

STUDENT ENGAGEMENT AND ASSESSMENT IN AN ASYNCHRONOUS ONLINE LEARNING ENVIRONMENT: THE IMPORTANCE OF INSTRUCTIONAL DESIGN WITH INTERACTIVE CONTENT

*Mousumi Bose, Fairfield University
Heather Ulrich, Fairfield University*

ABSTRACT

Purpose of the Study: *As online learning plays a greater role in graduate education, there is concern amongst instructors in terms of increasing student engagement with content. This apprehension is further exacerbated in the case of asynchronous, online learning. Previous research has discussed the importance of instructor-generated videos in engaging students with learning material.*

Method/Design and Sample: *This research investigates how interactive instructional design by embedding videos within reading material helps enhance student engagement and assessment in asynchronous online learning compared to providing videos and reading material separately.*

Results: *Results demonstrate that instructional design using a rich media blend by embedding instructor-generated videos amongst various reading material and interactive content may help students remain focused on course content and may use different ways to understand different facets of a concept and apply them. Interestingly, while student engagement was different in the two different types of instructional design, the results suggested that the final letter grade performance of students was not different.*

Value to Marketing Educators:

Keywords: asynchronous online, instructional design, student engagement, interactive content

INTRODUCTION

The rapid advancement in online learning reflects a growing acceptance of online teaching and remote learning (World Economic Forum, 2021). Access to quality online learning has become an important factor among students applying to various university programs. This trend, therefore, places greater emphasis on enhancing student engagement and assessment in online learning (Furst & Lefkoff, 2021). One of the challenges of teaching and learning in an online setting is the task of simulating a classroom learning environment (Heerema & Rogers, 2001; Revere, 2004; Rourke et al., 2001). This challenge is compounded when the online learning environment is asynchronous. The difficulty of making connections between faculty and students, providing a sense of community amongst students, and the pressure of creating content that is engaging so that students can gather maximum knowledge that they can apply in realistic settings are some unique issues that many educators teaching asynchronous, online courses contend with (Whiting et al., 2021).

Student engagement is defined as “the student’s psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote” (Newmann et al., 1992, p. 12). Lear et al. (2010) have provided a broad conceptual framework to help students become engaged learners. The authors have highlighted course factors such as content type, course management system, course structure, interactive technology, and focus of interaction as important aspects of student engagement. Using this framework, Martin and Bollinger (2018) have suggested techniques that can enhance student engagement using instructional design. Similarly, Cummins et al. (2016) have emphasized the importance of advanced technology that enriches the educational value of online learning. Specifically, Revere and Kovach (2011) and Kovach et al. (2010) have advocated that instructional design using new and emerging technologies to enhance video content increases student

interest in learning. In terms of the use of video-based technology, Draus et al. (2014) found that although instructional design employing video-based content helped increase grades to a certain extent, student persistence rates remained unaffected. Questions such as overuse of videos, student exhaustion from video-based content learning, and the impact of instructor immediacy and social presence through video-based content abound (Griffiths & Graham, 2009). Thus, extant research has suggested that while designing courses, instructors should be critical in choosing content structure, interactive technology, and content form carefully to enhance student engagement.

The aim of this study is to explore whether instructional design using alternate ways to commonly used videos and reading material helps in greater student engagement. To enhance student engagement in the process of learning and in their progression in assessment, this research investigates how alternative interactive instructional design that embeds instructor-generated videos within reading material in asynchronous online learning helps compared to engagement and assessment that uses videos and reading material separately. By evaluating student feedback, hours of engagement in video content, and formative and summative assessment outcomes, this research contributes to the student learning engagement literature by supporting the idea that, although content-based videos are important, alternate ways of drawing student attention by embedding videos in interactive content may provide better outcomes.

Using the central theoretical principles of Community of Inquiry (Col; Garrison et al., 2000) and Lear et al.'s (2010) conceptual framework, this research tries to investigate whether a sense of engagement can be obtained in an asynchronous online environment. The Col suggests that there are three important components in a learning environment: cognitive, social, and teaching presence (Garrison & Arbaugh, 2007). The cognitive presence emphasizes the extent to which learners make meaning by interacting with the course content; the social presence refers to the ability of learners to project themselves socially and emotionally; and the teaching presence suggests the design and facilitation of online content to enhance cognitive and social presence for better learning outcomes. The groundwork laid by Garrison et al. (2000) and Lear et al. (2010) helps in understanding how teaching presence and cognitive presence interact to create an environment that aids in selecting content and other interactive course factors to enhance student engagement. Thus, the core contributions of this research lie in explaining: a) the extent to which instructional design that embeds videos in interactive reading material affects student engagement in an asynchronous online marketing course taught in an MBA program. Specifically, the goal is to understand the extent to which instructor-generated videos and reading material posted separately engage students compared to when they are embedded to provide a single interactive learning material. b). the role alternative interactive content played in student assessment of formative and summative learning outcomes.

The rest of the article is organized as follows: First, a brief literature review of Col and the Community Process Model (Lear et al., 2010) is provided. This is followed by an understanding of instructional design using interactive teaching content that is provided. Second, the methodology for data collection is explained, and findings are discussed. Finally, the paper concludes with a discussion of the results, theoretical and managerial implications, limitations of the study, and future research directions.

LITERATURE REVIEW

The theoretical framework of online learning

Asynchronous online courses are temporally and geographically independent (Fabrizz et al., 2021) and are considered to be more self-paced and less instructor-dependent (Bernard et al., 2004; Murphy et al., 2011; Clark & Mayer, 2016; Xie et al., 2018; van der Keylen et al., 2020). However, there are some challenges inherent in such a learning environment: students are expected to be disciplined and motivated learners to stay on top of the course material and assignments (Hartnett, 2015). Students should also be adept at using digital skills for academic performance (Kim et al., 2019). Therefore, it becomes even more important for instructors to provide engaging content to help with ease of learning and to maintain student interest in course material for optimum learning and assessment.

Extant literature has used the theoretical framework of the Community of Inquiry (Anderson et al., 2001; Garrison et al., 2000) to understand the process of success in student learning and assessment. This framework goes beyond the norm of accessing information and facilitates the creation of communities of engaged learners who can explore, create meaning, and confirm understanding (i.e., inquiry) (Garrison 2009). It encompasses three essential components: a. cognitive presence; b. social presence; and c.

teaching presence.

The cognitive presence is defined as “the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry” (Garrison et al., 2000, p.11). It allows learners to be tasked with a problem and through iteration between content and reflection, they can construct meaning and confirm understanding. Thus, cognitive presence helps learners maximize the quality of online learning. The social presence is the ability of learners to project themselves socially and emotionally into a community of inquiry (Rourke et al., 2001). This can be achieved through student-student interaction and/or student-instructor interaction. Garrison (2009) has revisited the concept by suggesting an evolved concept of social presence, the ability of participants to identify with the community (e.g., course of study), communicate purposefully in a trusting environment, and develop inter-personal relationships even in an online environment (Rogers & Lea, 2005; Conrad, 2005). The teaching presence relates to course design, facilitation, and direct instruction. It is the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes (Anderson et al., 2001).

There are three aspects to the teaching presence: instructional design, facilitation, and direct instruction (Anderson et al., 2001). Instructional design is key for students to perceive the course as interesting, which is important for student engagement. Designing an online course is challenging considering that social and cognitive presence also need to be part of such planning. Additionally, facilitating learning experiences is equally important, especially in an asynchronous online environment. Here, instructors need to monitor and manage discourse to ensure that it is productive and learners stay engaged. Finally, teaching presence is demonstrated through direct instruction in the form of the transfer of knowledge from the instructor to the student. This framework suggests that student engagement comes from important ways that content, methods, and processes interact. Such interaction amongst students, instructors, and the content may lead to an active and engaged learner (Handelsman et al., 2005). Although Col provides a broad theoretical framework to follow, specific details regarding the establishment of instructional design in an asynchronous online course are necessary. This requirement is important, especially when instructors attempt to create an instructional design that takes into consideration the interaction of teaching presence with cognitive presence and some elements of social presence.

Community Process Model for the Online Education Environment

To have a teaching presence through the design, facilitation, and direction of cognitive and social presences, it is important to explore the conceptual model theorized by Lear et al. (2010), which is termed the Community Process Model (CPM). The model refers to the relationship between interactivity, a sense of community, and the engaged learner. Interactivity refers to (a) learner-content interaction, (b) learner-instructor interaction, and (c) learner-learner interaction. Such interactivity helps create a sense of community for the student, leading to higher levels of engagement (Moore, 1989). The model also suggests various other factors, such as student, course, and instructor factors, that may affect student engagement with learning material in different ways.

An important aspect of this model is the interactivity of the learner with the content. It is the process of intellectually interacting with the content that can change a learner's understanding and perspectives (Moore, 1993). Through design and learning activities, instructors ensure interactivity and participation (Kearsley 2000). As learners participate in the interactive activities, the increased level of exchanges with content may subsequently lead to an even greater sense of a community of inquiry (Anderson et al., 2001) and increased engagement (Lear et al., 2010).

The role of instructional design in an asynchronous online learning environment

One aspect of instructional design relates to the manner in which content is made available to learners in the asynchronous online learning community. Following Col (Garrison et al., 2000) and Community Process Model (Lear et al., 2010), teaching presence is highly important to engage student learners (Shea et al., 2005). As discussed earlier, Col (Anderson et al., 2001) suggests three components of teaching presence: instructional design and organization, facilitating discourse, and direct instrumentation. Although there are many aspects of instructional design and organization, the authors discuss curriculum setting and design as parameters that need attention. In their research, Madathil et al. (2017) have argued for the importance of the vehicle for the delivery of instruction. The authors have suggested the presence of a growing demand for the use of technology-based instruction. Similarly, Abrami et al. (2011) state that

student-to-content interaction can occur while watching instructional videos, interacting with multimedia, and searching for information. That is why online instructors need to carefully plan course content in terms of reading and interactive instructional materials for the purpose of encouraging student-to-content engagement (Abrami et al., 2011; Banna et al., 2015). Revere and Kovach (2011) recommend making the content come alive using appropriate technology, which enhances student engagement. Online instructors should be critical in choosing material and content when they wish to engage students more in their courses (Martin & Bolliger, 2018). Dixson (2010) reports that students found a variety of activities made them feel engaged, including course management system features, effective communication, and course facilitation strategies.

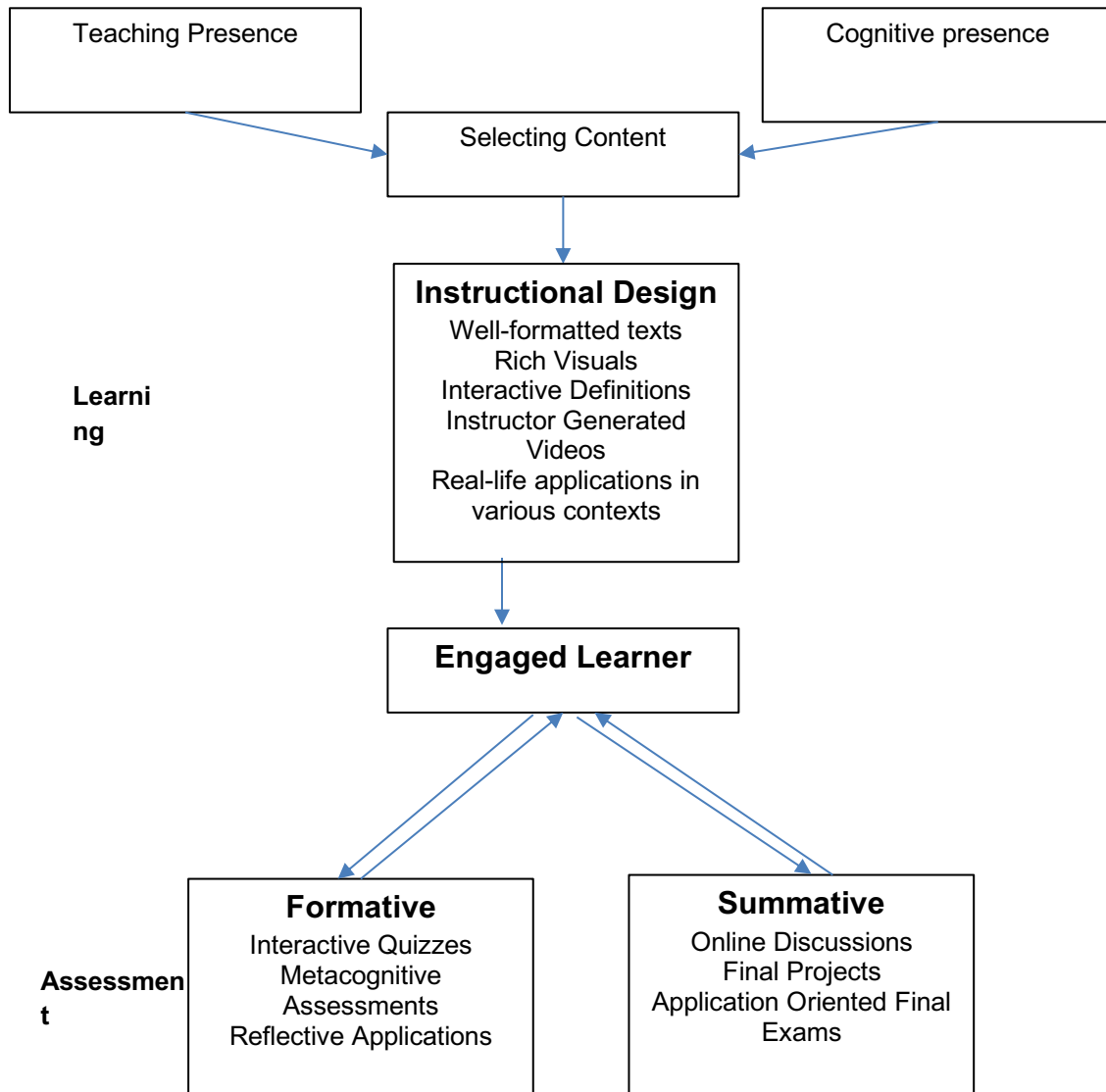
An area of instructional design to enhance student engagement relates to the use of instructor-generated content videos. There is evidence from existing research suggesting the positive impact instructor-generated video content may have on cognitive presence in student learning (Tu & Corry, 2003; Griffiths & Graham, 2009; Kovach et al., 2010). Drauss et al. (2014) suggested that instructor-generated content increased instructors' social presence as well. While Mandernach (2009) suggested that multimedia did not bring about significant differences in synchronous course learning outcomes, Harris (2002) indicated that the benefits of multimedia were more of a perception than those demonstrated in learning outcome metrics. In many online graduate programs where all courses have similar instructor-generated video-based online content, student learning fatigue and boredom become commonplace (Griffiths & Graham, 2009). However, prior research has not investigated the importance of instructional design in delivering video-generated, rich media blended content in an interactive manner. This research delves deeper into how instructor-generated video may become a powerful instructional design tool, provided it is embedded amongst other interactive reading material so as to enhance student engagement and reduce learning fatigue.

Peltier et al. (2003) have long advised instructors regarding the overall perceived effectiveness of online learning. According to them, not only are faculty-student interaction, student-student interaction, and instructor support and mentoring important, but also course structure, content, and information delivery technology are essential. Using their research as a backdrop, this study submits that as online teaching technology grows, it is important for instructors to go beyond the regular use of instructor-generated video content for better student engagement and assessment. Kim et al. (2015) found that embedding interactive exercises within video content helped capture student learning and thought processes, along with enhancing their engagement. However, their research referred to young learners in school as opposed to mature learners in a graduate program. This research finds that embedding videos within reading material and other interactive content works better at reducing student disengagement and boredom.

This research specifically discusses learning engagement when instructor-generated video content is embedded in an interactive website-based learning environment as opposed to providing content through videos, preceded by or followed by reading material. Such rich media blend "text, audio, video, and dynamic motion... [to increase] student interaction and engagement" (Havice et al., 2010, p. 54). With cognitive and teaching presence interaction in mind, this research proposes that good instructional design in the form of well-formatted texts, rich visuals, interactive definitions, and applications using real-life examples, along with instructor-generated video inputs, helps students become better engaged learners (Figure 1). First, students get to point and click at different items on screen to engage their various sensory channels. Second, by reading about a topic or a concept and then approaching a video, the student is mentally prepared to engage with the topic at hand. Third, different types of technology help diverse learners: auditory, visual, or both. Additionally, it is known that individual differences in learning preferences can affect motivation in terms of need for achievement, locus of control, and anxiety, and that isolation can impact motivation (Kim, 2009). By providing different technology-based, engaging experiences, instructors may help alleviate some of the anxiety associated with asynchronous, online learning. Fourth, different approaches are effective when accessibility is important to students. Whether it is through formatting texts, tagging images, charts, graphs, and maps, providing hyperlinks for detailed readings or explanations, formatting tables, etc., accessible course material provides cues to students that their knowledge enhancement is important to instructors and that instructors care about their learning. Fifth, by going beyond instructor-generated videos with reading material such as lecture notes, etc. and providing alternative ways to engage with content, instructors have the advantage of engaging with content topics from various facets or perspectives. For example, while a marketing definition is posted as web-based text, an instructor may use video-based examples to discuss the applications of the concept in different scenarios and use various

web-based tabs or links to provide detailed readings, followed by interactive quizzes or reflections to elicit student feedback on the same topic. This helps with understanding the breadth and depth of the particular topic in question. Thus, the use of interactive web-based content with instructor-generated video content embedded in it provides greater student interest and application-based knowledge enhancement, and that may be better reflected in student learning outcomes.

Figure 1. Conceptual Framework of Instructional Design and Assessment



Assessment in an online, asynchronous learning environment

An essential aspect of understanding student engagement with online, asynchronous course content is to assess their engagement. While prior research has demonstrated many techniques for assessment, such as online discussion forums and others, Varkey et al. (2022) have provided theoretical perspectives and techniques to assess learning in formative and summative ways. One formative approach to understanding and assessing student engagement is to appreciate that students need to deliberate on the prerequisite knowledge received from connecting with course material. The students need to comprehend the foundational knowledge to demonstrate to themselves and to the instructor that they have understood the concepts of the material. Such formative assessment helps with enhancing students' current learning and aids in building further on existing knowledge (Figure 1). Varkey et al. (2022) suggest spaced-out

question sets that may be available to the students on completion of their study of a specific topic. A best practice proposed by Bjork and Bjork (2020) and Bjork et al. (2015) is allowing multiple attempts at the question set within the time frame of the assignment (a week or so), such that students may learn through trial and error and eventually get all the questions correct. The primary objective here is to augment student learning by providing example questions in which their knowledge may be tested without fear of making errors without penalty. This process ensures that the homework assignment is formative in the student's understanding of the materials and engages the students actively in the learning process (Varky et al., 2022). Additionally, students can receive real-time feedback on their engagement with the material in a sequential manner especially when the material is dense and retention and application of the material are important (Bjork & Bjork, 2020; Bjork et al., 2015).

A second aspect of gauging engagement is to appreciate students' ability to see how their learning takes place, focus on the areas that need bolstering, and take steps to draw conclusions about the material. Such formative metacognitive writing may be a low-stakes way for students to reflect on their overall learning of a new material, to apply the material to a new and different problem or situation, and to recognize areas of strengths and weaknesses with the help of feedback from the instructor. This process may help students take conscious steps to improve assimilation and application of their course material (Figure 1). Prior research has suggested that metacognitive writing helps students determine what processes work well for them and helps them process emotional and other cognitive dimensions that become affected by the activities (Tanner, 2012; Desautel, 2009). According to Perera-Diltz and Moe (2014), case studies can encapsulate the principles of authentic, learner-centered education by focusing on problem solving and decision-making. These can be low-stake, metacognitive writing, involving learning of the course material, critical and creative thinking, and reflective application of the course material to a problem for decision-making (Bonk & Cummings, 1998). Elements in an authentic evaluation rubric for case study analysis could include (a) the richness (in both breadth and depth) of resources upon which analysis is based; (b) the ability to identify salient and divergent perspectives in best practices relative to the presented case material; (c) the articulation of a clear process of analysis that appears to incorporate consideration of alternative perspectives; and (d) the authoritative and/or innovative synthesis of all elements of the learning process into a coherent viewpoint (Perera-Diltz & Moe, 2014).

Just as formative assessments help students appreciate knowledge deficits and work towards learning better with a greater focus on concepts and theories, summative assessments tend to test the comprehensive knowledge that has been obtained (Trenholm, 2007). Summative assessments help students in two ways: first, they help students synthesize course material, and second, they provide the student and the instructor with an assessment of how the learning outcomes have been achieved (Straight, 2002). A method for summative assessment has been online discussions, as it measures student-centered active learning (Rovai, 2000). Other assessments include final projects and final examinations that tend to be holistic (Perera-Diltz & Moe, 2014). Williams (2006) suggested that an open-book, open-media, asynchronous format for administering exams in online education is preferred, especially when exams are application-oriented. Students not only have to assess their overall assimilation of their course material but also must think critically to apply the knowledge in various scenarios for problem-solving purposes.

METHODOLOGY

The main research objective was to understand the impact of instructional design using multimedia elements such as instructor-generated videos in a lesson to support student engagement and assessment in an asynchronous, online learning environment. Specifically, this research explores the impact on student engagement and assessment when alternative interactive content is provided compared to when it is not provided in an asynchronous online marketing course taught in an MBA program. To this end, a Strategic Brand Management course was used as part of the study. Data was collected from two semesters of the course (Spring 2021, n = 14 and Spring 2022, n = 24). During both semesters, the course was taught in a seven week, accelerated format. Students could access the course material every week in modular format. In each module, the course material was posted at the beginning of the week and assignments were submitted by students at the end of the week before another module would be made available to them the following week.

In terms of student learning and engagement, in each module, course material was offered in the form of instructor-generated videos and reading material. The difference between the courses offered in the two

semesters under consideration was that in one, the instructor-generated videos were available along with reading material in the same module. In the other, the videos were embedded amongst course material the students could read. The reading material was organized in the form of a website where students could click on different tabs for different concepts and click on further explanations and examples if they were interested. It is important to point out that the reading material in both the courses were the same. The videos in both the semesters were chinked into short clips so as to reduce student boredom. The only difference was in the organization of the videos and reading content: in one, the videos were offered separately from the reading material and in the other, the videos were embedded in the reading content. Student engagement with the course material was gauged by the number of times the videos were played, and end of semester student responses.

The students were assessed using both formative and summative assessment tools (Table 1). In terms of formative assessment, students had to complete quizzes that became available to them after they had covered the course material. The quizzes helped test their understanding of the course material for that week. Following Bjork and Bjork (2020), the quizzes were a low stakes way for students to gauge their understanding of the material. All students could complete the quizzes in two attempts and the highest score from the two attempts was considered as the final score for the quiz for that week.

Table 1. Rubric for Assessment

Assessment	Type (Formative - F/Summative - S)	Rubric
Multiple choice questions with two attempts to complete	F	Percentage of students taking two attempts to complete the quizzes
Case studies	F	Qualitative: a. Richness of thinking (both breadth and depth) b. Ability to identify salient and divergent perspectives (critical thinking) c. Articulation of problems and solutions (novel thinking) Quantitative: Length of writing Overall score of all case studies
Final exam	S	Qualitative: a. Richness of thinking (both breadth and depth) b. Ability to identify salient and divergent perspectives (critical thinking) c. Articulation of problems and solutions (novel thinking) Quantitative: Length of writing Overall grade

A second low stakes formative assessment pertained to analysis of case studies specifically relevant for the course material in a particular week. Upon going over all course material and completing the quiz, the students were prompted to read the case study assigned for the week. They then responded to prompted questions that referred them back to the course material that they would have studied before. The responses from case studies were evaluated in two ways: One, a quantitative evaluation of the length of responses to question prompts and second, a qualitative evaluation that included assessment of responses by two independent judges using the rubric modified from Perera-Diltz and Moe (2014). Assessments related to (a) the richness in thinking (both breadth and depth), which was based out of resources provided for that week; (b) the ability to identify salient and divergent perspectives presented in the case material (critical thinking); and (c) articulation of the problem and solutions taking into consideration various alternative perspectives (novel thinking). A five-point Likert scale was used to assess student responses with 1 = lack of richness/critical thinking/novel thinking and 5 = high degree of richness/critical thinking/novel thinking. To simplify the process, the coders used the following criteria for coding student responses: 1–2.5 points show less richness of analysis/critical thinking/novel thinking and it was designated

as low, and 2.6–5 points demonstrate a high degree of richness of analysis/critical thinking/novel thinking and it was designated as high to determine their understanding of the responses. Intercoder reliability was determined by considering the number of agreements with low or high, divided by the total number of coding decisions. Prior to their analyses, the coders were provided with sample coding responses, and post-analyses, any discrepancies were sorted over through discussions. Additionally, the case study scores were also taken into consideration to find whether there was significant difference in performance between the two semesters.

Finally, summative assessment was done in two ways. Similar to case study assessments, the final exam was assessed quantitatively based on the length of responses and qualitatively using the rubric modified from Perera-Diltz and Moe (2014). The exam was also assessed based on the grades students received at the end of the semester.

RESULTS

The aims of this study were to explore whether instructional design using alternate, interactive ways of content generation other than instructor-generated videos helped in greater student engagement. Specifically, the research focused on the extent to which instructor-generated videos and reading material posted separately engaged students compared to when they were combined to provide a single interactive learning material. b. the role alternative interactive content played in student assessment of formative and summative learning outcomes.

To understand how instructor-generated video-based content was effective in student engagement, a comparison of the total number of video plays for a strategic brand management asynchronous online course at the graduate level was undertaken across two semesters. In the first semester the course content was provided via instructor-generated video content and reading material, both provided separately within a module. In the second semester, the videos were embedded among reading material as discussed in the methodology section. Across thirteen chapters discussed in each of the semesters, there was 81.1% engagement with video content in the second semester compared to that in the first semester. While in the first semester, there were situations where the videos were not played at all (as students used reading material to engage with the course), in the second semester, all videos were accessed and watched by students with an average number of plays of 13.26 over the previous semester. As shown in Table 2, on an average, 16.82 student completions were recorded for all chapter videos, which was an improvement over the previous semesters ($F_{df36} = 3.95, p < .05$).

Table 2. Video playing for each chapter

	Completed	Incomplete	Not Started
Chapter 1	19	5	0
Chapter 2	20	2	2
Chapter 3	16	3	5
Chapter 4	14	5	5
Chapter 6	17	2	5
Chapter 7	18	4	2
Chapter 9	18	3	3
Chapter 10	17	4	3
Chapter 11	16	5	3
Chapter 12	15	4	5
Chapter 13	15	6	3
Average	16.82	3.91	3.27

The student preference for embedding instructor-generated videos amongst interactive course material was evident in qualitative student feedback. While students from the previous semester mentioned chapter

videos as one of the aspects of the course that contributed most to their learning, they also equally referred to the contribution of reading material to their learning. In comparison, students alluded to videos embedded in interactive reading material more often in the later course than was evident in the previous semester.

"The chapters in the HTML version are excellent." "Interactive lessons, chapter slides and notes, chapter quizzes" "Professors online interactive videos and slides" "Interactive Modules: It was nice not watching a 20-minute video but reading and then watching quick videos!" were frequent comments that were provided as aspects of the course that contributed most to student learning.

With regard to assessments, Table 1 provides the rubric that was used for both formative and summative assessments. There were two formative assessments and one summative assessment conducted. The formative assessments related to students using open book and notes to answer multiple choice quizzes. Students were given two attempts to take the quizzes and the highest score from each of the quizzes were recorded for grading purposes. Results from Table 3 demonstrate that the percentage of students taking two attempts to complete quiz assignments sharply fell in the second semester over the first semester. Cumulatively, across all quizzes, there were 14% fewer attempts to take quizzes in the second semester compared to the previous semester. This provides an indication that the students were more engaged with the course material so that they did not have to make extra attempts to do well in the quiz.

Table 3. Formative assessment through quizzes

	% of Students with 2 Attempts		Change
	Spring '21	Spring '22	
Quiz 1	53%	29%	24%
Quiz 2	40%	8%	32%
Quiz 3	47%	29%	18%
Quiz 4*	73%	63%	11%
Quiz 5	67%	58%	8%
Quiz 6	47%	58%	-12%

* Quiz 4 was a combination of an Escape Room and Assignment Upload in Spring '22

When examining the responses to formative case studies, two elements of analysis were taken into consideration. One, a quantitative analysis of the length of writing related to critical thinking was used as a way to understand whether students in the two different courses comprehended material and used their critical thinking differently. Second, qualitative analysis of their responses was done using two different coders. The criteria of analysis relate to the richness of analysis, critical thinking, and novelty in thinking, as discussed in the methodology section (please refer to Table 1 for the use of a rubric). Intercoder reliability was .78, suggesting moderate reliability. All discrepancies were discussed with reasons and resolved.

Following this, the coder responses for the three measures for qualitative analysis were summated: Cronbach's alpha >.90. T-tests were used to study the differences in the means for both quantitative and qualitative analysis of the responses of four case studies, as demonstrated in Table 4. As seen in the table, other than Case 1, all cases demonstrated a significant change in the depth of analysis in spring 2022. Students showed greater depth in thinking and more critical and novel thinking in 2022 than in 2021. Cases 2 and 3 also showed that students used significantly more analysis in 2022 compared to 2021. This demonstrates that there is some positive effect of embedding instructor-generated videos within the reading material compared to when they were provided separately. This is especially important considering that the case studies were low-stakes, formative, weekly assignments. However, when similar analyses were performed for the summative final exam, results demonstrated that there were no significant differences in the amount of material uploaded or the depth of analysis, critical thinking, or creative thinking across the two semesters.

Finally, when analyzing the overall student grade performance for quizzes and the final exam, Table 5 shows that there was no significant difference in grade performance over the two semesters. The mean of student performance across all quizzes for 2021 was 9.39 (SD = .51), while that of 2022 was 9.41 (SD = .68) ($F_{df 1} = .01, p > .05$). Similarly, the mean final exam score was 93.54 (SD = 3.41) for 2021, while that for 2022

was 95.47 (SD = 2.48) ($F_{df\ 1} = 2.99, p >.01$). This demonstrates that while instructor-generated video and other course material provided separately may have an impact on course engagement, student grade outcomes were not significantly affected based on instructional design. As long as course material was provided and students could access it, the overall exam assessment outcomes remained the same.

Table 4. Quantitative and qualitative analysis of case studies and final exam

	Year	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Case1_quant	2021	2.8	1.7388	-0.066	36	0.9
	2022	2.8	1.2978	-0.061	21.537	0.9
Case1_qual	2021	2.8	1.2315	-0.275	36	0.7
	2022	2.9	1.0099	-0.261	23.184	0.7
Case2_quant	2021	3.3	1.9158	-1.290	36	0.2
	2022	4.1	1.7599	-1.261	25.462	0.2
Case2_qual	2021	3.1	1.1465	-2.675	36	0.0
	2022	3.9	0.8531	-2.474	21.486	0.0
Case3_quant	2021	3.0	1.6833	-1.710	35	0.0
	2022	4.0	1.8113	-1.749	26.363	0.0
Case3_qual	2021	2.6	1.2506	-3.341	35	0.0
	2022	3.8	0.7914	-2.928	17.345	0.0
Case4_quant	2021	3.2	1.7632	-0.263	35	0.7
	2022	3.4	1.9072	-0.269	26.480	0.7
Case4_qual	2021	2.9	1.0963	-1.972	35	0.0
	2022	3.6	1.0476	-1.944	23.771	0.0
Final exam_quant	2021	7.8	3.23103	-1.420	35	0.1
	2022	9.6	3.92607	-1.490	31.725	0.1
Final exam_qual	2021	4.1	0.91162	-0.404	35	0.6
	2022	4.2	0.65411	-0.373	21.195	0.7

Qual refers to qualitative analysis of case studies and final exam
 Quant refers to quantitative analyses of case studies and final exam

Table 5. Grades analysis for quizzes and final exam

	2021		2022	
	Mean	Lowest	Mean	Lowest
Quiz 1	9.86	8	9.83	8
Quiz 2	9.86	8	9.92	8
Quiz 3	9	4	9.65	6
Quiz 4	9.71	8	NA*	NA*
Quiz 5	8.62	4	8.25	6
Quiz 6	9.29	4	9.42	2
Final exam	93.54	85	95.47	90

* The quiz was run in the form of an escape room. So, results could not be collected in the same way as the other quizzes

An important point to highlight is that student evaluation related to the excellence of the course at the end of the semester showed a marginal increase from 4.5/5 in spring 2021 to 4.64/5 in spring 2022. Although this evaluation may be dependent on a number of factors, it may be considered another parameter to gauge student assessment of how they felt about the course in the two different semesters.

GENERAL DISCUSSION

As online learning plays a greater role in graduate education, there is concern amongst instructors in terms of increasing student engagement with content. This apprehension is further exacerbated in the case of asynchronous, online learning. Previous research has discussed the importance of instructor-generated videos in engaging students with learning material. This research investigates how interactive instructional

design by embedding videos within reading material helps enhance student engagement and assessment in asynchronous online learning compared to providing videos and reading material separately.

By using the overarching theory of communities of inquiry (Anderson et al., 2000) and the conceptual basis of the community process model (Lear et al., 2010), this research suggests that the interaction of teaching and cognitive presence helps contextualize the teaching content and other course factors so as to involve learners in an asynchronous online setting. We affirm the importance of instructional design in driving enhanced student engagement: while instructor-generated video content is important in engaging students, excessive use of videos may lead to student exhaustion and, therefore, a lack of engagement. Our research demonstrates that instructional design that uses a rich media blend by embedding instructor-generated videos amongst various reading material and interactive content may help students remain focused on course content. The qualitative responses from students demonstrated the preference for interactive course material, which provides feedback in that direction. By embedding videos among other learning material, students can use different ways to understand different facets of a concept and apply them.

Additionally, our research demonstrates the impact that embedding instructor-generated videos among interactive course content may have on learning outcomes. First, there was a noteworthy increase in engagement, as demonstrated by the number of students that played the videos that were embedded in the reading material, making them interact more with the media-rich content. Second, the results demonstrate a decrease in the number of students who took two attempts to complete quizzes following course material learning. This highlights a probable greater engagement with course material as represented through formative evaluation. Third, qualitative and quantitative analysis of the case study assignments demonstrated that responses from three out of four cases showed a significant difference in formative performance in case analyses. Although it may not have a direct effect, at least indirectly, the results showed that students provided responses that had greater elements of critical and creative thinking and depth in analysis when instructor-generated videos were embedded in the reading material compared to when they were provided separately. Fourth, it is important to acknowledge that the summative final exam performance of students did not show a significant difference in the total amount of writing or in terms of the qualitative evaluation of critical and creative thinking and depth of analysis. Finally, the overall course performance grades did not change significantly between the results when students engaged with instructor-generated video content that was provided separately compared to when students learned using videos embedded in other interactive course material. It is unclear why the grade assessments do not show significant differences. One may speculate that while engagement is important, students may be using different ways to reach the end outcome of performing well in their final evaluation. Additionally, student ambition to achieve particular letter grades may drive their performance in the assessments. As long as all the required course material is provided, students may be motivated to achieve their ultimate letter grade. Future research should delve deeper to understand the processes that drive student engagement compared to those that drive student performance outcomes. Besides, there may be some personal factors that this research overlooked that may be determinants of performance outcomes. Finally, there may be instructor and instruction factors that may also play a role in the performance outcome. Would the base level of grading be a factor in this context? More research will help tease apart such intricacies.

There are some limitations to this research. First, data from only two semesters was considered for the analysis and the sample size from the online graduate courses were small. Besides, the course was taught by a single instructor and data was collected from one institution only. Therefore, more longitudinal data would need to be collected across multiple courses, instructors and institutions for generalizability of results. Second, although the videos were chunked into short clips so as to reduce student boredom, there was no way to prevent students from not watching the series of videos, specifically in the semester where the videos were provided separately from the reading material in a module. Future research should specifically examine the effect of alternating videos and reading material, even though they are provided separately. Third, the type of course may also have an effect on student engagement and learning. Further research is required to use course type as a covariate to remove its effect from the final analysis. Fourth, a graduate course was used for the analysis. Students in such a course may be very different from the undergraduate population. Therefore, to generalize the results, a different student population would need to be engaged. Fifth, although there is some evidence regarding student appreciation of going over interactive course material in which video was embedded, more research is required to understand what elements in course content appear to be engaging. A student survey to this end would be the next course of investigation in

this program of research. Additionally, it would be important to understand the boundary conditions and mediators of student interest.

In summary, our research appeals for a greater call to examine elements of course engagement in asynchronous online learning.

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For further information contact:
Mousumi Bose
Charles F. Dolan School of Business
Fairfield University
Fairfield, CT, USA