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Student Perspectives on the Use of Interactive Video Lectures in Online Classes

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ABSTRACT. As enrollment in online courses continues to rise, examining quality student engagement opportunities in online settings is important for their success and well-being. The current study sought to understand students' perspectives on using interactive video lectures in fully online classes. Surveys were collected from 161 undergraduate students across two psychology and two family studies and human development online courses. All four courses used online video lectures with embedded questions and pauses to allow time for answering. The survey results report students felt the embedded questions supported their understanding of the content and kept them engaged. Students explicitly reported paying more attention to the videos because there were questions to answer. Students also appreciated the immediate feedback they received, particularly from multiple-choice questions, and felt it helped solidify what they needed to further study. Implications for future practice and research are included.

Key terms: online learning; video lectures; student engagement

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Student Perspectives on the Use of Interactive Video Lectures in Online Classes

The use of active learning strategies has become more common in face-to-face college courses over the past few decades. The use of these strategies, particularly Personal Response Systems (PRS; the most common being clickers), has been well documented in objective and subjective measures of learning (see Hunsu, Adesope, & Bayly, 2016). This push for more active learning in the college classroom has coincided with a larger emphasis on learner-centered as opposed to teacher-centered teaching and learning. However, little research has investigated the inclusion of interactive video lectures (IVLs) meant to spur those similar learner-centered strategies in online courses by using active learning strategies. Interactive video lectures are videos with embedded questions, other activities, and/or links contained within them. This study investigates student perspectives on the inclusion of such videos in four different online classes, how the videos may support student engagement and perceived learning in the courses, and what features of the videos might be most beneficial for learning.

The education community generally agrees that student engagement is beneficial for an array of student outcomes (see review by Trowler, 2010). Student-content engagement includes opportunities for active learning and various modes of interaction, may build on course concepts, and preferably includes opportunities for personal and instructor feedback (Indiana University, n.d.). Student engagement has been shown to improve first year college students' GPAs and persistence (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008). This effect is particularly pronounced for historically underserved populations who may be at the greatest risk for attrition (Kuh et al., 2008).

Additionally, students have very positive reactions to the use of engaging course content. Learners indicate an increase in perceived learning (Marks, Sibley, & Arbaugh, 2005) and a reduction in time spent adequately learning course materials (Suhonen & Tilli, 2016). When asked, most learners indicate that student-content engagement is very important in online education (Martin & Bolliger, 2018).

A focus on engagement in online courses is relevant, given recent figures showing 15% of college students are exclusively online, and an additional 18% of students are enrolled in at least some online courses. This constitutes about a third of all college students (Lederman, 2018). The COVID-19 Pandemic illuminated our need to quality online courses, given poor outcomes academically and personally when they were conducted poorly (Madgrial & Blevins, 2021). And as in-person enrollment sags online learning continues to increase (Lederman, 2021). It is important then to investigate the implementation of active learning strategies intended to spur student engagement and perceived learning in online college classes. Below, we summarize research primarily from face-to-face (F2F) traditional lecture courses that have employed active learning strategies similar to the strategies used in the interactive video lectures (IVLs) in the current study. Our summary begins with the relationship between active learning strategies and students' actual and perceived learning, and then we review active learning and its relationship with student engagement. Where possible, studies that have specifically addressed online, hybrid, or blended courses have been included. A careful consideration of the pedagogical theory underlying the implementation of new technologies is also included

Active learning strategies and student learning

The use of active learning strategies in college courses have yielded largely positive findings, both objectively and subjectively for student learning (Poirier & Feldman, 2007). One of the most commonly used in face-to-face courses are Personal Response Systems (PRS), commonly referred to as “clickers.” These systems can be remote devices or fully online platforms which allow questions to be integrated into lectures. The systems can be used in real time, such as a multiple choice question posed to a synchronous class; or asynchronously, where students can review on their own time. Reasons for using PRS include allowing instructors to assess student knowledge and give instant feedback, the potential for increasing student engagement, and allowing more students to participate, particularly in large lecture courses (Poirier & Feldman, 2007).

The use of PRS has been found to benefit student academic performance in most, although not all, cases (Fitzpatrick, Finn, & Campsisi, 2011; Gauci, Dantas, Williams, & Kemm, 2009; Keough, 2012; Mayer et al., 2009; Poirier & Feldman, 2007; Shapiro & Gordon, 2012). In a meta-analysis of the use of clickers specifically, Hunsu, Adesope, and Bayly (2016) found that using PRS has a small but statistically significant association with student learning outcomes. Mayer and colleagues (2009) found in a study of 385 undergraduate students in educational psychology classes that students in the section featuring clickers had significantly higher exam scores than students in a section including non-clicker questions and students in a section that did not include questioning at all. Poirier and Feldman (2007) and Shapiro and Gordon (2012) found similar results in introduction to psychology courses. Poirier and Feldman (2007) compared an introduction to psychology course that used PRS and one that did not. In the section that used PRS, students earned significantly higher exam scores. Shapiro and Gordon (2012) found that questions asked via PRS yielded better results on exams than simply emphasizing material as very important.

Another method of active learning found to support student learning is the use of pauses during lectures. These pauses may include reflecting privately to oneself, discussing with peers, group discussions, and/or writing summaries (Bachhel & Thaman, 2014; Chowdhury, 2016; Richards et al., 2017; Ruhl, Hughes, & Schloss, 1987). Chowdhury (2016) taught two accounting classes, one using pauses during lectures and one that did not. The pauses included group discussions or short writing summaries. Students in the pause class performed significantly better on the exams compared to the non-pause class (Chowdhury, 2016). Another study randomized lectures within a continuing medical education course and found students recalled more information in lectures with pauses compared to lectures that did not include pauses (Richards et al., 2017). In addition, Bachhel and Thaman (2014) completed a study of 150 first year medical students using this strategy and found the pause group had a significantly better academic performance compared to the non-pause section.

Subjective measures of learning. Along with more objective measures showing active learning strategies can help improve academic performance, students have largely espoused the use of PRS as supporting their perceived learning and overall understanding of course content (Gauci et al., 2009; Johnson, 2005; Keough, 2012; Koenig, 2010; Llana et al., 2015; Milner-Bolotin et al., 2010; Patry, 2009; Poirier et al., 2007; Porter & Tousman, 2010; Uhari et al., 2003). For example, aside from objectively doing better on exams, the Poirier and Feldman (2007) study

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also found that students in the PRS section reported that they felt they learned more because of the use of clickers specifically (66% of students agreed or strongly agreed). Guaci and colleagues (2008) reported that 81% of student respondents agreed or strongly agreed that using PRS supported their understanding of the content, and 78% noted it supported their learning overall.

Students using the pause strategy have found similar results. In Chowdury's (2016) study comparing accounting classes, the students in the section that included pauses rated the course as more enjoyable and the instructional strategies as superior to the non-pause class (Chowdury, 2016). Another found students rated the lectures including pauses as more favorable than lectures that did not include pauses (Richards et al., 2017). Bachhel and Thaman's (2014) study on first year medical students found the majority of the students said it helped with the recall of content (84%) and their overall understanding of the content (86%). It is important then to gain a greater understanding of the use of active learning strategies in online courses via online video lectures and if students perceive it to be beneficial for their own learning.

Active learning strategies and student engagement

The use of active learning strategies has, beyond objective and subjective measures of student learning, been largely perceived by students as beneficial for engagement in their courses (FitzPatrick et al., 2011; Guaci et al., 2009; Keough, 2012; Koenig, 2010; Llena et al., 2015; Moredich & Moore, 2007; Patry, 2009; Porter & Tousman, 2010). In a study of 229 Anatomy and Physiology students across six course sections using clickers, FitzPatrick and colleagues (2011) found students reported being more engaged and participating more in a class that used clickers than in traditional lecture classes without clickers. Another study also found students reported being more engaged (83% agreed or strongly agreed; hereafter agreed) and intellectually stimulated (85% agreed) when PRS was used in courses (Guaci et al., 2009). Patry (2009) found in a survey of 516 undergraduate students, the majority of them in psychology, that PRS helped students stay engaged (5.11 on a 1-7 scale), while Porter and Toughman (2010) found that nursing students perceived the use of PRS in their classes to help with their in-class concentration.

In addition to students feeling that active learning strategies support their learning, students appear to particularly appreciate that these strategies provide instant feedback on their learning (FitzPatrick et al., 2011; Johnson, 2005; Koenig, 2010; Llena et al., 2015; Milner-Bolotin et al., 2010; Moredich & Moore, 2007; Patry, 2009; Porter & Tousman, 2010). Milner-Bolotin and colleagues (2010) found via semi-structured interviews with physics students that students appreciated the immediate feedback received from PRS questions; they reported it was a good opportunity to clarify concepts. Research on dentistry students (Johnson, 2005) and nursing students (Porter and Trousman, 2010) also found students liked the feedback they received when completing in-class questions. Koenig (2010) found that students could identify what they didn't know via the use of PRS. Patry (2009) additionally found students felt they could assess what they needed to study for exams because of the use of PRS.

A few studies using online videos with active learning strategies have found positive results in traditional and flipped courses. Flipped courses can be defined as courses in which students learn the content before class, often replacing a lecture with materials to be reviewed before the in-class session, including video lectures. In-class time is then spent engaging with the

content (Brame, 2013). Cummins and colleagues (2015) utilized online video lectures with embedded quiz questions in a flipped computer program class and reported that 83% of students cited the embedded questions as useful. The most common reason for this was their ability to get feedback on how well they understood the content (Cummins, Beresford, & Rice, 2015). Schoenner and Tiili (2016) utilized interactive video lectures in a physics course. The students watched the videos and answered questions within the videos before coming to their lab section. Students reported that they felt it was easier to do the labs because of the instructional videos and cited them as a better way to prepare for labs than only reading written instructions (Schoenner & Tiili, 2016). Studies that have included questions soliciting feedback on the use of active learning strategies have found students recommend continued and expanded use of them (Koenig, 2010; Llena et al., 2015; Milner-Bolotin et al., 2010; Molgaard, 2005; Patry, 2009; Porter & Tousman, 2010).

Theoretical Considerations

Although we know there are many benefits associated with active learning strategies, it is important that instructors think critically about new technologies before implementing them into classes. The SECTIONS model is a framework put forth by Bates (2015) to guide instructors on whether a particular technology is appropriate for their class. According to the model, instructors should consider eight factors in choosing whether to include new technology in any given course: Students, ease of use, costs, teaching functions, interaction, organizational issues, networking, and security and privacy (Bates, 2015). In examining the factors described by the SECTIONS model, we felt confident in implementing interactive video lectures into classes being studied in the present research. As part of enrolling in an online course, our students are advised in advance that they must have access to technology that meets minimum technical requirements set by the university, including a laptop or desktop computer with access to high speed internet. We chose to use a system, PlayPosit (<https://go.playposit.com/>), that would allow students to access IVLs through multiple platforms, including phones, tablets, or chromebooks in addition to laptops and desktop computers. Additionally, the PlayPosit video interface is easy to use, free for students, and is accessible for screen-reading devices (PlayPosit, 2022). The videos allow for appropriate student-content interaction and are designed to facilitate student learning. Additionally, appropriate technological support is available and already in place at the university, and student responses are securely saved and can be automatically synced with the university's learning management system.

The Current Study

The use of active learning strategies have been associated with student learning, both objectively and subjectively. Students report feeling more engaged in their lessons, appreciate feedback on how they are doing, and appear to enjoy courses more when active learning strategies are implemented. But little research has investigated these topics using online videos specifically and particularly using online videos in fully online classes. The current study seeks to explore these relationships in fully online courses that use interactive video lectures in the tool PlayPosit¹ (<https://go.playposit.com/>). PlayPosit allows users, in this case instructors, to upload

¹ PlayPosit was acquired in 2022 by WeVideo (<https://www.businesswire.com/news/home/20220816005318/en/WeVideo-Acquires-PlayPosit-to-Pioneer-Next-Evolution-of-Video-Creation-With-Interactive-Content-and-Measurable-Analytics>)

videos and embed questions, links, discussions, and pauses within them. Particularly, the study asks: do students feel that IVLs support their learning? Second, do students report feeling more engaged in their coursework because of the interactive nature of the videos? And third, what parts of the IVLs do they find most beneficial? As mentioned above, prior studies have found students perceive they learn more and feel more engaged in F2F classes that use active learning strategies (Fitzpatrick et al., 2011; Hensu et al., 2016). Given the similar nature of interactive lecture videos to the use of pauses and PRS in F2F lectures, it is expected that the current study will find similar results. Specifically, we hypothesize students will perceive that the IVLS supported their learning and engagement. It is important, given the increasing enrollment of students into online classes (Lederman, 2018), to investigate this area of higher education.

Methods

Participants

Participants consisted of 161 students from four undergraduate classes at a large university in the southwestern United States. The majority of participants identified as female ($N = 134$, 83.23%), Psychology majors ($N = 37$, 22.98%), or Family Studies and Human Development majors ($N = 28$, 17.39%), with the remaining students spread across a broad number of departments and disciplines. Most students were juniors ($N = 68$, 42.23%) or seniors ($N = 49$, 30.43%), with a mean age of 22.69 ($SD = 6.58$). The majority of participants had taken a fully online class previously ($N = 140$, 86.96%) and had experienced lecture videos as part of a previous class ($N = 118$, 73.29%), though most had no previous experience with the tool PlayPosit, specifically (N with previous PlayPosit experience = 36, 22%; See Table 1).

Materials and Procedures

Data were collected in Fall 2018 from two sections of courses in Psychology (Introduction to Psychology, $N = 73$, and Psychological Measurement and Statistics, $N = 37$) and two sections of courses in Family and Consumer Sciences (Introduction to Research Methods, $N = 33$, and Adolescence, $N = 18$).

A number of PlayPosit videos were shown in each class (range = 1-7 per week), where students were compelled to respond to embedded questions to continue. The length of videos ranged from three to 52² minutes, with most videos being 5-10 minutes in length. A variety of question types were embedded, including reflective pauses, free response, multiple choice, select-all-that-apply, polling survey, fill-in-the-blank, and embedded links (PlayPosit offers a discussion forum option as well, but it was used only once across all four classes. Data from that question were not included in the analysis because of its limited use). Student responses were graded (for correctness in the two psychology courses and completion in the two Family and Consumer Science courses), and the content covered in the PlayPosit videos was assessed in future exams or quizzes. In regards to student grades, engagement, completion, and accuracy of responses to PlayPosit videos ranged from 3% to 11% of final grades in the four classes.

² The 52 minute was a video with a guest speaker for the adolescence course and was an outlier in length. No other video was longer than 30 minutes.

During the last two weeks of each course, students were asked to complete a short survey to rate their experiences using PlayPosit. The survey, which was anonymous and voluntary, consisted of 19 close-ended questions that elicited feedback on the use of interactive video lectures and six open-ended questions designed to determine student perceptions of the benefits and challenges of using interactive video lecture systems like PlayPosit. The university's IRB deemed the study non-human subjects research and exempt from a full IRB review before approval.

Analyses

Descriptive statistics were obtained on sample demographics, including gender, age, class, which course the student was enrolled in, their major, their full-time student status, their status as an online student, as well as prior experience with online courses and video lectures, including interactive video lectures (See demographic information above and Table 1).

Table 1

Participant Characteristics

Characteristic	%
Gender	
Female	83.2
Male	16.8
Class	
Freshman	6.2
Sophomore	21.1
Junior	42.2
Senior	30.4
Course Enrolled	
Introduction to Psychology	45.3
Psychological Statistics	23.0
Research Methods	20.5
Adolescent Development	11.2
Major	
Psychology	23.0
Family Studies and Human Development	17.4
Nutrition	3.1
Undecided	1.9
General Studies	1.9
Other	52.7
Full-time student status	90.7
Fully online student status	8.7
Prior enrollment in an online class	87.0
Prior experience with video lectures	73.8
Prior experience with interactive lecture videos*	30.3

Note. $N=161$. Participant ranged 17-65 years old with an average age of 22.68 (SD = 6.56)

* Only asked students with prior video lecture experiences $N=161$

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Table 2
Student Perspectives on Use of Interactive Video Lectures

Features of IVLs	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
The embedded questions were beneficial for my learning	0%	2.9%	6.6%	35.3%	55.1%
The embedded questions helped increase my understanding of the content	0.6%	5.7%	3.8%	44.7%	45.3%
The embedded questions helped solidify what I needed to study	1.3%	9.4%	10.1%	35.8%	43.4%
The embedded questions helped keep my attention during the videos	1.9%	4.4%	10.7%	28.3%	54.7%
The embedded questions helped keep me engaged in the material	1.3%	4.4%	9.4%	36.5%	48.4%
I would continue the use of embedding questions in lecture videos	2.5%	8.2%	8.8%	30.2%	50.3%
I paid more attention to the video because of the questions embedded in the videos	1.9%	5.7%	8.8%	28.9%	54.7%
The embedded questions that asked me to think about my knowledge of the topic helped me make connections with the course content	1.3%	5.0%	8.2%	42.8%	42.1%
The embedded questions that asked me to predict an answer before being shown the information were beneficial to my learning	4.4%	9.4%	9.4%	38.4%	38.4%
The embedded questions were fun	8.8%	9.4%	30.8%	28.9%	22.0%

Note: $N=159$ for all items

Frequencies were then obtained on questions related to students' perspectives on the use of the interactive video lectures in the class and on questions related to how helpful particular question types were for their learning (See Tables 2 and 3 for question stems; full survey in Appendix A). Descriptive statistics were also obtained on students' perspectives on the question types that were their favorite, and the ones that they felt were most beneficial for learning. Students were asked to rank their top three question types as the most favorite and most beneficial for learning. Based on the results, we rank-ordered the seven PlayPosit question types overall. Students' overall feelings about the use of PlayPosit were solicited in six open-ended questions. Students were asked about the benefits of using interactive video lectures, what they found helpful, the drawbacks to its use, what they would change, their preference for the optimal number of embedded questions per video, and overall feelings about PlayPosit use. Using a grounded theoretical approach, student responses were open-coded (Corbin & Strauss, 1990),

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including direct feedback from respondents (such as “helpful” and “length of video”) and from prior research, such as “explanations” and “engaging.” These open codes were then grouped into similar categories to denote common themes in student responses, such as student feedback, question type, and student engagement. These themes were compared to the quantitative findings and used to complement those results discussed below. Finally, ANOVAs were performed between classes for items on the features of the IVLs.

Table 3

Student Perspectives on Specific Types of Questions

Now we would like to get your feedback on certain features of PlayPosit. Please note how helpful were the...	<i>N</i>	Extremely Unhelpful	Unhelpful	Neither Helpful Nor Unhelpful	Helpful	Extremely Helpful
The reflective pauses	156	0%	9.0%	25.6%	47.4%	17.9%
Free response questions	155	1.3%	9.7%	17.4%	53.5%	18.1%
The multiple choice questions	155	0%	1.9%	6.5%	52.9%	38.7%
Check all that apply	154	2.6%	6.5%	16.9%	48.1%	26.0%
The polling survey	154	0%	7.1%	20.1%	47.4%	25.3%
Fill in the blank	151	2.0%	6.6%	11.9%	53.0%	26.5%
The embedded links/videos	148	0.7%	7.4%	17.6%	44.6%	29.7%

Results

Students' perspectives on the use of interactive video lectures

The feedback on the use of interactive video lectures was largely positive. Most of the students agreed to strongly agreed (hereafter agreed) that the embedded questions were beneficial for their learning (90.4%; Table 2). Students also agreed that the IVLS helped with their understanding of course content (90%) and helped solidify what they needed to study (79.2%). Students agreed questions that asked them to predict an answer before reviewing the material were beneficial for their learning (76.8%). Student comments in the open-ended questions also further supported these findings. Comments often mentioned the videos supported their understanding of the material and learning in general. One student noted, “[It’s] a reliable study tool I used while preparing for midterms. I was able to go back and watch videos.” Another student noted, “I think it made you reflect more than usual.” Some students mentioned

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utilizing the videos later when doing course assignments, exemplified by this student's comment, "I would refer back during my homework if I was getting a problem wrong, I would go back to the video to see if I could figure out what I did wrong."

Students also appreciated the explanations of the materials and the modeling that occurred in them. Thirty-four comments in the open-ended questions were made specifically related to the fact that they liked being able to review and replay the interactive video lectures, which helped solidify their learning. One student in the statistics course noted, "Seeing a problem worked out in real-time, step-by-step, is just great. It's even better than an in-person class because it can be reviewed, you can rewind, and you can repeat parts."

For attention and engagement, 83% of students agreed to strongly agreed that the embedded questions helped keep their attention during the videos, and 83.6% said they paid more attention to the videos because of the embedded questions. Nearly 85% noted the questions kept them engaged in the material (Table 2). The open-ended responses also mirrored these findings. The most commonly cited benefit of using interactive video lectures was related to students maintaining their attention and staying engaged in the video lectures because of the embedded materials (66 total comments). One student noted, "It made me pay attention to the videos because I knew there would be questions regarding the material," and another said, "[the questions] helped me to stay more focused and actually retain the information." Another said simply, "They keep you more engaged than just watching a video."

Twenty-three comments were made in the open-ended questions that related to appreciating the interactive nature of the videos, giving the feeling that they were in a F2F class. One student noted:

It makes me feel like I am in an actual classroom since we have the professor asking questions. I think the benefit is having my undivided attention to the lecture since we engage with the content with questions. It is also helpful for us to see if we are understanding the content.

Another specifically related the videos to a F2F class using clickers, "I like them because [the interactive video] lecture is a similar method to asking follow-up/clicker questions in an in-person class setting."

Finally, a majority of students (80.5%) agreed to strongly agreed that interactive video lectures should be continued in courses. A smaller percentage of students (50.9%) even noted the use of the embedded questions were fun. One student in the open-ended questions wrote, "I really enjoyed them. They never felt like a waste of my time. I always looked forward to completing them." Two other students also noted, "I enjoyed the PlayPosit videos, I think you should continue to use them" and "I loved the PlayPosit videos and hope to see more use of them in the future." Finally, one student said simply, "I think it's a great idea and all online classes should be required to use them."³

Features of the interactive video lectures

The most helpful feature from students was the multiple-choice questions, with 91.6% noting them as helpful or extremely helpful (Table 3). This also aligns with the ranking questions/features, with multiple choice questions being ranked as both the feature most

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beneficial for their learning and their favorite question type (Table 4). The multiple-choice question type was also mentioned in the open-ended responses the most as being beneficial for their learning. This appears to stem from students appreciating the clear feedback that multiple choice provided on their understanding of course content, an important theme discovered through qualitative analysis of the responses. One student noted, “The multiple-choice questions would tell you the right answer after you answered it, which is helpful to know if you understand the information or not.”

Table 4

Rankings of Questions

Rankings of questions	Favorite Question Type	Question Most Beneficial For Learning
Multiple choice questions	1	1
The reflective pauses	2	2
The free response questions	3	3
Check all that apply	4	4
The polling survey	5	6
Fill in the blank	6	5
The embedded links/videos	7	7

Note. Student respondents were asked on two ranking questions to rate the questions in order for favorite and most beneficial for their learning. The rankings above reflect the highest ranked items for each question (i.e. multiple choice questions had the most students rank it 1 or 2).

Additional question types ranked as helpful included fill in the blank (79.5% helpful/extremely helpful), followed by check all that apply (74.1%), polling (71.6%), free response (71.6%), and reflective pauses (65.3%). When asked what question type students found to be most beneficial for their learning and their favorite question type, multiple choice ranked first overall, followed by reflective pause, free response questions, check all that apply, polling, and fill in the black. and embedded links/videos. (Table 4).

ANOVA Results

ANOVAs were run to determine whether results differed on the basis of class. Significant differences existed between classes for 4 specific statements: 1) The embedded videos were beneficial for my learning, 2) The embedded questions helped keep my attention during the videos, 3) The embedded questions helped keep me engaged in the material, and 4) I would

continue the use of embedded questions in lecture videos. Upon inspection of post hoc analyses, statement one (beneficial for learning) tended to be rated higher for Statistics and Adolescence compared to Introduction to Psychology. For all other statements, Introduction to Psychology, Statistics, and/or Adolescence (often all three) were rated higher than Research Methods. When looking at absolute numbers, the differences in all 4 cases were very minor in terms of effect size (mean difference scores differing by no more than 1 point and, typically closer to .5 point in difference) and in significance level (significant p-values mostly hovering in the .02 - .04 range).

Suggestions and drawbacks

The open-ended questions also provided additional feedback for future use of interactive video lectures. Students suggested overall that multiple attempts to answer be given when assigning completion of the interactive video lectures, as well as keeping the videos shorter. Although most students did not signify what they meant by short, some comments suggested 10-12 minutes maximum. Comments also reflected the desire for no more than three videos to be required per week.

Some drawbacks mentioned were experiencing technical issues, such as videos not properly loading or closing out before the video was completed, making the student have to re-do the whole video. Other technical issues noted the fill in the blank questions being too sensitive to the answers, meaning some students entered a correct answer, but because the wording was not in the exact language as the key, their response was marked incorrect. Students who watched the videos with subtitles reported that these sometimes blocked parts of the question wording. Finally, students also requested that questions provide clarification, such as giving rationale in multiple choice questions as to why one answer was incorrect and another correct.

Discussion

The continued expansion of online courses and the increased focus on student engagement support the implementation of active learning strategies into online courses. This study specifically sought to understand student perspectives on the use of interactive video lectures in online courses. Particularly, we were interested in learning if and how students felt IVLs supported their learning, as well as what features of them were found to be the most helpful for facilitating learning.

Overall, students held positive views of the inclusion of IVLs in these courses. They found it beneficial for their learning generally, felt it supported their understanding of course content, and helped them see what they needed to further review. They appreciated being able to watch the videos multiple times and gain feedback after answering questions. According to the students, the inclusion of the questions helped them pay attention and kept them engaged more so than videos without such features. Overall, students supported the continued and expanded use of similar videos.

Students felt the multiple-choice questions were the most helpful for their learning and were ranked as their favorite. These findings appear to be related to the quick and clear feedback students received when they answered questions incorrectly. Other features such as short answer, fill in the blank, check all that apply, and reflective pauses were also deemed supportive of their learning.

The findings from the interactive video lectures coincide with previous findings from active learning strategies used in more traditional F2F classes. Several studies have found that students rate the inclusion of PRS in F2F classes as supportive of their learning (Guaci et al., 2008; Poirier & Feldman, 2007). Guaci and colleagues (2008) specifically found that nearly four in five students said it supported their learning overall and helped their understanding of the material. The overall positive subjective feelings of students toward online lecture videos in the present study is a positive sign, particularly since Poirier and Feldman (2007) found students not only subjectively felt like they learned more in class because of the use of PRS but also because the PRS section performed better than the non-PRS section on exam scores. Future studies should investigate the objective and subjective aspects of student learning in online courses that include similar interactive lecture videos.

Related, the current study and prior studies on F2F courses have found students like the use of interactive lectures because they are able to gain feedback on how they are doing (FitzPatrick et al., 2011; Johnson, 2005; Koenig, 2010; Llena et al., 2015; Milner-Bolotin et al., 2010; Moredich & Moore, 2007; Patry, 2009; Porter & Tousman, 2010). Koenig (2010) found that students in physics courses appreciated seeing what they didn't know via answering clicker questions. Cummins and colleagues (2015) found students appreciated the feedback they received when doing in-video quizzes in a flipped computer programming class. For the current study using IVLs, we also found students valued the instant feedback and knowing whether they truly understand the content and what warranted further review. The multiple-choice questions were referenced in the open-ended questions because of the immediate feedback on their correctness. This suggests future use of IVLs supports student learning through asking questions and giving answers, but also that the feedback (no matter what the question type) is important for students to truly understand if they comprehend the information. We do, however, need more research looking specifically at the use of IVLs and in more experimental conditions which are better able to elicit cause and effect.

The inclusion of the questions and other features in interactive video lectures also appear to help keep students engaged and paying attention. Several prior studies in F2F courses found the inclusion of PRS in lectures helped maintain student concentration, helped them stay engaged in the material, and helped them feel more intellectually stimulated as compared to classes without the use of PRS (Gauci et al., 2009; Patry, 2009; Porter & Tousman, 2010). Given that students are often distracted while working on homework (Calderwood, Ackerman, & Conklin, 2014), the use of active learning components in video lectures may be a strategy to help improve student engagement overall and improve retention and learning. Future studies should continue to investigate the use of interactive video lectures for student perspectives on attention and more objective measures on learning via interactive versus non-interactive video lectures.

Finally, just pausing the videos and asking the students to think, write, or select an answer appears to be beneficial in itself. The reflective pause was ranked as the second most helpful component of the PlayPosit features by students. Prior research has found that students learn more when pauses are included in traditional F2F lectures, as evidenced by improved course performance (Bachhel & Thaman, 2014; Chowdhury, 2016; Richards et al., 2017; Ruhl et al., 1987). Although the current study's use of IVLS did not utilize (beyond one question in one class) the discussion forum option, the use of pausing to reflect and/or write appears to support student learning. Future online courses should think about ways of including IVLS or guiding

questions to accompany non-interactive videos to allow for students to pause and reflect/write, as it appears to support student learning. Additional work using PlayPosit and other similar programs should also investigate the perceived pros and cons of the discussion forum option.

Limitations

The current study was designed as a preliminary exploration of student's perceptions of learning and engagement using IVLs. While prior studies on the use of PRS in traditional F2F lectures have found positive academic results (Hunsu et al., 2016; Mayer et al., 2009), the current study did not have a non-interactive video control group and, thus, was not able to assess whether the interactive video lectures produced similar objective learning benefits in online courses. Future research needs to investigate this topic further, particularly given the continued expansion of online enrollment.

Another limitation is the lack of a within-person design to make comparisons across video types. The current sample included students who had prior online video experience (74%), and even some with interactive online video experience (30%). This means many students had some form of reference as to what it is like to watch online videos without interactive components compared to those with interactive components, and this study did not specifically tailor itself to be able to make comparisons across these two types. Future studies should implement experimental or quasi-experimental designs to help tease apart these findings in a sounder manner. An additional limitation is that only one discussion forum question was used across the four classes. Future work should study student perceptions of the use of this option.

Finally, the courses used were all online and in the social sciences (Psychology and Family and Consumer Science). Future studies should investigate this topic with other majors, as well as in different forms. For example, what are students' perspectives on using these videos in hybrid, flipped, and/or traditional lecture classes? These are important lines of inquiry to answer moving forward.

Recommendations

Despite these limitations, it is recommended for online courses that use video lectures to consider adopting interactive components, whether through the use of technology like PlayPosit or through adding accompanying thought questions to existing video components. The current study found students subjectively felt like they learned more because of the interactive features, felt more engaged, and recommended continued and expanded use of interactive videos in the future. Given the similar subjective findings in F2F lecture courses, which also found objective improvements in student grades due to interactive lectures, it suggests the online interactive components will also support student learning. To enhance accessibility for all students, instructors should consider adding caption files when creating interactive video lectures.

Another recommendation is to focus on giving timely feedback to students. Students ranked the multiple-choice question types as the most beneficial to their learning, with open-ended responses suggesting it was related to receiving instant feedback on how they were doing. The program used in the current study, PlayPosit, allows for feedback on short answer, multiple choice, and other question types once a response is given. It is suggested that the feedback option be utilized to give students clear support on how they are doing.

Finally, students recommended and appreciated the opportunity for multiple attempts. Programs such as PlayPosit include features that allow students to re-watch/complete the videos multiple times. For videos graded on full completion and/or correctness, it appears students feel they would benefit from trying multiple times to solidify the material and not be assessed on correctness after the first exposure to the content.

Conclusion

The inclusion of interactive online lecture videos in online courses was viewed by students as supporting their learning and engagement in the class. Students reported benefiting from knowing they will have questions to answer while watching the video, as well as appreciated the feedback they received via those questions. Students recommended continued and expanded use of interactive videos in the future. Scholarship of Teaching and Learning projects should continue to investigate the use of such videos in all course forms.

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Appendix A Survey Questions

Block 1: Demographics

What is your major?

- Education
- English
- Family Studies and Human Development
- General Studies
- Nutrition
- Psychology
- Sociology
- Undecided
- Other _____

What is your gender?

- Female
- Male
- Other _____
- Prefer not to say

What is your age? (Please answer with a whole number)

What is your class?

- Freshman
- Sophomore
- Junior
- Senior

Which of the statements below describe your status as a student? (Please select all that apply)

- Full-time student
- Part-time student
- Transfer student
- Returning student
- Fully online student

General Questions

Have you taken an online class before?

- Yes
- No

Have you taken a class that utilized video lectures previously?

- Yes
- No (skip logic)

Have you taken a class that utilized video lectures with features similar to the PlayPosit videos before?

- Yes
- No

In comparison to videos that did not utilize embedded questions and resources, how would you rate your views of the embedded lecture videos this semester?

- The embedded videos were more beneficial for my learning (1= not at all beneficial to 7= very beneficial)

Block 2: PlayPosit Specific Questions

We are interested in gaining feedback on the use of PlayPosit videos this semester. Please rate the statements below using the following scale to indicate your level of agreement or disagreement. (1-7 Likert scale strongly disagree to strongly agree; 8= not applicable).

1. The embedded questions helped increase my understanding of the content.
2. The embedded questions helped solidify what I needed to study.
3. The embedded questions helped keep my attention during the videos.
4. The embedded questions helped keep me engaged in the material.
5. I would continue the use of embedding questions in lecture videos.
6. I paid more attention to the video because of the questions embedded in the video.
7. The embedded questions that asked me to think about my knowledge of the topic helped me make connections with the course content.
8. The embedded questions that asked me to predict an answer before being shown the information were beneficial to my learning.
9. The embedded questions were fun.

Now we'd like to get your feedback on certain features of PlayPosit. Please note how helpful the types of questions were in supporting your learning. (1-7 likert style least helpful to most helpful; 8= not applicable).

1. The reflective pauses
2. The free response questions
3. The multiple choice questions
4. The check all that apply questions
5. The polling survey questions
6. The fill in the blank questions
7. The embedded videos/links
8. The discussion forum questions

Block 3: Ranking and Open-Ended

Please rank your **TOP THREE (3) FAVORITE** types of embedded questions you encountered in PlayPosit.

- The reflective pauses
- The free response questions
- The multiple choice questions
- The check all that apply questions
- The polling survey questions
- The fill in the blank questions
- The embedded videos/links
- The discussion forum questions

Please rank your **TOP THREE (3)** embedded questions you encountered in PlayPosit that you found to be **MOST BENEFICIAL TO YOUR LEARNING**.

- The reflective pauses
- The free response questions
- The multiple choice questions

The check all that apply questions
 The polling survey questions
 The fill in the blank questions
 The embedded videos/links
 The discussion forum questions

Block 4 (to be taken only for Dr. Ottusch's classes)

Did you participate in the FSHD 377 Adolescence or FCSC 202 Research Methods sections? (yes/no, skipped logic. If no advance to the open-ended questions)

Professor Ottusch is curious to get your thoughts of the use of muddiest points at the end of each PlayPosit video. Please answer these questions on a 1-7 style of completely disagree to completely agree.

- It was helpful to have a spot to voice any issues or points of confusion I had.
- The weekly check in announcement/emails covering the main muddiest points for each week were helpful.
- I typically viewed the weekly check in announcement/emails covering the muddiest points.
- I found the use of using a video to cover the muddiest points the most helpful way to cover those issues.
- I found the use of using just text to cover the muddiest points the most helpful way to cover those issues.
- I found the use of both text and video as the best way to cover the muddiest points the most helpful way to cover those issues.
- I would continue the use of having a muddiest point question at the end of videos in the future.

Open-ended question

Please note any thoughts on the use of the muddiest point question and the response videos. Any and all feedback is helpful and will be used in crafting my future classes.

Block 5: Open-Ended

- Ideally, how many embedded questions do you think would be appropriate for a 10-minute lecture video? (Please answer with a whole number).
- What were the benefits you saw of the use of PlayPosit lecture videos this semester?
- What aspects of the PlayPosit lecture videos did you find to be particularly helpful for your learning?
- What were the drawbacks of the use of PlayPosit lecture videos this semester?
- What aspects of the PlayPosit lecture videos would you recommend changing for future semesters?
- Overall what are your feelings of the use of PlayPosit videos?