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Using Prelab Video Demonstrations to Improve Construction Management Undergraduate Students' Preparedness for Materials Courses

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Abstract

Laboratory experiences are a core component of Construction Management undergraduate programs, yet traditional in-person demonstrations are becoming increasingly time-intensive and resource-constrained as class sizes grow. This study investigates the effectiveness of implementing prelab video demonstrations in two core materials courses: Construction Materials and Soils and Foundations taken by Construction Management students at Illinois State University. Instructional videos detailing step-by-step experimental procedures, equipment operation, and safety measures were produced and integrated into the curriculum across four semesters, involving a total of 227 student participants. The impact of this intervention was evaluated through quantitative surveys and qualitative feedback to assess student preparedness, engagement, and perceived learning outcomes.

The results indicate overwhelmingly positive student perceptions, with a significant majority of participants, approximately 85% in Construction Materials and over 90% in Soils and Foundations, reporting that the prelab videos aided them in effectively completing laboratory activities and increased their confidence with the equipment. Furthermore, survey results indicate that students perceived the video demonstrations as superior to traditional laboratory manuals or PowerPoint slides alone for understanding complex procedures. These findings suggest that integrating prelab video demonstrations is a scalable and highly effective pedagogical strategy for improving laboratory efficiency and student readiness in construction management education.

Introduction

Laboratory experiences are a core component of Construction Management undergraduate programs, particularly in materials-related courses such as Construction Materials and Soils and Foundations. These courses provide students with opportunities to explore the properties, behavior, and practical applications of construction materials through hands-on experiments, including concrete testing, soil compaction, and other standard laboratory procedures. Such experiential learning not only reinforces theoretical concepts but also develops critical technical, observational, and problem-solving skills that are essential for professional practice in construction.

Traditionally, laboratory instruction relies heavily on in-person demonstrations to clarify procedures, ensure safety, and guide students through complex experimental techniques. However, as class sizes grow and laboratory resources remain limited, these demonstrations become increasingly time- and materials-intensive. Repetitive or lengthy steps, such as mixing concrete during slump tests, can further reduce student engagement and attention, potentially limiting learning outcomes. To address these challenges, prelab video demonstrations have emerged as a promising pedagogical tool in STEM education. Prelab videos allow students to visually and audibly review experimental procedures before entering the laboratory, enabling them to become familiar with the materials, equipment, and step-by-step processes. Prior research in engineering and science education suggests that prelab videos can enhance student

preparedness, reduce cognitive load, and improve laboratory efficiency, while also supporting hybrid and online learning formats [1 – 14].

This study investigates the use of prelab video demonstrations in Construction Management materials courses, namely, Construction Materials and Soils and Foundations, to evaluate their impact on students' perceived preparedness, engagement, and academic performance. Specifically, this study addresses the following research questions:
RQ #1: To what extent do prelab video demonstrations improve students' perceived preparedness and confidence prior to performing laboratory activities?
RQ #2: Do students perceive prelab video demonstrations as more effective than traditional preparatory materials (e.g., lab manuals or PowerPoint slides)?
RQ #3: Do students support broader implementation of prelab video demonstrations in other construction management courses?

By integrating prelab videos, this research seeks to identify strategies for improving laboratory learning experiences in resource-constrained settings while promoting active and self-directed learning among undergraduate students.

Literature review

Literature review shows that several studies have explored enhancing the student preparedness and reducing the cognitive burden of in lab activities using pre laboratory resources. In an early study, Wulfsberg et al. [1] discussed the use of digitally animated videos to demonstrate experiments in the classroom when it is not feasible for students to perform the experiments themselves. The authors filmed and produced two discovery-based experiment videos, "Some Reactions of Cations" and "Periodicity in the Activity Series of Metals," which allow instructors to incorporate discovery-based learning into their curriculum in a safe and time-efficient manner. The videos provided students the opportunity to observe the experiments and engage in the discovery process without the logistical challenges of conducting the experiments directly. This approach enabled instructor to incorporate more discovery-based learning activities into their teaching while addressing safety and time constraints.

Hanson [2] described the use of video technology to enhance the learning experience in a geotechnical engineering laboratory course. By incorporating video demonstrations, the authors aimed to cater to different learning styles and improve student understanding of complex laboratory procedures. The video content covered key aspects of the experiments, allowing students to review the material at their own pace and revisit specific steps as needed. The authors reported positive feedback from students and improved performance on laboratory assignments, suggesting that the integration of video technology can be an effective strategy for extending learning opportunities in engineering education.

Jolley et al. [3] presented a synergistic prelab training program designed to enhance the preparedness of undergraduate students for analytical chemistry practical classes. The program utilized visual and critical thinking approaches, incorporating video demonstrations with audio explanations and compulsory prelab e-quizzes to guide students through the material. The study found that students who engaged with the prelab program reported a positive effect on their

learning and entered the laboratory with high levels of perceived preparedness. While there was no significant improvement in academic performance, the program's impact on student attitudes and engagement was significant, suggesting that it can be an effective tool in improving student preparedness for analytical chemistry practical classes.

Schmidt-McCormack et al. [4] explored the design and implementation of instructional videos for upper-division undergraduate laboratory courses. The researchers developed sets of videos for two upper-division laboratory courses, Analytical Measurements and Physical Measurements, which included prelab lectures, experimental videos, and data analysis videos. These videos were designed to address the challenges associated with rotation-style laboratory courses, particularly the temporal disconnect between prelab lectures and experiment completion, as well as the need for more student autonomy. The videos were assessed using a mixed-methods approach, which included video-recorded laboratory observations, student one-on-one interviews, and the meaningful learning in the laboratory inventory survey. The findings indicated that video-based resources can help alleviate some of these challenges, enhancing student preparation and autonomy in upper-division laboratory courses.

Moozeh et al. [5] developed web-based multimedia prelab modules which were aimed at increasing motivation and reducing cognitive load. Each prelab module consisted of a few short, animated videos followed by a couple of questions, which students have to respond before moving to the next video. The content of the videos included real-world relevance and the utility value of the experiments to help motivate deeper learning when performing the laboratories. In a follow-up publication, Moozeh et al. [6] reported positive views along with half of the students reporting increased motivation as a result of understanding the utility value of the knowledge they acquired. Thus, it was concluded that prelab modules based on this framework may alleviate some of the educational challenges in undergraduate laboratories.

Steiff et al. [7] examined the effectiveness of using online prelab videos to improve student performance in the general chemistry laboratory. The results showed that students who viewed the online prelab videos performed significantly better on the laboratory assessment compared to students who did not view the videos. The videos helped students better understand the laboratory procedures and concepts, leading to improved preparedness and efficiency in completing the experiments. The authors concluded that online prelab videos have significant potential for enhancing student learning and performance in the general chemistry laboratory.

Aronne et al. [8] examined the effects of video-based prelab instruction on college students' attitudes and achievement in science labs. The researchers found that students who received video-based prelab instruction showed more positive attitudes towards the lab activities and performed better on lab assessments compared to students who received traditional prelab instruction. The results suggested that incorporating video-based prelab materials can enhance the learning experience and outcomes for college science students in the digital era.

Lewandowski et al. [9] discussed the implementation and evaluation of custom interactive prelab video activities in a large introductory physics lab course. The authors developed these activities to help students prepare for lab sessions, improve their understanding of lab concepts, and reduce the time spent on administrative tasks during lab. The study found that the interactive prelab

videos were effective in improving student performance on lab quizzes and reducing the time spent on administrative tasks during lab sessions.

Krishnankuttyrema and Shilov [10] studied impact of prelab videos on improving students' learning outcomes in engineering technology courses. Specifically, prelab videos demonstrating equipment and software use were implemented in freshman electronics and sophomore solid modeling labs. Post-implementation evaluations showed improved performance, 20–30% faster lab completion, narrower grade distributions, 10–15% more material covered, and 40–50% less equipment mishandling. These results suggested that prelab videos enhance preparedness, efficiency, and safety, and support transitioning engineering technology courses to hybrid or online formats.

Kirkmann [11] applied the same perspectives to soil mechanics laboratories, exploring whether the online teaching tools used during remote learning were helpful for in-person learning experiences. Students appreciated the time spent in the lab more as they understood concepts better through pre-recorded lab videos, online access to data, and virtual demonstrations. This study noted the importance of online resources in combination with in-person instruction for clarity of safety and procedural understanding, describing the teaching as more efficient, even if the teaching was not experimental in nature.

Tan [12] used another approach through WeBWorK-based prelab problem sets, where the students solved individually assigned numerical problems related to upcoming experiments. This approach increased engagement, minimized answer sharing, and surfaced misconceptions before students walked into the lab. Although not video-based, the findings highlighted the importance of preparatory scaffolding to improve laboratory learning outcomes.

Yoo et al. [13] aimed to enhance the quality of electrical engineering online labs by implementing various learning strategies. This initiative focused on collaborative online lab experiences, where students engaged in open-ended design learning experiences using a lab-in-a-box approach. This research-based project aimed to increase student engagement, active learning, and problem-solving skills through these interactive online labs. Students who learned in the open-ended laboratory approach in an online setting showed generally better learning outcomes than their counterparts in the traditional laboratory setting especially with advanced concepts. Despite the generally positive learning outcomes, student perceptions regarding their laboratory settings were mixed. Some students preferred the traditional laboratory setting with step-by-step approaches whereas some students preferred the open-ended laboratory approach which involved problem solving group discussions, presentations, and idea sharing through various communication tools. The data through survey and interview revealed that student preferences were not necessarily tied to their learning outcomes. Some students stated that they learned better by solving problems together in the open-ended laboratory setting and also built learning communities by working together.

Additionally, Rathnayaka et al. [14] examined the use of prelab online resources in thermodynamics education to manage cognitive load. Data from students and instructors indicated that well-designed prelab materials improved student preparedness, engagement,

confidence, and understanding, with outcomes influenced by the quality of resources and the level of student engagement.

Although prelab videos have been shown to improve preparedness, engagement, and efficiency in STEM and engineering laboratories, their use in Construction Management materials courses remains underexplored. Hands-on labs in these courses, such as concrete and soil testing, are time- and resource-intensive, and traditional demonstrations can limit student focus and learning. Investigating prelab video demonstrations in this context is therefore important to enhance students' perceived preparedness, reduce procedural challenges, and support more efficient and effective laboratory learning. This study aims to evaluate the impact of prelab videos on student readiness, engagement, and performance in Construction Management materials courses.

Course Structure

Construction Materials Course

The Construction Materials course (course #TEC 292) is typically one of the core courses that all construction management students take in the second or third year at Illinois State University. One section of this course consists of not more than 24 students. This course allows students to gain knowledge about the fundamentals of different construction materials, the strength of materials, and standardized testing procedures. This course is offered every fall and spring semester. The course meets twice per week for 110 minutes for 15 weeks. It is a combined lecture and laboratory-based which consisted of the following four lab activities: Lab #1 (Density of metal, plastic and wood), Lab #2 (Compression testing of wood and concrete), Lab #3 (Flexure testing of concrete and wood beams), and Lab #4 (Tensile testing of concrete, metals, plastic and wood specimens). The lecture topics covered in this course were introduction to material testing, masonry, Portland cement concrete, asphalt materials, alternative concrete, steel, and wood.

Soils and Foundations Course

The Soils and Foundations course (course #TEC 224) is also one of the core courses that all construction management students take in the second or third year at Illinois State University. One section of this course consists of not more than 24 students. This course allows students to gain knowledge about soil properties, classification, compaction, improvement, investigation, and testing with applications to foundation design and construction. This course is offered every fall and spring semester. The course meets twice per week for 110 minutes for 15 weeks. This is a combined lecture and laboratory-based which consisted of following seven lab activities: Lab #1 (Soil moisture content), Lab #2 (Sieve analysis of soil sample), Lab #3 (Hydrometer test of soil), Lab #4 (Liquid and plastic limit test), Lab #5 (Proctor test of soil), Lab #6 (Sand cone test), and Lab #7 (Unconfined compressive strength test of soil). The lecture topics covered in this course were physical character of soil & natural soil deposits, soil index properties & soil classification, soil compaction, soil improvement, water in soil & dewatering, soil exploration & interpretation of soil reports, and foundation construction.

The required tasks in both courses are quizzes, laboratory reports, and class exercises. Quizzes and class exercises were given frequently in the class to help measure comprehension of the lecture and reading material. Most of the quizzes required students to read the assigned material or watch the posted visual content and then complete the tasks. All these quizzes were taken online through Canvas, the university's current learning management system. For lab activities in both courses, the entire class was divided into four groups consisting of five to six students. Laboratory activities were assessed through reports related to lab exercises. Additionally, out-of-lab activities were provided to help students use class time more effectively and to give additional background information which is related to lab report questions. At the end of each lab activity, students were required to prepare and submit an individual laboratory report electronically via Canvas within the assigned due date.

Prelab Video Demonstrations

The prelab video demonstrations were recorded in advance using a laptop computer and a wireless headphone-mounted microphone to provide clear visual instruction and narration. Prior to each laboratory session, the corresponding video was shown on a television screen connected to a computer in the lecture room, allowing all students to view the material together before heading to the laboratory. The videos presented step-by-step demonstrations of laboratory procedures, equipment operation, test data collection methods, and safety considerations relevant to each experiment.

For the Construction Materials course, a total of five videos were prepared. Specifically, one video was prepared for Lab #1 (density testing) and four videos for Lab #2 (one video for the slump cone test and concrete specimen preparation, one video for wood specimen preparation, one video for concrete specimen extraction, and one video for concrete and wood and specimen testing). Video duration varies by topic, ranging from a minimum of 3 minutes for simpler tests to a maximum of 16 minutes for more complex procedures, ensuring concise yet comprehensive preparation for the hands-on laboratory activities. Some of the steps, which were repetitive and time-consuming (e.g., mixing concrete), were edited to play at a faster speed to save time.

For the Soils and Foundations course, a total of seven videos were prepared: one video for each lab activity (Lab #1 through #7). Video duration varies by topic, ranging from a minimum of 5 to 6 minutes for simpler tests, such as soil moisture content (Lab #1) and sieve analysis (Lab #2), to a maximum of 17 to 19 minutes for more complex tests such as hydrometer (Lab #3) and liquid and plastic limit (Lab #4) testing. Figures 1 (a) and (b) show students watching the Proctor test (Lab #5) video in the lecture room and conducting testing in the laboratory, respectively, in the Soils and Foundations course.

(a) (b)

Figure 1: Soils and Foundations course students (a) watching the Proctor test (Lab #5) video, and (b) conducting test in the laboratory

All videos were also posted on the Canvas page of the course in advance so that students can get an opportunity to watch them in advance before coming to the class or watch them again later, if needed. However, no video was prepared for Lab #3 (flexure testing), but the specimen preparation and testing procedure was explained to students in the lecture classroom through PowerPoint presentation slides. Similarly, for Lab #4 (tensile testing), no video or PowerPoint presentation slides were shown in advance to students. Lab #4 testing procedure was explained to students verbally in the laboratory by the instructor on the day of testing.

Student Assessment Data Collection

The population of this study included undergraduate students enrolled in two fall (fall 2024, fall 2025) and two spring (spring 2024, spring 2025) semesters of Construction Materials and Soils and Foundations courses. Specifically, the number of students enrolled in Construction Materials course who responded to the survey was 32 (spring 2024), 22 (fall 2024), 35 (spring 2025), and 21 (fall 2025). The number of students enrolled in the Soils and Foundations course who responded to the survey was 26 (spring 2024), 20 (fall 2024), 43 (spring 2025), and 28 (fall 2025). Therefore, the total number of subjects for this study was 110 for the Construction Materials course and 117 for the Soils and Foundations course. The course sections with more than 24 students were offered in multiple sections. For collecting student perspective on prelab video demonstration, a questionnaire was developed, and approval was taken from Institutional Review Board (IRB) before distributing to students. Specifically, questionnaire included following questions:

Q-1 I watched the lab demonstration videos prior coming to the class
Q-2 I watched the lab demonstration videos in the class
Q-3 I felt that lab demonstration videos aided me in effectively completing the current lab
Q-4 I learnt and retained more information about the lab procedures by watching the lab demonstration videos
Q-5 I was more comfortable performing in the lab after watching the associated lab demonstration videos
Q-6 After watching videos, I still needed to read lab manual directions as a supplement

Q-7 The lab demonstration videos were unnecessary
Q-8 This lab demonstration video technology should be implemented in other courses
Q-9 Laboratory work helped me in understanding the related lecture theory
Q-10 I was able to understand about the lab procedure through lab demonstration videos better than lab manual directions

As discussed earlier, in the Construction Materials course, for one of the laboratories (Lab #3), no video was shown about testing and preparation of concrete and wood beams in the class, but it was discussed using PowerPoint slides. Similarly, in Lab #4, no video or PowerPoint was shown in the class about tensile testing of concrete, metals, plastics and wood. Therefore, two additional questions were included only in the Construction Materials course survey questionnaire.

Q-11 Only PowerPoint slides (no videos) were enough in understanding and effectively completing the lab activities
Q-12 No PowerPoint slides and no videos are needed in understanding and effectively completing the lab activities

Each question was rated on a scale of 1 to 5, 1 representing strong disagreement, 3 representing neutral or not sure response, and 5 representing strong agreement. All the students were asked to complete the survey at the end of the course. The collected data were analyzed to evaluate perceptions of students about prelab video demonstrations. The purpose of the survey questionnaire was to find out whether the students were able to take advantage of prelab video demonstrations and whether each group member contributed to the labs in the best possible way or not. Additionally, the following three separate questions were given to get written comments and feedback from students:
Q 1 Which year are you in?
Q 2 What did you like most about the lab demonstration videos?
Q 3 How can the lab demonstration videos be improved? Any other comments?

Results, Findings, and Discussion

In this paper, the survey results for each course were analyzed individually, providing a better understanding of students' learning improvement in each setting.

Survey Results on the Construction Materials Course

As discussed earlier, a survey questionnaire was given to the students in the last week of the semester. The responses of 110 subjects in the questionnaire are presented in Table 1. Also, for better understanding, responses were converted into percentages and presented in Table 1. Overall, the results indicate strong student agreement regarding the effectiveness and value of the videos. A large majority of respondents agreed or strongly agreed that the videos aided them in effectively completing the laboratories (Q-3), improved learning and retention of lab procedures (Q-4), and increased comfort while performing laboratory activities (Q-5), with agreement levels exceeding 75%. Most students also reported watching the videos in class (Q-2), whereas fewer students viewed them prior to class (Q-1), reflecting the instructional implementation approach. Importantly, students largely disagreed with the statement that the videos were unnecessary (Q-

7), while showing strong support for extending this technology to other courses (Q-8). Responses further suggest that laboratory activities complemented lecture content (Q-9) and that students understood lab procedures better through videos than through lab manuals alone (Q-10). In the Construction Materials course, responses to the additional questions revealed that students generally did not feel PowerPoint-only instruction (Q-11) or the absence of both videos and slides (Q-12) was sufficient, reinforcing the perceived instructional benefit of prelab video demonstrations compared to traditional or minimal preparatory methods. Furthermore, responses to the additional questions highlighted that students generally found PowerPoint-only instruction (Q-11) or the complete absence of visual aids (Q-12) to be insufficient for understanding the experiments (see Table 1).

Table 1: A Summary of Students' Responses to Survey Questionnaire in Construction Materials Course

Question # and description	**# of subjects with rating of 1 or 2 Disagree***	**# of subjects with rating of 3 Neutral***	**# of subjects with rating of 4 or 5 Agree***	**Total**
1) I watched the lab demonstration videos prior coming to the class	72 (65.5%)	19 (17.3%)	19 (17.3%)	110
2) I watched the lab demonstration videos in the class	8 (7.3%)	6 (5.5%)	96 (87.3%)	110
3) I felt that lab demonstration videos aided me in effectively completing the current lab	4 (3.6%)	12 (10.9%)	94 (85.5%)	110
4) I learnt and retained more information about the lab procedures by watching the lab demonstration videos	5 (4.5%)	20 (18.2%)	85 (77.3%)	110
5) I was more comfortable performing in the lab after watching the associated lab demonstration videos	4 (3.6%)	11 (10.0%)	95 (86.4%)	110
6) After watching videos, I still need to read lab manual directions as a supplement	13 (11.8%)	31 (28.2%)	66 (60.0%)	110
7) The lab demonstration videos were unnecessary	87 (79.1%)	11 (10.0%)	12 (10.9%)	110
8) This lab demonstration video technology should be implemented in other courses	6 (5.5%)	27 (24.5%)	77 (70.0%)	110
9) Laboratory work helped me in understanding the related lecture theory	1 (0.9%)	21 (19.1%)	88 (80.0%)	110
10) I was able to understand about the lab procedure through lab demonstration videos better than lab manual directions	11 (10.0%)	27 (24.5%)	72 (65.5%)	110
11) Only PPT slides (no videos) were enough in understanding and effectively completing the lab activities	66 (60.0%)	28 (25.5%)	16 (14.5%)	110
12) No PPT slides and no videos are needed in understanding and effectively completing the lab activities	74 (67.3%)	24 (21.8%)	12 (10.9%)	110

*Percentage of number of students providing specific response is provided in the parentheses

Survey Results on the Soils and Foundations Course

The questionnaire responses of 117 subjects collected from the Soils and Foundation course are presented in Table 2. Also, Table 2 presents the survey responses for Questions 1 through 10 in percentage, illustrating students' perceptions of prelab video demonstrations. The survey responses from the 117 students in the Soils and Foundations course, detailed in Table 2, demonstrate consistently high levels of agreement regarding the videos' educational benefits. A

vast majority of students affirmed that the prelab videos enhanced their learning effectiveness, improved retention of procedures, and boosted their confidence when performing hands-on laboratory work (Q-3, Q-4, Q-5). Furthermore, students expressed a strong preference for expanding this video technology to other courses (Q-8) and largely rejected the notion that the videos were unnecessary (Q-7). The data also highlights that most students utilized the videos in class rather than viewing them beforehand (Q-1, Q-2). Overall, the trends reflect that these visual demonstrations not only clarified laboratory procedures better than traditional manuals (Q-10) but also successfully bridged the gap between experimental activities and lecture theory (Q-9).

Table 2: A Summary of Students' Responses to Survey Questionnaire in Soils and Foundations Course

Question # and description	**# of subjects with rating of 1 or 2 Disagree***	**# of subjects with rating of 3 Neutral***	**# of subjects with rating of 4 or 5 Agree***	**Total**
1) I watched the lab demonstration videos prior coming to the class	89 (76.1%)	17 (14.5%)	11 (9.4%)	117
2) I watched the lab demonstration videos in the class	3 (2.6%)	2 (1.7%)	112 (95.7%)	117
3) I felt that lab demonstration videos aided me in effectively completing the current lab	1 (0.9%)	5 (4.3%)	111 (94.9%)	117
4) I learnt and retained more information about the lab procedures by watching the lab demonstration videos	5 (4.3%)	14 (12.0%)	98 (83.8%)	117
5) I was more comfortable performing in the lab after watching the associated lab demonstration videos	2 (1.7%)	7 (6.0%)	108 (92.3%)	117
6) After watching videos, I still need to read lab manual directions as a supplement	27 (23.1%)	25 (21.4%)	65 (55.6%)	117
7) The lab demonstration videos were unnecessary	104 (88.9%)	7 (6.0%)	6 (5.1%)	117
8) This lab demonstration video technology should be implemented in other courses	10 (8.5%)	18 (15.4%)	89 (76.1%)	117
9) Laboratory work helped me in understanding the related lecture theory	3 (2.6%)	14 (12.0%)	100 (85.5%)	117
10) I was able to understand about the lab procedure through lab demonstration videos better than lab manual directions	9 (7.7%)	17 (14.5%)	91 (77.8%)	117

*Percentage of number of students providing specific response is provided in the parentheses

Open-ended Questions Responses

The responses to additional questions in the Construction Materials course showed that out of the total 110 respondents, 19 were sophomores (17.3%), 59 were juniors (53.6%), and 32 were seniors (29.0%). In the Soils and Foundations course, the responses of additional questions showed that out of the total 117 respondents, 22 were sophomores (18.8%), 65 were juniors (55.6%), and 30 were seniors (25.6%). Across both courses, students' open-ended responses demonstrated overwhelmingly positive perceptions of the lab demonstration videos, with consistent themes emerging across both material courses. Students most frequently valued clear, step-by-step visual demonstrations of real laboratory procedures, which helped clarify expectations, reduced confusion and guesswork, and increased confidence and preparedness prior to entering the lab space. Many emphasized that seeing the actual equipment, materials, numerical values, and testing processes, rather than relying solely on written lab manuals, enhanced understanding, supported diverse learning styles, and enabled laboratory sessions to

proceed more efficiently. The integration of visual and auditory explanations, along with instructor commentary highlighting key steps and common mistakes, was reported to improve retention and overall laboratory performance, particularly for complex or unfamiliar tests. Suggestions for improvement were generally modest and focused primarily on shortening videos by removing repetitive or less critical content, as well as enhancing audio and video quality through improved microphones, camera resolution, lighting, and closer or top-down viewing angles. Additional recommendations included adding captions, on-screen text, timestamps, periodic updates to reflect new equipment or practices, and limited in-class discussion for clarification. Notably, many students across both courses indicated that no improvements were necessary, describing the videos as clear, thorough, and highly effective, thereby reinforcing their instructional value in undergraduate construction-related laboratory education.

Limitations

This study has several limitations. First, the findings are based primarily on self-reported perception data, which may not fully reflect objective learning gains. Specifically, this study did not include direct objective performance comparisons (e.g., laboratory grades, time-to-completion metrics, or historical control groups). As such, conclusions are limited to student perceptions rather than measured learning gains. Second, no formal control group was implemented, limiting the ability to make causal claims regarding instructional impact. Third, the analysis did not include detailed demographic comparisons beyond academic year, which may influence learning preferences and outcomes. Finally, while survey responses were collected across multiple semesters, the study was conducted within a single institution, potentially limiting generalizability. Future research is recommended to incorporate objective performance metrics, controlled comparisons, and broader institutional samples to strengthen causal inference and external validity.

Concluding Remarks

This study investigated the effectiveness of prelab video demonstrations in enhancing undergraduate student preparedness, engagement, and performance in Construction Management materials courses, specifically Construction Materials and Soils and Foundations. Motivated by the challenges of limited resources and time-intensive traditional demonstrations, the research sought to determine if video-based instruction could improve the laboratory learning experience. The quantitative analysis of survey responses from 227 students across four semesters revealed overwhelmingly positive perceptions of the prelab video interventions.

- Enhanced Preparedness and Efficiency: A significant majority of students in both courses (approximately 85% in Construction Materials and over 90% in Soils and Foundations) agreed that the videos aided them in effectively completing laboratory activities and increased their comfort levels with the equipment.
- Superiority Over Traditional Methods: Students indicated that video demonstrations provided a better understanding of procedures compared to lab manuals alone. Furthermore, specific data from the Construction Materials course showed that students largely disagreed that PowerPoint slides alone or the absence of visual aids were sufficient for learning, highlighting the unique value of the video format.

- Strong Student Demand: There was a strong consensus among participants that this technology should be implemented in other courses, with very few students viewing the videos as unnecessary.

Qualitative feedback reinforced these findings, with students citing the clear, step-by-step visual nature of the videos as a key factor in reducing confusion and improving confidence before hands-on work. While students offered constructive suggestions for technical refinements, such as shortening video duration and improving audio quality, the feedback primarily validated the instructional approach.

In conclusion, this study demonstrates that prelab video demonstrations are a highly effective pedagogical tool for Construction Management education. By bridging the gap between theoretical lecture material and practical application, these videos not only optimize laboratory time but also support active, self-directed learning. As enrollment grows and resources remain constrained, integrating video-based demonstrations offers a scalable and efficient strategy to ensure a high-quality laboratory experience for undergraduate students. Furthermore, informal instructor observations indicated that students required fewer procedural clarifications and demonstrated improved familiarity with equipment during laboratory sessions following video implementation. However, these observations were not formally quantified. Future work may focus on refining the technical production of these resources based on student feedback to further maximize their educational impact.

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