Matching Preparation with Examination: Effectiveness of Video Assignments on Oral Examination Outcomes

Abstract

Oral examinations have been widely utilized as an alternative form of assessment to traditional written exams. While oral exams are effective as a form of evaluation, students may miss on learning opportunities that come with oral exams while studying using strategies meant for traditional written exams. In this paper, we study how homework preparation (video assignments) can play a role in impacting student performance outcomes in oral examinations. We report on results from two engineering courses conducting oral examinations and analyze the correlation between student completion of video assignments and exam outcomes. Preliminary results show a correlation in better examination scores with students that consistently completed the video assignments as a part of their preparation for the oral exam. Students that completed the video assignments were able to better articulate their thoughts and show a deeper understanding of the conceptual aspects of the course content. While unconventional, video assignments alongside oral examinations provide new insight to the teaching team and students regarding the students' depth and mastery of the material that can be important to identifying knowledge gaps and dynamically improving overall course experience and learning outcomes.

Introduction

As we continue to see a rise in distance learning [1], instructors are challenged to develop new strategies to encourage student learning and engagement despite the limited control over the physical classroom environment. To meet the emerging obstacles of distance learning, oral examinations have recently been a subject of interest to encourage and maintain academic integrity and student engagement in undergraduate classes [2,3]. As an assessment tool, oral examinations have proven to be effective [3], but there still remains the barrier for students to properly prepare for this type examination. Coupled with the distance learning environment and limited verbal communication, oral examinations may pose a challenge for students without proper intervention to alter studying strategies.

Typically, oral examinations involve an examiner (typically members of the teaching team including the instructor and instructional assistant) verbally posing questions to students. Students are tasked to answer the question as appropriate and may use the assistance of a white board to think aloud and explain their thought process [4,5]. In utilizing the "think aloud" method, students have the opportunity to demonstrate their knowledge of the topic or concept. Their ability to answer the question(s) in a complete manner is assessed using a predetermined rubric. Examiners may provide hints, delve deeper into a particular aspect, and dynamically

adjust questions to facilitate further discussion. This is in stark contrast to the traditional written examination in which students are given fixed questions on a written test in which they would read thoroughly and write their answers on paper [5]. While oral examinations have been widely adopted as an alternative form of assessment to traditional written examinations, they are not commonly implemented in large undergraduate classrooms [6]. As a result, literature surrounding best practices for appropriate learning strategy to ensure positive student examination outcomes are limited [7]. Specifically, we are interested in methods to better prepare students for the oral examination and improve student learning throughout the course.

In this paper, we study video assignments within the context of undergraduate courses utilizing oral examinations as an assessment tool. We analyze the impact of these video assignments as a learning strategy to prepare students for the oral examination. From our studies, we report our findings on how implementing video assignments can be a useful strategy for improving student examination scores and conceptual understanding in a distance learning environment.

Methods

The studies in this paper were conducted in a lower-division Statics and Dynamics engineering course of 111 with primarily sophomores, and an upper division hands-on programming course of 24 students, primarily juniors and seniors. Each course implemented video assignments to facilitate students studying for their oral examination midterm exam or quiz.

Video Assignment Format

In the lower-division Statics and Dynamics engineering course, video assignments were assigned as part of the written homework for extra credits. To receive credit, groups of 3 students would turn in a video recording of their brainstorming or group discussion session. Provided to the students are multiple guiding questions in the written homework. Each group member leads discussion for at least one different question.

The discussion starts from one question led by the question leader, the rest of the group actively provide feedback and raise questions. Once done with one question, another student will lead the discussion for the next question, until everyone in the group has the chance to lead at least one discussion. The discussions are encouraged to be centered around “guidance prompts” that were given for each problem, but not limited to it. Each written homework problem was accompanied by a set of guidance questions. These guidance questions provide the students with a checklist and hints on how to solve the problem and contain suggestions on “think aloud” techniques for better conceptual mastery of the knowledge. Students are encouraged to answer these guidance questions aloud before they start the computational process to aid in their understanding of the reasoning behind the calculation process. Homework grading was based on both answers to the

guidance prompts and problem-solving process. The students are also encouraged to thoroughly review the questions, then hold the group discussion meeting before they solve all problems in detail, so that they could validate their correct problem-solving strategy. Whenever the group gets stuck in discussion, we encourage them to review the lecture and discussion materials for reference. If after a thorough discussion, the group is still unable to arrive at the solution or is not sure, students are encouraged to go to office hours. A sample group discussion video was provided to the students. Students were encouraged to share screens to present the problem they were discussing and use the annotation tools as needed. The instructors and TA went over each submitted video, usually played at 2X speed. Grading criteria was based on the number of questions discussed and whether key talking points were addressed.

In the upper-division programming course, video assignments were assigned as a part of weekly students' homework. To complete the assignment, each student was required to turn in a 4-minute video recording. Students were given a scenario with potentially multiple solutions and must narrow down on the best practice or approach and justify their reasoning within the video. To prepare for this assignment, students must think about the solution and how to explain their thought process in a concise and succinct manner. Retakes during recording allow students to think aloud and synthesize their understanding in a coherent and well articulated manner. Students typically have the flexibility of weighing the pros and cons of a particular solution and discussing potential alternative solutions. This process inherently provides an opportunity for students to say the same concepts in different ways, priming synthesis and rationale. Students' video recordings are evaluated based on completeness and students' explanation of the concepts. The teaching team would provide a short written feedback for each submission to help students improve their answers and promote follow up questions from students.

Oral Examination Format

Both courses participating in this study were conducted in a distance learning environment. Thus, the oral examination was conducted over Zoom where examiners and the testing student were in a Zoom breakout room and students were allowed to utilize the white board, annotation function, or share screen capability to assist with visualizing their answers.

In the Statics and Dynamics course, the oral exam was conducted as part of the mid-quarter assessment (5% of the overall course grade). Each exam session was 15 minutes long in which students were provided a prompt to answer alongside a list of 3-5 guidance prompts to help facilitate students' problem-solving process. Hints were provided as needed. Each student was paired with a teaching assistant or the instructor to take the exam. Students walked through their problem-solving process by addressing the prompts and explained the reasoning behind each decision. Examiners provided follow up questions to encourage depth and facilitate discussion.

Feedback was given during the oral exam and grading was based on a predetermined rubric that assesses the completeness of their answer.

In the programming course, the oral exams were conducted as a 10-minute session in which students were given a prompt and asked to share screen over Zoom and perform live coding to address problem objectives. There were two oral exams, each worth 3% of the overall course grade. Either two teaching assistants or one instructor prompted the student. In the sessions where two teaching assistants were moderating the exam, one teaching assistant interacted and prompted the questions, and the other teaching assistant focused on observing the examination. Students were graded on a predefined rubric that assesses the correctness of their answer. The final score was calculated by either taking the instructor score or averaging the teaching assistants' score.

Results

Post oral examination, student examination scores and video assignment scores were reviewed for both courses to determine student performance. We examine two areas: (1) students' overall score for their oral examination with video assignments (2) compare data from a previous course without video assignments with a course utilizing video assignments.

Oral Examination Scores with Video Assignments

In the Statics and Dynamics course, average oral exam score is positively correlated with the number of video submissions. The average score of the oral exam of those students who submitted all video assignments is 3% higher than the average of zero video assignments. Table 1 shows the data collected in a class of 111 students.

Table 1: Undergraduate Statics and Dynamics course data.

Number of Video Assignments Submitted	Number of Students	Average Oral Exam Score (Out of 10)
0	51	8.68 ± 1.98
1	4	8.80 ± 1.92
2	6	8.86 ± 1.86
3	14	8.86 ± 1.76
4	36	8.94 ± 1.60

In the programming course, we assess students' video assignment scores leading up to each midterm. Students' video assignment scores (out of 10) were separated into three groups: Group

1: 8-10; Group 2: 6-8, and Group 3: less than 6. Figure 1 shows the relationship between the video assignments average scores and the oral exam average score for each group for midterm 1 and midterm 2.

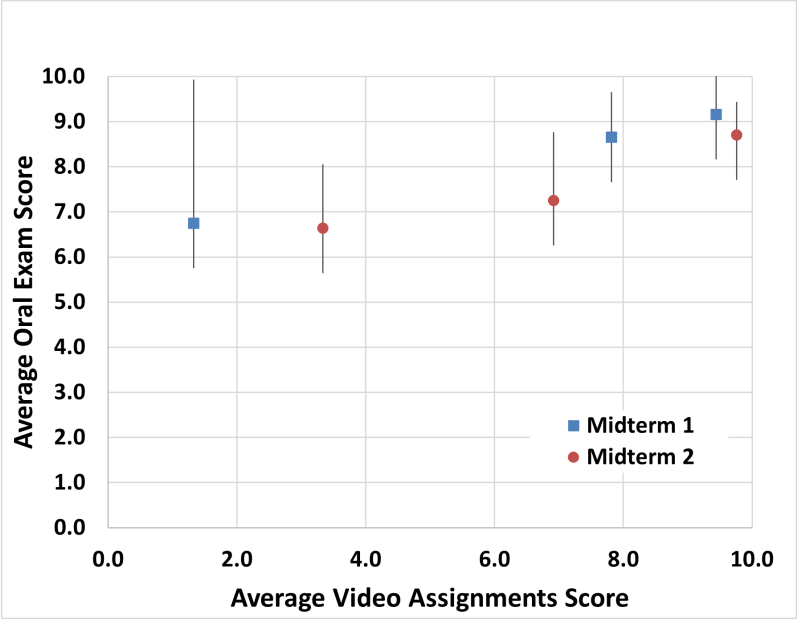

Figure 1: Undergraduate programming course data.

The results show that there is a positive correlation between the students performance on the video assignment and their performance on the midterms. Students in Group 1, who did relatively better on the video assignments, also performed better on the oral examination.

Oral Examination Score Comparison With and Without Video Assignments

Midterm scores were compared of two separate cohorts of students in the undergraduate programming course: one with video assignments, one without video assignments. In this comparison, we examine the effect of video assignments on performance of students on oral examination. In both classes, we taught the same curriculum, had the same lesson plan, and the same group of teaching assistants. The oral examinations maintained the same format, covering the same topics with comparable levels of difficulty. In the second class, we added the video assignments to each weekly homework. All oral exams were conducted over Zoom.

The average oral exam scores in the cohort without video assignments (n = 31) was 7.23±1.71 and in the cohort with video assignments (n = 24) was 8.79±1.28. This represents a 21% difference in oral exam performance between the two cohorts. The results suggest that the video assignments had a positive effect on the learning outcome of the students.

Discussion

The results from the undergraduate Statics and Dynamics course show that video assignments can facilitate peer discussion and enhance students' understanding of a subject. In particular, video assignments in the form of group discussions allow students to explain the concepts to their peers and receive feedback. The feedback probes their thought process and encourages them to rethink their reasoning and problem-solving approach. Moreover, listening to others and providing feedback requires in-depth thinking and creates an opportunity for higher order thinking and mastery of the material. This is reflected in the learning outcomes of the students in the Statics and Dynamics course and the results from their examination scores.

The results from the undergraduate programming course show a correlative trend on student understanding and score with number of video submissions. Students who consistently submitted their video assignments performed better in the course and scored higher on their oral exams. Students in Group 1 were able to demonstrate clear understanding of the subject matter and the ability to articulate and explain good coding practices through their video submissions. Many students in Group 2 and 3 were able to solve the given problems but their explanations were often generic and lacked specificity. The video submissions from these two groups often consisted of "what" elements they used to solve the problem but often lacked the "why" they chose those elements. The ability to explain the "WHY" requires a deeper understanding of the topic and shows that the problem solving approach is more intentional and not a result of trial and error. This deep understanding allows students to apply the concept more generally to different types of problems and applications. When the students were not able to clearly explain a certain step in their solution, that is a sign of a knowledge gap. This type of assignment helps the students recognize this knowledge gap themselves and fill in the missing information.

Overall, the results from both courses show promising student learning outcomes with the incorporation of video assignments as a preparatory tool for oral examinations. In the context of distance learning, the video assignments whether individual-based or group-based can foster strong verbal communication skills and provide opportunities for self-regulated learning via thinking aloud and knowledge gap identification.

Conclusion

Oral examination as an assessment modality provides valuable information different from traditional written examination for both instructors and students. However, without intervention, students exercise studying strategies that are familiar to them in preparation for a written exam such as reviewing lecture notes, written homework, and studying past quizzes. While these studying strategies continue to be helpful in their learning, the oral examination requires a level of synthesis and articulation that is not necessarily required in written examinations.

We propose the integration of video assignments into students' learning that would help facilitate student preparedness for oral examinations and provide students with opportunities to: (1) identify key knowledge gaps (conscious of the steps it takes arrive at a solution), (2) convey their thoughts aloud (verbal communication), (3) synthesize the material (depth of understanding), and (4) exercise the ability to converse and discuss the course topics. Students who completed the video assignments ultimately performed better on their examination than those who did not. As can be observed by the teaching team, the video assignments require students to be more conscious about how they arrived at a particular solution, which facilitated a deeper understanding of the concepts.

In addition to supporting students' preparedness, video assignments have demonstrated value in providing the teaching team with information on where the course can be improved and what topics students find challenging. Topics that students found more difficult to process were harder to articulate confidently, clearly, and concisely than those that were easier.

As we continue to adapt to distance learning, oral examinations and preparation will continue to be a topic of interest to help promote aspects such as academic integrity, student engagement, and learning outcomes. Video assignments are a great addition or alternative to traditional written assignments and can be a powerful tool in promoting student learning outcomes.

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