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How appropriateness and enjoyment of instructors' virtual backgrounds affect students' perceptions of learning

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The present study examines how the appropriateness and enjoyableness of an instructor's virtual background affects student learning. The results of the study indicate that while students' perceptions of the appropriateness and their enjoyment of an instructor's virtual lecture background influence whether students believe that they learned, neither of these variables contribute to how much students are able to demonstrate they have actually learned. Furthermore, while female students perceive that they learned more, there is no difference in performance between male and female students.

KEYWORDS

virtual background, cognitive learning, perceived cognitive learning, enjoyment, appropriateness

1 Introduction

The COVID-19 pandemic caused the great virtual pivot, moving learning to a digital platform (Kelly, 2023). Despite the world's return to many pre-COVID conditions, education is not anticipated to revert to a primarily face-to-face experience. In fact, the National Center for Education Statistics (2023a) indicates that more than half of students enrolled in undergraduate higher education are having virtual learning experiences regardless of whether they have enrolled in a face-to-face, hybrid, or online education program. Zoom and other video conferencing software have become a normal mode for synchronous and asynchronous (i.e., pre-recorded) virtual instruction (Yang et al., 2023).

When instructors use video conferencing software for teaching, most guidance recommends use of a virtual background to obscure the environment around them for a number of reasons (Barchas, 2020; Ohnigian et al., 2021; Chen et al., 2023). First, the utilization of virtual backgrounds is an equalizer, placing everyone in the same virtual world rather than homes of varying levels of socio-economic status (SES; Chen et al., 2023). Second, virtual backgrounds help instructors maintain credibility by hiding messiness and external intrusion in their physical backgrounds (Barchas, 2020). Finally, using a virtual background simply keeps one's home life private, creating a barrier between school and home even when school happens at home (Ohnigian et al., 2021). Thus, instructors are encouraged to use a virtual background for face-saving and security reasons.

Despite the general consensus among scholars that virtual backgrounds are useful for education, very little research exists on how to optimize instructors' use of these backgrounds (c.f., Seitz et al., 2023). Though a review of the literature revealed many thought pieces on the use of virtual backgrounds in education, only three research studies were found. Kelly et al. (2023) conducted a virtual learning experiment where an instructor

compared use of a professional background (i.e., university branded background) and personal background options; the study found that female students rated instructors as credible and had high perceived cognitive learning regardless of the background choice, but male students most consistently perceived higher cognitive learning and professor credibility with the professional, university branded background. In a pandemic education investigation, Goethe et al. (2022) found that some students become distracted by instructors' virtual backgrounds and in these cases prefer to see the instructors' real environment instead of a virtual background. Finally, Kelly et al. (2024) found that male students experienced less affective learning than female students when online instructors used a blurry virtual background filter compared to an uploaded virtual background or allowed students to see their actual environment.

In a holistic review of research on virtual background use, Seitz et al. (2023) identified only two additional studies on the impact of virtual backgrounds on communicators outside of the education setting. In a workplace meeting study, Palanica and Fossat (2022) found that using virtual backgrounds with nature scenes stimulated more creativity than backgrounds using urban scenes. The second study was a pilot test of the FocalSpace video conferencing software, which found that blurry backgrounds can be less distracting for users than the authentic background (Yao et al., 2013). This research was somewhat contradicted by Kelly et al. (2024) in the educational context, who found male learners responded negatively to instructors' use of blurry background filters.

Together, these studies indicate that communicators pay attention to virtual backgrounds when using video conferencing software and have perceptual responses to them. Yet, the existing literature is not enough to generate evidence-based best practices for online teaching. Despite the arguments for why using a virtual background is a best practice (Barchas, 2020; Ohnigian et al., 2021; Chen et al., 2023), there is still uncertainty about which backgrounds are the best choices for learning (c.f., Goethe et al., 2022; Kelly et al., 2023, 2024). To address this gap, this study aims to advance the extant literature by examining the how perceived appropriateness and enjoyment of an instructor's virtual background affects learning.

Social presence theory suggests that individuals have an innate need for social interaction and connection, even in mediated environments (Short et al., 1976). According to social presence theory, individuals seek cues in mediated communication, such as video conferencing, that enhance the sense of immediacy and warmth, making the interaction feel more personal and engaging. Further, the theory suggests that emotional engagement plays a crucial role in fostering social presence and connection in mediated communication (Short et al., 1976).

People experience strong social presence when they perceive that the technology chosen is appropriate for the conversation (Rice, 1993; Biocca et al., 2003). Also, when perceiving strong social presence, mediated communicative experiences become more enjoyable (Lee et al., 2013; Wang and Lee, 2020). As such, enjoyment and appropriateness of technology can contribute to that desired sense of warmth and immediacy individuals seek when communicating through technology (Short et al., 1976). Therefore, social presence theory would anticipate that students will have more positive social responses to instructor's backgrounds in online learning environments if they find the background to be appropriate and enjoyable.

TABLE 1 Fit statistics.

	GFI	CFI	SRMR	RMSEA
Enjoyable	0.91	0.95	0.03	0.17
Appropriate	0.93	0.94	0.06	0.15
Perceived learning	0.84	0.86	Indeterminate	0.13
Perceived learning respecified	0.93	0.93	0.05	0.13

Yet, what is unclear is whether that positive affective response will translate to learning. While Kelly et al. (2023) found that male students perceived that they learned more when a university branded, professional background was used by their instructors, it is unclear whether they actually did learn more. To address this issue, the present study investigates how instructor choices of virtual backgrounds may affect student learning, making a distinction between perceived learning and actual learning, by raising the following research question.

RQ1: To what extent does enjoyment and perceived appropriateness of the instructor's virtual background affect learning (i.e., perceived cognitive learning and actual cognitive learning)?

The extant literature notes that female and male students tend to respond differently to the way instructors utilize technology in classroom learning. Schrodt and Turman (2005) found that female students perceive instructors who infused a moderate amount of technology into their teaching practices to be more competent than instructors who used no technology, while male students found instructors to be most competent when they used no technology. More germane to the present study's context, Kelly et al. (2023, 2024) noted that male and female students respond differently to instructors' virtual background choices. As such, to further address the potential effects of student sex in learning experiences, the following research question is raised:

RQ2: To what extent does learner sex interact with virtual background choice to predict learning (i.e., perceived cognitive learning and actual cognitive learning)?

2 Method

2.1 Study design and procedure

The design of this study was multiple treatment posttest only. Students were invited to participate in the study as an extra credit opportunity in multiple mass lecture courses and given a URL that took their browser to an informed consent. Once they acknowledged their consent, they proceeded to participate in the experiment study.

For the experimental conditions, a two-minute lecture on one-way interview skills was recorded in front of a greenscreen. Then, the greenscreen recording was rendered with three different background options: the instructor's office, the university branded

TABLE 2 Descriptive statistics.

	Minimum	Maximum	Mean	SD	Skewness	Kurtosis	α
Appropriate	1.00	5.00	3.33	0.86	−0.42	−0.05	0.88
Learning	1.00	4.00	3.39	0.76	−1.34	2.12	0.33
Enjoyable	1.00	7.00	3.96	1.29	0.01	−0.11	0.93
Perceived learning	1.00	5.00	4.25	0.69	−1.28	2.19	0.87

official virtual background, and the treehouse from Adventure Time (an animated series popular among young adults). See the Supplementary Table 1 for additional virtual background details. Participants were randomly assigned to watch the lecture with one of the three virtual backgrounds. This allowed participants to view identical lectures, keeping all variables consistent about their learning experience except the virtual background. The virtual backgrounds were chosen to vary in professionalism (i.e., cartoon vs. university affiliation) and authenticity (real vs. artificial).

Immediately after viewing the lecture, students were asked two questions to ensure they had paid attention to the study. Participants were asked to recall the instructor's biological sex and whether the background was an office, university branded, or a cartoon. Individuals who could not recall the instructor's sex or the background were excluded from the study because they did not pay close enough attention to the induction for their data to be informative.

Directly following these screening questions, participants were then given a brief multiple-choice quiz on the lecture content. The quiz can be seen in the Supplementary Table 2. Following the quiz, participants were asked to complete the continuous measures of enjoyment, appropriateness, and then perceived learning experience before sharing demographic information. For most participants, 1–2 min of time elapsed between the end of video viewing and beginning to respond to the continuous measures.

2.2 Participants

In total, 224 students completed this study. In terms of gender, 85 students identified as male, 138 identified as female, and none identified with a third gender. Student rank broke down as follows: 16 freshmen, 39 sophomores, 104 juniors, 63 seniors, and 2 unspecified. Sample ethnic breakdown was primarily White/Caucasian ($n = 114$), followed by Hispanic or Latinx ($n = 60$), Black/African American ($n = 35$), multiple ethnic identities ($n = 10$), Asian ($n = 3$), and two unidentified. The average age of participants was 22.1 ($SD = 4.60$) years old.

2.3 Instrumentation

Before the primary analyses to answer proposed research questions, each measure was scrutinized for evidence of validity. The continuous measures (perceived cognitive learning, enjoyment, and appropriateness) were assessed through confirmatory factor analysis (CFA) to ensure that the hypothesized factor structure mirrored the observed factor structure, providing evidence of content validity (c.f., Kelly and Westerman, 2020). Byrne's (2016) standards of fit for CFA using the AMOS maximum likelihood parameter estimation algorithm were used to determine fit: goodness of fit index (GFI) ≥ 0.90, comparative fit index (CFI) ≥ 0.90, standard root mean residual (SRMR) ≤ 0.08, and root mean standard residual error approximation (RMSEA) ≤ 0.10. Fit statistics can be seen in Table 1. Descriptive statistics for the continuous measures, including reliability scores, can be seen in Table 2.

TABLE 3 Exam point biserial correlations.

Question	Mean	pBis
1	0.93	0.20
2	0.60	0.05
3	0.96	0.19
4	0.89	0.18

Perceived cognitive learning was assessed through Frisby's et al. (2014) assessment. The measure contains 10 Likert-type items with 5-point response scales ranging from *Strongly Disagree* to *Strongly Agree*. The factor structure initially had poor fit with three items causing a statistically significant amount of residual error on other items (I can see clear changes…, I have learned more…, I can clearly recall…). Once these items were removed, the fit statistics were strong.

Enjoyment of the virtual background was assessed with six original items (see Supplementary Table 2). The items were composed based on the conceptual work of Oliver and Bartsch (2010), who distinguish enjoyment of media (i.e., finding it to be pleasant) as separate from the appreciation (i.e., noting the quality). The fit statistics for these items were strong. The measure was composed of six Likert-type items with 7-point response scales ranging from *Strongly Disagree* to *Strongly Agree*.

Appropriateness of the virtual background was assessed with an adapted version of Canary and Spitzberg's (1987) measure (see Supplementary Table 2). The original measure pertained to appropriateness of conversations. Thus, the items were adapted to reflect a lecture background. The measure was composed of six Likert-type items with 5-point response scales ranging from *Strongly Disagree* to *Strongly Agree*. Fit statistics for this measure were strong.

Actual cognitive learning was assessed through a four-item quiz (see Supplementary Table 2), with possible scores ranging from 0 to 4 with each item weighted at 1 point for correct answers and 0 points for incorrect answers. Validity of exam-type items can be assessed with individual point-biserial correlations of items

(Bandalos, 2018). These analyses reveal that students who score well on the exam overall tend to do well on a particular item when the value of the point-biserial correlation is positive and that students who do well overall on the exam do poorly on that item when scores are negative. Thus, positive point-biserial correlations are evidence of content validity. As shown in Table 3, each of the point-biserial scores were positive, indicating exam content validity.

3 Results

3.1 Primary analysis

The first research question (RQ1) asked to what extent enjoyment and appropriateness explain students' learning. RQ1 was answered through two linear regressions, first with perceived cognitive learning as the dependent variable and then with actual cognitive learning as the dependent variable. Regarding perceived cognitive learning, the results indicated that both perceived appropriateness ($\beta = 0.19$, $p = 0.003$) and enjoyment ($\beta = 0.15$, $p < 0.001$) were statistically significant predictors with adjusted $R^2 = 0.12$. For actual cognitive learning, neither appropriateness ($\beta = 0.05$, $p = 0.47$) nor enjoyment ($\beta = -0.05$, $p = 0.51$) were predictors.

The second research question (RQ2) asked whether learning varied based upon the interaction between the background and learner sex. RQ2 was addressed through two 2 × 3 ANOVAs with sex and background options as independent variables and a learning measure as the dependent variable. Cell sizes broke down as follows: males office background $n = 25$, female office background $n = 59$, males branded background $n = 37$, female office background $n = 43$, males cartoon background $n = 23$, and female cartoon background $n = 36$.

First, perceived cognitive learning was examined. Levene's test was not statistically significant ($p = 0.05$), but very close. There was no main effect for background $F_{(1, 221)} = 1.74$, $p = 0.18$ ($x_{office} = 4.35$, $x_{branded} = 4.14$ and $x_{cartoon} = 4.24$), but there was for learner sex $F_{(1, 221)} = 6.86$, $p = 0.01$, $\eta p^2 = 0.03$ ($x_{male} = 4.07$ and $x_{female} = 4.35$). There was no interaction effect $F_{(1, 221)} = 0.81$, $p = 0.44$.

Second, actual cognitive learning was examined. Levene's test was not statistically significant ($p = 0.97$). There was no main effect for background $F_{(1, 221)} = 0.41$, $p = 0.66$ ($x_{office} = 3.36$, $x_{branded} = 3.39$ and $x_{cartoon} = 3.42$) nor gender $F_{(1, 221)} = 0.13$, $p = 0.64$ ($x_{male} = 3.35$ and $x_{female} = 3.41$). There was also no interaction effect $F_{(1, 221)} = 0.70$, $p = 0.50$.

3.2 Supplemental analysis

Although all of the quiz questions yielded evidence of content validity, the point biserial correlation was low for the second item compared to the other three. This means that this question was more difficult than the others, and that only students doing very well on the quiz were able to answer this item correctly. The reliability score for the quiz was also lower than standard accepted conventions for exam reliability, which is generally at least 0.4 or higher (Cicchetti, 1994). If the difficult second item is dropped, the reliability score of the three-item quiz falls within acceptable standards at $\alpha = 0.43$. Thus, the research questions were reanalyzed with just the easier three-item quiz, to reassess actual cognitive learning.

First, addressing RQ1, a regression was run to identify whether perceived appropriateness or enjoyment of the backgrounds affect learning. The results indicated that while enjoyment was still not a statistically significant predictor ($\beta = 0.01$, $p = 0.89$) of actual cognitive learning, perceived appropriateness was ($\beta = 0.14$, $p = 0.04$) with adjusted $R^2 = 0.01$.

Second, the backgrounds and learner sex were tested as predictors of actual cognitive learning with the easier version of the quiz. Once again, Levene's test was not statistically significant ($p = 0.20$). Likewise, there was no main effect for background $F_{(1, 221)} = 0.27$, $p = 0.77$ ($x_{office} = 2.77$, $x_{branded} = 2.78$ and $x_{cartoon} = 2.81$) or gender $F_{(1, 221)} = 0.43$, $p = 0.79$ ($x_{male} = 2.75$ and $x_{female} = 2.80$). There was also no interaction effect $F_{(1, 221)} = 350$, $p = 0.71$.

4 Discussion

The purpose of this study was to better understand the roles that enjoyment and perceived appropriateness of an instructor's virtual background play in student learning. The experimental design required students to watch a 2-min lecture on one-way interviews with one of three virtual background options varying in professionalism and authenticity to assess students' learning experiences when all other conditions are held constant. Overall, the results indicate that students' enjoyment and perceived appropriateness of the background do not influence whether they learn, but they do influence whether students think that they learn.

First, the study finds that both enjoyment and perceived appropriateness of the background were statistically significant predictors of whether students thought that they learned. However, neither variable predicted how students actually performed on the quiz. This finding is potentially explained by the halo effect (Thorndike, 1920). The halo effect explains that individuals associate positive attributes to people and things that they like more easily than those they dislike. Thus, students who found the background enjoyable and appropriate are more likely to think they had a good learning experience regardless of whether they actually learned.

Another possible explanation for the finding lies in social presence theory. Part of the fundamental tenet of social presence theory implies that more enjoyable and appropriate uses of technology will elicit higher social presence (Short et al., 1976), and this experience of perceiving another person to be socially present elicits changes in perception (Biocca et al., 2003). As such, perceived cognitive learning increase may be an indicator of positive perceptual change prompted by the experience of social presence. Perception and reality are not always unified, so it is possible that higher social presence may have caused learners to feel that they were learning more though the same amount of learning took place across learners. Additional research is needed to confirm this supposition.

A supplemental analysis examined students' learning on the easier version of the quiz, using only the three most simplistic items to assess learning. While enjoyment of the background still did not predict students' performance of the easier quiz, perceived appropriateness did. It may be that with backgrounds that students found to be more appropriate, they were less distracted, and

therefore more able to capture some of the bigger, repeated ideas during the lecture, which can be easily demonstrated in simple questions. This would be in alignment with the findings of Yao et al. (2013) that learners prefer virtual backgrounds that are not distracting. If this is the case then it is possible that when a higher level of thinking or problem solution skills is needed through a difficult quiz question, it may require more cognitive ability from students beyond what the instructor repeatedly conveyed in the lecture. More studies are required to test this conjecture.

Yet, the finding that appropriateness of the background did predict students' performance must be considered in terms of the magnitude of the effect. Perceived appropriateness only explained 1% of the total variance in how students performed on the easier version of the quiz. This means that students perceiving the background to be appropriate only made a difference in 1% of the variability in whether they were able to recall the most simplistic, high-level concepts overviewed in the lecture within minutes of viewing it. While this study had ample statistical power to make this finding statistically significant, a variance control of 1% is not a substantive impact.

Further, recall, the type of learning assessed in this study is the lowest possible level of learning (Chandio et al., 2021). Students' ability to recall information does not indicate that they can create, evaluate, analyze, or apply the information or that they even understand the information. So, at best, students finding a virtual background to be appropriate can affect 1% of the variance in a student's ability to recall the most basic information from a lecture, which is a negligible impact on the grand scale of learning.

An important question to address is whether considering students' perceived appropriateness and enjoyment matters when instructors choose their virtual background. Certainly, instructors must make pedagogical decisions based on what actually impacts learning rather than whether students feel like they learn (Rudick, 2024). Yet, socioemotional aspects of the classroom are still important for overall satisfaction in the class (Yang et al., 2023). As such, additional research is needed to see whether appropriateness and enjoyment of virtual backgrounds can affect students' satisfaction in a course overall to know whether being concerned about such influence is truly impactful to the learning environment.

In addition to exploring whether enjoyment and appropriateness of instructors' virtual backgrounds affect learning, this study also sought to identify whether learner sex interacted with choices of virtual backgrounds to predict learning as observed in a study of perceived cognitive learning by Kelly et al. (2023). Again, the results of this present study indicate that actual learning did not differ according to learner sex or background choice. Background choice also did not affect how much students thought that they learned. However, female students had higher perceived cognitive learning than male students. Notably, the Levene test was very close to statistical significance for that analysis, raising the probability of Type I Error. That this analysis replicated the findings of Kelly et al. (2023) lends more credibility to the finding, but the results should be accepted with some caution.

As Rudick (2024) points out, perceived and actual cognitive learning are not often equivalent. It would be interesting to know if the Kelly et al. (2023) study design were replicated with the addition of an actual cognitive learning measure whether they would have found that the difference in gender was limited to perception. Female students tend to have better performance and persistence than male students at the college level (National Center for Education Statistics, 2023b). As such, female students in these studies may perceive that they learned more because they are accustomed to learning and performing well, even though there was no difference in actual learning between male and female students in the present study. Future research is needed to better explain this finding.

4.1 Limitations

As with any scientific research, this study was not without limitations. First, there are a plethora of virtual background options for instructors to choose from, and this study represented only three options. To address this limitation, researchers are encouraged to conduct follow-up studies to capture a fuller understanding of how and why different virtual backgrounds may or may not affect student learning.

Second, the scope of the learning outcomes was limited to cognitive learning in this study. While the validity and reliability evidence of the measure indicate its appropriateness, only short-term recall, the absolute lowest level of cognitive learning (Chandio et al., 2021), can be confirmed from this data. Instructors are encouraged to take note of how their varied virtual background choices correspond to evidence of higher levels of learning in their classrooms and future research is encouraged to consider other learning outcomes like course satisfaction.

Additionally, the multiple treatment post-test only design is one of the weaker experimental designs because it does not have a control group (Croucher and Cronn-Mills, 2021). The lack of a control group prevents assessment of how students respond to these backgrounds compared to the total absence of a background. Future research may wish to consider adding a blank background as a condition in virtual background research.

A final limitation of this study is that the results can only be said to apply to students' initial impressions of a virtual background. Students' perceptions of learning in relation to virtual backgrounds may change over time as they have more interactions with an instructor. As such, longitudinal data is needed to see the effects of students' enjoyment and perceived appropriateness of instructors' background choices throughout a semester of learning.

5 Conclusion

In the end, the results of this study indicate that whether students enjoy an instructor's virtual background or think it is appropriate does not actually affect whether they learn, but it does affect whether they feel like they have learned. Future research may find other socioemotional classroom variables that justify instructors being concerned with the perceived appropriateness and enjoyment of their virtual backgrounds. The results of this study indicate that instructors cannot actually negatively affect students' cognitive learning based on their choice of virtual background though.

Data availability statement

The datasets presented in this article are not readily available due to confidentiality but data can be shared by the authors

upon reasonable request. Requests to access the datasets should be directed to sekelly@ncat.edu.

Ethics statement

The studies involving humans were approved by University of Central Florida Internal Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SK: Formal analysis, Methodology, Writing – original draft, Writing – review & editing. JK: Conceptualization, Data curation, Methodology, Writing – review & editing. JC: Conceptualization, Methodology, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomp.2024.1409711/full#supplementary-material

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