Photogrammetry: Measuring Student Success Using Interactive 3D Digital Learning Objects

by

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Abstract

This thesis study examined the learning effect of an interactive learning object in the form of a digital 3D model by analyzing student grades on a technical competency exam across different methods of instruction, including in-person face-to-face instruction and hybrid learning at the undergraduate university level. This study aimed to evaluate the effectiveness of a 3D model in solving 1) access to limited resources because of protocols during the COVID-19 pandemic, and 2), the persistent issue with courses that use highly technical equipment, which is the lack of student access to that equipment because of the high cost and scarcity of tools. The results from evaluating technical competency average exam grades across three semesters using Analysis of Variance (ANOVA) show that there was a statistically significant grade average difference between the three semesters, $F(2, 85) = 3.5$, $p = .03$. When comparing grades for the face-to-face semesters to the hybrid semester, the grade data shows an overall positive learning effect for the students who used the 3D model. Although there was only one statistically significant comparison when using *t*-tests--the Fall 2019 and the Spring 2020 Hybrid semesters--the grades show that the students who had access to 3D models were able to perform similarly, if not better than, the students who did not have access to the model but had significantly more in-person training. This study introduces the process of 3D model creation, Photogrammetry, and its integration into a Learning Management System. This study also discusses the neuroscience of digital interaction with a 3D model and the implications for remote and hybrid learning, instructional design, and educational emerging technologies.

Keywords: learning effect, interactive learning object, 3D model, student grades, face-to-face, hybrid learning, COVID-19, photogrammetry, educational emerging technologies

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Chapter 1: Introduction

Introduction

When the COVID-19 pandemic was declared by the World Health Organization in the Spring of 2020, the quality of online education was already being scrutinized (Soares et al. 2016) because of rising costs and other factors. Because of the pandemic, universities had to drastically change their instructional methods, and faculty and staff found themselves having to adapt rapidly to the needs of remote students (Kelly 2020). Students across the country accessed their Learning Management Systems (LMS) at a much higher rate during the initial phase of the COVID-19 pandemic (Gordon 2020) than at any previous time. There were students who suddenly no longer had access to essential tools needed for their disciplines such as in science labs, art studios, and film production classes. There were two problems that educators with students who needed access to tools faced: 1) the impracticality of access to those resources because of undeveloped protocols during the initial phase of COVID-19 lockdowns, and 2), the issue that has faced all instructors at all times who teach courses with highly technical tools, which is limited student access to those tools because of the high cost and scarcity of such tools.

Photogrammetry is the process of parsing and compiling multiple digital photographs into a three-dimensional model (Rahaman & Champion 2019). Photogrammetry is used in many industries, including media such as video games (GDC 2016,) movies, historical documentation (Medina et al. 2020), topographical monitoring (Chidburee 2019, Kozikowski 2020), and 3D printing (Lužanin & Puškarević 2016). The Smithsonian institute began a digitization initiative in 2017 and has digitized millions of artifacts and published them as open-source models (PR Newswire 2020). Digital 3D documentation of physical objects was once very expensive and limited to specialists with training and equipment such as lasers and specialized cameras (Rahaman

& Champion 2019.) Now, users can utilize simple cameras built into their mobile devices, then import pictures and process them on computers using commercial desktop software such as Agisoft Metashape (Rahaman & Champion 2019) or open-source software such as Photosynth and Meshroom.

Understanding human-computer interaction allows us to design human-centered interfaces and build better experiences for users (Hodent 2018). We know through extensive research that a wide range of cognitive variabilities exists in learners in higher education (Carey 2018, Watts et al. 2016). With the expanding availability of Photogrammetry applications and distribution networks, educators can now produce models with existing tools (Luna 2018) to provide access to training for their remote students for a specialized tool.

Much has been written recently about the new advances in 3d object creation for educational purposes in the K-12 classroom and the availability of open-source resources for 3-D model creation and distribution (Sanii 2020). However, not much has been discussed in quantitative measurement (Merrill et al. 1996) of experimental design using these 3-D models in higher educational environments, especially in remote or hybrid modalities. This study examines the learning effect of a 3d model by comparing student practical exam grades across different teaching modalities and three semesters in an undergraduate film production course when students were being tested on their competency with using a professional video camera. This thesis study also seeks to develop a pedagogical framework for the design of digital interactive learning objects using photogrammetry.

This thesis is divided into five sections: i) literature review, ii) methods, iii) results, iv) discussion, and v) conclusion. The literature review discusses the background of the neuroscience of interactive learning. The methods section describes the steps taken to produce and implement the interactive 3D models and the statistical process of analysis. The results section presents the grade data. The discussion section evaluates and compares the grades to show the learning effect of the 3D model. Lastly, the conclusion discusses access and study limitations and recommends the next steps in researching and implementing photogrammetry while designing courses.

Chapter 2: Literature Review

Design and the Neuroscience of Learning

For the past century, much has been written about the science of learning (Mayer 2008). Early theories favored behaviorism models, which introduced conditioning into the learning process. "In the traditional behaviorist model, learners undergo some form of associative conditioning. Ultimately, the goal of conditioning is to produce a behavioral result." (Boghossian 2006). This result can include declarative knowledge such as semantic and episodic knowledge (Carey 2018). Cognitive neuroscience theories then shifted away from behavioral associationism, followed by psychologists such as B. F. Skinner, to a more cognitive understanding (Gazzaniga et al. 2002). Constructivism follows the idea that knowledge is created through experiences. "Where behaviorism views knowledge as resulting from a finding process, constructivism views knowledge as the natural consequence of a constructive process. Where behaviorism views learning as an active process of acquiring knowledge, constructivism views learning as an active process of constructing knowledge. Finally, where behaviorism views instruction as the process of providing knowledge, constructivism views instruction as the process of supporting construction of knowledge." (Bichelmeyer & Hsu, 1999).

In the 1970's the paradigm in education shifted further to include more problem-based learning (Bichelmeyer & Hsu, 1999) in order to address knowledge retention and transfer metrics. Transfer is the ability to demonstrate knowledge by applying that knowledge to solve a different problem (Mayer 2008). Recently, it is understood that both behaviorist and constructivist theories of learning are important to learning (Carey 2018, Boghossian 2006). The brain is shaped by stimulus and connects new information to prior learning; therefore, a mixture of both theories can help encode information to-long term memory. The ***processing*** of information encodes working memory to long-term memory, which increases availability and retention. When stimuli are later perceived, long-term memory works to recall information in an efficient way (Kahneman 2011). "Articulated by Descartes, Leibniz, Kant, and others— complexity is built into the human organism. Sensory information is merely data on which preexisting mental structures act." (Gazzaniga et al. 2002, p.12). What we consciously perceive is already in our long-term memory, it is merely reconstructed.

Mayer describes learning:

> This Learning is a change in the learner's knowledge that is attributable to experience. Learning depends on the learner's cognitive processing during learning and includes (a) selecting—attending to the relevant incoming material; (b) organizing—organizing the incoming material into a coherent mental representation; and (c) integrating— relating the incoming material with existing knowledge from long-term memory. (Mayer 2008, p. 761)

Alan Baddeley's hypothesis of contextual clues says that to make a memory match prior knowledge, variabilities, and specificity should be presented to the learner (Baddeley 2018). To encode knowledge, information should be presented in various ways, with ideally spaced practice in multiple contexts as many times as possible. "Frequency of practice makes us faster and precise" (Johnson 2014, p.151). All visual thinking is skilled and depends on pattern learning (Ware 2008, Meng & Ling 2021). The ultimate goal of learning is to reach a high level of procedural knowledge, and ultimately, automaticity (Flair 2019, Carey 2018). A procedural task requires coordination of many different parts of the brain; the frontal lobe, which is responsible for cognitive and motor behaviors, coordinates with the basal ganglia, and finally, the cerebellum is responsible for creating automaticity (Gazzaniga et al. 2002, Carey 2018). Practice makes coordination much more efficient; success is strengthening of pathways supporting a neural activation sequence. When automaticity is crucial for the successful completion of a task--for example, when operating a professional camera to create a narrative film--access to the camera for practice is crucial. Research has shown that using physical objects allows humans to learn much faster (Levine et al. 1992), but when access to physical objects is limited because of health concerns, budget considerations, or space restrictions, a supplemental pedagogical method is a simulation.

Simulation

Through data visualization, simulations can help learners hold elaborative rehearsals to make information meaningful and engaging. “Data visualization exploits the strengths of the human visual system— which consists mainly of automatic processes—to allow people to perceive relationships in complex data" (Ware p. 177). The neural connections of the limbic system and the cortical system set up automatic processes which lead to higher learning. Our brains actually support higher learning more effectively than simple recall memory (Johnson 2014). In higher education, simulations can also be used to assess student knowledge of the equipment without having to be co-located with the equipment.

In a study in the Boston Combined Residency Program (BCRP) between 2015 and 2017, researchers created a simulation scenario that dealt with quality improvement in pediatric medical treatment. Their research investigated whether running a simulation would improve test scores of a test given to interns about Quality Improvement. The results showed that test scores increased an average of 2.6 points (SD = 0.6. p <.001) of a possible 28 points amongst 82 participants that were part of the test. They also asked their participants to complete a survey and showed that “survey data indicated that interns initially lacked confidence in their abilities to lead a QI initiative, but after completing the simulation, interns expressed that they had gained valuable experience in initiating a quality improvement pilot."

Annotations

A key feature in digital 3D models is the ability to annotate, or highlight, important information on a model. Baldwin specifies the use of "Interactive Storytelling" which uses narrative as a method of learning as a way of making learning more meaningful and more easily retained. She ties the method of storytelling with constructivist theory. Baldwin describes interactive stories that "include features (dynamic presentation, data visualization, multisensory media) that provide a non-linear path for users to interact with the narration." (Baldwin 2016). Annotations on a 3D model, when placed in sequential order, can help tell a story. Mayer describes the technique called "signaling," which highlights essential material to adhere to the coherence principle that states that people learn better when extraneous materials are excluded, and essential materials are highlighted (Mayer 2008). Annotations serve to highlight important information on the models and increase saliency.

Student Competency

Education design researcher Sally Baldwin interviewed dozens of colleagues to understand their methods for transitioning their courses from face-to-face instruction to online instruction. Those interviews showed that online professors "rarely use formal instructional design models, but their design tasks show a striking similarity to those formalized in the ADDIE model (i.e., analysis, design, development, implementation, and evaluation)" in designing their online courses (Baldwin 2019, Ching & Friesen 2018). Unfortunately, faculty must often wait for student feedback until after the semester is completed, meaning that re-design of courses often waits until after the semester as well. This delay can lead to dissatisfaction in student experience, especially with the first cohort of students. This dissatisfaction may lead to a sense of disconnection and lack of emotional investment on the part of students (Baldwin 2019). User-centered design has the potential to shorten this feedback/redesign cycle. User-centered design is an approach that has been practiced for decades in the UX community (Rubin & Chisnell 2008), placing the user at the center of the design. The motivating factor to learning is to become competent: "The need for competence is about a desire to be in control and to master the environment" (Hodent 2018). When tools are no longer available for students to practice and become competent, simulations in the form of interactive learning objects can supplement learning. In industry, the development of 3D models has evolved from analytical and optimization-oriented purposes to integrating decision support tools (Poziomkowska et al. 2021). In education, interactive learning objects should similarly provide a meaningful task (Hodent 2018), and ideally have real-world consequences (Mayer 2008) such as supporting a decision.

Measuring Student Success

Much has been written recently about the new advances in 3d object creation for educational purposes in the K-12 classroom and the availability of open-source resources for 3-D model creation and distribution (Sanii 2020). However, not much quantitative measurement of well-designed experiments using these 3-D models in higher educational environments has occurred, especially in remote or hybrid modalities. Neuro-typical adults have physical neurological maturities, such as myelinated neurotransmitters and frontal lobe development, which leads to more efficient retrieval of information and refined motor skills (Gazzaniga et al. 2002). Therefore, if the value of 3D models in educational settings is to be accurately evaluated, these studies should not be conducted with adult participants. In studies that are conducted with students, too many researchers have presented 3D models to students that do not have practical real-world meaning and consequences, and data has been collected in the form of satisfaction ratings, which although valuable (Lo et al. 2020, Sanii 2020), would be enhanced by analyzing student success by including evaluative methods such as grades (Mayer 2008), and by attending to the real-world meaning of the 3D models. There has been some grade data (Greenlaw et al. 2020) where simulations were used in pilot projects in scenario-based interaction, but these studies lack real-world consequences. Mayer calls instructional design research that uses both theoretical studies and authentic tasks "basic research on applied problems" (Mayer 2008 p.761.). This study attempts to provide quantitative measurement of using 3D objects in education with a meaningful task and real-world consequences.

To measure inferential statistics, Rubin and Chisnell recommend 10-12 participants to derive conclusions (2008). To measure the effect that an experimental teaching theory has on learning, Mayer (2008) used Cohen's median effect size x in which the mean of the control group is subtracted from the mean of the experimental group and divided by the pooled standard deviation (Cohen 2013). "According to Cohen, an effect size greater than 0.8 is considered large, an effect size greater than 0.5 is considered medium, and an effect size greater than 0.2 is considered small" (Mayer 2008). In addition to grade data, qualitative data in the form of satisfaction surveys can help complete a more insightful analysis. For example, Mayer looked at satisfaction ratings at the end of the course as well as compared overall grades at the end of the semester to better understand the effect of teaching techniques, and he observed a large/medium/small effect using Cohen's categories (Mayer 2008). These methods are examples of Research on Applied Problems.

Chapter 3: Methods

Overview

This thesis study was a collaboration with the Electronic Media and Film (EMF) department at Towson University in support of their Narrative Filmmaking Film 2 Production classes, and the department's gear rental office, "The Cage". The Electronic Media and Film (EMF) department offers a degree in media production with a concentration in film. Students who follow the production track must become experts in operating video cameras and other production hardware. This production course is offered only to majors and requires students to provide evidence of competency before they can borrow the expensive and limited supply of university-owned video equipment. At the end of the semester, the students screen their final films, produced with the Canon EOS C100, which will serve as content for demo reels to use in their professional careers.

To prove competency when using the Canon C100, "The Cage" typically works with the professor to administer a 27-question quiz (The Film 2 Practical) to students in the Film 2 classes. The quiz is offered via Blackboard, Towson's Learning Management System. The quiz is not included in the final grade for the class; however, passing with a minimum of 70 points is required to borrow equipment. Students are typically administered the quiz in-person with the camera disassembled but enter their answers into the Blackboard quiz for a record of their results. The quiz covers topics that include the rules for rentals as well as specialized camera topics such as exposure and power supply based on the Canon EOS C100 video camera. This quiz has been administered to 87 students over 4 semesters in 6 sections (see Table1), starting in the Fall of 2019. The quiz was administered before the university transitioned to completely online instruction in March 2020. The quiz was not administered to students in the course in the Fall of 2020 because of population density protocols in response to COVID-19, and the quiz was altered in the Spring of

2021 to accommodate scheduling changes forced by weather cancellations and a hybrid model of instructional delivery and online assessment.

Table 1.
Different teaching modalities over the past 4 semesters

	Fall 2019	Spring 2020	Fall 2020	Spring 2021
Teaching modality	Face-to-face (F2F)	Face-to-face (F2F)	Hybrid	Hybrid
# of students who took the Film 2 Practical	29	30	N/A	29

During face-to-face instruction in the Fall of 2019 and Spring of 2020, students were allowed to assemble the camera with supervision during the class time before taking the quiz. They received a total of 6 hours of in-person instruction. Students in the Spring 2020 semester were able to have in-person instruction and took the proficiency quiz before the COVID-19 shutdowns forced the University to close the campus. The Fall 2020 sections were taught in a hybrid model, but the Film 2 practical was not administered due to COVID-19 population density restrictions, and the lack of a workable instructional alternative. The course was taught in two sections in the Spring of 2021. Two students out of twenty-nine were allowed to take the course entirely remotely because of COVID 19 health concerns. Students who chose to come in for in-class instruction were given hands-on camera training for 3 hours; however, the Thursday section's fifteen students were unable to hold in-class training because of weather cancellations. During in-class portions of the Spring of 2021, the professor followed a low-density hybrid model where students spread out in different rooms during face-to-face (F2F) class sessions and met via Zoom web conferencing during remote days. All Spring 2021 students were given access to the 3D models of the Canon C-100 as a new supplemental learning tool to increase exposure to the equipment before the quiz was administered.

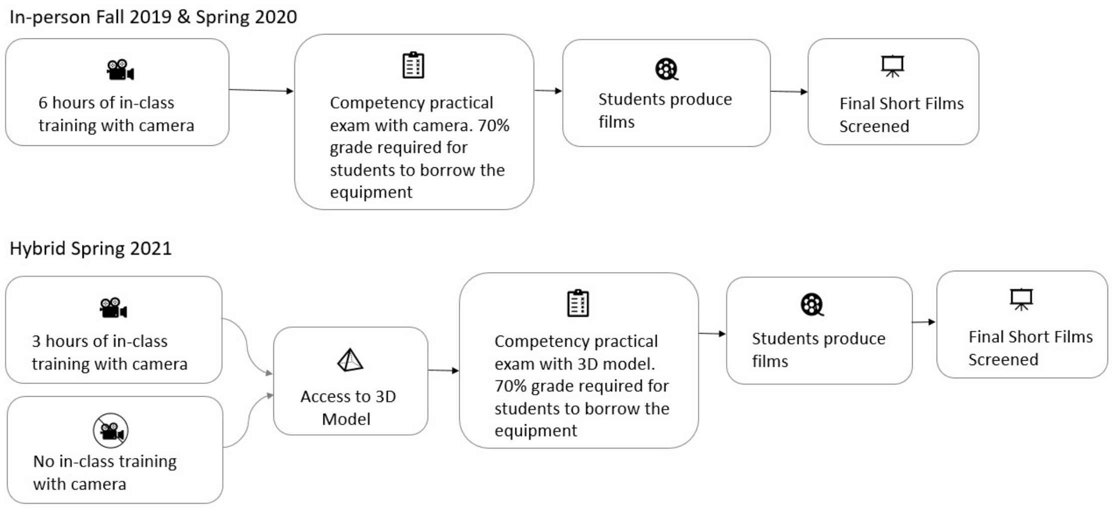

Figure 1. Film 2 F2F and Hybrid Journeys

Demographics

To ensure the privacy and anonymity of the students, grades were provided to the researcher by the instructor without any information that could be used to identify students, and this study received approval from the Institutional Review Board at the University of Baltimore. Towson University states that their student body consists of a population of 60% female and 40% male; 49% White, 26.7% African American or Black, 9.2% Hispanic or Latino, 6.8% Asian, and 8.3% other; out of a total of 17,228 undergraduate students in the Spring of 2021. We can postulate that the student population in the study reflects similar demographics. The course is offered only to film majors who have completed prerequisites which include some production courses.

Methods of Data Collection

Grades have been compared for years to examine if experimental methods affect learning (Mayer 2008). The focus of this study is to compare quiz results for the Film 2 practical from different sections in different methods. The intent is to analyze differences and similarities in student performance on the quiz with the introduction of a 3D interactive learning object for a specialized piece of equipment. The quiz has practical real-world consequences because students are required to pass the practical to have access to equipment. Operational scenarios are presented in the quiz which leads to contextual clues (Bichelmeyer and Hsu 1999). Although grades were provided to the researcher by the instructor with all personal identifiable information removed, the grades did include student grades for individual questions.

Tools and Procedure

The process of creating models with photogrammetry analyzes sequential 2D photographs of an object to create a 3D model by finding tie points, or match points from multiple photos from different angles (Luna 2018, Burk & Johnson 2019). The camera used to generate these 2D images was a Canon T3 DSLR camera in RAW format. The aperture was manually set at 5.375, the ISO was set at 400, and the picture resolution was 2848 x 4727 pixels. The camera was placed on a tripod and a three-point LED lighting set-up (Luna 2018) was used. A mechanical electric turntable was used to rotate the camera at a steady, consistent pace. It is critical to use a consistent focal length and exposure while photographing the object and to rotate the object without shaking it. A smooth, white background was placed behind and underneath the white turntable to create a contrasting background to the object (Luna 2018). The white background was also used to set the white balance (see Figure 2).

Figure 2. Camera on a white turntable with white background.

The Canon EOS C100 includes multiple pieces assembled to be used as a kit. The kit was photographed in its entirety and then in individual sections including the body, the matte box, the focus ring, and the battery system. For each section, the object was photographed from different angles that included from above, from below, and in profile (Luna 2018) in a sequence of photographs that averaged 30 photos for each angle, for a total of about 90 photos per section. 546 photos were produced for the models and were not altered in a post-processing software such as Photoshop except to crop excess background that was captured. The images were saved as JPEG files in 72 dpi resolution for importing to the photogrammetry software. Some models may need to be isolated from backgrounds (Luna 2018) in photography software; however, this model did not require key correction.

The software used to create the 3D models was Agisoft Metashape Standard Edition. Metashape is a photogrammetry application that produces digital 3D shapes, orthomosaics, and digital elevation models (DEM's.) The photogrammetry process for this model was a multi-step process with the need to refine photo data in between steps. The necessary steps included importing the images in JPEG format, aligning the images to create tie points in multiple chunks, creating a dense point cloud for each chunk, aligning the dense point chunks, creating a mesh, and finally creating the texture.

The series of pictures for each section were imported in chunks for each set of pictures, which included a chunk for the pictures from above, from below, and in profile, with the camera assembled in its entirety, followed by chunks for each section of the camera from all of the different angles for the body of the camera, the focus ring, and the matte box hood. The pictures in each chunk were aligned using the highest accuracy settings. Sequential reference preselection was chosen, which follows the naming sequence of the image files for higher accuracy, and a key point and tie point limit of 60,000 was selected to create the highest quality point cloud. Masking out background and irrelevant image content in Metashape was not necessary for this model before alignment. The twelve separate chunks were aligned in an overnight batch process as each chunk averages 1-2 hours to align in the highest accuracy setting.

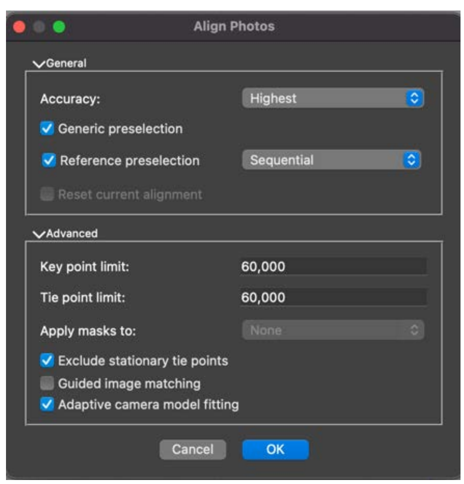

Figure 3. Metashape photo alignment settings.

After alignment, tie points that were automatically created during alignment of the turntable but were not part of the camera were deleted manually by selecting unnecessary colors and regions for each chunk. Removing unnecessary tie points ensures an accurate point cloud and faster rendering of point clouds (Luna 2018). The region was updated to include all of the remaining tie points. To save time and to test the tie points, point clouds were rendered in the lowest quality setting to test the quality of the tie points. Lower quality settings do not provide an accurate point cloud but provide a preview of the model. If the low-quality preview of the point cloud shows excess points or missing parts, the chunk may need to be re-aligned or more tie points may need to be removed. After confirming the quality of the tie points, all chunks were batch-processed overnight in medium quality settings with mild depth filtering.

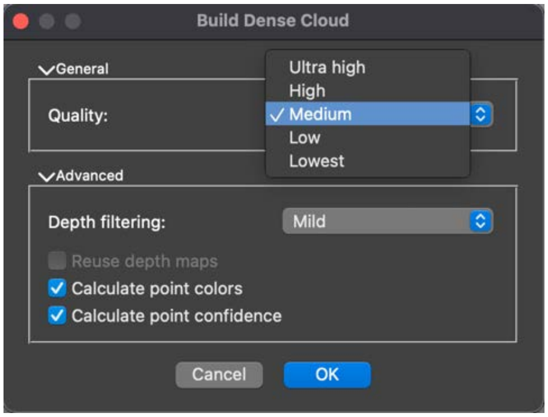

Figure 4. Metashape Build Dense Cloud settings.

The 12 separate chunks were then combined into groups to create four main chunks, each representing a separate part of the camera: the body, the matte box, the battery system, and the focus ring. The chunks were combined by aligning the chunks to create a higher resolution point dense cloud for each section of the camera. This process was done overnight. Excess cloud points were then deleted before creating the meshes. The mesh produces the geometric triangles necessary to create a 3d object. The dense cloud was selected as the source data for the mesh, Arbitrary (3D) was selected for the surface type, a high face count (180,000) was selected, and interpolation was enabled. The 4 chunks were then batch processed overnight to create the mesh.

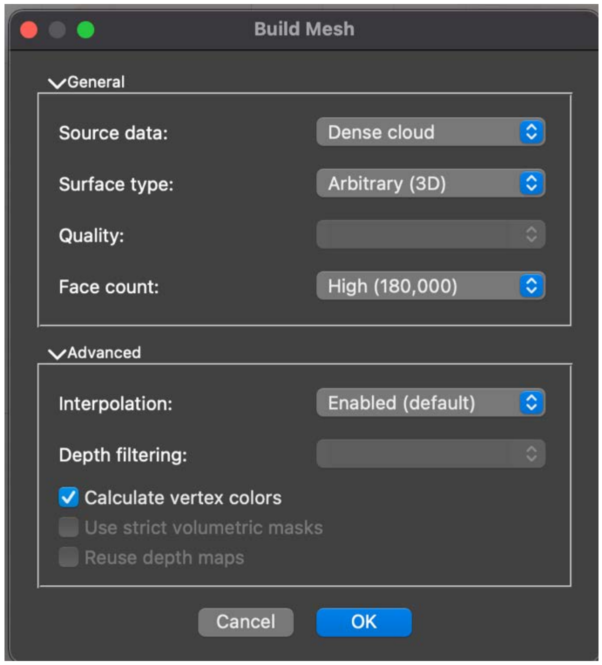

Figure 5. Metashape Build Mesh settings.

The stitched images of each section's model, the textures, were exported in 4096x4096 pixel quality. The 3D models were exported as individual textured .obj models, including the camera as a whole build, the individual matte box, the focus ring, and the body. The 3D models were refined in Meshmixer, a free 3d mesh editor. The meshes were combined, made "watertight" by ensuring all the triangles or polygons that comprise the surface of the mesh have no holes and decimated to reduce file sizes. Standard geometric shapes with no texture were recreated in Meshmixer to save time. The shiny and reflective portions of the model such as the rails were not reproduced with high fidelity and were added in Meshmixer as geometric shapes and positioned to scale with the rest of the model.

The model, with all sections included, was exported as one .OBJ (waveform) file with .JPEG textures. The .OBJ and .JPEG files were uploaded to Sketchfab.com Pro account. Sketchfab is used as a 3d model repository for institutions such as the Smithsonian Institution (PR Newswire 2020). Each section was also exported as a separate model. The 4 models were grouped as a collection, or playlist in Sketchfab. Annotations were added to the full camera model to label important operational features in order of operational sequence to create an interactive "story" (Baldwin 2016). The models were then transferred to the Learning Management System (LMS) Blackboard, as iframe code. The instructor inserted the code using the source code feature in content creation and selected "Track Number of Views" to track the number of students who accessed the model. The model can be viewed on Sketchfab: https://skfb.ly/6Z9ZV. When the Blackboard webpage with the content loads, the model moves and rotates, triggering a natural response to movement (Gazzaniga et al. 2002) and a small hand moves, prompting the user to interact with the model (Figure 6). To mitigate further potential inexperience with 3D models, students were directed to "Use the left mouse button to rotate the model, the right mouse button to move the model, and the mouse scroll button to zoom."

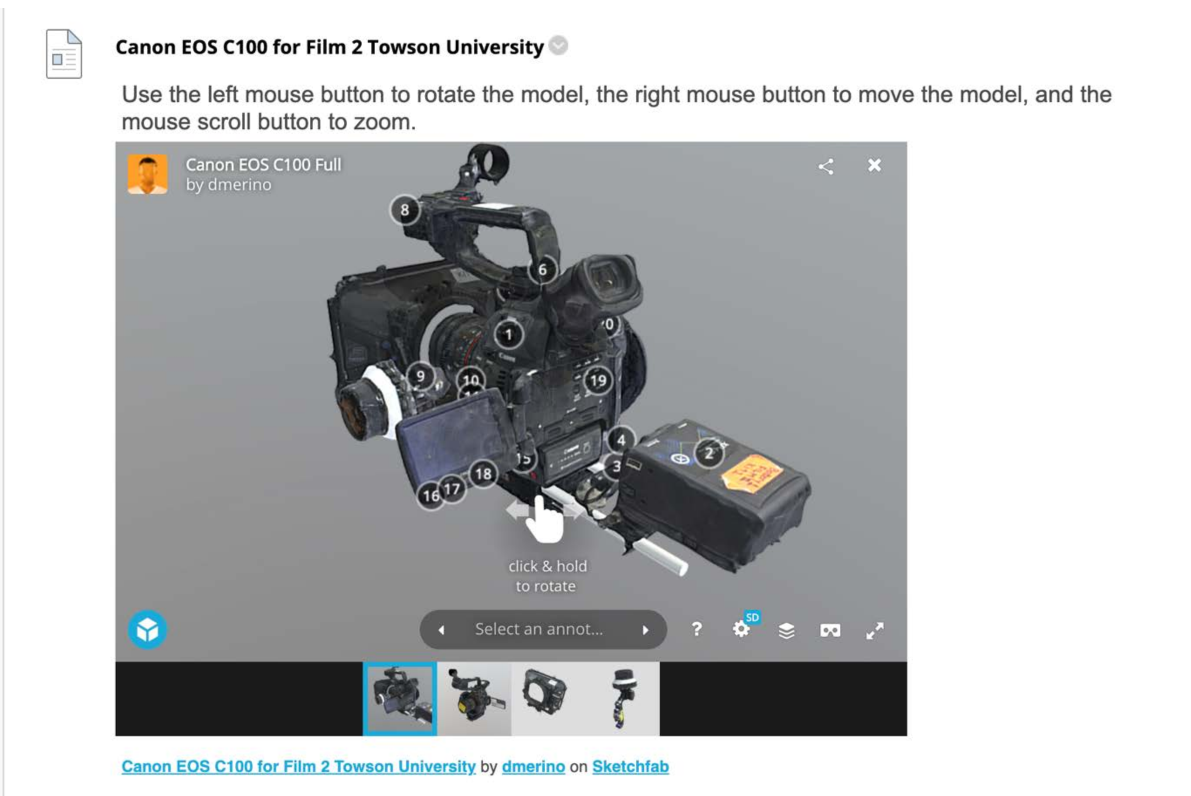

Figure 6. The integrated model in the learning management system (LMS), Blackboard.

Methods of Analysis

Students in the Fall of 2020 and Spring of 2020 were allowed four class periods for an average of 6 hours of in-person camera training with the instructor. Those students were administered the practical exam in person, with the camera available to them during the exam. Twenty-nine students took the exam in the Fall 2019 F2F semester and thirty students took the exam during the Spring 2020 F2F semester before the University was forced to shut down. The 59 students in these semesters entered their answers into the Blackboard quiz in person. Students who did not pass the quiz with at least a 70% score on the first try were allowed to retake the quiz. The grades for these students' failed attempts were averaged per individual before being aggregated into the class average for the purposes of this study. The practical was not administered in the Fall of 2020 due to COVID-19 restrictions, and no grades from this semester were included in the study. The Spring 2021 semester included two sections in a hybrid model with a total of 29 students. Half of the class sessions were held in person for a total of 8 out of 16 sessions. Two students were given the option to take the class remotely because they did not feel comfortable with taking the class in person due to health concerns. The Spring Hybrid Section 1 "Tuesday" students were given one three-hour in-person class session with the equipment for hands-on training. The Section 2 "Thursday" students were not able to hold a face-to-face training session because of class cancelation due to weather closures. Students in both sections were given access to the 3d model for one week before the quiz was due online.

The practical exam consists of 27 questions that include some questions about general departmental policies and other topics that were not relevant to knowledge about the camera itself. The practical quiz was altered to accommodate the hybrid model of delivery in the Spring of 2021 by combining some questions covered in the F2F quiz and was reduced to 12 questions. Points for questions that did not involve the operation of the camera from both exams were omitted during the formulation of the class average for the grades used in this study. Furthermore, points for topics that involved the camera build that were included in the quiz in Fall 2019 and Spring 2020, but which were not included in the Spring 2021 hybrid quiz, were omitted from the calculation. After all irrelevant and inconsistent topics were removed, 7 remaining questions (see Appendix E: Practical Exam Questions) were calculated for the face-to-face and hybrid practical. Topics included the body of the camera, picture settings, storage, and power. Scores were then calculated to represent a percent grade for comparison to measure student learning before and after the introduction of the 3d model.

To mitigate the discrepancy in the sample size if grouped by the method of instruction (59 face-to-face (F2F) vs 29 hybrid students), the grade averages were analyzed by semester using a one-way analysis of variance (ANOVA) to detect statistical significance (Urdan 2005). Analyzing the grade by semesters allowed for the larger F2F group of students to be split into similar sample sizes; 29 for the Fall 2019 F2F, 30 for Spring 2020 F2F, compared to the Spring 2021 hybrid semester of 29 students. Individual student grades were entered into SPSS statistical software to facilitate calculation. The ANOVA analysis was followed by *t*-tests (Urdan 2005) of all possible comparisons; Fall 2019 F2F vs. Spring 2020 F2F, Fall 2019 F2F vs. Spring 2021 Hybrid, and Spring 2020 F2F vs. Spring 2021 Hybrid. *t*-tests assume that the populations sampled are normally distributed and that they are of relatively equal variances (Cohen 2013). Amongst the groups of *t*-tests, the one significant difference comparison was followed by a measurement of the effect size, what statistical scholar Cohen calls the "pure number" or the Median effect size d (Cohen 2013 p. 20) in which the mean of the control group section is subtracted from the mean of the experimental group and divided by the pooled standard deviation. "According to Cohen, an effect size greater than 0.8 is considered large, an effect size greater than 0.5 is considered medium, and an effect size greater than 0.2 is considered small" (Mayer 2008 p. 763).

Data was provided for the Spring 2021 Hybrid class by class sections. Section 1, "Tuesday" had 15 students, and Section 2, "Thursday" had 14 students. A *t*-test was conducted to analyze any possible differences between the two sections. The study had a component of mixed methods because students in the Spring 2021 course were also asked to reflect on their use of the 3D models which produced qualitative data (Creswell & Plano Clark 2011, Robinson & Cook 2018). Spring 2021 Hybrid students were asked to reflect on their experience with the interactive learning object by answering "Did you utilize the 3D model when taking the exam today? Feel free to add additional comments if you found it to be helpful or distracting." 25 out of 29 students responded to this voluntary question. This voluntary feedback provided useful insight into the users' interaction since we could not conduct user-testing because of privacy considerations. Students were able to confirm if they were able to successfully use the model. These debriefing reflections were analyzed to find qualitative patterns as well as behavioral themes (Rubin & Chisnell 2008). This feedback allowed for identifications of errors and difficulties and a tally of the success rate came into play. An adjusted Wald Confidence Interval (Sauro 2012) was applied to calculate the success rate.

Chapter 4: Results

Grade Averages

A two-way independent-samples Analysis of Variance (ANOVA) of student grades was conducted to investigate the learning effect by measuring the statistical significance (Urdan 2005) of a 3d digital interactive learning object across three semesters in different instructional modalities. Grade average results show that there was a significant grade average difference between the three semesters, $F(2, 85) = 3.5$, $p = .03$. (Table 2).

Table 2. ANOVA - Grades in the Practical Exam Across all Semesters

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1625.60	2	812.80	3.5	.03
Within Groups	19702.36	85	231.792		
Total	21327.96	87			

The ANOVA was followed by *t*-test analyses to detect any significant statistical difference (Cohen 2013 & Urdan 2005) across all possible comparisons; Fall 2019 F2F vs. Spring 2020 F2F, Fall 2019 F2F vs. Spring 2021 Hybrid, and Spring 2020 F2F vs. Spring 2021 Hybrid. The greatest difference was seen between one of the face-to-face semesters, Fall 2019 F2F, and the Spring 2021 Hybrid semester with access to the 3D model; $t(56) = 2.57$, $p = .013$, with class grade percentage averages of 82.91% (SD = 17.54) for Fall 2019 F2F and 92.46% (SD=9.67) for the Spring 2021 semester. The Spring 2020 F2F semester showed no significant statistical difference in grades with the Spring 2021 Hybrid semester and the grade percentage averages were similar: 91.60% (SD = 17.10) for Spring 2020 F2F, and 92.46% (SD=9.67) for the Spring 2021 hybrid semester $t(57)$ =

0.24, $p = .81$. There was also no statistically significant difference present in the t-test of the two face-to-face semesters; $t(57) = 1.89$, $p = .06$.

Table 3. *t*-test Results Comparing Fall 2019 F2F and Spring 2021 Hybrid semesters

Class section	n	Mean	SD	T-cal	T-crit	df	p	Decision
Fall 2019 F2F	29	82.91%	17.5	2.57	2	56	.01	Reject
Spring 2021 Hybrid	29	92.46	9.6					

Table 4. *t*-test Results Comparing Spring 2020 F2F and Spring 2021 Hybrid semesters

Class section	n	Mean	SD	T-cal	T-crit	df	p	Decision
Spring 2020	29	91.60%	17.1	.24	2	57	.81	Do not Reject
Spring 2021 Hybrid	29	92.46%	9.7					

Table 5. *t*-test Results Comparing Fall 2019 F2F and Spring 2020 F2F semesters

Class section	n	Mean	SD	T-cal	T-crit	df	p	Decision
Fall 2019 F2F	29	82.91%	17.5	1.86	2	57	.06	Do not Reject
Spring 2020 F2F	29	91.60%	17.1					

Hybrid Section Grades

Out of the two sections in the Spring 2021 Hybrid semester, Section 2 “Thursdays” of the Spring 2021 semester was not afforded an in-person class session because of class cancellations due to weather. The *t*-test results for that section show that the Thursday section scored a lower average class percentage grade of 91.1% (SD = 11.28) when compared to the Tuesday section which had one 3-hour in-person class session, which scored an average of 93.8% (SD= 8.04), however, there was no statistically significant difference between the two class averages $t(27) = 0.76$, $p = .44$.

Table 6. t-test Results Comparing the two Spring 2021 Hybrid Sections

Class section	n	Mean	SD	T-cal	T-crit	df	p	Decision
Tuesday (3 hours of in-person training)	15	93.8%	8.04	0.76	2.05	27	.44	Do not Reject
Thursday (no in-person training)	14	91.1%	11.28					

Student Reflections

Students were also asked to reflect on their experience with the 3D model while taking the exam. “Did you utilize the 3D model when taking the exam today? Feel free to add additional comments if you found it to be helpful or distracting.” Out of the twenty-five students who responded, nineteen gave positive responses of their experience with the 3D model. Four gave negative feedback and two had neutral responses (See Appendix C). The negative feedback included comments such as “It was a bit challenging to rotate, but that could just be me,” “I tried to use it, but couldn't get it to work properly,” and “The zoom was really sensitive/hard to control on the model.” The neutral responses included comments such as “No (on my phone right now) but I will probably be using it in the future.” Some of the positive responses included: “It was incredibly helpful since I haven't been able to go into the labs and test it out myself just yet," "Having the interactive tool was good because it helps orient me or just remember what I saw when I went to do the build-up. Also, the small descriptions of different areas help to remember different parts," A word cloud with common themes from the student reflections was produced (See Appendix D). Out of twenty-five respondents, twenty claimed to have successfully used the model during the practical exam.

Table 7. Voluntary Responses to 3D Model

	Positive Response	Negative Response	Neutral Response
Hybrid student responses	19	4	2

Chapter 5: Discussion

Much has been written recently about the new advances in 3d object creation for educational purposes in the K-12 classroom and the availability of open-source resources for 3-D model creation and distribution (Sanii 2020). However, not much quantitative measurement (Merrill et a. 1996) of well-designed experiments using these 3-D models in higher educational environments has been performed, especially in remote or hybrid modalities. This study examined the learning effect of an interactive 3D digital model by comparing student practical exam grades across different teaching modalities and three semesters in an undergraduate film production course when students were being tested on their competency with using a professional video camera. This thesis study aimed to evaluate the effectiveness of a 3D model in solving 1) access to limited resources because of protocols during the COVID-19 pandemic, and 2), the persistent issue with courses that use highly technical equipment; i.e., the lack of student access to that equipment because of the high cost and scarcity of tools. The results from evaluating technical competency average exam grades across three semesters using an Analysis of Variance (ANOVA) show that there was a statistically significant grade average difference between the three semesters, $F(2, 85) = 3.5$, $p = .03$.

The ANOVA was followed by t-test analyses to detect any significant statistical difference (Cohen 2013 & Urdan 2005) across all possible comparisons. The greatest difference was seen between one of the face-to-face semesters, Fall 2019 F2F, and the Spring 2021 Hybrid semester with access to the 3D model, $t(56) = 2.57$, $p = .013$, with class grade percent averages of 82.91% (SD = 17.54) for Fall 2019 F2F and 92.46% (SD=9.67) for the Spring 2021 semester. This shows a clear positive learning effect of the interactive learning object for students who had access to the 3D model in the Spring 2021 Hybrid semester. Spring 2021 Hybrid students with access to the 3D model not only scored much higher grade averages when compared to the Fall 2019 F2F semester but also showed less variability within individual grades. This may show that students not only prove that they are competent at a higher rate when given access to the 3D model, but that there is less likelihood that a student will score a failing grade when given access to the 3D model.

The Spring 2020 F2F semester showed no significant statistical difference with the Spring 2021 Hybrid semester and the grade averages were similar: 91.60% (SD = 17.10) for Spring 2020 F2F, and 92.46% (SD=9.67) for the Spring 2021 hybrid semester $t(57) = 0.24$, $p = .81$. Although there was no statistically significant difference present (Urdan 2005) between the two semesters, the grade average for the Spring 2021 Hybrid semester with access to the 3D model was slightly higher, and we again see reduced individual grade variability with the students who had access to the 3D model. Although the t-test showed no significant statistical difference between these two semesters, it also points to the possibility that the hybrid student learning was on par with the high-achieving and hands-on Spring 2020 F2F semester due to the availability of the 3D model despite the circumstances that the students were presented: less in-person training, less face-to-face time with the instructor and all other COVID-19 concerns.

As expected, there was no statistical significance present in the t-test of the two face-to-face semesters, $t(57) = 1.89$, $p = .06$. Despite the large difference in grade averages for these F2F semesters; Fall 2019 F2F; 82.91% (SD=17.5), Spring 2020 F2F; 91.60% (SD=17.1), the ANOVA was correct when analyzing variance and confirms the statistical significance when comparing the F2F semesters with the Hybrid semester with access to the 3D model.

The instructor was able to provide individual section grades for the Section 1 “Tuesday” and Section 2 “Thursday” classes in the Spring 2021 Hybrid semester. These grades were also analyzed using a *t*-test for statistical significance. The Thursday section of the Spring 2021 semester was not afforded a planned in-person class session because of class cancellations due to weather. The *t*-test results for that section show a lower average class percent grade of 91.1% (SD

= 11.28) for the Thursday section when compared to the Tuesday section, which scored an average of 93.8% (SD = 8.04) (See Table 6); however, there was no significant difference between the two class averages $t(27) = 0.76$, $p = .44$. This again gives evidence that similar to when comparing the high-achieving Spring 2020 F2F semester with the Hybrid semester, there is no statistically significant difference when comparing the two grades, which is not a bad thing. Despite the misfortune experienced by the Thursday students when an unplanned snow day led to the cancellation of all classes, there was still not enough statistical difference to stipulate that the Thursday students scored significantly worse grades. This may be because of the access that they had to the 3D model, where they could manipulate and practice remotely for as long as they needed.

When comparing grades for the face-to-face semesters to the hybrid semester, the data shows an overall positive learning effect for the students who used the 3D model. Although there was only one statistically significant comparison when using *t*-tests; The Fall 2019 F2F vs. the Spring 2020 Hybrid semesters, the overall grades show that the students who had access to 3D models were able to perform similarly, if not better than the students who did not have access to the model but had significantly more in-person training. To analyze the significance between the Fall 2019 and Spring 2021 semesters, Cohen's ES calculation was applied to analyze the effect size. "We need a 'pure' number, one free of our original measurement unit, with which to index what can be alternately called the degree of departure from the null hypothesis of the alternate hypothesis, or the ES (effect size)" (Cohen 2013). The calculation between these two semesters shows an effect size of .76 which Cohen describes as medium. "According to Cohen, an effect size greater than 0.8 is considered large, an effect size greater than 0.5 is considered medium, and an effect size greater than 0.2 is considered small" (Mayer 2008). The effect size in this study (.76) is on the higher end of "medium." This effect size indicates that the model does have an important positive effect on learning. Students in the Spring 2021 semester were asked to endure difficult changes to their learning experiences during the COVID-19 pandemic, and despite all the obstacles, including 75% less hands-on training when compared to their F2F predecessors, they were able to score higher or equivalent grades on the test of technical proficiency. Overall, the highest average score across all methods of instruction, 93.8% (SD = 8.04), was when the students were offered both in-person training and access to the 3D model in the Tuesday section of the Spring 2021 Hybrid semester. This may be evidence that in-person training with physical objects does affect student learning, as has been indicated by prior research (Levine et al. 1992). These findings reinforce the hypothesis of Contextual Clues, that to make a memory match prior knowledge, variabilities, and specificity should be presented to the learner (Baddeley 2018). To encode knowledge, information should be presented in various ways, such as digitally and physically. Ideally, spaced practice should be allowed in multiple contexts as many times as possible, such as in-person and hands-on but also remotely and self-paced. Humans are visual and repetitiveness brings about automaticity, which is the goal of competency in motor skills when using specialized equipment.

Students were also asked to voluntarily reflect on their experience with the 3D model while taking the exam by answering “Did you utilize the 3D model when taking the exam today? Feel free to add additional comments if you found it to be helpful or distracting.” Out of the twenty-five students who responded, nineteen gave positive responses of their experience with the 3D model, two had neutral responses and four had negative responses. The student reflection also confirmed successful completion of the task; to use the 3D model to take the exam. Out of twenty-five respondents, twenty claimed to have successfully used the model during the practical exam. By applying the adjusted Wald Confidence Interval (Sauro 2012) we see a 78% success rate (99% margin of error $\pm$ 2%). A 70% success criterion rate is a typical benchmark in an assessment test, although the goal is to reach a 95% success rate (Rubin & Chisnell 2008). Although the success rate is not near the 95% recommended, it was made clear from their reflections that the students were eager to use the model. Four students gave negative feedback about the usability of the 3D model. It may be a novel medium for the students, and they may need more exposure and experience. There is room for practice, when necessary (Whelan 2020).

Chapter 6: Conclusion

We see from courses like Film 2 at Towson University that highly technical equipment is routinely limited because of expense and fragility. Access to a digital 3D version of the camera allows the student to create scenarios, manipulate and practice with a high-resolution version of the equipment on any digital device for as long as they need. We also know that students arrive at universities with high cognitive variability (Salend & Whittaker 2017). This method of instructional delivery addresses issues of equal access, developmental variabilities, and equity. With the 3D model, students can have access to the model and manipulate it in any way necessary for as long as they need in a self-paced environment. This may give students more contextual clues (Baddeley 2018) when they reach the stage of operating the device in the real world and they can quickly match prior knowledge. Access to practice with the 3D model may help lower student anxiety of breaking delicate and expensive equipment. It may also lower anxiety for lab managers, who have to worry about equipment damage due to negligence or ignorance. Ultimately, the addition of a 3D model allows for pedagogical methods that would otherwise not be possible. For the Fall 2020 semester, there was no competency exam because there was no guaranteed access to the camera to take the exam. In the Spring 2021 semester, the development of the 3D model allowed for a remote version of the practical when there otherwise would have been no practical exam at all.

This thesis study sought to find qualitative data to reinforce the argument for using photogrammetry and 3D models for instruction. Data was missing or scarce in previous scholarly work to prove the learning effect of digital interactive learning objects (Sanii 2020). This study gives evidence that there may be a positive learning effect when using 3D models. When creating pedagogical frameworks and advocating for the Neuroscience of learning, it is important to allow for the autonomy of instruction (Carey 2018, Horvath & Donoghue 2016). As education scholar Ronald Thomas writes, “Embedded in the improvement paradigm is a key shift from telling educators what to do to creating broad agency for improvement while fostering an environment in which everyone is learning about how and why schools work better” (Thomas 2021). This 3D photogrammetry approach is not meant to be a prescriptive model of teaching, rather it is meant to show methods and evidence to make an argument for the utility of human-centered design, in this case, student-centered design. During the COVID-19 pandemic, students were mostly at home and under increased anxiety. Anxiety may affect performance negatively (Vogel & Schwabe 2016). Through data visualization, simulations can help learners hold elaborative rehearsals to make information meaningful and engaging for as long as they’d like and perhaps with less pressure than they would feel when taking the practical exam in person. As one student said; “I took the [in-person] camera build twice but the 3D model was able to point out the highlighted points of the camera with a few clicks! It made it easier to navigate (a lot less intimidating too!)”.

Limitations

This study followed processes already implemented in the film production department to prove student competency when using the camera for Film 2. The study used real student grade data from past semesters and the Spring 2021 semester. With low-population density restrictions because of health concerns, weather cancellations, and the collaborative nature of the study, flexibility was necessary at all steps of the process, and the practical exam had to be altered in the Spring of 2021. Because of the alterations, not all questions from the two versions of the exam were included in the calculations to have a consistent basis of questions. Seven questions were calculated out of an original 27-question quiz. Grade data was not available for the Fall 2020 hybrid section because the practical exam was not administered due to staffing limitations. For the hybrid sections, the exam was administered online instead of in person and without the physical camera present. Because of the hybrid model, the need for flexibility with the course schedule, and the sensitive student grade information, empirical qualitative research data was not collected apart from the short reflection answers the students gave after taking the quiz. Although 87 students' grades were included in the study, there is a need for an even larger sample to mitigate samples' grade variability. For example, the Spring 2020 F2F semester scored much higher than the Fall 2019 F2F section--Fall 2019; 82.91% (SD=17.5), Spring 2020 F2F; 91.60% (SD=17.1)--despite the instructional modality being the same. This may be because there was a significant number of higher achievers in one semester (See Appendix A). A larger sample size would lessen the impact of these statistical variabilities.

Next Steps

Online and blended learning could be a mainstay for years to come with student assimilation in the online learning environment after the COVID-19 pandemic (Gordon 2020). The importance of user-centered design (Rubin & Chisnell 2008) is clear as students expect a better experience in their increasingly expensive courses. Instruction needs to be visual, interactive, and engaging for increased learning and long-term memory encoding. There is a need for further empirical research studies of student interaction with 3D models. Some students mentioned in their reflections that they had trouble rotating the models or that they used their mobile devices to take the quiz and were not able to use the model well. A contextual inquiry may help answer design implications about equity by observing limitations and accessibility. Usability tests may include completion rates, errors, time, and other usability measures (Sauro 2012) which can provide insights into problems, satisfaction, and effectiveness. The design of the model can then be adjusted based on user research in an iterative user-centered design process (Rubin & Chisnell 2008). If we couple empirical user research with grade data (Mayer 2008), we can better understand the student experience and the effect of the 3D models. This type of design "lends itself to team research, in which the team can include individuals with both quantitative and qualitative expertise" (Creswell & Plano Clark, 2011, p. 78).

Students in the hybrid sections took the practical exam online, and in-person students took the quiz in person. We heard from a student who said that taking the exam online eased anxiety while taking the quiz. We know that there is a negative impact on motor learning when punishment is introduced such as this anxiety during in-person learning (Vogel & Schwabe 2016). However, there are some benefits to taking a test in person (Lozano 2013). To better evaluate the learning effect of the 3D model, future comparisons of student grades should have fewer variabilities in the method of test administration and the quiz should be administered in person with the same method of instruction (full in-person) with the only variable being the prior availability of the 3D model. Plans are being prepared to continue this study with more grade data in the Fall of 2021, which is expected to be fully face-to-face.

Finally, future studies could include an auditory element. Auditory stimulus is considered "one of the most relevant elements in the science of learning" (Gazzaniga et al. 2002). Temporal connections directly affect attention and long-term memory (Mayer 2008). There are certain areas of the brain that are dedicated to specific memory tasks like the prefrontal cortex and remembering a voice (Goldman-Rakic 1987, Meng 2021). The online 3D model repository used for this study, Sketchfab, has a narration feature that would allow the professor to record their voice as narration that would not replace the text but go in tandem with the annotations to engage all learners. This addition in stimuli may have a larger effect on learning and should be explored.

The photogrammetry process has become more accessible with the introduction of adequate photographic processors within mobile phones (Burk & Johnson 2019.) Handheld smartphones are equipped with distance measuring lasers, also known as LIDAR (Cross 2020). New technology will soon allow for impressive innovations such as algorithms that allow for artificial intelligent interpretation of 2D images that automatically creates 3D meshes from 2D images and produces life-like 3D models with minimal human interaction (Shen et al. 2020). Objects will become easier to reproduce in 3-dimension in the very near future. With innovations in artificial intelligence and increased computer processing potential, it will take much fewer photos to produce a 3-D object (Fu et.al 2020). Despite these advancements in technology, there needs to be a support system to provide these services for teachers and learners with a lack of access to technology or expertise. This is where maker spaces can play a crucial role in developing 3D interactive learning objects to help learners. Maker spaces, or innovative teaching labs or centers in higher education, can help support photogrammetry. Out of a survey of dozens of maker spaces in libraries and colleges in the New England area (Davis 2018), only 5 out of 55 spaces reported providing 3D scanning or photogrammetry to clients. This is a clear service that has the potential to increase community engagement (Davis 2018) and improve student learning in preparation for their careers.

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Appendix A: Student Grades

Table A1. Fall 2019 F2F Individual Grades

1	Student	Grades
2	Fall 2019 F2F Student 26	34.78
3	Fall 2019 F2F Student 9	60.86
4	Fall 2019 F2F Student 4	60.87
5	Fall 2019 F2F Student 18	60.87
6	Fall 2019 F2F Student 23	60.87
7	Fall 2019 F2F Student 17	65.22
8	Fall 2019 F2F Student 5	69.56
9	Fall 2019 F2F Student 27	69.56
10	Fall 2019 F2F Student 1	78.26
11	Fall 2019 F2F Student 2	78.26
12	Fall 2019 F2F Student 3	78.26
13	Fall 2019 F2F Student 6	78.26
14	Fall 2019 F2F Student 7	78.26
15	Fall 2019 F2F Student 11	78.26
16	Fall 2019 F2F Student 14	78.26
17	Fall 2019 F2F Student 8	86.95
18	Fall 2019 F2F Student 13	86.95
19	Fall 2019 F2F Student 10	100
20	Fall 2019 F2F Student 12	100
21	Fall 2019 F2F Student 15	100
22	Fall 2019 F2F Student 16	100
23	Fall 2019 F2F Student 19	100
24	Fall 2019 F2F Student 20	100
25	Fall 2019 F2F Student 21	100
26	Fall 2019 F2F Student 22	100
27	Fall 2019 F2F Student 24	100
28	Fall 2019 F2F Student 25	100
29	Fall 2019 F2F Student 28	100
30	Fall 2019 F2F Student 29	100

Table A2, Spring 2020 F2F Individual Grades

1	Student	Grades
2	Spring 2020 F2F Student 3	30.43
3	Spring 2020 F2F Student 1	47.82
4	Spring 2020 F2F Student 2	60.87
5	Spring 2020 F2F Student 17	78.26
6	Spring 2020 F2F Student 19	78.26
7	Spring 2020 F2F Student 9	82.6
8	Spring 2020 F2F Student 14	86.95
9	Spring 2020 F2F Student 4	95.65
10	Spring 2020 F2F Student 13	95.65
11	Spring 2020 F2F Student 16	95.65
12	Spring 2020 F2F Student 24	95.65
13	Spring 2020 F2F Student 5	100
14	Spring 2020 F2F Student 6	100
15	Spring 2020 F2F Student 7	100
16	Spring 2020 F2F Student 8	100
17	Spring 2020 F2F Student 10	100
18	Spring 2020 F2F Student 11	100
19	Spring 2020 F2F Student 12	100
20	Spring 2020 F2F Student 15	100
21	Spring 2020 F2F Student 18	100
22	Spring 2020 F2F Student 20	100
23	Spring 2020 F2F Student 21	100
24	Spring 2020 F2F Student 22	100
25	Spring 2020 F2F Student 23	100
26	Spring 2020 F2F Student 25	100
27	Spring 2020 F2F Student 26	100
28	Spring 2020 F2F Student 27	100
29	Spring 2020 F2F Student 28	100
30	Spring 2020 F2F Student 29	100
31	Spring 2020 F2F Student 30	100

Table A3, Spring 2021 Hybrid Individual Grades

1	Student	Grades
2	Spring 2021 Hybrid Student 17	64.28
3	Spring 2021 Hybrid Student 7	78.57
4	Spring 2021 Hybrid Student 12	78.57
5	Spring 2021 Hybrid Student 23	78.57
6	Spring 2021 Hybrid Student 25	78.57
7	Spring 2021 Hybrid Student 1	85.71
8	Spring 2021 Hybrid Student 11	85.71
9	Spring 2021 Hybrid Student 18	85.71
10	Spring 2021 Hybrid Student 26	85.71
11	Spring 2021 Hybrid Student 16	88.57
12	Spring 2021 Hybrid Student 6	92.85
13	Spring 2021 Hybrid Student 10	92.85
14	Spring 2021 Hybrid Student 13	92.85
15	Spring 2021 Hybrid Student 27	92.85
16	Spring 2021 Hybrid Student 2	100
17	Spring 2021 Hybrid Student 3	100
18	Spring 2021 Hybrid Student 4	100
19	Spring 2021 Hybrid Student 5	100
20	Spring 2021 Hybrid Student 8	100
21	Spring 2021 Hybrid Student 9	100
22	Spring 2021 Hybrid Student 14	100
23	Spring 2021 Hybrid Student 15	100
24	Spring 2021 Hybrid Student 19	100
25	Spring 2021 Hybrid Student 20	100
26	Spring 2021 Hybrid Student 21	100
27	Spring 2021 Hybrid Student 22	100
28	Spring 2021 Hybrid Student 24	100
29	Spring 2021 Hybrid Student 28	100
30	Spring 2021 Hybrid Student 29	100

Appendix B: t-tests

Table B1. Fall 2019 F2F vs. Spring 2020 F2F

	Fall 2019, face-to-face	Spring 2020, face to face	
	78.26	95.65	
	78.26	95.65	
	78.26	100	
	60.87	100	
	69.56	100	
	78.26	100	
	78.26	100	
	86.95	100	
	60.86	100	
	100	100	
	78.26	100	
	100	100	
	86.95	100	
	78.26	47.82	
	100	82.6	
	100	100	
	65.22	100	
	60.87	100	
	100	60.87	
	100	86.95	
	100	100	
	100	95.65	
	60.87	30.43	
	100	78.26	
	100	100	
	34.78	78.26	
	69.56	100	
	100	100	
	100	100	
		95.65	
Mean	82.90724138	91.45310345	8.54586207
StDev	17.54400893	17.08757608	
Variance	307.7922493	291.9852562	
n	29	30	
	10.61352584	9.732841874	20.3463677
t-test	0.059167637		
		sqrt of	4.51069481
		t-value	1.89457776
		critical value	2

Table B2. Fall 2019 F2F vs. Spring 2021 Hybrid

	Fall 2019, face-to-face	Spring 2021, hybrid		
	34.78	64.28		
	60.86	78.57		
	60.87	78.57		
	60.87	78.57		
	60.87	78.57		
	65.22	85.71		
	69.56	85.71		
	69.56	85.71		
	78.26	85.71		
	78.26	88.57		
	78.26	92.85		
	78.26	92.85		
	78.26	92.85		
	78.26	92.85		
	78.26	100		
	86.95	100		
	86.95	100		
	100	100		
	100	100		
	100	100		
	100	100		
	100	100		
	100	100		
	100	100		
	100	100		
	100	100		
	100	100		
	100	100		
	100	100		
Mean	82.90724138	92.46103448	9.5537931	
StDev	17.54400893	9.666963752		
Variance	307.7922493	93.45018818		
n	29	29		
variance/n	10.61352584	3.222420282	13.8359461	
t-test	0.012909191			
		sqrt of 13.835	3.71967016	
		t-value	2.56845169	
		critical value	2	
			Reject Null Hypothesis	

Table B3. Spring 2020 F2F vs. Spring 2021 Hybrid

	Spring 2021, hybrid	Spring 2020, face to face	
	64.28	95.65	
	78.57	30.43	
	78.57	47.82	
	78.57	60.87	
	78.57	78.26	
	85.71	78.26	
	85.71	82.6	
	85.71	86.95	
	85.71	95.65	
	88.57	95.65	
	92.85	95.65	
	92.85	100	
	92.85	100	
	92.85	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
	100	100	
		100	
Mean	92.46103448	91.593	**0.86803448**
StDev	9.666963752	17.08757608	
Variance	93.45018818	291.9852562	
n	29	30	
variance/n	3.222420282	9.732841874	12.9552622
p-value	**0.811938042**		
		sqrt of 12.955	**3.59934191**
		tvalue	0.24116478
		critical value	2
			Don't reject Null

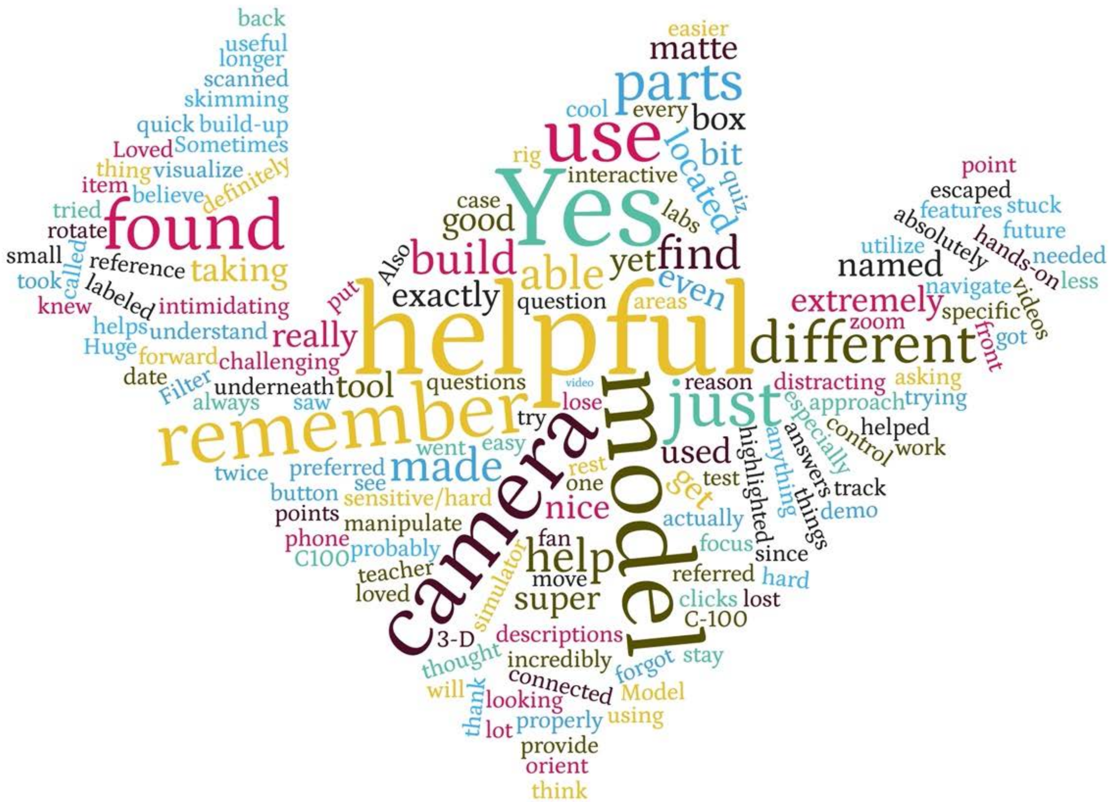
Table B4. Spring 2021 Hybrid Section 1 vs. Section 2

	Tuesday Section	Thursday Section	
	85.71	88.57	
	100	64.28	
	100	85.71	
	100	100	
	100	100	
	92.85	100	
	78.57	100	
	100	78.57	
	100	100	
	92.85	78.57	
	85.71	85.71	
	78.57	92.85	
	92.85	100	
	100	100	
	100		
Mean	93.80733333	91.01857143	**2.7887619**
StDev	8.040205636	11.28395379	
Variance	64.64490667	127.3276132	
n	15	14	
variance /n	4.309660444	9.094829513	13.40449
t-test	0.447603439		
			3.6612143
		t-value	0.7617041
		critical value	2.05
			Don't reject Null

Appendix C: Student Reflections

I did use the 3D Model while taking this quiz. It was helpful to use that and the video that you made on the C-100. The only thing it was a bit hard to manipulate to where I was trying to move. For some reason, I always got stuck underneath the camera when looking for the ND Filter.
I did use the 3D model, especially to remember where to put the matte box. It was definitely a good help. I didn't find anything distracting about it.
I did, I actually found it to be very helpful.
I didn't but it is super cool and I think its super helpful if you haven't been able to build the C100 yet.
I didn't I preferred skimming back over the video just because the zoom was really sensitive/hard to control on the model.
I thought that the 3D simulator for the camera is very helpful. Sometimes with longer videos, I lose focus easy so this hands-on approach was very helpful.
I tried to use it, but couldn't get it to work properly.
I used it. Very useful.
I used the 3D model to help me remember what the specific parts of the camera were. I do believe this was helpful because it helped me remember exactly what the different parts of the build are called.
I utilize the #D model for every question that had to do with the camera. Having the interactive tool was good because it helps orient me or just remember what I saw when I went to do the build-up. Also, the small descriptions of different areas help to remember different parts of your video.
It was a bit challenging to rotate, but that could just be me.
Loved it.
No (on my phone rn) but I will probably be using it in the future.
No i did not. It did not provide the answers that I needed. I referred to the demo video you made. I did try the 3d model but I did not find the use for it.
Yes I did, It was incredibly helpful since I haven't been able to go into the labs and test it out myself just yet. Huge thank you to the teacher who 3-D scanned it for us!
Yes I did! I took the camera build twice but the 3D model was able to point out the highlighted points of the camera with a few clicks! It made it easier to navigate. (a lot less intimidating too!)
Yes I did. I knew the matte box was the forward most item but exactly how it's connected to the rest of the rig escaped me.
Yes, I did and found it very helpful! I'm a fan.
Yes, I did, it's a really nice tool to use for a quick reference.
Yes, I found it extremely helpful.
Yes, I found it very helpful to visualize what the questions were asking and even understand the camera more.
Yes, just to stay up to date with what all the features are named and where they are located in case I lost track of what one was named or where a button was located.
Yes, the 3D model was helpful. I couldn't find out how to get the different parts labeled but I forgot if we could even do that with the model.
Yes! I absolutely loved the 3D model! It was nice to see the camera in front of me while taking it! I found it extremely helpful!
Yes. It was helpful for things I couldn't remember

Appendix D: Student Reflection Word Cloud



Appendix E: Practical Exam Questions

	Question	Point average	Possible Points	Hybrid Model Practical Questions (29 attempts)	Point Average	Possible Points
Body of the Camera	It is recommended to attach the handle to the camera to provide extra security when handling the camera. Attach the handle to the hotshoe mount on top of the camera, tighten the screw, and connect the cable to the camera by lining up the white triangle. TRUE FALSE	4.6	5	It is recommended to attach the handle to the camera to provide extra security when handling the camera. Attach the handle to the hot shoe mount on top of the camera, tighten the screw, and connect the cable to the camera by lining up the white triangle. TRUE FALSE	9.6	10
ISO	ISO is set using the button on the camera body and the toggle on the LCD screen. What is the native ISO for the Canon C100?	0.8	1	Briefly explain "native" ISO and why you may not want to go above native ISO in your camera settings.	10	10
Mattebox	Attach the mattebox to the rails. Be careful not to unscrew any screws on the mattebox so far that they fall out! How many 4x4 filter slots are available on the mattebox?	2.6	3	Where would you attach the matte box and what is one of the purposes of a matte box? When might you want to use it?	9.6	10
ND Filter	The camera body has a built in ND filter wheel. Spin the wheel the observe the changes in exposure. Which is NOT an option for built-in ND?	3.4	5	The camera body has a built in ND filter wheel. What does ND stand for and when might you use it?	9.6	10
Power Supply	Time to supply power to the camera. What's the ideal method for providing power to the camera?	3.4	4	Time to supply power to the camera. Aside from the canon battery, what's the ideal method for providing power to the camera?	8.2	10
SD Card	The camera can still record while the SD card slot door remains open. TRUE/FALSE	1.9	2	The camera can still record while the SD card slot door remains open. True or False?	9.6	10
Shutter	Shutter Speed is set using the button on the camera body and the toggle on the LCD screen. What is the standard shutter speed for the Canon C100 at the standard frame rate?	2.7	3	Shutter Speed is set using the button on the camera body and the toggle on the LCD screen. What is the standard shutter speed for the Canon C100 at the standard frame rate?	7.9	10

Appendix F: Film 2 Practical Exam, In-person

Question 1
When checking out, the entire Film 2 group must be present for checkout to occur.
True / False

Question 2
Other items outside of the Film 2 kit are available for check out from the cage, but are subject to regular cage checkout and return policies.
True / False

Question 3
If the kit is returned with items missing that were not reported as missing during checkout, students can claim, "that wasn't there when I checked out" and have their fine waived.
True / False

Question 4
When checking out the equipment, who is responsible for reviewing the kit to ensure all items are accounted for before leaving campus?

- The cage employees
- The student

Question 5
If a student encounters a problem or question regarding the equipment, their first step should be to consult the manual and user forums on the internet by Googling the problem.
True / False

Question 6
Set up the tripod. Make sure the legs are set to equal heights and the tripod head is balanced using the level bubble. What knobs must be locked on the tripod before mounting the camera?

- Pan
- Tilt
- Leg Locks
- Spreader Locks
- All of the above

Question 7
Mount the camera to the tripod. Which items must be attached to the camera in order for it to mount on the tripod? Check all that apply:

- Tripod Plate
- Monitor
- Rail Plate
- Viewfinder

Question 8
Now attach a pair of rails to the rail mount. Which accessories can then be attached to these rails? Check all that apply:

- Battery Plate
- Follow Focus
- Audio Recorder
- Mattebox
- External Monitor

Question 9
Make sure you have 2 SD cards inserted into the camera. What type of card is provided?

- 4GB SD Card Class 6 SD Card
- 64GB Sandisk Class 10 SD Card
- 120GB SanDisk Ultra Fast 95mb/sec SD Card

Question 10
The camera can still record while the SD card slot door remains open.
True / False

Question 11
Time to supply power to the camera. What's the ideal method for providing power to the camera?

- Camera battery
- Power cable connected to a wall outlet
- Brick battery (V mount)

Question 12
Attach the battery plate to the rails and then mount the brick battery onto the battery plate. What cable supplies power from the battery to the camera's "DC In" port?

- HDMI
- SDI
- XLR
- P-Tap (sometimes called D-Tap)

Question 13
Time for lenses. Each lens should have a front and back cap. Check the front and back glass on each lens for dirt and smudges and clean them before use, using the lens cleaning kits available in the cage. What are the focal lengths provided in the kit? Check all that apply:

- 18mm
- 24mm
- 35mm
- 50mm
- 85mm
- 105mm

Question 14
Attach a lens to the camera by removing the body cap on the camera the back cap on the lens. Place lens caps and the body cap in the camera case so they don't get lost! Line up the red dot on the camera's lens mount with the red dot on the back of the lens, then turn clockwise until you hear the click. What is the lens mount on the Canon C100?

- Micro 4/3rds
- EF Mount
- PL Mount
- F Mount

Question 15
Now attach the follow focus and make sure that the focus ring gear on the lens is lined up with the gear on the follow focus wheel for smooth focus pulling. Make sure the screws holding the follow focus in place are snug. True or False: The follow focus can be attached on either side of the lens.
True / False

Question 16

Which materials should NOT be used to set marks on the follow focus? Check all that apply:

Pencil

Pen

Dry Erase Marker

Tape

Sharpie

Question 17

Attach the mattebox to the rails. Be careful not to unscrew any screws on the mattebox so far that they fall out! Note that you can adjust the height of the mattebox to fit the lens and also that the mattebox has the ability to swing out to allow for changing lenses without having to remove the mattebox from the rails. Attach the top and side eyebrows to the mattebox. How many 4x4 filter slots are available on the mattebox?

1

2

3

4

Question 18

It is recommended to attach the handle to the camera to provide extra security when handling the camera. Attach the handle to the hotshoe mount on top of the camera, tighten the screw, and connect the cable to the camera by lining up the white triangle on the cable's plug with the white triangle on the camera. What functions does the handle provide?

Secondary record button

XLR inputs for running sync sound into the camera

Advanced audio controls

All of the above

Question 19

NEVER twist or turn the handle's cable when detaching it from the camera body. Instead gently pull on the metallic tip of the cable's plug to release it.

True / False

Question 20

Your first step when preparing to start shooting with the camera is to format the cards, which is done within the camera menu.

True / False

Question 21

Also called "Initialize Media," the function to format your cards is found in which sub menu?

Camera Setup

Audio Setup

Video Setup

Other Functions

Question 22

Next, choose your recording format in the Other Functions sub menu. What are the recording formats offered? Check all that apply:

AVCHD

MP4

MOV

RAW

Question 23

We recommend you use MP4 as your recording format. Next, set your frame rate and bitrate for the recording format. Higher bitrates mean higher quality. What is the standard frame rate for narrative motion picture video recording?

23.98

25

29.97

59.94

Question 24

ISO is set using the button on the camera body and the toggle on the LCD screen. What is the native ISO for the Canon C100?

200

400

800

850

1600

Question 25

Shutter Speed is set using the button on the camera body and the toggle on the LCD screen. What is the standard shutter speed for the Canon C100 at the standard frame rate?

1/24

1/48 or 1/50

1/60

1/100

Question 26

What important exposure tool is accessible as a button on the body of the camera?

Histogram

Waveform Monitor

False Color

Light Meter

Question 27

The camera body has a built in ND filter wheel. Spin the wheel the observe the changes in exposure. Which is NOT an option for built-in ND?

ND filter off

1 stop ND

2 stops ND

4 stops ND

Appendix G: Film 2 Practical - Hybrid

Question 1
When checking out, the entire Film 2 group must be present for checkout to occur.
True / False
Question 2
Other items outside of the Film 2 kit are available for check out from the cage, but are subject to regular cage checkout and return policies.
True / False
Question 3
If the kit is returned with items missing that were not reported as missing during checkout, students can claim, "that wasn't there when I checked out" and have their fine waived.
True / False
Question 4
When checking out the equipment, who is responsible for reviewing the kit to ensure all items are accounted for before leaving campus?

- The cage employees
- The student

Question 5
If a student encounters a problem or question regarding the equipment, their first step should be to consult the manual and user forums on the internet by Googling the problem.
True / False
Question 6
Set up the tripod. Make sure the legs are set to equal heights and the tripod head is balanced using the level bubble. What knobs must be locked on the tripod before mounting the camera?

- Pan
- Tilt
- Leg Locks
- Spreader Locks
- All of the above

Question 7
Mount the camera to the tripod. Which items must be attached to the camera in order for it to mount on the tripod? Check all that apply:

- Tripod Plate
- Monitor
- Rail Plate
- Viewfinder

Question 8
Now attach a pair of rails to the rail mount. Which accessories can then be attached to these rails? Check all that apply:

- Battery Plate
- Follow Focus
- Audio Recorder
- Mattebox
- External Monitor

Question 9
Make sure you have 2 SD cards inserted into the camera. What type of card is provided?

- 4GB SD Card Class 6 SD Card
- 64GB Sandisk Class 10 SD Card
- 120GB SanDisk Ultra Fast 95mb/sec SD Card

Question 10
The camera can still record while the SD card slot door remains open.
True / False
Question 11
Time to supply power to the camera. What's the ideal method for providing power to the camera?

- Camera battery
- Power cable connected to a wall outlet
- Brick battery (V mount)

Question 12
Attach the battery plate to the rails and then mount the brick battery onto the battery plate. What cable supplies power from the battery to the camera's "DC In" port?

- HDMI
- SDI
- XLR
- P-Tap (sometimes called D-Tap)

Question 13
Time for lenses. Each lens should have a front and back cap. Check the front and back glass on each lens for dirt and smudges and clean them before use, using the lens cleaning kits available in the cage. What are the focal lengths provided in the kit? Check all that apply:

- 18mm
- 24mm
- 35mm
- 50mm
- 85mm
- 105mm

Question 14
Attach a lens to the camera by removing the body cap on the camera the back cap on the lens. Place lens caps and the body cap in the camera case so they don't get lost! Line up the red dot on the camera's lens mount with the red dot on the back of the lens, then turn clockwise until you hear the click. What is the lens mount on the Canon C100?

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- EF Mount
- PL Mount
- F Mount

Question 15
Now attach the follow focus and make sure that the focus ring gear on the lens is lined up with the gear on the follow focus wheel for smooth focus pulling. Make sure the screws holding the follow focus in place are snug. True or False: The follow focus can be attached on either side of the lens.
True / False
Question 16

Which materials should NOT be used to set marks on the follow focus? Check all that apply:

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Pen

Dry Erase Marker

Tape

Sharpie

Question 17

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1

2

3

4

Question 18

It is recommended to attach the handle to the camera to provide extra security when handling the camera. Attach the handle to the hotshoe mount on top of the camera, tighten the screw, and connect the cable to the camera by lining up the white triangle on the cable's plug with the white triangle on the camera. What functions does the handle provide?

Secondary record button

XLR inputs for running sync sound into the camera

Advanced audio controls

All of the above

Question 19

NEVER twist or turn the handle's cable when detaching it from the camera body. Instead gently pull on the metallic tip of the cable's plug to release it.

True / False

Question 20

Your first step when preparing to start shooting with the camera is to format the cards, which is done within the camera menu.

True / False

Question 21

Also called "Initialize Media," the function to format your cards is found in which sub menu?

Camera Setup

Audio Setup

Video Setup

Other Functions

Question 22

Next, choose your recording format in the Other Functions sub menu. What are the recording formats offered? Check all that apply:

AVCHD

MP4

MOV

RAW

Question 23

We recommend you use MP4 as your recording format. Next, set your frame rate and bitrate for the recording format. Higher bitrates mean higher quality. What is the standard frame rate for narrative motion picture video recording?

23.98

25

29.97

59.94

Question 24

ISO is set using the button on the camera body and the toggle on the LCD screen. What is the native ISO for the Canon C100?

200

400

800

850

1600

Question 25

Shutter Speed is set using the button on the camera body and the toggle on the LCD screen. What is the standard shutter speed for the Canon C100 at the standard frame rate?

1/24

1/48 or 1/50

1/60

1/100

Question 26

What important exposure tool is accessible as a button on the body of the camera?

Histogram

Waveform Monitor

False Color

Light Meter

Question 27

The camera body has a built in ND filter wheel. Spin the wheel the observe the changes in exposure. Which is NOT an option for built-in ND?

ND filter off

1 stop ND

2 stops ND

4 stops ND

Appendix H: Film II Syllabus

Narrative Filmmaking (aka 'Film II')
EMF 367 / Sec. 001 / Spring2021 Professor Jena Burchick (she, her, hers) Email: Jburchick@towson.edu
Email: jburchick@towson.edu
Office Hours: By appointment: https://calendly.com/jburchick/jburchick-office-hours **Once you have made your appointment, you can attend your meeting via zoom:** https://towson-edu.zoom.us/j/98967480963?pwd=YkhESEJ1UjBBK2JLS3I1SW12Zm5Rdz09 Meeting ID: 989 6748 0963
Passcode: JBurchick

Class meets Tuesdays, 11:am-1:45pm, Via Zoom. F2F (face-to-face) portions will be in Media Center 102 (TV Studio) or the Production Labs in the basement of the Media Center.

Class Lectures Via Zoom: For Weeks that note "Synchronous" below, that means we will all meet together via zoom. "Asynchronous" means you may plan your lesson according to your own schedule for the week.
To Join: Please go to "Zoom Lectures" on the sidebar of our course blackboard. **You can also use that space to view past recorded meetings. **

Class Format:
This class will follow a hybrid model. Your lectures will be a mix of asynchronous and synchronous which will be noted on the schedule. I will invite half of the class (Groups A & B) in at a time over the first four weeks to get acquainted with the equipment and prepare you for the technical side of your shoots.

You will be responsible for completing the asynchronous portion at home in addition to attending these equipment sessions. If you choose to use the gear provided by EMF you will need to attend these F2F sessions but if you prefer to stay home this semester you will also be permitted to use your own phone or camera for distant learning. As long as the campus is open, you'll be able to reserve space in the labs and studios.

F2F equipment sessions will be in room: MC 102 on during our regular class hours starting promptly at 11:00 AM. Please do not be late because we must follow strict safety protocol. I will post a "F2F schedule" on Blackboard so you will know which weeks you are invited into the classroom.

Even though hybrid teaching is my intention, there are many things that I cannot control. If I feel that I am compromising my personal safety, or if the university system creates further restrictions, there is a chance that the face-to-face option will be removed.

Each week will be a mix of interacting with the online lectures, critiquing and analyzing films, and participating in group screenings/discussions.

**** If you would like to be a part of a crew but also want to work remotely this semester you can fulfill the role of Producer or Editor. Otherwise, you can make your work individually.****

Course Description:
Filmmaking methods and aesthetics emphasizing narrative storytelling and production techniques.

Prerequisites:
EMF 222 & EMF 275. May be taken concurrently with EMF 275. EMF majors only.

Course Objectives:
This course should be a significant cornerstone in your developing knowledge of narrative filmmaking and cinematic storytelling. After taking this course, you will have experience in basic film production from "script-to-screen." Not all knowledge is acquired overnight, but your thinking and attitude about storytelling and film production should see significant change. Further objectives include:

- Creating a portfolio-quality short film to build your reel, with the potential for film festival distribution.
- Gaining hands-on experience in one or more essential film crew positions.
- Gaining deeper knowledge and understanding about each stage of film production from concept development to pre-production planning to on-set production to post-production finishing.
- Developing confidence and experience working with professional-level cinema cameras and film equipment.
- Networking with your peers to develop working relationships and gaining essential experience in the collaborative process.
- Continuing to develop your unique artistic vision and gain a deeper understanding of visual language and cinematic storytelling.

Required Readings: There is no textbook. Readings will be provided online via Blackboard.

Required Course Materials:
1. External hard drive – SSD or 7200rpms, USB 3.0 and/or Thunderbolt, 1TB or larger capacity
2. Additional backup drive of equal or greater capacity (all data must exist in at least two locations!)

3. Headphones – Closed-back, studio monitoring, 20Hz-20kHz range. Google Drive for production documents. Helpful to have a 1 inch binder to have physical copies on set with you!
4. If you plan on using Adobe at home, subscriptions are $19.99/month. You are also permitted to use Davinci Resolve for this course which is available online as a free download.

TU Emergency Fund:
If you have a significant financial need for a laptop, Adobe, etc please reach out to:
TU Student Emergency Funds: https://www.towson.edu/studentaffairs/care/student-emergency-fund.html

VoiceThread:
This course will utilize VoiceThread in some lectures. VoiceThread is an online collaboration and discussion platform in Blackboard. You can easily comment and respond with audio, video, or text; upload media (images, videos, presentations, etc.) for discussion; and create graded or ungraded assignments. The instructional uses for VoiceThread include student presentation, online discussions, foreign language assignments, and more. https://www.towson.edu/technology/training/blackboard/faculty/voicethread.html

COMMUNICATION: Virtual & F2F
Verbal and "netiquette" – This class follows the rules of conduct expected by Towson University. Please see COFAC Civility Code paragraph for more information.
Digital/Electronic – You will be required to use Blackboard, zoom, your Towson email and your Youtube/Vimeo account to access and share work. Your emails should be sent from your Towson address. Your email should include a greeting, body content, and signature as if you are writing to your future employer.
Online Conduct: The discussion board should be viewed as a course forum to discuss the readings, videos, and other course-related content. Your participation in the discussions counts as attendance/participation. The tone of all posts and Zoom etiquette should be respectful and professional in nature.
Treat the other students and your faculty member the same online as you would in person. Engage with others in a respectful manner.
Keep in mind that written communication lacks the non-verbal cues we use to understand each other. It may be helpful to review what you write to ensure the message reads the same way you are intending it to.

Copyright/Ownership & Use
My lectures and course materials, including, but not limited to powerpoint presentations, tests, outlines, and similar materials, are protected by copyright. I am the exclusive owner of copyright in those materials they create. You may take notes and make copies of course materials for your own use; however, you may not, nor may you allow others to, reproduce or distribute lecture notes and course materials publicly whether or not a fee is charged without my express written consent. Similarly, you own copyright in your original papers and exam essays. If I am interested in posting your answers or papers on the course web site, I will ask for your written permission.

Research Study For Master Thesis:

You will be given access to a digital 3D model of the camera and asked to make a video describing the different functions of the camera before taking the proficiency quiz for Film 2.

The purpose of the research is to investigate if interactive digital 3D models help students become as proficient in handling a specialized tool or object in a remote or hybrid learning environment when compared to a face-to-face, hands-on classroom.

You will not be observed during the quiz and your name and grade will remain anonymous for the purpose of this study. Quiz grades will be provided by the professor to the researcher as whole class averages and individual names and grades will not be shared with the researcher.

If you would like for your grade to be omitted from the class average, please email Professor Burchick to be excluded from the research study. Participation will not affect your grade for the class.

If you should have any questions about the research, please feel free to call or email the Principal Investigator, David Merino (david.merino@ubalt.edu), or Faculty Sponsor, Kathryn Summers, (ksummers@ubalt.edu).

Recommended Texts:
General Reference: Ascher, Steven & Edward Pincus. *The Filmmaker's Handbook.* 4th Edition. Penguin Books: 2013.
Directing Actors: Weston, Judith. *Directing Actors*. Michael Wiese Productions: 1999. Cinematography: Brown, Blain. *Cinematography: Theory and Practice*. Focal Press: 2012. Lighting: Box, Harry. *The Set Lighting Technician's Handbook*. Focal Press: 2010.
Editing: Murch, Walter. *In the Blink of an Eye: A Perspective on Film Editing*. Silman-James: 2001. Producing: Rea, Peter & David Irving. *Producing and Directing the Short Film & Video*. Focal Press: 2015.

Connect with the EMF Department:
Like on Facebook: http://www.facebook.com/towsonemf Follow EMF on Instagram & Twitter: @TowsonEMF
Join EMF Crew Call Group: https://www.facebook.com/groups/TowsonEMF/ (Crew & casting calls) EMF Google Group: https://groups.google.com/forum/#!forum/towsonemf (Jobs & internships)

Linkedin Learning at TU:
https://www.towson.edu/technology/training/resources/linkedin-learning.html

Collaboration Statement:

Collaboration is key to a successful film production. Learning to work with others is one of the most important aspects of this class. From this point on, with very few exceptions, you will be doing coursework with other people, often outside of class time. Working with partners presents unique challenges, mostly enriching, but sometimes producing very negative feelings. **The first step towards conflict resolution is to speak directly with your crew openly and honestly.** If problems persist, your instructor can become involved to help you through any partnership difficulties you may have, but ultimately the success of your teamwork is your responsibility. Each team member is expected to make meaningful contributions to the progress of the film projects at all times, and no other student is permitted to restrict that ability.

Communication Policy:
Your success as a filmmaker depends on having good communication skills. Thus, you are expected to remain in consistent, reliable communication with your project collaborators and the instructor throughout the semester. You must check your Towson email account and the course Blackboard page regularly. Communication should remain professional in tone and be conducted through email, phone calls and face-to-face meetings. Your grade will in part reflect your ability to communicate and coordinate as a group.

Time Commitment:
Filmmaking is a time and labor-intensive activity and thus time management is crucial to your success in this class. **You are expected to spend 4-6 hours of outside class time each week on work for this class**. You must be available to meet with your group members on a regular basis outside of class time, at a time and place mutually agreed upon by the entire group. Furthermore, this course include**s one week of intensive on-set production for t**he final film project. Be prepared to dedicate your time wholly to this task aside from your other required courses, which means keeping your schedule open for that week, since you are expected to be on set for the duration of the shoot. It is important to identify and mitigate scheduling conflicts well in advance, to be on set for the entirety of the shoot.

Monetary Commitment:
Filmmaking costs money. I cannot accurately gauge how much you will spend on your final film (ultimately up to you, your team, the script, and the scope of the shoot), **but expenses for production may range from $100 to several hundred dollars or more.** How those costs are shared between group members must be decided collectively by the group far in advance of the film shoot. The instructor and EMF department are not responsible for settling disputes about money and will not be able to arbitrate the distribution of funds or expenses between group members.

Respecting the VML and the Equipment:
Equipment policies are posted on the EMF website and you are expected to understand and follow them. Scheduled equipment checkout times must be respected. **All team members must be present for the checkout and return of the gear and must sign the contract assuming equal responsibility for the care and safe return of the gear.** You are responsible for inspecting and testing all of the gear prior to checkout and, once you check it out, you are agreeing to return it in the exact same condition. Report all malfunctions and damage immediately to the equipment cage. You will be financially responsible for lost or damaged gear due to misuse or neglect.

EMF ID and Lab COVID Policy

As of the Fall 2020 semester, all students are required to have both an EMF ID and a sticker certifying that they have completed an additional COVID Policy test in order to use Production Lab facilities or rent equipment. **Students must pass a virtual exam prior to gaining checkout privileges.** Both the EMF ID Test and the COVID Policy test are housed on the EMF Production Labs Blackboard page. This video instructs students on how to enroll in the EMF Production Lab Blackboard, and how to complete the test: https://youtu.be/7AiYjdEA2NU

Final Film Project Parameters:
As with any filmmaking endeavor, there are finite resources available to you (time, money, equipment, crew, etc.) and will result in an unsuccessful production to stretch beyond the extent of your resources. **Final films are to be kept within the time range of *5-8 minutes* and scripts within *5-7 pages* in length.** The instructor has the right to prevent a film from going into production that is deemed not ready or feasible. Scripts that exceed these page limits risk being disqualified from consideration during pitch day. Final films that exceed these runtime limits risk grade penalties. Any film longer than 10 minutes (including credits) risks not being screened at the end of semester screening. All films must include subtitles to meet ADA compliance.

Filming on Campus:
Filming on campus is heavily discouraged as part of your education is finding the appropriate location that will service your story. If you aim to film on campus this must be approved in advance by your professor and the appropriate pre-production and paperwork must be followed.

Pitch Day and Pitching Your Script:
Pitch Day is an incredibly important day that is mandatory. This is the day when final project teams are formed, crew roles assigned, and scripts green-lit for production. Those seeking to pitch their script must first attend one or more office hour meetings with the instructor to discuss and workshop their story idea, and then must submit a full draft of the script to Blackboard prior to Pitch Day. Submitted scripts must be entirely original and demonstrate proficiency as defined by standards set forth in the screenwriting classes at EMF. Scripts must also run 5 to 7-pages, be properly formatted and free of grammatical and spelling errors. **Those not submitting scripts will pitch on their desired crew roles as well as a desired backup role (Cinematographer, Assistant Director/Producer, and Sound/Post Supervisor, Art Director).** Students must consider more than one crew role because not all students will get to serve in their first-choice role. In the event of an absence during pitch day, students must submit a video pitch to be screened in front of the class.

Attendance Policy:
Due to extenuating circumstances with COVID, I will not take formal attendance this semester. You are however expected to show up on time to F2F portions of class if you choose to participate with the equipment. You are also expected to show up for your group if you are making your film with a group. Failure to carry your load of group projects will penalize your grade.

Late Assignments Policy:
Assignments are due **before** the start of class on the due date specified. Late assignments will affect your grade in the following ways:

- Projects will drop a letter grade for every 2 days they are submitted late.
- Late projects will not be accepted after one week unless you have spoken to Prof. Burchick in advance. Scheduling issues and equipment reservation failures will not be accepted as an excuse for late work.

Assignments will not be accepted more than one week late and will receive a 0% grade. ***Final projects and the reflective report will not be accepted past the due date.***

Policy on Cell phones, Laptops and Food & Drink:
Turn your cellphone on silent during class time unless photographing an equipment demo/set up. Food and drinks should be kept to a minimum in the classroom and are not allowed in the Media Labs or near the equipment. Failure to follow these simple rules will negatively affect your grade.

Statement on Title IX:
Towson University is committed to ensuring a safe, productive learning environment on our campus that does not tolerate sexual misconduct, including harassment, stalking, sexual assault, sexual exploitation, or intimate partner violence. This also applies to student behavior both on set and during off-campus interactions. There are resources available if you or someone you know needs assistance. You may speak to a member of university administration, faculty, or staff, but keep in mind that they have an obligation to report the incident to the Title IX Coordinator. Know that the information will be kept private to the greatest extent possible. If you want to speak to someone who is permitted to keep your disclosure confidential, please seek assistance from the TU Counseling Center 410-704-2512 to schedule an appointment. Your instructor is always available to talk to or seek advice from.

Special Needs and Disabilities:
Any student with the need for accommodation based on the impact of a documented disability should coordinate with the Disability Resources and Services Center to provide the instructor with an accommodation letter within the first two weeks of the semester.

Civility Statement:
All EMF students, staff, and faculty must remain committed to collegial and academic citizenship demonstrating high standards of humane, ethical, professional, and civil behavior in all interactions. In order to achieve these ideals, everyone is expected to exhibit and practice civil behaviors that exemplify:
(1) respecting faculty, staff, fellow students, guests, and all university property, policies, rules and regulations; (2) taking responsibility for one's choices and actions; (3) delivering correspondence, whether verbal, nonverbal, written, or electronic, with respectful language and in complete sentences; and (4) accepting consequences of one's inappropriate choices and actions. The use of offensive, threatening, harassing or abusive language, writing, or behavior will not be tolerated and can lead to academic dismissal. Further information about civility is found in the university code of conduct.

University-Wide Policies and Academic Honesty:
All Towson University students are expected to adhere to the university-wide policies on classroom behavior, academic integrity, and student conduct. *See Towson University's Policies and Procedures and Student Code of Conduct: http://www.towson.edu/studentaffairs/policies/*. In this class we will abide by all rules and regulations defined by Towson University concerning academic honesty. You are expected to do all of your own work. No work done for another class may be turned in for this class. Per department policy, any student caught cheating or plagiarizing on any assignment or exam will either fail the assignment, fail the course, or face university disciplinary action which could result in expulsion from the university, depending on the severity.

Policy on Departmental Exhibition and Promotion of Student Work:
Occasionally, EMF will encounter opportunities from film festivals, organizations, competitions, and other entities seeking student films to showcase or consider for awards. The EMF Department reserves

the right to use your work from this class for these purposes, as well as for promotional materials, including on the department website, promotional DVDs, press releases and other screenings. You may choose to opt out of consideration for these opportunities by notifying the instructor in writing. You will receive advanced notice of any situation in which your work is chosen for these purposes. You will always maintain copyright ownership over your work.

Self Care:
During some weeks I will post an optional self-care activity via the blackboard "Self Care." Some weeks may offer extra credit for participation. The intention is to create a positive community in our virtual classroom space and to offer you time to focus inward in how you care for your mental and physical well-being.

Grading Breakdown:
Final grades will be calculated using the following percentage breakdown:
A (93-100%), A- (90-92%), B+ (87-89%), B (83-86%), B- (80-82%), C+ (77-79%), C (70-76%),
D (60-69%, doesn't count toward major), F (59% & below, doesn't count toward major).
**No INCOMPLETES given except for exceptional, medical circumstances. Consult with the instructor.*

Final Grades: (See ***class rubric*** for further details on how final grades are calculated.)

- **A grades** require excellent coursework, exemplary work ethic, active participation, enthusiasm in course materials, strong creative effort and revision, and a mastery of course concepts.
- **B grades** require evidence of significant effort, improving creativity, frequent participation, a solid understanding of concepts and techniques, and above-average coursework.
- **C grades** require meeting basic course requirements, a satisfactory understanding of the course materials, following instructions, and average coursework.

- **D grades** means the student struggled to meet the basic course requirements, demonstrated poor work ethic, incomplete understanding of course concepts, and/or the coursework had serious flaws.
- **F grades** means the student failed to complete the basic requirements of the course.

SEMESTER SCHEDULE:
Please note that this schedule is subject to change at the instructor's discretion.

Week 1: January 26, 2021: Meeting on Zoom
Asynchronous Lecture: Introductions. Screen short films. What makes for a successful short film? Principles of dramatic storytelling. Go over Project 1.
ASSIGN: Project 1: "Reimagine The Scene"

- individual script breakdowns due next week
- Group pre production is due week 3
- Final completed project is due week 5

Discussion Board will be a place for your crew call if you want to complete Project 1 with a group of 3-4 people.
Screening (By Week 3): Please review the C-100 training video: https://youtu.be/dQFgpkuNr0c

Week 2: February 2, 2021: Everyone Meet on Zoom

Asynchronous Lecture: Lenses and story. Coverage: the anatomy of a scene. Pre-pro essentials: Storyboard, shot list, line script, floor plan.
Demo: Watch the lecture and camera build & menu system tutorial video at home. READING Assigned:
1.) Blain Brown, *Cinematography: Theory and Practice,* "Language of the Lens" 2.) Linda Cowgill, *Writing Short Films* excerpt 1
DUE: Script breakdowns for Project 1: "Shoot The Scene"
QUIZ 1: Please complete the quiz on lectures 1 & 2 via blackboard. It is due by the start of class next week. The quiz is not timed but once you begin it, you must complete it in one sitting. It will be a mix of short answer and multiple choice.

Week 3: February 09, 2021: Group A in TV studio with equipment. Group B (asynch) watches the lecture and audio & lighting tutorial video at home.
Asynchronous Lecture: Exposure theory. Sync-sound techniques. Slating and set protocol. Setting exposure and focus pulling exercises.
READINGS Assigned:

1. Michael Rabiger, *Directing: Film Techniques and Aesthetics*, "Coverage & the Shooting Script"
2. Peter Rea & David Irving, *Producing and Directing the Short Film and Video*, "Sound"

DUE: Pre-Pro Docs for "Shoot the scene" Project: Storyboards, Shot List, Floor Plan
COVID tests are due via the Production Labs Blackboard BEFORE you rent ANY equipment.

Week 4: February 16, 2021: Group B in the TV studio with equipment. Group A (asynch) watches the lecture and reviews tutorial video at home
Asynchronous Lecture: Lighting equipment demonstrations.
READING Assigned:

1. Blain Brown, *Motion Picture and Video Lighting,* "Fundamentals of Lighting"
2. "10 Things You Must Know About Light"

DUE: Filming and editing your projects.

Week 5: February 23, 2021: Everyone online synchronous: Screen Project 1, group discussion and critique. Asynchronous Lecture: How to give a successful pitch.
READING Assigned:

1. Canon C100 Camera Manual
2. Michael Rabiger, *Directing: Film Techniques and Aesthetics*, "On Set Production"

DUE: Project #1: "Shoot the scene" – Screening and critique
QUIZ 2: Please complete the quiz on lectures 3 & 4 via blackboard. It is due by the start of class next week. The quiz is not timed but once you begin it, you must complete it in one sitting. It will be a mix of short answer and multiple choice.

*****SUNDAY 2/28, 5:00PM – DUE: Those seeking to pitch a script to direct for the final project must submit <u>a full draft of the script</u> to the class Blackboard "Discussion Board" titled "Final Project Scripts for Pitch Day."*****

Week 6: March 2, 2021: Everyone online synchronous. Pitches and Voting Form final project teams. Pre-production workflow and crew responsibilities. **READING Assigned:**
1. **Howard Suber, *Letters to Young Filmmakers* excerpt**

DUE: Final Film Pitches

Week 7: March 9, 2021: Everyone Online Synchronous. Table Reads with Prof. Marc May!
Schedule film shoots.
DUE: Script Draft #1 (Writer/Director) – Table reading for feedback and critique with Prof. Marc May! DUE: Mood Board (DP) Round Table
READING Assigned:
Watch: https://www.youtube.com/watch?v=PpDxFqFICHg&feature=emb_logo

Read:
- **https://www.studiobinder.com/blog/indie-short-film-casting-pointers/#3-3-auditions https://www.studiobinder.com/blog/what-does-a-line-producer-do/**

Week 8: March 16, 2021: Happy Spring Break

Week 9: March 23, 2021: Everyone Online Synchronous. DP and Sound Presentations DUE: Aesthetics Presentations (Presented by D.P. & Sound Crew) via Google Drive
DUE: Casting Call (Director & Producer), Location Scout Reports (All Crew) via Google Drive "How they did it" Film 2 Q & A- COVID planning Breakout Rooms.
Production Labs COVID Planning
Synchronous lecture: Casting and directing actors. Pre-production documents: breakdowns, budgets, stripboards, and call sheets.
DUE: Screenplay Draft #2 (Writer/Director)

Week 10: March 30, 2021: Face-to-Face Camera Tests on Campus
Now that you have your script and your visual plan, it is time to put it into action! You will have the entire class period to break out the equipment and develop your on set culture and style for production.

Week 11: April 6, 2021: Zoom Small Group Meetings
Check blackboard announcements for your group's schedule zoom time.
DUE: Pre-Production Folder Uploaded to Google Drive Containing Breakdown Sheets and Stripboard Schedule (Producer/AD), Shooting Script and Storyboards (Writer/Director), Shot List and Floor Plans (DP), Sound Map (Sound)

- Groups 1 & 2 checks out the kit and begins principal photography. **(3 weeks for pre production/6 for post)**
- Groups 3-6 continue pre-production.

Week 12: April 13, 2021: Zoom Small Group Meetings
Check blackboard announcements for your group's schedule zoom time.

- Groups 3 & 4 checks out kit and begins principal photography. **(4 weeks for pre production/5 for post)**
- Groups 5 & 6 continues pre-production. **DUE: Progress updates.**
- Groups 1 & 2 begins post-production. **DUE: Bring in dailies to screen. Debrief on film shoot.**

Week 13: April 20, 2021: Zoom Small Group Meetings
Check blackboard announcements for your group's schedule zoom time.
- Groups 5 & 6 checks out kit and begins principal photography. **(5 weeks for pre production/4 for post)**

- Groups 1 & 2 continue post-production. **DUE: Assembly with synced production sound.**
- Groups 3 & 4 begins post-production. **DUE: Bring in dailies to screen. Debrief on film shoot.**

Week 14: April 27, 2021: Zoom Small Group Rough Cut Screenings
Check blackboard announcements for your group's schedule zoom time. Each group will present what they have completed at this point to me for feedback and conversation.
Asynchronous Lecture: Sound design aesthetics and techniques and Color correction techniques and post-production workflow.
DUE: Sound Design Catalogue (Sound) & Color Correction Looks (DP & Editor) via Google Drive Folder.

Week 15: May 4, 2021: Rough Cut Day! Everyone Online Synchronous
Each group will bring what they have completed of their edit and present it to the class for critique. This is an excellent time to ask what is not working! Ask questions and be opened for constructive critique! You are not expected to have your film polished and finished.
DUE: Rough Cuts exported and uploaded to youtube or vimeo with a password for feedback and critique.
DUE: Posters and Film festival Plans are due (Google Drive)

Mandatory: At least 1 member from each group needs to represent at Virtual Rough Cut Day Friday, May 7th at 3PM. TBD Zoom Room. Upload your film to youtube or vimeo with a password.

Week 16: May 11, 2021: Today is a final day to ask final questions and make last minute tweaks. Color and sound design should be completed. Final preparations for screening.
DUE: Fine Cuts are due!
DUE: Personal Reflection Essay (email to jburchick@towson.edu).

ASSIGNMENTS:
(More details will be provided for each assignment in class as handouts or in lecture notes)

Project 1: "Reimagine The Scene" Due Week 5: Students are provided with a pre-written scene. Use your imagination and consider what is the best approach for bringing the text to life and getting the coverage you need! This scene must be adapted into a cinematic piece that will be shot and edited into a 1-3 minute short narrative film (1 page=1 minute of running time roughly.)
Tell the story mostly through visuals, mise-en-scene and editing. Think about setups and payoffs and brainstorm how to visually build suspense and surprise your viewer. Focus on creating memorable moments, especially with the beginning and ending images of the film.
Next, students will get with their groups to bring all of their individual lined scripts together and collaborate on ONE master approach for shooting the scene. Find actors to perform. These need not be professional actors, but the better they are, the better the film will be. Develop a pre-production

visual design for the film: printed storyboards, a shot list, floor plan, and master line script will all be submitted week 3 as noted above. The more work done in pre-production preparation, the more successful and smooth your film production will be.
Finally, film the script, using one of the Film 2 kits or, as a backup, the DSLR kit (or your own gear if working from home.) Share in the workload as a team: take turns operating camera, lighting,

recording production sound and directing the actors. It should take roughly 4- 6 hours on set, assuming you carefully planned out your shoot. Edit the film into a finished film ready to screen in front of the class.

****COVID Planning**:**

- If you have elected NOT to come to any F2F classes you are allowed to do this project alone with your own equipment at home. Monologue scenes will be provided.
- You are allowed to act in your own project for this first assignment. It might also be a good idea to cast roommates, family members or people that are in the same household so they can be physically closer than 6'. If you are casting professional actors or those not in the same household they will need to be 6' apart at all times when on set and on camera.

(2) Quizzes: There will be two quizzes administered assessing the student's retention of key concepts and techniques taught in class and addressed in the readings. The quiz will consist of multiple choice, fill in the blank, and short answer questions. The quiz will be completed via blackboard. Additional quizzes may be added at the professor's discretion.

Final Project. Rolling deadlines. Finished Film DUE: Tuesday, May 11th.
Teams of 3-4 students will collaborate on a week-long film shoot using an extensive production package of equipment to create one 5 to 8-minute original narrative short film that must be ready to screen by the End of Semester Screening (May 15th). Students will assume key production roles: Director, Cinematographer, Sound Recordist/Post-Production Supervisor, or Producer/Assistant Director. Pre-production, production and post-production responsibilities will be shared equally among all team members with crew roles being assigned specific tasks with deadlines leading up to production and again in post-production. Tasks include, but are not limited to:

- Script Drafts #1, #2, and Final Shooting Script
- Mood Board
- Casting and Crew Calls
- Location Scout Report
- Aesthetics Presentation
- Breakdown Sheets, Shooting Schedule, Budget
- Storyboards, Shotlist, and Floor Plans
- Sound Map and Sound Catalogue
- Post Production Requirements: Rough Cut, Fine Cut, Sound Design & Mix, Color Correction, Titles

Final Project Reflection (DUE 5/11): emailed to jburchick@towson.edu: A one-page, typed reflection will be required, tasking the student with reflecting upon their work on the final project, what they learned, and assessing the work of their team members.

Final Project Marketing and Distribution. Rolling Deadlines.
Collaborate with your team to plan for the life of your film. The work does not end when the Director says "That's a Wrap!" It is important in the pre-production stage to consider who your audience will be and where you want your film to go! It is important to share the workload and spread out tasks evenly between crew members.
- Poster: To be completed by the Producer, Editor or DP
- Due: 5/04/21
- Create a catchy poster to promote your film! This should include basic crew credits and where people can learn more about your film (website, social media, etc) Size: 1 for print (so you can put it up at film festivals)
- 1 for Instagram/facebook posts

- **Festival plan: To be completed by the Producer or Director (whoever does the poster should not have to do the festival plan)**

- Due: 5/04/21

- Develop a plan for your budget. Set aside funds from the very beginning that will go to film festivals. Create a spreadsheet and post via Google Drive with at least 5 festivals that fit your film or your crew demographic. Include the cost and submission dates for each festival. Then create your own Filmfreeway.com account and prepare your page.
- Submit your Filmfreeway link via Google Drive on your budget sheet.

Final Film Shoot Checkout Dates: Each Crew will have one full week with the equipment
Option #1: Checkout Tuesday, 4/6, morning. Return Monday, 4/12, morning. Option #2: Checkout Tuesday, 4/13, morning. Return Monday, 4/19, morning. Option #3: Checkout Tuesday, 4/20, morning. Return Monday, 4/26, morning. **EMF 367 Grading Rubric:**

INDIVIDUAL WORK: (35% of final grade):
Participation (attitude, in-class work, collaboration, communication, etc.) – 10% Project 1 Individual Script Breakdown- 5%
(2) Quizzes – 10 %

Final Film Reflection Essay (1) – 10%

PROJECT 1 Group Work (15% of final grade):
Pre-Production – 5% Completed Film - 5%

FINAL FILM: (40% final grade):

Pre-Production – 10%

- Student completes the assigned tasks and responsibilities related to their crew role.
- Pre-production planning shows marked progress each week with each member contributing work.
- Screenplay evolves over several drafts, showing improvement and openness to feedback.
- Script meets the standards for excellence as taught in the screenwriting classes at EMF.
- Final script runs 5 to 7 pages in length, is properly formatted and free of spelling and grammatical errors.
- Appropriate and believable actors are cast for each role.
- Interesting and appropriate locations are scouted and secured. Off campus locations are utilized.
- Aesthetics presentation shows a strong aesthetic and conceptual design to the film.
- Storyboards, Shot List, Floor Plans and Sound List demonstrate effective aesthetic planning and vision.
- Shooting Schedule, Budget and Breakdowns demonstrate effective logistical planning and preparation.

Production – 1 Student is on set and successfully performs their crew role, making significant contributions.

- Film shoot successfully executes the pre-production plan.
- Equipment is well cared for, kept in good condition, check out and return on time as scheduled.
- Film shoot runs 2 full shooting days (8-12 hour days), at a minimum.
- Sync-sound captured for all scenes. Dialogue is clearly recorded. Room tone for each scene.

Proper slate.

- Scenes are well-lit using professional light kits or natural light where appropriate. Exposure is accurate.
- Camera composition, framing, movement, and focus are all well executed.
- Coverage is adequately captured to facilitate editing options. Performances of the actors are effective.
- Filming demonstrates a careful aesthetic design with a variety of shots & camera movements.
- Footage and sound files are backed up onto each group members' hard drives.

Post-Production – 10%

- Student is attending group edit sessions, reviewing edits, providing notes and contributing work.
- Edit evolves over several drafts, showing improvement and openness to feedback.
- Production sound is synced to footage one week after wrapping principal photography.
- Rough Cut and Fine Cut deadlines are met with improvements made to each version of the film.
- Color Correction – basic correction completed in order to correct and balance color and exposure.
- Color correction presentation is submitted on time and has a clear plan for execution.
- Sound Catalogue – the recording and collecting of essential sound design elements is completed.
- Post-production files are backed up onto each group members' hard drives.

Final Film – 10%

- Final Film is finished and ready for the End of Semester screening by the deadline.
- Finished film is picture-locked and runs 5 to 7 minutes.
- Final sound design is effective and cinematic, without dro
- Sound Design – Creative use of SFX, foley, ambience, music. Problematic set audio is replaced in post.
- Sound Mix – Audio levels are balanced, well-mixed. No sync problems or gaps in sound or incorrect levels.
- Color Correction is consistent and helps improve image clarity and exposure with color, contrast and hue.
- No use of copyrighted material without written permission / appropriate licenses.
- File delivery matches the technical specs requested by the instructor.

Distribution Package: (10% of Final Grade)

- Poster is consistent with the overall aesthetic of the film.
- Poster is submitted for both print and digital sizes.
- Film festival plans are submitted via Google Drive and organized clearly on a spreadsheet.

- At least 5 film festivals have been identified with their submission date and costs noted.
- Filmfreeway account is created and profile is completed.

Grand Total: 100

Appendix I: Informed Consent Form

CONSENT FORM

TITLE OF STUDY: Photogrammetry: Measuring Student Success Using Interactive 3D Digital Learning Objects

STUDY PURPOSE/SUMMARY:

The purpose of the research is to investigate if interactive digital 3D models help students become as proficient in handling a specialized tool or object in a remote or hybrid learning environment when compared to a face-to-face, hands-on classroom.

PROCEDURES

Students at Towson University in the Film 2 production course take a 27-question proficiency quiz on the learning management system Blackboard to determine if they are eligible to borrow University-owned camera equipment. In the Spring 2021 semester, two sections (approximately 40 students) will be offered in a hybrid model and one section will be offered completely online. The Spring 2021 students will be given access to a digital 3D model of the camera and asked to make a video describing the different functions of the camera before taking the quiz in February. After students take the quiz, class grade averages for the Spring 2021 classes that have access to the 3D model will be compared to the grade averages from Spring 2020 and Fall 2019 classes that did not have access to a digital 3D model. No in-person interviews will be held and no direct contact with students will be made.

CONFIDENTIALITY

Quiz grades will be provided by the professor to the researcher as whole class averages and individual names and grades will remain completely anonymous to the researcher.

Data will be maintained in a password protected laptop and all data will be destroyed at the end of the study with all identifiers removed.

POTENTIAL BENEFITS

There are no direct benefits for you participating in this research. However, you may be able to contribute to the understanding of 3D digital models as a tool in distance learning and to provide a learning asset to your current and future students.

POTENTIAL RISKS AND DISCOMFORTS

No known risks.

VOLUNTARY PARTICIPATION

Your participation is completely voluntary. You can withdraw from the study at any time. You do not have to answer any questions that you do not want to answer.

WHO TO CONTACT WITH QUESTIONS?

If you should have any questions about the research, please feel free to call or email the Principal Investigator, David Merino (david.merino@ubalt.edu), or Faculty Sponsor, Kathryn Summers, (ksummers@ubalt.edu).

If you have questions regarding your rights as a research subject, or if problems arise which you do not feel you can discuss with the Investigator, please contact the UB Institutional Review Board at: irb@ubalt.edu 410-837-4057

SUMMARY

I understand the information that was presented and that:

I am 18 and older and my participation is voluntary.

Refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

I may discontinue participation at any time without penalty or loss of benefits.

I hereby give my consent to participate in the research by using the 3D model with my classes and providing average scores on quizzes to the researcher for comparison.

Name (please print): Jena Burchick

Signature: Jena Burchick Date: 4/29/2021

Researcher Name (please print) David Merino

Signature David Merino Date: 01/28/21