

## PAPER

# Investigating the Effect of Using Educational Videos and Recorded Lectures in Understanding the Contents of Pre-Engineering Courses

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## ABSTRACT

Some students may struggle to understand the contents of courses with intensive conceptual content and problem-solving, especially when the courses are offered online. Offering courses online may present challenges such as technological issues, time management, and a lack of interaction with instructors. This paper investigates the effect of using educational videos and recorded lectures on students enrolled learning and performance. A questionnaire survey was conducted among students in the “Engineering Economics” course at an international institution for pre-engineering students before they chose their specialization. The survey was conducted during the Fall 2021 semester (before the coronavirus pandemic) and the “Spring 2022” semester (during the pandemic). The performance of students during the “Spring 2022” semester was compared with their performance during the “Fall 2021” semester, when students relied solely on face-to-face lectures. During the “Spring 2022” semester, educational videos and recorded lectures were made available to students. Analysis results revealed that students had a positive perception towards the use of educational videos and recorded lectures. Students’ feedback regarding watching videos and recorded lectures was quite positive and enhanced their performance in the course. A generic VBA framework was developed to suggest educational videos and recorded lectures relevant to selected course topics. An initial pilot test of this tool received very positive feedback from students.

## KEYWORDS

coronavirus pandemic, educational videos, higher education, online learning, recorded lectures

## 1 INTRODUCTION

It is undeniable that the influence of information and communications technology (ICT) on our day-to-day practices has historically reached its peak, particularly with the lockdown measures of the coronavirus pandemic on our planet. In fact,

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ICT usage is no longer limited to checking grocery lists or transferring money to the other side of the globe; instead, it is now fully integrated into our educational settings. It acts as a virtual medium connecting students and their teachers, facilitating regular teaching through online platforms. The growing number of online open courses has made online-learning videos increasingly acceptable for both students and teachers [1]. Due to these technological advancements, educators are shifting towards the utilization of more effective teaching methods to enhance the learning process [2]. YouTube, for example, plays an important role in providing access to educators and students. However, finding suitable videos for educational purposes can be challenging.

The “Engineering Economics” course is one of the fundamental core courses that all pre-engineering students must take before specializing. The course provides students with basic knowledge related to the principles of engineering economics, cost components, price-demand relationship, time value of money, the concept of inflation, cost estimation techniques, cash flow analysis, evaluating a project’s performance, and comparing alternative engineering solutions. In essence, most students have difficulty understanding these essential concepts solely by attending lectures and reading the course lecture notes. This can be attributed to the ineffectiveness of the current traditional practices used for delivering course material, which focus heavily on explaining the theoretical aspects of the courses rather than emphasizing understanding the conceptual essence of the topics. Millions of students and teachers have been utilizing the digital platforms for learning, whether willingly or reluctantly. One method that has been utilized is the incorporation of online and recorded educational video lectures for learning purposes. Using videos for education is a versatile method because it allows information to be covered succinctly while providing an engaging environment for the learner.

## 2 BACKGROUND AND LITERATURE REVIEW

It is evident that the traditional face-to-face lecturing method may not be the most effective instructional approach, as it fails to assist students in fully comprehending course topics and does not inspire them to expand upon their existing knowledge [3]. This is in addition to the fact that remote education may become prominent in certain circumstances, such as the coronavirus pandemic [4]. When students enroll in any engineering program, they are expected to acquire knowledge related to estimating the cost of engineering alternatives, economically evaluating and comparing different engineering solutions considering the time value of money, preparing financial statements and business plans for engineering projects, creating cash-flow analysis reports, conducting feasibility studies, and more. Various research efforts are available in the literature to help students gain knowledge related to their engineering disciplines. Pena and Chen [5], for example, developed a 2D application to be used as a stand-alone instructional module. Many concepts in engineering economics are challenging to grasp through traditional lectures alone. Therefore, integrating educational videos as a crucial component of the course pedagogy has a positive impact on students’ learning at both the undergraduate and graduate levels [6, 7, 8, 9]. Introducing instructional videos as part of the course pedagogy will also enhance the educational process and improve the quality of students’ learning [10]. The video-based materials include the course subjects to be learned and their corresponding educational videos. By utilizing videos, students will have the flexibility to watch them at their convenience and from any location. Users can pause watching

at any time, resume later, and replay the material as needed. Video-based education is not a new learning method and is considered an important addition to students' learning processes. Many educational institutions now utilize and promote online educational videos as an important and useful delivery tool.

Video-based learning practices should be evaluated to explore their pros and cons, as well as to investigate their educational usefulness and effectiveness. Several research studies in the literature explore the effectiveness of using videos to enhance learning. The study by [11] and [12], for example, evaluated the effect of video-based learning on students' performance. In a study conducted in Ghana involving 20 students, the perception orientation was positive despite the students' dissatisfaction with the format, content, and domain of the videos [13]. A study by [14] utilized a web-based information system to enhance learning videos by incorporating various methods of interaction and communication through on-demand and live broadcasting videos. Ketsman et al. [15] examined the students' performance after incorporating problem-solving videos with quizzes into an undergraduate course. More recently, the study by [16] examined the effect of using instructional videos with embedded virtual humans for learning. The result of this study suggests that certain aspects of learner control can be beneficial when learning from instructional videos featuring embedded virtual humans. In another study by [17], a scheme for classifying instructional videos based on eight features was presented. Interaction, screen design, sequence, included components (picture, voice, and text), and content are among the important features. Ring and Brahm [18], on the other hand, developed a framework comprising twelve criteria in five different categories: video content, learner orientation, representation and design, language, and process structure, to evaluate the quality of educational videos. A very recent study by [19] investigated the impact of blended online and offline teaching environments and resources on students' learning satisfaction. Most of the studies in the literature demonstrate a relatively positive impact on students' performance when utilizing educational videos compared to not utilizing them. However, using online educational videos and recorded lectures for learning has its advantages and disadvantages. The pros and cons of using online educational videos and recorded lectures are presented in the following subsections, followed by some research efforts related to adapting recorded lectures to best fit students' educational needs.

## 2.1 Pros of using online educational videos and recorded lectures

Online lectures and educational videos have provided students with greater flexibility in their learning experience, which has been positively reflected in their academic performance [20]. Videos, such as online lectures or recorded lecture videos, can be uploaded to various educational platforms for students to watch and download. This form enables multiple students to gather virtually at the same moment, despite being in different time zones. Hence, class capacities have drastically increased compared to class sizes in traditional (face-to-face) settings, which provides an opportunity for all students to continue their studies despite long distances [21]. Similarly, through recorded videos, students can listen to their lectures repeatedly and at their own pace, anytime and anywhere. Watching recorded lectures enables students to take additional notes for studying or to refer back to clarify topics and consolidate knowledge [20, 22, 23, 24]. Students can listen effectively and digest the presented information, which enhances their concentration

during the lecture. This approach helps prevent distractions, confusion, and frustration caused by trying to take notes quickly while also understanding the lesson [23, 24, 25, 26].

The study of [24] indicated that 80% of the students perceived lecture recordings as helpful, and educational videos encouraged students to work outside of face-to-face contact hours. In another study by [13], the attitudes and perceptions of students at a university in Ghana towards the use of videos as a teaching and learning medium were assessed. The outcome of this study indicates that most participants perceived that the videos they watched enhanced their overall learning and improved their learning experience. In general, the adoption of watching videos has been positive. A study by [25] revealed that out of 395 students surveyed, 96.3% utilized the available video materials. When it comes to appropriate devices, both mobile phones and laptops have been found to be beneficial for video-based learning [27]. In a study conducted by [28], it was found that the content of video subscription streaming services was exciting and motivating for foreign language learners in Japan, demonstrating their effectiveness in providing informal learning opportunities. When comparing PowerPoint presentations, projector presentations, videos, the Internet, and standard lectures for face-to-face learning, [29] found that students enjoyed educational videos the most compared to other modalities. Therefore, the findings support the use of videos for both distance and traditional face-to-face education.

Video lectures are not restricted to being used alone; instead, in some cases, students have the option to attend a live lecture, watch a video lecture, or utilize both formats. Many studies on online video lessons and recorded lectures have concluded that utilizing these two formats throughout students' academic years is highly beneficial. Douglas et al. [30] found that dental students valued video instruction. They noted that using videos before classes allowed for better utilization of in-class time to be spent on discussions and reinforcing learning. [31] revealed that, despite the availability of recorded lectures for business students studying mathematics ( $n = 161$ ), some students preferred online courses and remained committed to attending them due to the interactive learning opportunities they provided. Furthermore, these students distrusted the videos because they were concerned that some materials might not be covered in the videos but would be in live lessons. However, students found that the video lectures were convenient and allowed them to work at their own pace, catering to both more and less able students. Additionally, although there is a certain level of convenience associated with recorded lectures, [32] suggests that they cause students to gain surface-level knowledge of the subjects taught.

Other studies support the idea of complementing traditional instruction with video lectures instead of substituting face-to-face interactions with virtual experiences. In a study by [33], 396 biopsychology students were not required to attend face-to-face lectures. Instead, they opted out of attending in-person lectures and utilized recorded lectures as an alternative. Bos et al. [33] found that the number of students who watched the video recordings was greater than the number of students who attended the face-to-face lectures in this sample. Furthermore, no difference in the final grades was observed between students who attended face-to-face lectures and those who watched recorded video lectures. Recently, 360-degree videos have been widely used for educational purposes. Due to their interconnected nature, 360-degree videos can be used in conjunction with several other technologies, such as augmented reality and virtual reality, to enhance the teaching and learning process [34]. The study by [34] suggested that educators

and students should be involved in the development process of 360-degree videos to better assess the effectiveness of such videos in education, create more student-centered environments, and achieve promising results. Herault et al. [35] developed a prototype that includes interactive, simulated 360-degree learning videos for nursing students. The purpose of this prototype is to train students to treat trauma patients.

## 2.2 Cons of using online educational videos and recorded lectures

With today's youth being familiar with the recent advances in technology and using smart devices in their everyday lives, leveraging technology for education can be advantageous in this modern world. However, some studies reported the opposite. Hajhashem et al. [23] found that students in Australia had positive responses to video integration in their courses. Students who were considered to be more visually attentive would be more inclined toward video lectures. Therefore, this learning method may be more suited to some individuals than others. In a study by [36], this idea was challenged in the context of education, questioning whether using recorded lectures is more effective than traditional in-class methods. One group of 106 law students received face-to-face lectures in the study. In contrast, the other group completed a self-paced module with video instructions. A study by [36] found that one method had no advantage over the other in this case. However, it was noticed that creating online videos takes considerable time and effort from instructors. Bahnson and Olejnikova [36] challenged the possibility that this time could be better spent on face-to-face student contact. Despite students' positive attitude towards video lectures in the context of the flipped classroom model, [26] found that students disliked the inability to ask questions and felt burdened by the videos. In another study, [13] noted additional costs to consider when using videos in teaching, such as the requirement for students to purchase a device on which the video can be watched. Regarding expenses, students in Ghana faced challenges with large videos and encountered difficulty in storing them on a suitable device [13]. Despite the cost-related issues, it is expected that the price of devices and storage will decrease as technology advances. It is well established in the literature that as technology advances, the prices of electronic devices drop and the quality of products improves. Since 2001, the prices of electronic products have been declining, and other technological inputs have been causing the production costs and the final product prices to drop by 0.5% each year [37].

## 3 ADAPTING RECORDED LECTURES TO BEST FIT STUDENTS' EDUCATIONAL NEEDS

Cilesiz [21] explored student experiences with recorded lectures. It was noted that the students went through various stages when using the recorded lectures. Cilesiz [21] described the stages using the terms 'ignorance,' 'disillusionment,' 'crisis,' and 'coping' to highlight how students transition from a lack of awareness on how to effectively use video lectures to disillusionment, where they may focus on the negative aspects, to a crisis (another challenging stage), and finally to coping, where they manage this form of learning more effectively. The study revealed that students require training and support on how to effectively utilize video lectures. It should be acknowledged that students may need time to adapt to video lectures. Although this

was not possible during the COVID-19 pandemic, it is worth considering. Previous experiences and confidence in using technology have also been linked to students' video-based learning experiences. Therefore, students must be trained to use videos for learning to maximize the impact of video-based learning experiences [27]. There is a need to prepare students for this type of learning.

Karppinen [38] warned that simply presenting information in a stimulating and interesting digital video format will not automatically lead to in-depth learning. Therefore, she cautions that video lectures must be perfectly integrated into the broader learning context to achieve the best outcomes for students. Long et al. [39] found that students preferred instructor-developed videos over other types of videos used for learning. The study provided this information because students felt engaged with the instructor and were familiar with their voice. Therefore, this made this type of video more engaging for students. Sex can also play a role, with a study [27] reporting that after surveying Indian Science, Engineering, and Business Management students, a more substantial relationship was observed in male students between the perceived usefulness and actual usage of video-based learning. However, it depended on the students, with [25] observing that students who were less proficient in mathematics spent more time watching math video resources. Hajhashem et al. [23] warned that video lectures should not be used independently but as a complement to face-to-face teaching. Although it has not been possible during the coronavirus pandemic, it is a consideration for the future. The study also indicated that videos could be used as a flexible method to engage students, but they may not be suitable for everyone. There must be a suitable support network to maximize the benefits that video lectures provide and allow both students and teachers to use this resource, particularly during unexpected crises, such as the coronavirus pandemic.

Staff must be familiar with the technology required to optimize video lectures, and lecturers should be mindful of the video's duration to prevent student boredom [23]. Research indicates that students prefer shorter, more concise videos [39], with one study [26] suggesting that students can maintain focus while watching a video for around 23 minutes. Additionally, there are various methods to edit and enhance videos. By including subtitles, recorded lectures and videos used for learning can be enhanced. Matthew [40] noted that students obtain information from other sources on the screen, such as graphs or tables, not solely from subtitles. This study also concluded that students preferred edited subtitles over verbatim subtitles. Therefore, this is another factor for instruction to consider when using recorded lectures and videos for learning in higher education. Although there is ample research on the perceptions of students and instructors towards video-based learning, to support these key stakeholders, higher education institutions must provide practical technical support and administration for staff to develop videos and utilize appropriate technology to make them effective [27].

#### 4 PROBLEM STATEMENT AND RESEARCH QUESTIONS

It has been noticed that students, in general, have difficulty understanding certain course concepts, which is evident in their performance on assignments, term projects, quizzes, and exams. Therefore, various research efforts have investigated viable solutions that could help students understand the contents of courses and their essential concepts. Utilizing educational videos (including 360-degree videos) and recorded lectures in the form of video clips were some of the techniques

that demonstrated positive outcomes. In this study, the researchers provided students with lecture recordings and links to useful YouTube educational videos by posting them on the Blackboard eLearning management system. The researchers designed possible tools to measure students' perceptions and performance, enabling them to draw conclusions regarding the effectiveness of recorded lectures and educational videos for learning purposes. This research addresses the following six questions:

1. How do students perceive the use of educational videos and recorded lectures for learning course content?
2. Is there a significant difference between male and female perceptions regarding the use of videos for learning course content?
3. Is there a significant difference in students' perceptions of using recorded lectures and educational videos to learn course content before and during the coronavirus pandemic?
4. What is the effect of using recorded lectures and educational videos on the overall performance of students?
5. What is the effect of watching educational videos after viewing their corresponding recorded lectures?
6. Can the process of suggesting educational videos and presenting recorded lectures related to a selected course topic be automated?

## 5 METHODOLOGY

The methodology of this research can be summarized as follows:

1. Conduct a questionnaire survey among students registered in the "Engineering Economics" course at an international institution during the Fall 2021 semester (before the coronavirus pandemic) and the Spring 2022 semester (during the pandemic) to gather students' perceptions regarding the use of educational videos and recorded lectures for learning course content.
2. Compare student perceptions before and during the coronavirus pandemic.
3. Investigate the effect of providing students with recorded lectures and educational videos on their overall academic performance.
4. Develop a Visual Basic for Applications (VBA) framework using Excel software to suggest educational videos and present recorded lectures related to a selected course topic.

## 6 THE QUESTIONNAIRE SURVEY

In this study, 272 students enrolled in the "Engineering Economics" course during the Fall 2021 and Spring 2022 semesters at the College of Engineering, United Arab Emirates University, were requested to participate in the questionnaire survey. Before asking students to respond to the survey, they were informed that their participation was entirely voluntary, and their consent and approval were obtained. Students were informed about the purpose and content of the survey, and they were told that their participation is optional. Students were also informed about the meaning of each question in the survey. They were assured that their responses would be anonymous and would not affect their grades or be included

in the course evaluation. It was made very clear to students that the purpose of the survey is to gather their feedback on the use of recorded lectures and educational videos, assess their usefulness in the learning process, and examine the impact of these supplementary educational resources on their academic performance. The survey was posted on Blackboard, and a two-week period was given for respondents to complete the survey. A copy of the questionnaire survey is provided in Appendix A.

This “Engineering Economics” course is a general compulsory pre-engineering course offered to all engineering students before they specialize. It may be noted that the percentage of female students was 54%, while it was 46% for male students. As this study was conducted during two semesters and in different contexts, the students’ performance was compared. The main purpose of this comparison is to examine the effect of using recorded lectures and educational videos on students’ performance before and during the coronavirus pandemic. During the coronavirus pandemic (Spring 2022 semester), lecture sessions were delivered online, and course materials were also posted on the Blackboard learning platform. These materials included lecture notes, assignments, quizzes, exams, recorded lectures, educational videos, and surveys. At the start of the Spring 2022 semester, students enrolled in the Engineering Economics course were advised that if they needed help with a specific topic, they should first rewatch the recorded lectures and then view the corresponding educational videos. During the Fall 2021 semester, lectures were delivered traditionally in face-to-face format. Lecture notes, course material, and announcements were posted on the Blackboard learning platform. The Blackboard system allows educators to monitor the progress and performance of students.

To gather feedback and assess students’ perceptions of the effectiveness of recorded lectures and educational videos as learning tools for comprehending course materials, a questionnaire survey was created and distributed to 272 male and female students. A total of 215 student responses were collected using the Blackboard’ learning platform, representing a 79% response rate. The questionnaire survey consisted of questions answered using a 5-point Likert scale ranging from very low (1) to very high (5) [41, 42]. The questionnaire survey items were reviewed for clarity, readability, and completeness to determine which questions should be included or excluded from the survey. As a result, only 20 items were included in the questionnaire. The internal consistency and reliability of the questionnaire were calculated using Cronbach’s alpha, which assesses the extent to which items in a questionnaire or survey measure the same construct or dimension. The results showed that the questionnaire has remarkably high reliability, with a Cronbach’s alpha of 0.913. A panel of experts in the fields of education, engineering, and statistics analyzed and validated the responses received from students. The Statistical Package for the Social Sciences (SPSS) was used in this study to analyze the data collected from the survey respondents. Using SPSS, two types of statistical analysis were employed: (1) descriptive statistics of central tendency for the questionnaire items, and (2) independent sample t-tests to investigate any significant differences between male and female students, as well as between results before and during the coronavirus pandemic. It is also important to understand the learning outcomes (CLOs) of the ‘Engineering Economics’ course to evaluate the performance of students before and after using recorded lectures and educational videos. The following section presents the topics covered in the Engineering Economics course, along with the CLOs and course objectives.



## 7 COURSE LEARNING OUTCOMES AND OBJECTIVES

This study was conducted for the “Engineering Economics” course, which is a mandatory course for all pre-engineering students at the United Arab Emirates University. It is a required course for students pursuing various engineering disciplines. This course covers topics related to the main principles of engineering economics, different cost components, the price-demand concept, cash flow analysis, money-time relationships, the concept of equivalency, present-economy studies, cost estimation techniques, measuring project performance, comparing alternatives, and the entrepreneurship concept and its relation to the engineering design process. The course is designed to ensure that the learning objectives and outcomes align with the general objectives and outcomes of the College of Engineering. This helps ensure that the course aligns with the college’s overall goals and equips students with the essential skills and knowledge needed to excel in their future careers. The course objectives and learning outcomes are as follows:

Course objectives:

1. Various principles of engineering economics are essential for making engineering decisions.
2. Comprehend the money-time relationships between money and time and their applications in engineering problems.
3. Draw and analyze cash flows for a single project and multiple projects.
4. Identify the techniques of cost estimation and their relationship with the design process.
5. Evaluate the economic feasibility of both a single project and multiple projects.
6. Identify a new venture and develop a business and financial plan.

Course learning outcomes:

Upon successful completion of the “Engineering Economics” course, students are expected to understand the principles of engineering economy, basic cost terminologies, the relationship between price and demand, various cost estimation techniques, and the concept of the time value of money. Students are expected to evaluate a single project, choose among alternative projects, and comprehend entrepreneurship concepts, including the preparation of a feasibility study, a business plan, and a financial plan for a new venture.

## 8 THE USED EDUCATIONAL VIDEOS AND RECORDED LECTURES

An intensive search was first performed to find the best educational videos, including 360-degree videos, for the ‘Engineering Economics’ course. These videos were collected, reviewed, and filtered for further use in this study. Lectures were also recorded during class sessions and made available to students on the Blackboard learning platform, along with selected educational videos. The recorded lectures and educational videos covered various course topics, including cost terminology, engineering economic analysis processes, price-demand and money-time relationships, equivalency concepts, evaluating a single project, comparing alternative engineering solutions, cost estimation techniques, integrating cost estimation with the design process, entrepreneurship, business and financial planning, and the new venture valuation rule. During the Spring 2022 semester, the instructor introduced the course topics, and students were instructed to

watch educational videos related to the topics discussed in class. Students were also advised to watch the recorded lectures at their convenience to ensure that they fully comprehended the concepts covered in the topics. The course instructors carefully reviewed the selected educational videos and recorded lectures before posting them for students to ensure their suitability and relevance to the course topics.

In this study, the assessment tools used to evaluate the students' performance in the 'Engineering Economics' course include in-class activities, homework assignments, quizzes, term projects, midterm exams, and final exams. At the end of the semester, students were asked to respond to the questionnaire survey posted on Blackboard.

## 9 ANALYSIS OF RESULTS

It is well established in the literature that the implementation of blended learning in educational institutions is limited. The delivery of engineering courses has been constrained by the conventional teaching approach and the use of limited technology, such as smartboards and PowerPoint presentations. In general, educational videos and recorded lectures offer significant advantages to students by enhancing their comprehension of various course topics, thereby improving their overall learning process. This is in addition to the advantage of having educational videos and recorded lectures available for students to watch anytime and anywhere. In the present study, we investigated the efficacy, advantages, and usefulness of incorporating videos and recorded lectures into the learning process, as well as students' satisfaction with watching these resources. The study emphasizes the need for instructional videos that could be either be created by course instructors or selected from YouTube and published on the university website. This was then achieved through a careful step-by-step process to select the most appropriate and relevant educational videos for the current study.

The results related to the responses of students to the first question of the survey, which inquired about how students perceive the use of recorded lectures and educational videos for learning course content. The results are shown in Table 1. The results revealed that students had an overwhelmingly positive perception of the use of recorded lectures and educational videos for learning course content (see Table 1). As shown in the table, the students' mean scores (M) ranged from 3.6 to 4.2, with a standard deviation (SD) ranging from 0.9 to 1.5 on a 5-point Likert scale. In this scale, 1 stands for "strongly disagree (SDA)," 2 for "disagree (DA)," 3 for "neutral (N)," 4 for "agree (A)," and 5 for "strongly agree (SA)." Since the responses were above 3.0, it can be inferred that the students agreed or strongly agreed with the use of recorded lectures and educational videos to study course topics. This is clearly supported by the percentage of responses. For example, 61.2% of the students agree or strongly agree that they prefer studying content using recorded lectures and educational videos. Also, 71.2% agree or strongly agree that they prefer that the instructor record lectures and provide educational videos, while 73.3% agree or strongly agree that the university should offer online educational videos for learning purposes.

The students' positive responses and preferences for using recorded lectures and educational videos for learning could be because the recorded lectures and videos not only present and explain the course topics and concepts but also cater to visual and auditory learning styles. Additionally, the recorded lectures and videos can help

students understand the content more easily if they are well-prepared and carefully selected by course instructors. In several comments received from students, they mentioned that having these additional learning tools has enhanced their learning experience, making the learning process more attractive and interesting. This is in addition to the fact that some students may lose focus during lectures. Having recorded lectures and videos available online provides an additional benefit to students, as it allows them to access these educational materials online anytime and anywhere, remotely and conveniently. They also have the option to rewatch them as many times as they want and whenever needed.

Table 2 shows the responses of male and female students to question 2: Is there any significant difference between male and female perceptions towards the use of recorded lectures and educational videos for learning course contents?. The paired t-test results presented in Table 2 for this study revealed significant differences in most items between males and females.

**Table 1.** Students' perception towards the use of recorded lectures and educational videos for learning course contents

Perception	Percentages of Responses					M	SD
	SDA	DA	N	A	SA		
Recorded lectures and educational videos helped students comprehend course topics	9.4	7.5	21.9	31.8	29.4	3.6	1.2
Recorded lectures and educational videos improved students' understanding of the course concepts	1.3	8.1	24.4	31.2	35.0	4.0	1.0
The contents of educational videos is similar to the lectures	0.6	3.1	21.3	36.9	38.1	4.1	0.9
Students prefer recorded lectures	6.3	5.6	16.9	30.0	41.2	4.0	1.2
Students prefer to see the instructor in the recorded lectures	6.3	10	20	34.4	29.3	3.7	1.2
The assistance received from the educational videos was very helpful	5.6	3.8	21.9	36.9	31.8	4.0	1.1
The materials of some videos were distracting	5.6	10	30.6	25.6	28.2	3.6	1.2
Some videos contain materials that are not covered in the course lectures	4.4	11.9	39.4	13.8	30.5	3.6	1.2
Blended learning is preferred	5.0	6.9	43.1	15.6	29.4	3.6	1.2
Videos are clear enough to understand	1.9	7.5	21.9	36.3	32.4	4.0	1.1
Students prefer posting videos posted on Blackboard rather than YouTube	3.9	6.4	16.4	31.9	41.4	4.1	1.2
Videos are made for commercial purposes rather than for education	6.4	12.0	18.2	32.0	31.4	3.8	1.4
The main problem with the videos is the quality of recording	7.0	9.5	25	30.7	27.8	3.7	1.4
Selecting good video materials helped students better understand course concepts	1.9	6.9	12.6	34.5	44.1	4.2	1.3
It is always preferred to have videos for all course lectures and topics	3.8	4.4	18.2	37.7	35.9	4.1	1.4
Participating in this survey was important to improve teaching	3.8	2.5	23.1	38.8	31.8	4.0	1.5
Responding to this survey will make positive changes in the course learning process	5.6	2.5	18.8	29.4	43.7	4.1	1.6
It is recommended that other courses use recorded lectures and videos in teaching	6.3	6.9	10.6	32.5	43.7	4.1	1.7

As depicted in Table 2, the average scores of male students were significantly higher than those of female students. Male students had higher mean scores, ranging from 3.47 to 4.31, than female students, whose scores ranged from 2.79 to 3.69, on a 5-point Likert scale.

**Table 2.** Perceptions of male and female students towards the use of recorded lectures and educational videos for learning course contents

Question	Male	Female	<i>t</i>
Do you prefer studying using recorded lectures and videos?	3.90	2.79	4.67**
Do you think that the selected videos were helpful?	4.02	3.42	2.85**
Were the videos materials similar to the one covered during lectures?	4.29	3.50	4.66**
Do you prefer your instructor to record his own videos?	4.12	3.21	3.74**
Do you like the instructor to appear in the video?	3.61	3.17	1.75
Did you get helpful assistance form the videos seen?	3.90	3.23	2.95**
Were the materials of some videos distracting?	3.65	2.88	3.53**
Some videos contain materials not covered in course lectures	3.47	3.12	1.51
Do you prefer to have blended learning?	3.49	3.50	-0.04
Videos are clear enough to understand	3.96	3.44	2.39*
It is preferred to have videos posted on Blackboard rather than on YouTube	4.10	3.58	2.19*
Videos are made for commercial purposes rather than for education	3.45	3.21	0.92
The main problem with the videos is the quality of recording	3.55	3.02	2.22*
The sound of the videos was clear enough	3.92	3.54	2.04*
Selecting good video materials helped students better understand course concepts	4.31	3.67	2.94**
It is always preferred to have videos of all course topics	4.22	3.60	2.76**
It is preferred to have extra videos of solved cases	4.12	3.73	1.66
Participating in this survey was important in order to improve teaching of courses	4.29	3.48	3.82**
Responding to this survey will make positive changes in the course learning process	3.90	3.69	0.82
In general, is it recommended that other courses start using videos in teaching course concepts?	4.08	3.42	2.57*

Notes: \* $p < 0.05$ ; \*\* $p < 0.01$ .

From these results, male students exhibited a positive attitude towards using recorded lectures and videos to learn course content. They preferred studying through recorded lectures and videos. They found the educational videos extremely helpful and wanted more videos of the same nature. They also liked the idea of other courses using such videos and recorded lectures. Contrary to male students, female students were neutral towards using recorded lectures and videos to learn course content. A possible explanation is that male students are busier with other out-of-class life-related issues and prefer to take advantage of online studying rather than attending classes face-to-face, allowing them to fulfill their other daily responsibilities. Another reason can be attributed to the fact that male students tend to lose focus during class time. Having lectures recorded online, along with additional educational videos, will help them review the course material after class hours and at their convenience. This is in addition to the fact that male students participate more in other extracurricular activities compared to female students. Some male

students were interviewed later and asked about the reasons for preferring to use recorded lecture notes and educational videos over attending face-to-face lectures, in comparison to female students. Their response was that male students who work have a heavier workload and busier social lives and commitments compared to female students.

Table 3 presents the results of the responses to question 3: Is there a significant difference between students' perceptions of using recorded lectures and educational videos to learn course content before and during the coronavirus pandemic? The mean scores of male students were higher than those of female students. Male students had higher mean scores ranging from 3.69 to 4.47 compared to female students, whose scores ranged from 3.26 to 3.98 on a 5-point Likert scale. The paired t-test revealed significant differences in the students' mean scores regarding their perceptions of using recorded lectures and educational videos to learn course content. It was noticed that students' perceptions were more positive towards the use of recorded lectures and videos during the coronavirus pandemic than before the pandemic. This might be because the students were not aware of the possibility of accessing recorded lectures and educational videos. They realized the importance of these resources during the pandemic. Due to the face-to-face constraints, students typically relied solely on the posted lecture notes and other course materials to learn course content. They were unaware of other useful resources that could help them comprehend course material and grasp course concepts.

The study also examined the overall performance of students in the 'Engineering Economics' course in the Fall 2021 semester, when students relied solely on face-to-face lectures to understand course concepts, compared to their performance in the Spring 2022 semester, when recorded lectures and educational videos were available. Interestingly, it was noticed that the performance of students during the Spring 2022 semester was relatively better than their performance during the Fall 2022 semester. This advantage can be attributed to the availability of recorded lectures and educational videos, which students can refer to whenever they have difficulties understanding the course lecture notes. While providing pre-prepared instructional videos seems to have a positive impact on students' understanding of course topics, this might not be effective without using the right technology and tools and carefully selecting high-quality videos.

It can be inferred from the results of the questionnaire survey data that recorded lectures and educational videos available online can provide several benefits to students. These benefits can be summarized as follows:

1. Flexibility of access: Recorded lectures and videos enable students to access course materials at their own pace and convenience. Students can watch the lectures and videos at their convenience, whether it be early in the morning or late at night. This provides flexibility that is not always possible with traditional in-person lectures.
2. Review of course material: Recorded lectures and videos enable students to review and revise course materials as often as needed. This can be particularly helpful for students struggling to understand a specific concept or who missed a lecture due to illness or any other commitment.
3. Improved information retention: watching recorded lectures and videos can be an effective way for students to learn and retain information. Learners can pause and rewind as needed, take notes, and re-watch parts of the course they find difficult to comprehend and understand. This can help students understand course material better and retain the information for longer periods of time.

**Table 3.** Students' perceptions towards the use of recorded lectures and educational videos for learning course contents before and during the coronavirus pandemic

Question	During the Pandemic	Before the Pandemic	<i>t</i>
Do you prefer studying using videos?	4.24	3.33	5.51**
Do you think that the videos selected were helpful?	4.28	3.71	3.91**
Were the materials similar to the one you are studying?	4.47	3.88	4.71**
Do you prefer your instructor to do videos?	4.45	3.65	5.05**
Do you like the presenter to be shown in the video?	4.24	3.39	5.44**
Did you get helpful assistance form the videos seen?	4.36	3.55	5.59**
Were the materials of some videos distracting?	4.19	3.26	5.63**
Do you think that some videos contain materials not covered in the course?	3.97	3.29	3.83**
Is it better to have blended learning?	3.69	3.50	1.12
Videos are clear enough to understand	4.24	3.69	3.91**
Students prefer having the videos posted on Blackboard rather than on YouTube	4.33	3.83	3.27**
Videos are made for commercial purposes rather than for education	4.36	3.33	6.66**
The main problem with the videos is the quality of recording	4.24	3.28	5.98**
The sound of the videos was clear enough	4.4	3.72	5.11**
Selecting good video materials helped students better understand course concepts	4.36	3.98	2.65**
It is always preferred to have videos of all course lectures and topics	4.1	3.90	1.36
It is preferred to have extra videos of solved cases	4.24	3.92	2.02*
Participating in this survey was important to improve teaching of courses	4.0	3.87	0.887
Responding to this survey will make positive changes in the course learning process	4.43	3.79	4.23**
In general, it is recommended that other courses start using videos in teaching course concepts	4.45	3.74	4.43**

Notes: \* $p < 0.05$ ; \*\* $p < 0.01$ .

In addition to the three main benefits listed above, recorded lectures and educational videos can be particularly beneficial for students with disabilities or those who have other accessibility needs. Such students can watch the lectures and educational videos at their own pace and utilize features such as 'captions' and 'transcripts' to enhance their understanding of course material. However, it is important to note that recorded lectures and educational videos should not substitute for the engagement of students with the course instructors and with other students. Students should always actively participate in the course, interact with instructors, and engage with their peers during class sessions. This is in addition to the fact that high-quality educational videos should be carefully selected to accurately represent the topics covered in the course syllabus.

## 10 THE DEVELOPED GENERIC VBA FRAMEWORK

Considering the positive feedback and important comments received from surveyed students, a generic VBA framework was developed to provide basic information about the various colleges in the international institution, the different departments in these colleges, the curriculum courses offered by these departments, and the topics of each course. While this generic framework can be further developed at this initial design stage to encompass all the colleges of the institution, all the departments of the colleges, all the courses of the departments, and all course topics, it currently focuses solely on the

“Engineering Economics” course offered by the College of Engineering and its related topics. The interface of the designed generic VBA framework is shown in Figure 1. As depicted in Figure 1, the user will be prompted to log in and then choose a college. The student will then be asked to select a department and then a course. Once a course is selected, a screen will appear requesting the student to select a course topic. When a course topic is selected, the student will have two options: to watch the recorded lecture or view a set of educational videos related to the selected topic. The framework will suggest one or more carefully selected high-quality educational videos related to the chosen topic and list them in order of their duration, with shorter videos appearing first.

Following this sequence, students will have the opportunity to watch the recorded lecture and then view an educational video related to the topic of the lecture. Thus, students who did not attend a lecture, attended but did not fully understand it, or did not grasp certain parts will have the opportunity to rewatch the lecture. They can then proceed to watch the related educational videos, starting with the one with the shortest duration. When a student finishes watching an educational video, they will be asked to evaluate the recorded lecture or video and provide comments. To complete the evaluation process, students were asked to provide a score for each recorded lecture and educational video on a scale from 1 to 5, where 1 represents ‘not useful’ and 5 represents ‘very useful.’ The results of the overall scores provided by students are listed in Table 4. Except for three topics (present economy studies, internal and external rates of return, and an incremental approach for mutually exclusive alternatives), students’ overall scores were above 4 in all other topics.

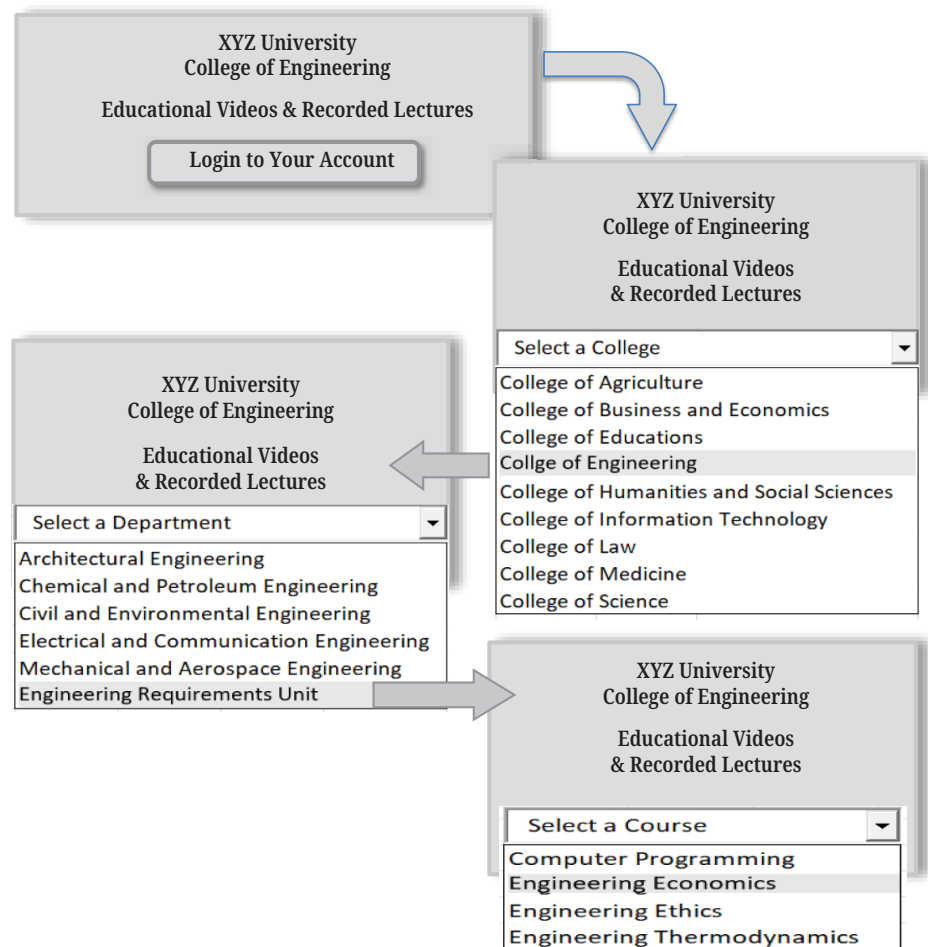


Fig. 1. The developed generic framework for viewing educational videos and lecture notes

**Table 4.** List of educational videos (EV) and recorded lectures (RL) and their overall scores

Educational Video/Recorded Lecture	Type	Time Length (mm:ss)*	Overall Score (Out of 5)
Engineering economics: introduction	RL	31:50	4.25
Principles of engineering economics	RL	50:24	4.37
Engineering economics and the design process	RL	05:39	4.18
Engineering economic analysis	RL	43:51	4.42
Engineering economic analysis	EV	10:27	4.53
Cost terminologies	RL	57:48	4.47
Cost terminologies	EV	16:57	4.52
Life-cycle stages of products	RL	15:33	4.55
Life-cycle stages of products	EV	09:06	4.62
Price-demand relationship	RL	58:37	4.69
Price-demand relationship	EV	15:42	4.74
Present economy studies	RL	53:49	3.64
Present economy studies	EV	18:26	3.71
Time-value of money concept	RL	38:46	4.73
Time-value of money concept	EV	11:21	4.84
Interest and interest rates	RL	15:29	4.86
Interest and interest rates	EV	07:18	4.91
Economic equivalence concept	RL	41:53	4.33
Economic equivalence concept	EV	10:18	4.42
Cash flow diagrams	RL	54:56	4.39
Cash flow diagrams	EV	29:48	4.47
Effective and nominal interest rates	RL	24:38	4.51
Effective and nominal interest rates	EV	08:21	4.58
Minimum attractive rate of return	RL	12:37	4.72
Minimum attractive rate of return	EV	06:44	4.81
Equivalent worth (PW, FW, AW**)	RL	58:51	4.63
Equivalent worth (PW, FW, AW**)	EV	23:42	4.69
Internal rate of return & external rate of return	RL	24:27	3.88
Internal rate of return & external rate of return	EV	14:33	3.94
Payback period method	RL	18:21	4.77
Payback period method	EV	05:51	4.83
Benefit cost ratio method	RL	51:22	4.57
Benefit cost ratio method	EV	15:43	4.76

*(Continued)*



**Table 4.** List of educational videos (EV) and recorded lectures (RL) and their overall scores (*Continued*)

Educational Video/Recorded Lecture	Type	Time Length (mm:ss)*	Overall Score (Out of 5)
Analysis period and useful life	RL	11:29	4.87
Analysis period and useful life	EV	03:19	4.91
Independent & mutually exclusive (ME) alternatives	RL	37:56	4.23
Independent & ME alternatives	EV	16:47	4.37
Incremental approach for ME alternatives	RL	44:52	3.79
Incremental approach for ME alternatives	EV	21:23	3.86

Notes: \*mm: ss (minutes: seconds); \*\*PW, FW, AW: present worth, future worth, annual worth.

The reason for scoring below 4 in these topics is that they are relatively more challenging and less easy to comprehend compared to the other topics in the course. On the other hand, students' overall scores for all educational videos were higher than those for the corresponding recorded lectures on all topics. This is expected since students were asked to watch the recorded lecture if they did not understand a specific topic before viewing its corresponding educational video. As a result, students will have a better understanding of the topic after watching the educational video, and, consequently, they are likely to rate it more highly. On the other hand, students provided interesting comments on the recorded lectures and educational videos they watched. Among the important comments is the suggestion that course instructors should create their own instructional videos for the different course topics rather than relying on recorded lectures or YouTube educational videos. They said that creating instructional videos by instructors will eliminate the time lost when some students do not understand a specific concept and the instructor repeats it for them. This is in addition to the time lost when taking attendance or due to technical issues during class, such as disconnections, absence of the instructor's voice, lag time, etc. These instructional videos should be watched before attending classes. Interactions and engagement with students can be achieved during class sessions. Students also suggested considering the following when preparing instructional videos:

1. Keep videos brief and concise, focusing on the course learning goals. Students tend to lose focus when watching lengthy videos. If the topic requires more explanation, split the video into two or even three parts.
2. Utilize audio and visual elements to communicate the concepts of the course topics, ensuring they complement each other rather than being redundant.
3. Highlight important ideas and key concepts.
4. Enhance interaction with students and engagement by providing short assignments for discussion during class time. This addresses the challenge that online courses lack sufficient interactions between students and instructors [43].
5. Separate topic concepts from problem-solving.
6. Make the recording engaging to prevent the content from becoming dry and boring.

## 11 CONCLUSIONS

The study investigated the effect of using educational videos and recorded classroom lectures on students' learning to provide valuable insights into the effectiveness of these tools and how they can support student learning outcomes. The study was conducted for the "Engineering Economics" course at an international institution during the Fall 2021 semester (before the coronavirus pandemic) and the Spring 2022 semester (during the pandemic). The performance of students during the Spring 2022 semester was compared with their performance during the Fall 2021 semester, when students relied solely on face-to-face lectures to understand course concepts. During the Spring 2022 semester, online educational videos and recorded lectures were provided to students via the Blackboard learning platform, along with other course materials. The study revealed that students, particularly male students, had a positive perception of using recorded lectures and educational videos to learn course concepts. During the coronavirus pandemic, students showed a more positive attitude towards this learning method compared to before the pandemic. This shift was due to the fact that recorded lectures and educational videos were not accessible to students prior to the pandemic. Students found these resources highly beneficial when they became available to them during the pandemic. Some potential findings of the study include the following:

1. Improved students' engagement: Educational videos and recorded classroom lectures help increase students' engagement and motivation, leading to improved learning outcomes. This is because these tools can provide a more interactive and immersive learning experience, which may be more engaging for students compared to traditional face-to-face lectures or textbooks.
2. Enhanced understanding: Educational videos and recorded classroom lectures may help improve students' comprehension of course material by offering extra explanations, visual aids, and additional examples. This can be particularly helpful for students who struggle with certain concepts or have different learning styles.
3. Increased flexibility: Educational videos and recorded classroom lectures can provide students with greater flexibility in terms of when and where they learn. This can benefit students who have other commitments or prefer to study outside the traditional classroom hours.
4. Enhanced performance: When students become more engaged, they will have a better understanding of the course material. This could enhance their overall academic performance. However, it is important to note that other factors, such as the quality of the course material, including the quality of the selected educational videos, instructors' teaching style, and students' prior knowledge and skills, can also impact students' academic performance.

However, in order to obtain a more comprehensive understanding and achieve more thorough results, the authors suggest the following as an extension to the current study:

1. Further research on the utilization of recorded lectures and educational videos for learning course content should be carried out through qualitative data collection methods, such as focus group interviews with students, input from course instructors, and feedback from other stakeholders.

2. The use of recorded lectures and educational videos should be explored in various contexts and disciplines, including medicine, science, business, the humanities, engineering and other subjects.
3. More research should be conducted to investigate the use of recorded lectures and educational videos for acquiring higher-order thinking skills.
4. Investigate the effectiveness of using pre-prepared short instructional videos for the topics of a selected engineering course, including separate pre-prepared videos for the problem-solving components of the course.

## 12 REFERENCES

- [1] M. Sablić, A. Miroslavljević, and A. Škugor, “Video-based learning (VBL)—past, present and future: An overview of the research published from 2008 to 2019,” *Technology, Knowledge and Learning*, vol. 26, pp. 1061–1077, 2021. <https://doi.org/10.1007/s10758-020-09455-5>
- [2] E. Zaneldin and S. Kabbani, “Online education: Lessons learned from teaching undergraduate courses,” *Turkish Online Journal of Qualitative Inquiry*, vol. 12, no. 6, pp. 9727–9736, 2021. <https://www.tojqi.net/index.php/journal/article/view/3502/2388>
- [3] A. Kirkwood, “Teaching and learning with technology in higher education: Blended and distance education needs ‘joined-up thinking’ rather than technological determinism,” *Open Learning: The Journal of Open, Distance and E-Learning*, vol. 29, pp. 206–221, 2014. <https://doi.org/10.1080/02680513.2015.1009884>
- [4] S. Chipamaunga, C. N. Nyoni, M. N. Kagawa, *et al.*, “Response to the impact of COVID-19 by health professions education institutions in Africa: A case study on preparedness for remote learning and teaching,” *Smart Learning Environments*, vol. 10, no. 31, 2023. <https://doi.org/10.1186/s40561-023-00249-7>
- [5] N. Pena and A. Chen, “Development of structural analysis virtual modules for iPad applications,” *Computer Applications in Engineering Education*, vol. 26, pp. 356–369, 2018. <https://doi.org/10.1002/cae.21889>
- [6] W. Ahmed and E. Zaneldin, “E-Learning as a stimulation methodology to undergraduate engineering students,” *International Journal of Emerging Technologies in Learning*, vol. 8, no. 3, pp. 4–7, 2013. <https://doi.org/10.3991/ijet.v8i3.2550>
- [7] B. El-Ariss, E. Zaneldin, and W. Ahmed, “Using videos in blended e-learning for a structural steel design course,” *Education Sciences*, vol. 11, no. 6, p. 290, 2021. <https://doi.org/10.3390/educsci11060290>
- [8] W. Ahmed and E. Zaneldin, “Blending QR code with video learning in the pedagogical process for the college foundation level,” *Interactive Technology and Smart Education*, vol. 17, no. 1, pp. 67–85, 2019. <https://doi.org/10.1108/ITSE-08-2019-0043>
- [9] E. Zaneldin, W. Ahmed, and B. El-Ariss, “Video-based e-learning for an undergraduate engineering course,” *E-Learning and Digital Media*, vol. 16, no. 6, pp. 475–496, 2019. <https://doi.org/10.1177/2042753019870938>
- [10] W. K. Ahmed and A. H. Al Marzouqi, “Using blended learning for self-learning,” *International Journal of Technology Enhanced Learning*, vol. 7, pp. 91–98, 2015. <https://doi.org/10.1504/IJTEL.2015.072025>
- [11] W. Tuong, E. R. Larsen, and A. W. Armstrong, “Videos to influence: A systematic review of effectiveness of video-based education in modifying health behaviors,” *Journal of Behavioral Medicine*, vol. 37, pp. 218–233, 2014. <https://doi.org/10.1007/s10865-012-9480-7>

- [12] A. D. Greenberg and J. Zanetis, "The impact of broadcast and streaming video in education," *Cisco: Wainhouse Research*, vol. 75, p. 21, 2012.
- [13] R. Boateng, S. L. Boateng, R. B. Awuah, E. Ansong, and A. B. Anderson, "Videos in learning in higher education: Assessing perceptions and attitudes of students at the University of Ghana," *Smart Learning Environments*, vol. 3, no. 1, pp. 1–13, 2016. <https://doi.org/10.1186/s40561-016-0031-5>
- [14] J. Wachtler, M. Hubmann, H. Zöhrer, and M. Ebner, "An analysis of the use and effect of questions in interactive learning-videos," *Smart Learning Environments*, vol. 3, no. 13, 2016. <https://doi.org/10.1186/s40561-016-0033-3>
- [15] O. Ketsman, T. Daher, and J. A. Colon Santana, "An investigation of effects of instructional videos in an undergraduate physics course," *E-Learning and Digital Media*, vol. 15, pp. 267–289, 2018. <https://doi.org/10.1177/2042753018805594>
- [16] N. L. Schroeder, J. Chin, and S. D. Craig, "Learner control aids learning from instructional videos with a virtual human," *Technology, Knowledge and Learning*, vol. 25, no. 4, pp. 733–751, 2020. <https://doi.org/10.1007/s10758-019-09417-6>
- [17] E. Köse, E. Taşlıbeyaz, and S. Karaman, "Classification of instructional videos," *Technology, Knowledge and Learning*, vol. 26, pp. 1079–1109, 2021. <https://doi.org/10.1007/s10758-021-09530-5>
- [18] M. Ring and T. A. Brahm, "Rating framework for the quality of video explanations," *Technology, Knowledge and Learning*, 2022. <https://doi.org/10.1007/s10758-022-09635-5>
- [19] J. Cai, "Evaluation of blended teaching in STEAM education using structural equation model questionnaire technology," *International Journal of Emerging Technologies in Learning*, vol. 18, no. 19, pp. 72–83, 2023. <https://doi.org/10.3991/ijet.v18i19.43873>
- [20] J. Månsson, J. Löfgreen, and P. Warfvinge, "Effective use of video in engineering education," in *6th Development Conference for Swedish Engineering Education*, Chalmers University of Technology, Gothenburg, Sweden, 2017.
- [21] S. Cilesiz, "Undergraduate students' experiences with recorded lectures: Towards a theory of acculturation," *Higher Education*, vol. 69, no. 3, pp. 471–493, 2015. <https://doi.org/10.1007/s10734-014-9786-1>
- [22] A. Alobaid, "Smart multimedia learning of ICT: Role and impact on language learners' writing fluency—YouTube online English learning resources as an example," *Smart Learning Environments*, vol. 7, no. 24, 2020. <https://doi.org/10.1186/s40561-020-00134-7>
- [23] K. Hajhashemi, N. Caltabiano, and N. Anderson, "Students' perceptions and experiences towards the educational value of online videos," *Australian Educational Computing*, vol. 31, no. 2, 2016.
- [24] D. F. Mullamphy, "Screencasting and its effect on the traditional lecture," *ANZIAM Journal*, vol. 53, pp. C592–C605, 2011. <https://doi.org/10.21914/anziamj.v53i0.5121>
- [25] M. R. Laugerman and K. P. Saunders, "Supporting student learning through instructional videos in business statistics," *Decision Sciences Journal of Innovative Education*, vol. 17, no. 4, pp. 387–404, 2019. <https://doi.org/10.1111/dsji.12193>
- [26] Y. Xiu, M. E. Moore, P. Thompson, and D. P. French, "Student perceptions of lecture-capture video to facilitate learning in a flipped classroom," *TechTrends*, vol. 63, no. 4, pp. 369–375, 2019. <https://doi.org/10.1007/s11528-018-0293-6>
- [27] D. Pal and S. Patra, "University students' perception of video-based learning in times of COVID-19: A TAM/TTF perspective," *International Journal of Human-Computer Interaction*, vol. 37, no. 10, pp. 1–19, 2020. <https://doi.org/10.1080/10447318.2020.1848164>
- [28] G. Dizon, "Subscription video streaming for informal foreign language learning: Japanese EFL students' practices and perceptions," *TESOL Journal*, vol. 12, no. 2, p. e566, 2021. <https://doi.org/10.1002/tesj.566>

- [29] T. L. P. Tang and M. J. Austin, "Students' perceptions of teaching technologies, application of technologies, and academic performance," *Computers & Education*, vol. 53, no. 4, pp. 1241–1255, 2009. <https://doi.org/10.1016/j.compedu.2009.06.007>
- [30] K. M. Douglas M. H. Wells, E. J. Deschepper, and M. E. Donaldson, "Traditional lecture versus video/discussion-based instruction and their effects on learning behavior guidance techniques," *Journal of Education and Ethics in Dentistry*, vol. 7, no. 2, p. 30, 2017. [https://doi.org/10.4103/jeed.jeed\\_22\\_17](https://doi.org/10.4103/jeed.jeed_22_17)
- [31] E. Howard, M. Meehan, and A. Parnell, "Live lectures or online videos: Students' resource choices in a first-year university mathematics module," *International Journal of Mathematical Education in Science and Technology*, vol. 49, no. 4, pp. 530–553, 2018. <https://doi.org/10.1080/0020739X.2017.1387943>
- [32] S. Trenholm, B. Hajek, C. L. Robinson, M. Chinnappan, A. Albrecht, and H. Ashman, "Investigating undergraduate mathematics learners' cognitive engagement with recorded lecture videos," *International Journal of Mathematical Education in Science and Technology*, vol. 50, no. 1, pp. 3–24, 2019. <https://doi.org/10.1080/0020739X.2018.1458339>
- [33] N. Bos, C. Groeneveld, J. Van Bruggen, and S. Brand-Gruwel, "The use of recorded lectures in education and the impact on lecture attendance and exam performance," *British Journal of Educational Technology*, vol. 47, no. 5, pp. 906–917, 2016. <https://doi.org/10.1111/bjet.12300>
- [34] G. Lampropoulos, V. Barkoukis, K. Burden, and T. Anastasiadis, "360-degree video in education: An overview and a comparative social media data analysis of the last decade," *Smart Learning Environments*, vol. 8, no. 20, 2021. <https://doi.org/10.1186/s40561-021-00165-8>
- [35] R. C. Hérault, A. Lincke, M. Milrad, E-S. Forsgårde, and C. Elmqvist, "Using 360-degrees interactive videos in patient trauma treatment education: Design, development and evaluation aspects," *Smart Learning Environments*, vol. 5, no. 26, 2018. <https://doi.org/10.1186/s40561-018-0074-x>
- [36] J. Bahnson and L. Olejnikova, "Are recorded lectures better than live lectures for teaching students legal research," *Law Library Journal*, vol. 109, p. 187, 2017.
- [37] L. Lv, Z. Liu, and Y. Xu, "Technological progress, globalization and low inflation: Evidence from the United States," *PLOS ONE*, vol. 14, no. 4, p. e0215366, 2019. <https://doi.org/10.1371/journal.pone.0215366>
- [38] P. Karppinen, "Meaningful learning with digital and online videos: Theoretical perspectives," *AACE Journal*, vol. 13, no. 3, pp. 233–250, 2005.
- [39] T. Long, J. Logan, and M. Waugh, "Students' perceptions of the value of using videos as a pre-class learning experience in the flipped classroom," *TechTrends*, vol. 60, no. 3, pp. 245–252, 2016. <https://doi.org/10.1007/s11528-016-0045-4>
- [40] G. Matthew, "Do additional, visual elements in recorded lectures influence the processing of subtitles?" *Southern African Linguistics and Applied Language Studies*, vol. 39, no. 1, pp. 66–81, 2021. <https://doi.org/10.2989/16073614.2021.1883450>
- [41] G. D. Holt, "Asking questions, analysing answers: Relative importance revisited," *Construction Innovation*, vol. 14, no. 1, pp. 2–16, 2014. <https://doi.org/10.1108/CI-06-2012-0035>
- [42] O. A. Bolarinwa, "Principles and methods of validity and reliability testing of questionnaires used in social and health science researches," *Nigerian Postgraduate Medical Journal*, vol. 22, no. 4, pp. 195–201, 2015. <https://doi.org/10.4103/1117-1936.173959>
- [43] J. Zeng, K. Luo, Y. Lu, and M. Wang, "An evaluation framework for online courses based on sentiment analysis using machine learning," *International Journal of Emerging Technologies in Learning*, vol. 18, no. 18, pp. 4–22, 2023. <https://doi.org/10.3991/ijet.v18i18.42521>

### 13 APPENDIX A: QUESTIONNAIRE SURVEY

#### Students' Perception towards the Use of Recorded Lectures an Educational Videos for Learning Engineering Course Content

1. Your gender:            Male             Female
2. Semester: \_\_\_\_\_
3. GPA: \_\_\_\_\_
4. The Use of Recorded Lectures and Educational Videos for Learning Course Contents.

(Please select the most appropriate option)

Perception	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Recorded lectures and educational videos helped students comprehend course topics					
Recorded lectures and educational videos improved students' understanding of the course concepts					
The contents of educational videos are similar to the lectures					
Students prefer recorded lectures					
Students prefer to see the instructor in the recorded lectures					
The assistance received from the educational videos was very helpful					
The materials of some videos were distracting					
Some videos contain materials that are not covered in the course lectures					
Blended learning is preferred					
Videos are clear enough to understand					
Students prefer having the videos posted on Blackboard rather than on YouTube					
Videos are made for commercial purposes rather than for education					
The main problem with the videos is the quality of recording					
Selecting good video materials helped students better understand course concepts					
It is always preferred to have videos for all course lectures and topics					
Participating in this survey was important to improve teaching					
Responding to this survey will make positive changes in the course learning process					
It is recommended that other courses use recorded lectures and videos in teaching					

5. Using Recorded Lectures and Educational Videos for Learning Course Contents.

(Please select “Yes” or “No”)

Question	Yes	No
Do you prefer studying using recorded lectures and videos?		
Do you think that the selected videos were helpful?		
Were the videos materials similar to the one covered during lectures?		
Do you prefer your instructor to record his own videos?		
Do you like the instructor to appear in the video?		
Did you get helpful assistance form the videos seen?		
Were the materials of some videos distracting?		
Some videos contain materials not covered in course lectures		
Do you prefer to have blended learning?		
Videos are clear enough to understand		
It is preferred to have videos posted on Blackboard rather than on YouTube		
Videos are made for commercial purposes rather than for education		
The main problem with the videos is the quality of recording		
The sound of the videos was clear enough		
Selecting good video materials helped students better understand course concepts		
It is always preferred to have videos of all course lectures and topics		
It is preferred to have extra videos of solved cases		
Participating in this survey was important in order to improve teaching of courses		
Responding to this survey will make positive changes in the course learning process		
In general, is it recommend that other courses start using videos in teaching course concepts?		

6. Benefits of recorded lectures and educational videos available online to students:

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7. Other suggestions and recommendation to improve students’ learning: \_\_\_\_\_

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## 14 AUTHORS

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