DO HIGHER PRODUCTION VALUE VIDEOS LEAD TO IMPROVED ENGAGEMENT AND LEARNING OUTCOMES? A FIELD EXPERIMENT

Sean Alley, Tennessee Tech University
Steve Isbell, Tennessee Tech University

ABSTRACT

Course content in higher education is increasingly provided via video lectures. Video quality varies widely, from textbook publishers that provide professional quality videos to individual instructors recording videos on their laptops. In this study, we randomly assigned students to one of two videos, one high quality and one lower quality, to measure the causal effect of video quality. We combined this with a difference-in-difference framework to account for possible confounding correlates. We examined the effects on exam scores, homework scores, and student engagement. Our results suggest that video quality has no impact on any of these student outcomes.

Keywords: *online courses, video production quality, attention economics, online learning, economic education*

INTRODUCTION

In today's information-rich world, students have many things competing for their attention. This competition is particularly acute in an online setting where the entire internet is a click away during an online lecture. Some video lectures are undoubtedly more interesting than others. "In an attention utopia, dry lectures and textbooks would be replaced by more entertaining educational experiences—often technologically facilitated" (Davenport & Beck, 2001, p. 218).

In this paper, we conduct an experiment to test whether improving the production quality of online content improved student engagement and learning outcomes in a business statistics class. The higher production value video did not significantly affect student engagement or performance. Perhaps this should not come as a surprise, as more sophisticated videos also add to the cognitive load of the student. After a background and literature review, this paper describes our data and methodology, discusses the model and results, then concludes and offers suggestions for future research. Recent developments in artificial intelligence (AI) are changing the way course content is provided in significant ways, and this includes producing lecture videos. It is now relatively easy (but not yet inexpensive) to produce high quality video content with off-the-shelf software. The question is whether the expansion of video content with high production value, from whatever source, improves student outcomes.

BACKGROUND AND LITERATURE REVIEW

In 1971, Herbert Simon warned of a new reality brought about by expanding technology. We are now living in his foretold "information-rich world" where a chief problem is no longer how to deal with scarcity of information, but how to allocate our scarce ability to pay attention to important information when there exists an overabundance (Simon, 1971). Indeed, "…information is not in short supply in the new information economy. We're drowning

in it" (Lanham, 2001, p. 39) and attention is a scarce cognitive resource (Kahneman, 1973). The amount of information available far exceeds our ability and desire to process it, sometimes leading to situations where people pay attention to the wrong things to the detriment of themselves and others (Anderson & de Palma, 2012).

In such an information-rich world, students bear a cost when acquiring information each time they decide to allocate their scarce attention to a topic. In an online setting, for example, each student compares the uncertain benefit of paying attention to an online lecture for an hour to the attention cost of doing so when deciding whether to spend the hour on the online lecture (Simon, 1971). Engagement is costly and the benefits are uncertain (Caplin & Dean, 2015). A student deciding whether to carefully watch an online video compares the cost of doing so against the uncertain payoff of having a better understanding or, perhaps, a higher grade. While more information is better, the student's attention is scarce. So, they must decide not whether the lecture is informative, but whether it is worth the cost of reduced cognitive capacity for all the other things in life competing for their attention. Further, the act of paying attention (and even of deciding what to pay attention to) draws down the well of attention left for other things (Wojtowicz & Loewenstein, 2020).

Student Attention and Engagement

Student attention is a particularly important issue in an online setting where student motivation is negatively impacted by, among other things, distractions at home, a lack of instructor's physical presence, and issues with technology (Adelson & Keen, 2023). Online education has grown rapidly over the last 30 years, even before COVID-19 (Ni, 2013; Scagnoli et al., 2019). The COVID-19 pandemic forced many higher education institutions to shift to online or partially online learning, dramatically increasing students' exposure to online coursework (Humber, 2021). Overall, faculty and students reported that the online courses were not as good as the previous, in-person versions (Kelly & Columbus, 2020). Keeping students engaged in this new setting quickly emerged as an important challenge for faculty (Stewart et al., 2021). Engaged students are more likely to be successful, but student engagement can be a complex endeavor that requires a multidimensional effort (Bartlett, 2022). Faculty attempted many strategies to maintain engagement, including shorter 10- to 15-minute instructional videos (Gordon, 2020). Guo et al. (2014) found that students were more likely to watch an entire video if it was very short—six minutes or less. Gantner & Kimbrel (2022) found that engagement is positively correlated with instructor-made videos that feature embedded quizzes. Students have responded more to some innovations than others, but they preferred materials prepared by the instructor (Stewart et al., 2021).

Universities should be very concerned about online student attention and engagement, as well. Student engagement has generally been positively linked to student satisfaction and retention, putting financial pressure on universities to keep students engaged. If online learners are not sufficiently engaged, it can negatively affect persistence and attrition (Angelino et al., 2007). Even small decreases in retention can translate into millions of dollars in lost revenues from tuition, state appropriations, and external funding (Kelly & Columbus, 2020). Research on engagement in an online course setting has increased in the last decade as online coursework and degree programs have proliferated (Humber, 2021). Engagement has to do with the amount of time and energy a student devotes to a learning experience (Angelino et al., 2007; Kuh, 2009; Robinson & Hullinger, 2008) as well as the knowledge gained as part of the course (Humber, 2021). Students recognize that engagement involves listening to lectures in addition to completing other coursework, and their engagement is related to their perceived engagement of the instructor (Humber, 2021). Likewise, student satisfaction is a prerequisite for effective online learning and is an important factor in course completion. If the instructor seems to be putting in a high-quality effort providing a high-quality experience, students report higher satisfaction and engage more in response (Abdallah & Abdallah, 2022).

Student engagement with online course materials is sensitive to the types of communication tools used by faculty (Humber, 2021). Well-run discussion boards, for example, have been found to increase engagement (Hamann et al., 2012). Asynchronous tools, such as video lectures, allow students to engage at their own pace. The additional time for understanding and reflection are linked to improved performance measures (Lundberg &

Sheridan, 2015; Robinson & Hullinger, 2008). Also, recorded lectures allow students to go back and rewatch them before taking exams (Humber, 2021). The content of recorded lectures may be particularly important in math and statistics classes where student anxiety and low self-efficacy are likely present (Jiang & Ballenger, 2023). Using high quality online teaching materials are in the interest of colleges and universities, as the perceived quality of the online experience can impact accreditation and rankings (Bennett & Bennett, 2002; Robinson & Hullinger, 2008).

How do faculty get students to pay attention and engage in an online environment? McCarthy (2023) noted the need for more research to understand what technologies and methods are effective at promoting student engagement. This is a complicated undertaking. Perifanou and Economides (2022) identified no fewer than twenty digital competencies that must be developed for effective online teaching. A necessary condition of successful engagement and learning is keeping the students' attention focused on the task at hand (Keller, 1987; Major, 2015). Modern technologies such as Google Analytics or online video analytics have made measuring student attention possible (Maćkowiak et al., 2020). Dobrian et al. (2011) quantified user engagement as total play time and as total number of videos viewed. They found that student engagement is sensitive to technical session quality. Long join times or buffering times have a negative impact on engagement, while the perceived quality of the video has a positive impact. In the future, there may be easy access to devices that track brainwave activity or monitor head or eyeball movements that give an indication of whether or not a student is paying attention to the online lecture that is playing (Davenport & Beck, 2001).

Potential Role of Video Quality

We are interested in whether the production quality of the video in terms of sound, lighting, etc., affects engagement in the same way that technical issues like buffering times do. There exists a dearth of literature directly investigating the connection between video production quality and student learning. One exception is Rickley and Kemp (2021), who conducted a quasi-experimental study where some students (control group) were exposed to instructor-made videos, while others (treatment group) were exposed to video lectures designed and shot in studio with the help of instructional designers. At the end of the course, both groups were asked about their perceptions of learning and satisfaction. The treatment group exhibited a significant, positive correlation with perceived learning and satisfaction. The reasons for this correlation are unclear, but related literature indicates that these results should, perhaps, not be surprising.

In an online setting, an instructor can attract (but not necessarily maintain) attention with an inspiring, well-made video (Keller, 1987, 2010; Milman & Wessmiller, 2016). It is costly in terms of time and resources to produce high quality online teaching materials, which has led to faculty reluctance to develop them (Allen & Seaman, 2015; Gillett-Swan, 2017). However, student satisfaction with online lectures has a strong positive relationship with student perceptions of both the impact of the video on learning outcomes as well as the overall learning experience (Scagnoli et al., 2019). Making the content interesting to the student is key to sustained, focused attention because student interest has been positively connected to self-regulatory skills that impact student performance outcomes (Hidi & Ainley, 2012; Wang et al., 2013). Student engagement can be positively affected by building a rapport, or trying to make the students feel like they know the instructor (Samawi & Al-kreimeen, 2022). Rosenthal and Walker (2020) noted that students are sensitive to the instructor's social presence in a class and that the social presence is strengthened when the instructor is seen on-screen in recorded videos. Grant (2021) pointed out, however, that "although students might enjoy listening, reading, or doing, they don't actually learn better that way" (p. 177). So, even if the different video got their attention, that might not lead to better learning.

The Community of Inquiry (COI) model is among the most frequently used to study online learning (Kim & Gurvitch, 2022). COI establishes an explanation for why a dynamic video with high production values might impact student attention. This model describes three critical factors in learning environments: teaching presence, social presence, and cognitive presence (Garrison et al., 1999). Teaching presence is an important factor for student outcomes in online classes (Croxton, 2014; Spears, 2012), and it is highlighted by the presence

of the instructor in video and audio (Scagnoli et al., 2019). Interaction with well-made video lectures has been tied to better student perceptions of teacher presence and social presence, which increases engagement by establishing a connection with the instructor who is shown as a real person in the class (Jones et al., 2008; Scagnoli & Packard, 2011). Videos featuring teacher presence help create an emotional tie for the student with the material, the class, and the instructor (Garrison & Vaughan, 2008). Social presence involves interaction and engagement among students and with instructors (Kehrwald, 2008). Teaching videos that include audio and video of the instructor also enhance the instructor's social presence and facilitate engagement and positive learning outcomes (Scagnoli et al., 2019). Cognitive presence refers to how much students build and confirm meaning through discourse and reflection (Arbaugh, 2008). This type of presence begins with a *triggering event*, which leads to exploration and engagement with the content (Garrison & Arbaugh, 2007). This triggering event is something that piques the student's interest and motivation to engage with the course material, such as an entertaining, high quality production of a lecture (McHugh et al., 2020). Social presence can be an important driver of cognitive presence and is often overlooked in online course design (Kim & Gurvitch, 2022).

To attract a student's attention, "It would be far more effective to send one very unusual message than a thousand typical ones" (Davenport & Beck, 2001, p. 59). Rose (2010) asserted that online educators can combat the negative effects of continuous partial attention by either producing flashier content to temporarily attract attention or developing tools to help learners control their attention. Importantly, students have identified action, entertainment, and production value as desirable features of instructional videos (Pflugfelder, 2013). Students who are satisfied with video lectures are known to engage more and report feeling like they learn more (Scagnoli et al, 2019). Student perceptions of online coursework improve with innovative and engaging course materials, including videos (Bhattacharya et al., 2020). Occasional humor can be a way to build the kind of engagement-inducing rapport discussed above (Dumford & Miller, 2018). These innovations may function by projecting referent power that is developed when students are able to more personally identify with the instructor. Drawing from such referent power helps calm anxiety in difficult subjects and aids student learning through improved cognitive presence (Watts, 2022).

A lively presentation combined with well-crafted content can be used to effectively relay serious, relevant material (Polek, 2010). People are biologically predisposed to pay attention to some things more than others. Invoking a psychological need, such as food and water, takes precedence over a lower priority need. Weapons, new or interesting facts, accurate information, music, and adventures rate higher in Maslow's attention hierarchy than, say, personal enlightenment (Davenport & Beck, 2001). Perhaps partly because of this, storytelling is a widely recommended way to secure attention (Christie, 2018). Zak (2014) advised businesspeople to begin each presentation with a story, which invokes empathy and motivates cooperation. Stories and parables are well-documented drivers of student interest in lectures because they engage the audience's mind and emotions (Green, 2004; Green & Brock, 2000). A good story adds a plot and makes a lesson a memorable experience (Christie, 2018). Storytelling continues to motivate viewers after the story ends, which explains why viewers might be motivated to work out after watching the movie *300* (Zak, 2014), or, perhaps, to study statistics after watching an engaging video about the central limit theorem. Davenport & Beck (2001) asserted that psychobiology research suggests adhering to the following principles: (a) limit the video to a few pieces of information, (b) make the video as different as possible from those around it, and (c) invoke basic needs like safety, such as by holding a snake during the video(!).

Students pay attention to things they must pay attention to, but also to things they want to pay attention to (Davenport & Beck, 2001). Attention is everything in cyberspace, and the words, images, and sounds teachers use are the keys to grabbing and holding student attention online, where merely making information available does not guarantee students (or investors) will pay attention to it (Da et al., 2011). In fact, disengaged students may respond to online course materials by adopting ruthlessly efficient behaviors such as satisficing, rather than optimizing, their educational experience with a class. In other words, they may be incentivized to

skip through subject content and adequately meet the course expectations rather than work towards excellence. (Gantner & Kimbrel, 2022). Students report that good videos improve their engagement and motivation (Evans & Cordova, 2015). Style and substance are critical in this new economy of attention, where the abundance of online videos increases the responsibility of content providers to maximize their ability to attract attention. (Dobrian et al., 2011; Lanham, 2001). High production values, music, jump cuts, novelty in format and tone, storytelling, action, and a touch of serendipity or randomness engage higher levels of attention. Production values, in particular, make an important statement in a visual age where images surpass words for a new generation of students (Davenport & Beck, 2001). A group's collective attention can be affected by the degree of novelty in the storytelling, especially if a social network exists that allows the group to communicate with one another about the story (Wu & Huberman, 2007). Unfortunately, many online economics and statistics videos are high on substance but lacking in style.

DATA & METHODOLOGY

Most introductory statistics textbooks focus too much on math and too little on conceptual understanding. Some professors have tried alternate approaches using tricks, activities, stories, and real-life examples to encourage student engagement. Raviv and Barb (2020) explain that students feel they learn abstract concepts like the normal distribution best through visual and engaging lessons. Our hypothesis is that a lively video with a good story and high production values will increase student engagement in an online business statistics class. Consistent with the literature above, an occasional video that is unusual and engaging in its presentation may increase student attention and engagement by stimulating cognitive, teaching, and social presence, as well as triggering the established benefits of storytelling. To test our hypothesis, we conducted an experiment in our online business statistics class.

Students in the class were randomly assigned to treatment and control groups. For the first half of the class, content lectures were recorded with the instructor writing notes and working problems on the screen with a voice over audio. The instructor was not on screen. About halfway through the course is the introduction to the central limit theorem lecture. For this week, students in the control group saw a lecture like the previous ones—notes on the screen with an audio voice over. Students in the treatment group saw a lecture that was identical in content, but very different in style from the previous lectures. The treatment lecture was produced by a professional video producer on the university staff and featured the instructor on screen delivering the content as part of a story featuring loud rock music in the intro, professional video and sound, and occasional action movie special effects. The students take the course online and independently, so they were unaware that an alternative video was shown to other students.

Estimation Strategy

Our estimation strategy is a randomized trial, where the treatment group (T) was directed to the higher quality video, and the control group (C) was exposed to the status quo video. Though the treatment was initially randomly applied, some students may have been exposed later to the video that was not assigned to them, and there is no way to determine if this occurred. In addition, there is evidence that some students did not complete viewing the entire video assigned, and a handful did not engage with the video content at all. In order to mitigate any noncompliance bias, we used an "intention to treat" approach where outcomes are measured according to the original assignment to treatment and control groups. We also controlled for observed possible confounders.

Causal Framework

The difference in the outcome for the treated group is

$$E(Y_1|T) - E(Y_0|T)$$

where Y_1 is the posttreatment outcome and Y_0 is the pretreatment outcome. Likewise, the difference in outcome for the control group is

$$E(Y_1|C) - E(Y_0|C).$$

The difference-in-difference estimate of the causal effect of the treatment is

$$\big(E(Y_1|T) - E(Y_0|T)\big) - \big(E(Y_1|C) - E(Y_0|C)\big).$$

If the treatment is randomly applied, then

$E(Y_0|T) = E(Y_0|C)$

and the difference-in-difference is simply

$E(Y_1|T) - E(Y_1|C)$,

or, the difference in the average posttreatment outcomes.

In a regression context, let *time* = 0,1 if pre- or posttreatment, and *treat* = 0,1 if in the control or treatment group. Then our estimation equation is

$$Y=\beta_0+\beta_1 \text{time}+\beta_2 \text{treat}+\beta_3 \text{treat*time}+\beta_4 \text{covariates}$$

With random assignment of the treatment, **(**the average difference in pretreatment outcomes**)** should be equal to zero. The coefficient is the difference-in-difference estimate of the causal effect of the treatment.

Experimental Design

The assignment of students to the treatment and control groups was random and completed at a point in the semester just prior to covering sampling distributions and the central limit theorem. Data on possible covariates were collected for each individual student, including sex, ACT composite score (or equivalent, using standard equivalency tables), overall Grade Point Average (GPA) up to the beginning of the semester, major field of study, and class (determined by cumulative credit hours up to the beginning of the semester—classified as Sophomore, Junior, or Senior). Attrition was very low—only two students dropped the course after group assignment but before the next exam occurred, one in the control group and one in the treatment group. As mentioned in the previous section, the students were not informed about what type of study was being conducted and, unless they were informed by students in another group, did not know that they were watching different content videos. Likewise, the instructors were unaware until after completion of the trial which students were in which group. This can be considered a double-blind test since neither student nor instructor knew whether the student was in the control or treatment group. The video that the students were provided in the control group can be considered a placebo. These two designs of the experiment helped minimize the effects of any confounding variable.

RESULTS

We examined the data for any pretreatment differences in observed characteristics for the treatment and control groups, as detailed in Table 1. A *t*-test of differences in means between control and treatment groups for numeric variables showed no statistically significant differences. These include ACT score and GPA as well as pretreatment outcome variables average homework score up to the treatment (pre-homework), the score on the first exam (pre-exam), and average percentage of the videos viewed (pre-pctview) prior to. A chi-squared test of independence was conducted for the categorical variables "female" (a dummy variable equal to 1 if female) and "junior" (a dummy variable equal to 1 if a junior, 0 if sophomore or senior). Again, all differences are statistically insignificant. Though there may still be an unobserved confounder that might bias the measure of the treatment, it is less likely as the balance between control and treatment groups of the observed characteristics indicate that the random assignment was successful in removing the effects of possible endogeneity or selection bias.

Table 1:.

Descriptive Statistics Pretreatment Variables

Variable	Mean Control	Mean Treated	Difference	Test Statistic
GPA	3.136	3.233	-0.097	
	(0.596)	(0.493)	(0.124)	-0.78115
ACT	24.399	23.539	0.860	
	(4.265)	(3.435)	(0.897)	0.95922
pre-homework	85.941	89.352	-3.411	
	(16.7656)	(15.696)	(3.700)	-0.92185
pre-exam	79.843	82.681	-2.838	
	(10.024)	(9.471)	(2.222)	-1.2771
pre-pctview	73.674	78.424	-4.750	
	(23.619)	(19.059)	(5.050)	-0.94054
female	0.3847	0.5263	-0.1417	
	(0.0779)	(0.0809)	(0.1135)	1.5587
junior	0.3589	0.4211	-0.0621	
	(0.0768)	(0.0801)	(0.1112)	0.31189

Note. Standard errors in parentheses

Regression estimates of the difference-in-difference measure of the treatment effect on three different outcomes are reported in Table 2. The first column of the table shows the measure without controlling for covariates. The only variable that is statistically significant is , the coefficient on Time. This merely indicates that the average grade on the second exam was 6 points lower than that on the first exam. This is the usual pattern of performance in this course as the material becomes conceptually more difficult between the first and second exam. The coefficient , the coefficient on the interaction term that is the difference-in-difference measure of the causal effect, is negative. This indicates the treatment actually lowered performance on the exam, though the difference is statistically insignificant. Column 2 of Table 2 adds potential covariates: Male, Senior, BMGT ACT, and GPA. Again, the difference-in-difference estimate of the treatment effect is negative, though not statistically significant from zero. Note that two observations are lost due to missing values. The only other nonzero coefficient is GPA.Columns 3 and 4 of Table 2 provide estimates of the causal effect on the Homework score.

Table 2.
Difference-in-Difference Estimates of Causal Effects

	Dependent Variable					
	Exam		Homework		Pctview	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	2.837	2.649	3.411	1.071	4.749	5.022
	(2.348)	(2.285)	(3.516)	(3.416)	(5.220)	(5.443)
Time	-6.064**	-5.942**	4.264	3.607	6.076	5.742
	(2.332)	(2.230)	(3.516)	(3.358)	(5.450)	(5.583)
Time*Treat	-3.867	-3.989	1.025	1.604	3.068	3.280
	(3.320)	(3.133)	(5.005)	(4.718)	(7.495)	(7.597)
Male		1.590		2.399		-3.414
		(1.627)		(2.451)		(3.941)
Senior		3.080		-0.495		-2.917
		(2.512)		(3.783)		(6.379)
BMGT		3.582		5.135		-11.157
		(4.261)		(6.379)		(9.963)
GPA		7.4966***		12.303***		5.833
		(1.695)		(2.563)		(4.185)
ACT		0.132		-0.786**		0.496
		(0.236)		(0.358)		(0.588)
Constant	79.843***	51.323***	85.941***	65.520***	73.674***	45.67**
	(1.649)	(7.248)	(2.470)	(10.973)	(3.766)	(17.88)
Observations	77	75	76	74	71	69
R2	0.141	0.282	0.041	0.199	0.050	0.099

Note: standard errors in parentheses; *p < 0.1; **p < 0.05; ***p < 0.01

Once again, the estimated causal effect is not statistically significant. The only nonzero effects were the coefficients on GPA and ACT. Interestingly, the coefficient on ACT is negative. Finally, columns 5 and 6 are regression estimates for the outcome variable "pctview," the percentage of the video that was viewed by the student. There was essentially no effect of the higher production value video on our measure of student engagement.

CONCLUSIONS & FUTURE RESEARCH

The higher production value video did not significantly affect student engagement or performance, at least in our experiment. Perhaps this should not come as a surprise. A known potential pitfall of interventions designed to improve attention and engagement concerns the cognitive load. Deck and Jahedi (2015) examine cognitive load experiments and conclude that increasing cognitive load leads to impaired reasoning and poorer math performance, among other effects. Reeves (2013) describes the online phenomenon of *flow*, where one activity online spurs an internet user to engage in another online activity that may only be tangentially related (e.g., a YouTube rabbithole). A central limit theorem video that evokes old action movies may encourage the viewer to go watch *Rambo* instead of developing a deeper understanding of probability or otherwise increase the cognitive load on the viewer's scarce attention. Further, online users learn to avert their eyes from ads on their screens, indicating that our brains have automatic attention-protecting features that work against innovative distractions (Davenport & Beck, 2001). Indeed, the most important function of attention may involve screening information out rather than taking it in (Davenport & Beck, 2001).

We are, however, reluctant to assert the generalizability of the results in this paper for several reasons. First, online course innovations are likely to have different impacts on engagement and learning in different classes (Ni, 2013). Higher production value videos may be received very differently in an art, economics, sociology, or education classes, for example. Likewise, students in majors not business-related may respond differently to enhanced video production. Second, we have concerns about the variable "pctview" as a measure of engagement. This variable represents the percent of the video played by the student and is measured by the university's learning management system. On the one hand, the results in this paper were unchanged by other specifications of this variable, such as Total Time Viewed or Video Impressions. On the other hand, the students were physically unobserved. We have no way of distinguishing a student who carefully watched the video and took notes from one who turned on the video and walked away while it played. The random assignment should take care of this—on average, the treatment and control groups should have similar rates of nonwatching. Technically, however, we have no way of knowing how large the problem of noncompliers is. Third, students may not be effectively incentivized by higher grades. For example, a student whose goal is a D may not be motivated to learn a difficult concept if they already have a C in the class. Literature in experimental economics indicates that money is a much more reliable motivator. Finally, anecdotal evidence from students indicates that their viewing habits were entrenched one way or the other by the middle of the semester when our experiment was performed. By then, they may be watching the videos carefully or not, no matter what the content looks like.

These results and concerns suggest there is room for considerably more research in this area. Future experiments should be conducted with higher production quality videos in other subject areas. Experiments could be designed using eye-tracking technology or in the classroom where subjects are observed. Cash awards for higher performance could be added. An entire course of higher quality videos (or at least a sequence of videos) could be produced and started early instead of just one video midsemester. Such experiments may be time consuming and resource expensive, but it is important to pinpoint what is effective and what does not matter. Online coursework in higher education and the attention economy are not going away. The benefits of determining the factors relevant to capturing and keeping student attention in the information age are enormous.

ACKNOWLEDGEMENTS

We would like to thank Gary Bradford for excellent assistance filming, producing, directing, and editing the treatment video as well as the anonymous referees for their helpful feedback.

References

Abdallah, N, & Abdallah, O. (2022). Investigating factors affecting students' satisfaction with e-learning: An empirical case study. Journal of Educators Online, 19(1). https://doi.org/10.9743/JEO.2022.19.1.3

Adelson, L., & Keen, G. S. (2023). F2F versus online: Student perceptions of foreign language learning in the time of Covid-19. Journal of Educators Online, 20(2). https://doi.org/10.9743/JEO.2023.20.2.1

Allen, I. E., & Seaman, J. (2015). Grade level: Tracking online education in the United States. Babson Survey Research Group and Quahog Research Group. bayviewanalytics.com/reports/gradelevel.pdf

Anderson, S. P., & de Palma, A. (2012). Competition for attention in the Information (Overload) Age. The RAND Journal of Economics, 43(1), 1–25. https://doi.org/10.1111/j.1756-2171.2011.00155.x

Angelino, L. M., Keels Williams, F., & Natvig, D. (2007). Strategies to engage online students and reduce attrition rates. Journal of Educators Online, 4(2). https://doi.org/10.9743/JEO.2007.2.1

Arbaugh, J. B. (2008). Does the community of inquiry framework predict outcomes in online MBA courses? The International Review of Research in Open and Distributed Learning, 9(2). https://doi.org/10.19173/irrodl.v9i2.490

Bartlett, M. (2022). Model for engaging the online learner. Journal of Educators Online, 19(1). https://doi.org/10.9743/JEO.2022.19.1.14

Bennett, J. F., & Bennett, L. B. (2002). Assessing the quality of distance education programs: The Faculty's perspective. Journal of Computing in Higher Education, 13(2), 71–86. https://doi.org/10.1007/BF02940966

Bhattacharya, M., Howard, T. L., & Ulferts, G. W. (2020). A study of students' perceptions about online versus traditional teaching. Journal of Higher Education Theory and Practice, 20(15), 117–125. https://doi.org/10.33423/jhetp.v20i15.3941

Caplin, A., & Dean, M. (2015). Revealed preference, rational inattention, and costly information acquisition. American Economic Review, 105(7), 2183–2203. https://doi.org/10.1257/aer.20140117

Christie, I. (2018). "Storification": Or, What do we want psychology and physiology to tell us about screen stories? In I. Christie & A. van den Oever (Eds.) Stories (pp. 85–96). Amsterdam University Press. https://doi.org/10.1515/9789048537082-007

Croxton, R. A. (2014). The role of interactivity in student satisfaction and persistence in online learning. Journal of Online Learning and Teaching, 10(2), 314–325. https://jolt.merlot.org/vol10no2/croxton_0614.pdf

Da, Z., Engelberg, J., & Gao, P. (2011). In search of attention. The Journal of Finance, 66(5),1461–1499. https://doi.org/10.1111/j.1540-6261.2011.01679.x

Davenport, T. H., & Beck, J. C. (2001). The attention economy: Understanding the new currency of business. Harvard Business School Press.

Deck, C., & Jahedi, S. (2015). The effect of cognitive load on economic decision making: A survey and new experiments. European Economic Review, 78, 97–119. https://doi.org/10.1016/j.euroecorev.2015.05.004

Dobrian, F., Sekar, V., Awan, A., Stoica, I., Joseph, D., Ganjam, A., Zhan, J., & Zhang, H. (2011) Understanding the impact of video quality on user engagement. In *IGCOMM '11: Proceedings of the ACM SIGCOMM 2011 conference* (pp. 362–373). Association for Computing Machinery. https://doi.org/10.1145/2018436.2018478

Dumford, A. D., & Miller, A. L. (2018). Online learning in higher education: Exploring advantages and disadvantages for engagement. Journal of Computing in Higher Education, 30(3), 452–465. https://doi.org/10.1007/s12528-018-9179-z

Evans, H. K., & Cordova, V. (2015). Lecture videos in online courses: A follow-up. Journal of Political Science Education, 11, 472–482. https://doi.org/10.1080/15512169.2015.1069198

Gantner, M. W., & Kimbrel, L. A. (2022). Shaping the engagement of online learners through instructor-made videos with quizzes. Journal of Educators Online, 19(1). https://doi.org/10.9743/JEO.2022.19.1.4

Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. The Internet and Higher Education, 2(2-3), 87–105. https://doi.org/10.1016/S1096-7516(00)00016-6

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the Community of Inquiry framework: Review, issues and future directions. The Internet and Higher Education, 10, 157–172. https://doi.org/10.1016/j.iheduc.2007.04.001

Garrison, D. R., & Vaughan, N. D. (2008). Blended learning in higher education: Framework, principles, and guidelines. Jossey-Bass.

Gillett-Swan, J. (2017). The challenges of online learning: Supporting and engaging the isolated learner. Journal of Learning Design, 10(1), 20–30. https://doi.org/10.5204/jld.v9i3.293

Gordon, L. (2020, June 16). Endangered: Large university lecture hall classes. EdSource. https://edsource.org/2020/are-the-days-numbered-for-the-large-university-lecture-hall-class/633619

Grant, A. (2021). Think again: The power of knowing what you don't know. Penguin Random House.

Green, M. C. (2004, April 1). Storytelling in teaching. The Association for Psychological Science Observer. https://www.psychologicalscience.org/observer/storytelling-in-teaching

Green, M. C. & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. Journal of Personality and Social Psychology, 79(5), 701–721. https://doi.org/10.1037/0022-3514.79.5.701

Guo, P. J., Kim, J., & Rubin, R. (2014). How video production affects student engagement: An empirical study of MOOC videos. In Proceedings of the First ACM Conference on Learning@Scale Conference (pp. 41–50). Association for Computing Machinery. https://doi.org/10.1145/2556325.2566239

Hamann, K., Pollock, P. H., & Wilson, B. M. (2012). Assessing student perceptions of the benefits of discussion in small-group, large-class, and online learning contexts. College Teaching, 60(2), 65–75. https://doi.org/10.1080/87567555.2011.633407

Hidi, S., & Ainley, M. (2012). Interest and self-regulation: Relationships between two variables that influence learning. In D. H. Schunk & B. J. Zimmerman (Eds.), Motivation and self-regulated learning: Theory, research, and applications (pp. 77–110). Lawrence Erlbaum.

Humber, J. F. (2021). In their own words: Student engagement as defined by online learners. Journal of Higher Education Theory and Practice, 21(2), 13–24. https://doi.org/10.33423/jhetp.v21i2.4114

Jiang, M., & Ballenger, J. (2023). Nontraditional doctoral students' perceptions of instructional strategies used to enhance statistics self-efficacy in online learning. Journal of Educators Online, 20(1). https://doi.org/10.9743/JEO.2023.20.1.7

Jones, P., Naugle, K., & Kolloff, M. A. (2008, March 31). Teacher presence: Using introductory videos in online and hybrid courses. Learning Solutions Magazine. https://www.merlot.org/merlot/viewMaterial.htm?id=868696

Kahneman, D. (1973). Attention and effort. Prentice-Hall.

Kehrwald, B. (2008). Understanding social presence in text-based online learning environments. Distance Education, 29(1), 89–106. https://doi.org/10.1080/01587910802004860

Keller, J. M. (1987). Development and use of the ARCS model of instructional design. Journal of Instructional Development, 10(3), 2–10. https://doi.org/10.1007/BF02905780

Keller, J. M. (2010). Motivational design for learning and performance: The ARCS Model Approach. Springer. https://doi.org/10.1007/978-1-4419-1250-3

Kelly, A. P., & Columbus, R. (2020). College in the time of Coronavirus: Challenges facing American higher education. American Enterprise Institute. https://www.aei.org/research-products/report/college-in-the-time-of-coronavirus-challenges-facing-american-higher-education/

Kim, G. & Gurvitch, R. (2022). Community of Inquiry analysis of alignment between instructors' intentions and students' perceptions in online courses. Journal of Educators Online, 19(2). https://doi.org/10.9743/JEO.2022.19.2.7

Kuh, G. D. (2009). The national survey of student engagement: Conceptual and empirical foundations. New Directions for Institutional Research, 141, 5–20. https://doi.org/10.1002/ir.283

Lanham, R. A. (2001). An economics of attention: The pure state. Educational Technology, 41(5), 39–41. https://www.jstor.org/stable/44428696

Lundberg, C. A., & Sheridan, D. (2015). Benefits of engagement with peers, faculty, and diversity for online learners. College Teaching, 63(1), 8–15. https://doi.org/10.1080/87567555.2014.972317

Maćkowiak, B., Matějka, F., &Widerholt, M. (2020). Rational inattention: A review. CEPR Discussion Papers 15408. Centre for Economic Policy Research. Handle: RePEc:cpr:ceprdp:15408

Major, C. H. (2015). Teaching online: A guide to theory, research and practice. Johns Hopkins University Press. https://doi.org/10.1353/book.38784

McCarthy, K. (2023). An unintentional case study: How synchronous meetings may influence student perception of instructors. Journal of Educators Online, 20(1). https://doi.org/10.9743/JEO.2023.20.1.8

McHugh, P., Taub, R., Gafo, I., & Baumgarthuber, C. (2020). Optimizing student satisfaction measures through teacher presence interventions and contextual awareness in an online course. Journal of Higher Education Theory and Practice, 20(13), 42–52.

Milman, N. B., & Wessmiller, J. (2016). Motivating the online learner using Keller's ARCS model. Distance Learning, 13(2), 67–71.

Ni, A. Y. (2013). Comparing the effectiveness of classroom and online learning: Teaching research methods. Journal of Public Affairs Education, 19(2), 199–215. https://doi.org/10.1080/15236803.2013.12001730

Perifanou, M., & Economides, A. (2022). Digital competencies for online teachers. Journal of Educators Online, 19(3). https://doi.org/10.9743/JEO.2022.19.3.13

Pflugfelder, E. H. (2013). The minimalist approach to online instructional videos. Technical Communication, 60(2), 131–146.

Polek, C. (2010). Effective communication in economics: Lessons from Peter Boettke. The Journal of Private Enterprise, 26(1), 39–46.

Raviv, D., & Barb, D. (2020). A visual and engaging approach to teaching and learning the normal distribution. Journal of Higher Education Theory and Practice, 20(14), 124–155.

https://doi.org/10.33423/jhetp.v20i14.3857

Reeves, J. (2013). Temptation and its discontents: Digital rhetoric, flow, and the possible. Rhetoric Review, 32(3), 314–330. https://doi.org/10.1080/07350198.2013.797878

Rickley, M., & Kemp, P. (2021). Effects of video lecture design and production quality on student outcomes: A quasi-experiment exploiting change in online course development principles. The Electronic Journal of e-Learning, 19(3),170–185. https://doi.org/10.34190/ejel.19.3.2297

Robinson, C. C., & Hullinger, H. (2008). New benchmarks in higher education: Student engagement in online learning. Journal of Education for Business, 84(2), 101–109. https://doi.org/10.3200/JOEB.84.2.101-109

Rose, E. (2010). Continuous partial attention: Reconsidering the role of online learning in the Age of Interruption. Educational Technology, 50(4), 41–46. https://www.jstor.org/stable/44429840

Rosenthal, S., & Walker, Z. (2020). Experiencing live composite video lectures: Comparisons with traditional lectures and common video lecture methods. International Journal for the Scholarship of Teaching and Learning, 14(1), Article 8. https://doi.org/10.20429/ijsotl.2020.140108

Samawi, F. S., & Al-kreimeen, R. A. (2022). Shifting to remote learning: Students' engagement and anticipating challenges: A review article. Journal of Educators Online, 19(2). https://doi.org/10.9743/JEO.2022.19.2.2

Scagnoli, N. I., Choo, J., & Tian, J. (2019). Students' insights on the use of video lectures in online classes. British Journal of Educational Technology, 50(1), 399–414. https://doi.org/10.1111/bjet.12572

Scagnoli, N. I., & Packard, C. (2011). Improving a blended delivery model in a large enrollment business course. In Proceedings of the 2011 Conference Academy of Human Resource Development (pp. 3717–3727). Academy of Human Resource Development.

Simon, H. (1971). Designing organizations for an information-rich world. In M. Greenberger (Ed.), Computers, communications, and the public interest. The Johns Hopkins Press.

Spears, L. R. (2012). Social presence, social interaction, collaborative learning, and satisfaction in online and face-to-face courses [Doctoral dissertation, Iowa State University]. Iowa State University Digital Repository. https://doi.org/10.31274/etd-180810-507

Stewart, B. L., Goodson, C. E., & Miertschin, S. L. (2021). Pandemic online transitions: Student reactions, adaptations, and course feature preferences. Journal of Higher Education Theory and Practice, 21(1), 38–52. https://doi.org/10.33423/jhetp.v21i1.4036

Wang, C. H., Shannon, D. M., & Ross, M. E. (2013). Students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning. Distance Education, 34(3), 302–323. https://doi.org/10.1080/01587919.2013.835779

Watts, J. (2022). Communicating instructor power online: A case study examining communities of inquiry. Journal of Educators Online, 19(3). https://doi.org/10.9743/JEO.2022.19.3.16

Wojtowicz, Z., & Loewenstein, G. (2020). Curiosity and the economics of attention. Current Opinion in Behavioral Sciences, 35, 135–140. https://doi.org/10.1016/j.cobeha.2020.09.002

Wu, F., & Huberman, A. (2007). Novelty and collective attention. Proceedings of the National Academy of Sciences of the United States of America, 104(45), 17599–17601. https://doi.org/10.1073/pnas.0704916104

Zak, P. J. (2014, October 28). Why your brain loves good storytelling. Harvard Business Review. https://hbr.org/2014/10/why-your-brain-loves-good-storytelling.