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Case Study on the Use of Digital Media Assignments in an Undergraduate Engineering Course

Dr. Lindsay Ivey Burden, University of Virginia

Lindsay Ivey Burden is an Associate Professor in the Academic General Faculty at the University of Virginia's Department of Civil and Environmental Engineering. In addition to her teaching duties, Lindsay is also the Director of the Center for Transportation Studies which houses several workforce development training programs specific to transportation professionals. Lindsay's interests include undergraduate teaching in the area of Civil Engineering and workforce development.

A CASE STUDY ON THE USE OF DIGITAL MEDIA ASSIGNMENTS IN UNDERGRADUATE ENGINEERING COURSES

Abstract

The incorporation of video-based digital media projects into engineering education provides a means to enhance student engagement, practice student communication skills, and reinforce conceptual understanding of complex topics. This paper explores the integration of video-based assignments—such as explanatory YouTube-style content—as a pedagogical tool in an undergraduate civil engineering course. Through these assignments, students were encouraged to distill complex technical concepts into accessible video formats. As a result, these projects fostered deeper learning of the focus topics, improved the students' ability to communicate engineering principles to diverse audiences, and offered the opportunity to discuss responsible AI use, reputable scientific sources, and proper citation of references in the classroom.

This paper presents a case study from 3 different civil engineering courses in which a digital media project was implemented. The study includes 1.) the pedagogical logistics involved in using video creation as a learning tool, 2.) examples of rubrics that can be used to grade these types of assignments, and 3.) how these rubrics could also be used to assess ABET outcomes. The findings from this study support the conclusion that digital media integration in the classroom not only enhances technical communication but also promotes active learning and retention of core concepts.

Introduction

Studies have shown that active learning in an engineering classroom helps students engage directly with core concepts through problem-solving, discussion, and hands-on activities moving beyond passive listening [1]. The approach encourages both deeper conceptual understanding and improves overall retention of concepts [2] [3]. Some methods of active learning also promote collaboration and communication, which are skills essential for modern engineering practice [4].

In examining various ways to incorporate active learning in engineering classrooms, creating a YouTube-style video about a technical topic is a powerful form of active learning because it requires students to *construct* knowledge rather than simply consume it. This construction requires students to research a topic, distill complex ideas into an accessible narrative, clearly explain the concept on video, and anticipate audience questions. Each of these tasks help to deepen overall understanding. The process of scripting and visualizing technical content encourages students to reorganize information in meaningful ways, strengthening long-term retention. Additionally, demonstrating (or performing) ideas on camera builds communication skills, while the creative format makes learning more engaging and personally relevant. The creation of digital media in the classroom also seems to keep student particularly engaged given current data on digital media consumption among college-age adults. According to recent findings, 93% of U.S. adults aged 18–29 use YouTube [5], making it the most widely used social media platform among this demographic. The popularity of the platform and its wide use among

students suggests that video-based assignments align with students' existing media habits, thus increasing the likelihood of participation in and enthusiasm for the assignment.

Given these benefits and potential popularity of a digital media project, the author assigned such an assignment in 3 different civil engineering courses at a 4-year public institution over a time period of 4 years. Through the implementation of this assignment, the author intended to evaluate the following research questions:

1.) What are the logistics of assigning this type of assignment and is this type of assignment feasible in an engineering classroom?
2.) Can an assignment of this nature offer a means to practice effective communication in engineering?
3.) Beyond communication, what are the benefits of a digital media assignment?

The following paper aims to answer these questions through detailing the pedagogical logistics involved in using video creation as a learning tool, giving examples of rubrics that were used to evaluate student performance, discussing how these rubrics could also be used to assess ABET outcomes, and discussing the overall value found in assigning digital media projects in engineering classrooms.

Methodology

Data was collected on digital media assignments by assigning a digital media project in 3 different Civil Engineering classes over a 4-year period. **Table *1*** details the courses and class sizes included in the study:

Table 1- Courses Involved in Study

Year	Course	Class Size
2022	Geotechnical Engineering Core Course	36
2022	Environmental Engineering Elective Course	30
2023	Geotechnical Engineering Core Course	44
2023	Geotechnical Engineering Elective Course	21
2024	Geotechnical Engineering Core Course	42
2024	Environmental Engineering Elective Course	29
2025	Geotechnical Engineering Core Course	48
2025	Environmental Engineering Elective Course	13

Initial assignment instructions were tailored toward each class topic, but the general instructions for the assignment were the same in each instance. Additionally, the rubric and peer evaluation used to evaluate the assignment were the same for each class as well. Data sources used in the evaluation of the research questions included rubric scores, peer evaluation scores, and student comments from anonymous semester course evaluations.

Assignment Logistics

Students were introduced to the assignment on the beginning of the second day of classes with an FAQ sheet that include a description of the digital media project itself (**Figure *1***), common questions they might have in completing it, an explanation of how it will be graded, what the project deadlines were, and a copy of the project rubric.

Q: What is the digital media project?
A: Project Description - The Digital Media Project (DMP) gives you the opportunity to explore a topic related to this class in a manner that interests you and then to produce a 3-5 minute movie or photo story that creatively teaches a concept, condition, or civil engineering application. The completed project must effectively illustrate the chosen topic and should be self-explanatory to a knowledgeable layperson; (i.e. the "point" of the project should be clear without explanation). Exceptional projects will be both technically sound and aesthetically pleasing.

Figure 1- DMP Project Description

The instructor went through the FAQ sheet with the class and the class was also shown an example project from a previous year. Students were asked to form a small group of no more than 5 students and create a 3-5 minute video on topic of their choice related to that class. As an example, when the Digital Media Project (DMP) was assigned in the Geotechnical Engineering Core Course, the DMP would be required to relate to a soil or geotechnical topic, for a the Environmental Engineering Elective class it would need to be a sustainability topic, etc. Students are also given a series of deadlines to help them plan their DMP and so that the instructor could advise them along the way. Deadlines for all 3 courses in which the DMP was assigned included (**Table *2***):

Table 2- DMP Deadlines

Date	**Deadline**
One month into the class	Choose your group and topic
2 weeks later	Submit a story board for project topic
3 weeks before project due date	Students were required to come to the instructor's office and show them a 60 second preview of their project.
2-3 weeks after 60 second demo	Project is due to instructor

Rules for DMP

Assigning a DMP provided the instructor the opportunity to have a conversation with the students about plagiarism, fair-use rights of media, and AI. For the DMP projects assigned by the author, the following rules were used with respect to these subjects:

- Projects will be submitted using YouTube, therefore students must follow the copyright rules set forth by YouTube.
- Students should try to use openly licensed digital media, music, etc, or they should create their own media. If students want to use interviews, photos, media, etc. that are not open access, then they should make sure to cite the original source of that media clearly in their video
- All videos should be G-rated.

- Students are allowed to use AI in the creation of their videos. However, students should use AI as a tool and critically think about appropriate uses for the technology. AI should NOT be used to impersonate an actual person.

Final Due Date

Two different final due dates were assigned in the 3 classes used in this study. For the 2 elective classes, the due date was the last day of class, for the Geotechnical Core Course, it was 2/3 of the way through the semester. Both due dates had advantages and disadvantages and are discussed below:

End of Class- For the 2 classes which the due date was assigned as the last day of class, the project was used a retrospective of all the things students learned within the class / final project. It was a fun thing that all the students could look forward to, and students watched all of the projects together on the final classroom day.

2/3 of the way through the semester – The end of October was chosen as the due date for the Geotechnical Core Course. The reasoning for this was that the end of the semester is always extremely busy and students have a lot of other assignments for other classes due at this time as well. This particular core course also had a final associated with it and multiple homework assignments, which made the end of the semester already extremely busy within the course itself. Instead, the watch day (due day) was set as the class day closest to Halloween. At that point in the semester students were well into the class material, but still far from the stress of the end of the semester. It was also nice to make a fun holiday like Halloween the watch day. To "celebrate" the instructor used the whole class period to watch videos and brought in candy and snacks.

During the watch day, students were also tasked with filling out an online peer evaluation survey for each video watched. It is through this online survey that peer evaluation scores were collected. Additionally, after the watch day class, students were also asked to fill out another survey to evaluate the dynamics of their groups so that the instructor could evaluate teamwork within each group.

Grading

75% of the project grade was based upon the final project content. The other 25% is based on submitting the planning parts of the project on time (See Table 3):

Table 3 - Project Grade Breakdown

Points	Criteria
5	*Original Project Idea* – Submit via e-mail and initial idea for your soil topic, the digital media (movie or digital story), and a list of your team members.
10	*Draft Storyboard* – Turn in a draft storyboard, a description of each group member's project responsibilities, and a tentative meeting schedule that will ensure you complete the project on time. Work that is on time, well developed, thoughtful, organized, and neat will receive full credit.
10	*Instructor Meeting & 60-second Demo* - Meet with the instructor and complete a 60-second demo of your project at your scheduled meeting time. Work that is on time, well developed, thoughtful, organized, and neat will receive full credit.

75	*Final Project & Self/Peer Critiques* – Present your final project during class and complete a self- and peer- critique. Work that is on time, well-developed, thoughtful, organized, neat, and of high quality will receive full credit. Technical (40 points) • Is the topic clearly defined and fully explored? • Is the topic illustrated in the project accurate and at an appropriate level and depth? • Does the project teach something important, interesting, or valuable? Creativity & Aesthetics (35 points) • Does the project capture the essence of the topic in an interesting or novel way? • Does the pacing support the project or detract from it? • Is the project visually interesting and of high quality?

Submit Group and Topic – 5 points

Students were allowed to self-select groups. This method was chosen over using something like CATME because this project was completed entirely outside of class. The main goal was to encourage creativity and excitement about the project and it was assumed these would be greatest when students were allowed to work with their friends. However, in each of the courses where a DMP was assigned, there were students who did not end up in a group or there were instances of multiple small groups (2-3 students). In these cases, the instructor was required to do some match-making so that each group had 4-6 members.

Groups were encouraged to pick a topic of interest to them with inspiration coming from observations of the world, the news / current events, or history. Groups were also encouraged to choose a topic that was unexpected, out of the ordinary, and beyond something learned in the class, but it was required that the topic chosen had to relate to what was presented in class in some way. Instructors also reserved the right to veto any boring, uninspired, or ho-hum project ideas, and all topic ideas (or changes) needed to be approved by the instructor.

Storyboard – 10 points

Storyboards were an outline of the project videos. In the storyboard, students were required to outline each scene in their video, planning the length, visuals, and music that they would show during each part of their project.

When turning in the storyboard, it was also required that the students report out the responsibilities of each group member within the project and a present a rough schedule of their goals for completing the video.

This initial stage of planning was helpful for the instructor in guiding students toward a more successful DMP. For instance, the instructor could point students in the direction of something they were missing, make sure that they were explaining the science correctly, or explaining enough of the science. This was also a time when the instructor could point students toward specific references or examples that might help to enhance their projects.

60 second demo – 10 points.

The 60-second demo was part of the project prep for two reasons: 1.) It forced the students to at least start working on their project well before the actual due date. By doing this, students get a feeling of how long it takes to film / record a small section, as well as edit that footage into a watchable format. 2.) The instructor watches the demos with the students and in doing this is able to give them feedback before they turn in their final project. Typically, the feedback given involved either making sure that students include enough visuals to describe what they are covering and keep the viewer interested, or ways that they need to enhance the project (e.g. updating blurry pictures, making sure that viewers can hear the content)
The remaining 75% (75 points) of the project grade was based on the content submitted. Projects were graded by the instructor and also peer graded by the class as a whole then averaged. The following rubric was used (**Figure *2***) by both the instructor and the peer graders:

SCIENCE (40 points)

- **Focus (15 points):** *Is the geotechnical topic clearly defined and fully explored?*
  The topic and focus of the project should be obvious throughout. Transitions between ideas should be clear and easy to follow. At the end, the viewer should be able to recap the main ideas of the project.

- **Accuracy & Depth (15 points):** *Is the engineering illustrated in the project accurate and at an appropriate level and depth?*
  The science explored should be clear and understandable to a knowledgeable layperson, regardless of their engineering background. All complex terms and engineering jargon should be clearly explained. Equations and complex materials should be presented in a clear and concise manner and projected long enough for the viewer to understand their significance.

- **"Teachability" (10 points):** *Does the project teach something important, interesting, or valuable?*
  Viewers should learn something new about your topic from the project. They should be able to walk away and "teach" someone something about the topic presented.

CREATIVITY & AESTHETICS (35 points)

- **Creativity (8 points):** *Does the project capture the essence of the topic in an interesting or novel way?*
  Regardless (or in spite of) the complexity of the science, the project should creatively explore the focus of the project. This can be achieved through creative backstories, unconventional filming and editing techniques, sound manipulation, framing, etc.

- **Communication/Story (14 points):** *Is the "story" of the project clear and supported by the images, audio, narration, etc? Does the project communicate the topic chosen well?*
  The project should have a clear beginning, middle, and end. The images, audio, narration, editing, storyline, etc. should aid to communicate the story rather than detract from it.

- **Pacing (5 points):** *Does the pacing support the project or detract from it?*
  The rhythm of the words, images, video, and sounds should shape and reinforce the project story. The pace should be quick enough to keep the viewer's attention (short scenes with little white space/noise) but slow enough that the pace does not feel disorienting.

- **Visual Quality (8 points):** *Is the project visually interesting and of high quality?*
  All video, images, audio and graphics should be of high quality. The project should not have large chunks of grainy video, blurry images, dark scenes, inaudible dialogue, overly loud music, etc.

Figure 2- Example of DMP Rubric for Geotechnical Core Engineering Class

Groupwork Peer Evaluation

Groups received an overall project score based on the 25 points for turning in the planning portions of the assignment and the 75 points from the content of the project itself. However, to encourage equal work amongst the group members, each student was also asked to fill out one last group peer evaluation that was turned in directly to the instructor. This evaluation asked questions about how well the group worked together, who was responsible for what, and if the student was pleased with their final product. Students were also asked in this evaluation to distribute 100 points amongst themselves and each of their group members based on that group member's contribution to the project. Groupwork scores were then calculated by adding together the responses of each individual group member. This score was used to adjust the assignment score each student received based on that student's effort. Table 4 shows the adjustments based on the score received:

Table 4- Groupwork Score Adjustments

Groupwork Score	Points Adjusted from Group Score
>110	+2
101-109	+1
90-100	0
80-89	-3
70-79	-10

60-69	-20
<59	-30

Benefits of Assigning Digital Media Projects

The benefits of assigning a digital media project during the study period were numerous and included student excitement for the project, the ability to discuss ethics of AI and media use in the classroom, practicing communication skills, and the ability to use the assignment evaluations to evaluate ABET outcomes. Each benefit is subsequently discussed:

Student Excitement

The students were generally excited by this type of assignment, particularly because it was a novel assignment type in an engineering classroom. It was also a great way for students to research something of interest to them that related to the classroom topics. Moreover, students were allowed and encouraged to be creative in their presentations, and the results were enjoyable to watch. For instance, in the Geotechnical course, examples of submitted projects included a beauty vlog that explained how and why soils can be used in cosmetics / the beauty industry, a video podcast about landslide failures, and a fake infomercial about the mechanics and uses of organic soils.

Course evaluations confirmed that most students enjoyed participating in the assignment with the majority of comments specifically about the DMP assignment saying something along the lines of "I really enjoyed the Digital Media Project". Comments that showed a negative reaction to the assignment commented on the added stress from completing the assignment, and how they didn't feel it added to the class. However, it should be noted that all of the negative comments were associated with the courses in which the assignment was due at the end of the semester as opposed to the mid-semester.

Ability to Discuss Ethics of AI and Fair Media Use

This assignment was also beneficial in that it gave the instructor the opportunity to discuss the ethics of AI use and the fair use of media created by others. Since these are purely educational videos and not uploaded to YouTube for monetary gain, copyright rules are slightly more lax, but it still allows for the discussion about how to properly cite sources of information and images. In addition, this assignment requires ethical discussions of why it would be inappropriate to use copyrighted music, and the applicable and ethical use of AI. With more students using AI in both their daily lives and in their educational pursuits [6], the AI discussion is particularly important because it forces students to critically think about when it is appropriate to use, when it is not, and why. This issue will also be relevant when they enter engineering practice, so it is important that we as educators help students to critically think about AI use.

Practicing Engineering Communication

Perhaps one of the biggest benefits to a project of this nature is that it provides an opportunity for students to practice communication skills (Research question #2). Researchers have long agreed that communication is an essential skill for engineers within the workforce. [7] [8] As engineering challenges require examination under lenses beyond the technical, the ability to convey technical information clearly and persuasively is fundamental to the successful translation of engineering knowledge into impactful real-world solutions. Engineers, and by

extension, engineering students must be able to clearly articulate complex ideas, methods, and results to varied audiences, including peers, interdisciplinary collaborators, policymakers, and the public, to ensure that technical work is correctly understood and appropriately applied.

Within the DMP assignment, students are required to practice several essential communication skills that directly apply to skills that engineers use in the workforce daily:

1.) Creation of Graphics - Students create visual graphics or animations to illustrate complex topics and processes. They also are sometimes required to decide how to display collected data. The practice of these skills translates directly into the effective communication required by engineers when creating presentations to communicate their work to other engineers or the public.
2.) Creating a Narrative – The DMP Assignment also requires the students to develop a script for their video. These scripts are used to not only describe their topics but also to create a narrative that communicates to the viewer what is important about that topic. In this communication skill, not only are the words used in their script important but also how students use them to craft a compelling argument or to promote an idea is equally important. Moreover, engineers being able to persuasively and clearly present content is a skill that engineers use during meetings, for proposals, and in technical briefings.
3.) Distilling Down Information – Like many engineering presentations, the DMP assignment has a time limit. Therefore, it is necessary for the students to decide what information is required to clearly explain their given topic vs what information might be interesting but ultimately unnecessary.
4.) Audience Awareness - Creating an effective DMP requires students to consider the background and expectations of the intended audience. Students are specifically instructed that it should be self-explanatory to a “knowledgeable layperson”. This practices the essential professional skill of communicating within interdisciplinary teams or to external stakeholders.

These 4 essential communication skills were graded within the rubric to assess communication skills and map out in ***Table 5*** as follows:

Table 5- Mapping Communication Skills with Rubric Categories

Skill	**Rubric Category**
Creation of Graphics	Visual Quality
Creating a Narrative	Communication/Story & Pacing
Distilling Down Information	Focus
Audience Awareness	Teachability

For the courses analyzed within this study rubric scores for the 4 skills evaluated were relatively high, which shows good achievement of the communication objectives evaluated. Note that scores reported in ***Table 6*** were normalized out of 100 points.

Table 6- Rubric Communication Scores

Rubric Category	Skill	Mean	Standard Deviation	Variance
Visual Quality	Creation of Graphics	90.15	6.72	45.18
Communication/Story	Creating a Narrative	92.06	4.50	20.25
Pacing	Creating a Narrative	92.18	3.57	12.78
Focus	Distilling Down Information	95.31	5.31	28.21
Teachability	Audience Awareness	93.74	5.50	30.28

Reviewing the data, scores for each skill were relatively high which shows that students achieved the objectives set forth and evaluated by the rubric. What is also interesting about this data is that the highest scores were for the category of focus meaning that the students did a good job of defining the topic and explaining it in a "clear and easy to follow" manner. Lowest scores were achieved in the category of creation of graphics, a category which also had the largest standard deviation and variance. This score is unsurprising because the most common comments in the student evaluations of those projects that score the lowest in the visual quality category were that additional graphics were needed, or that the concepts could have been better illustrated by showing examples.

Using DMP Rubrics in ABET Evaluations

Lastly, a benefit of implementing a project like this in a core engineering course is that it can be used in multiple ways to evaluate specific ABET outcomes. Specifically, the DMP project assigned in a core civil engineering course during the study period was used to evaluate the following ABET outcomes:

- ABET outcome (3): an ability to communicate effectively with a range of audiences
- ABET outcome (5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- ABET outcome (7): an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

For communication (outcome 3) achievement was considered if the student rubric score for communication/story (Figure 3) was over 80%. This threshold corresponded to having at a minimum level of good achievement (see Table 7). Likewise, the knowledge outcome (outcome 7) achievement was assessed using the overall Science score from the DMP rubric (Figure 3) with achievement evaluated as the percentage of students with a score greater than 80%.

Table 7- ABET Achievement Levels

Level of Overall Achievement	Percentage of Available Points Earned
Excellent achievement	100 to 90

Good achievement	89-80
Demonstrated Basic Competence	79-70
Poor achievement	69-66

For Teamwork (outcome 5) achievement was evaluated using the groupwork peer evaluation in which students are asked specifically about how their group worked together and were given a score. Depending on student scores, group grades for DMPs were adjusted (up or down) based on the peer evaluation score. For ABET, the achievement of outcome 5 was evaluated as the % of students who's individual DMP score changed a maximum of 5% from the group score after peer evaluation adjustments were applied. Students whose scores changed less than 5% would have had either good or excellent achievement scores for the groupwork score. Students whose scores changed more than 5% would have had either demonstrated basic competence or had poor achievement.

For the course year analyzed for ABET during the study period, 100% achievement for outcome 3 (communication) and 7 (acquiring new knowledge) was documented using the DMP rubric data. For outcome 5, 98% achievement was documented.

Future Work

One aspect in which this student could have been enhance would be to better capture student perceptions of the Digital Media Project (DMP), particularly regarding its impact on their communication abilities and overall learning experience. While course evaluations and rubric scores provided valuable initial insights, in future work, a targeted survey will be developed and administered specifically for the DMP to gather more nuanced and comprehensive data. This survey will aim to assess students' perceived gains in technical communication, confidence in explaining engineering concepts to non-experts, understanding of ethical media and AI use, and overall attitudes toward creative, project-based learning. Incorporating this structured feedback will also allow for a deeper understanding of student experiences and enable opportunity for refinements to the assignment design and grading rubrics. Ultimately, these improved assessment methods will support stronger evaluation of communication-related outcomes while contributing to broader research on the role of digital media in engineering education.

Conclusion

This case study showed that integration of video-based digital media projects into undergraduate engineering courses offered a meaningful and practical way to enhance student learning, communication skills, and engagement. The active learning that took place when students were asked to translate complex engineering concepts into concise, accessible formats, deepened their conceptual understanding and ability to communicate complex topics in a meaningful way. Students also practiced essential professional competencies through the way the assignment was structured: the storyboards and 60-second demos encouraged early planning, peer evaluation

promoted accountability within teams, and iterative feedback supported students in managing a multi-stage project.

Beyond improving communication and reinforcing technical content, the digital media project created valuable opportunities to discuss ethical considerations related to AI, copyright, and responsible sourcing of information. These conversations are increasingly important as students navigate emerging technologies and digital tools that shape modern engineering practice.

Finally, the adaptability of the project rubric allowed instructors to meaningfully assess ABET outcomes related to communication, teamwork, and the acquisition of new knowledge. Strong achievement across all outcomes demonstrates that digital media assignments can serve as both an engaging pedagogical approach and a robust assessment tool. Overall, this work highlights the multifaceted benefits of incorporating digital media projects into engineering education and provides a replicable model for instructors seeking to cultivate active learning, creativity, and professional skill development within their classrooms.

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