprint for the Way We Really Live*. Newtown: Taunton, 2001. Print.

TSAI, KUAN CHEN. *FACILITATING CREATIVITY IN ADULT LEARNERS*. Diss. University of the Incarnate Word, 2013. Ann Arbor: ProQuest LLC, 2014. *search-proquest-com.ezproxy.lib.purdue.edu*. Web. 07/20/2017.

Williams, Richard. *The Animators Survival Kit*. New York: Faberand Faber Limited, 2001. Print.

Wright, Esmond. *Benjamin Franklin: His Life as He Wrote it*. Cambridge: Harvard University Press, 1989. *https://books.google.com*. Web. 07/08/2017.