Learning Remotely: Does Self-Awareness Reduce Comprehension in a Virtual Learning Environment?

Brianna K. Gilman

Department of Psychology, Westmont College

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Correspondence concerning this paper should be addressed to Brianna Gilman, Department of Psychology, Westmont College, MS# 1482, 955 La Paz Rd., Santa Barbara, CA 93108. bgilman@westmont.edu.

Abstract

Educational learning has been severely disrupted by COVID-19 and most institutions have adapted by transitioning to online learning using platforms like Zoom. However, online learning brings its own set of challenges. The current study examined the effect on comprehension of presented material while having one's own video on the screen during a lecture. We hypothesized that the presence of a participant's own video on the screen would decrease performance on the comprehension assessment compared to the control group. 66 undergraduate students from a liberal arts college on the west coast were randomly assigned to either the experimental group or the control group. In the experimental group, participants watched a recorded lecture about the rift between poetry and fiction while a live video of themselves was on the screen. This was meant to simulate an environment similar to a Zoom class. The control group watched the same lecture, but without a video of themselves on the screen. Eye-tracking software determined the amount of time that participants looked at themselves compared to the instructor. After watching the video, participants in both groups took a comprehension assessment. There was no significant difference between the average scores of the two groups, though the experimental group scored significantly worse on the first question of the assessment. This is consistent with some previous research, but it did not support our hypothesis. The results of this study could provide insight into how to make online learning more effective and potentially lead to further research into how the pandemic has affected classroom learning.

Keywords: online learning, self-awareness, comprehension, remote learning

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With the COVID-19 pandemic forcing more and more interactions to take place virtually, it is more important now than ever to investigate the effect that communicating via computer screens has on attention and memory. One major area that has little-to-no research to date is the potential effects of remote instruction on learning. In a survey of schools across the United States in the spring of 2020, 99% of teachers said they were facilitating remote instruction (Hamilton et al., 2020). Less than half of students in a Delaware Department of Education survey were satisfied with online learning and even fewer felt like they were learning new things after moving to remote instruction with the strengthening of COVID-19 restrictions (Resources/Remote Learning Survey Results, 2020). This is no surprise when research has found that live faces increased physiological arousal while video-mediated faces did not, meaning that video-mediated faces drew less attention (Riby et al., 2012).

Doherty-Sneddon and colleagues (1997) also found that communication was much more formal when virtual and that people are less confident in mutual understanding when communicating via video. In fact, task performance was reduced when communication was virtual rather than in-person (Doherty-Sneddon et al., 1997). A survey put out by the EdWeek Research Center found that 76% of teachers reported that student engagement declined in a two-week period after moving to remote instruction (Bushweller, 2020). More than three-quarters (77%) of students in a survey given by the University of Wisconsin Milwaukee during COVID-19 claim that they are not learning as much as they were before the COVID-19 crisis (Distance-Learning in the Time of COVID-19, 2020).

It seems clear that remote instruction may be having a negative impact on students' education, but what could be causing this decline in learning? One potential factor could be that online learning introduces an element of self-awareness as the students have their own videos

on the screen in platforms like Zoom. The presence of the students' own faces on the screen could act as a potent distractor, or could function as a source of accountability since self-awareness increases the likelihood that people will conform to acceptable standards of behavior (Beaman et al., 1979)

The brain has limited neural resources, so depending on how many of those resources are available, it must filter which information is important and which can be ignored (Fiebelkorn & Kastner, 2020). Attention has thus been conceptualized as this filtering process: when a person focuses on specific information while ignoring other pieces of information. Stimuli that are not in the focus of attention do not take up neural resources, so there are more resources for the information that is relevant to the task being performed (Desimone & Duncan, 1995).

In the same way, giving attention to one thing leaves less for another (Desimone & Duncan, 1995). This leads to competition between stimuli which is biased towards information that is relevant to the task at hand (Desimone & Duncan, 1995). More attentional resources are taken up when the stimuli are informative than if they are extraneous to the task being performed (Li et al., 2013). Due to the limited attentional resources, dividing attention between two objects decreases performance compared to when attention is focused on just one of the objects (Desimone & Duncan, 1995).

There are many, many things that affect a person's ability to focus attention on an object or information and remember it later. What several studies have found captures attention regardless of mental effort or the task being performed are faces (Devue & Brédart, 2008; Eitam et al., 2014; Riby et al., 2012).

Faces are processed regardless of whether they are relevant to the task being performed and whether the person is under high or low perceptual load (Eitam et al., 2014). In fact, Eitam and colleagues (2014) found that faces actually are highly effective at drawing attention away from the task being performed. A person's own face, and highly familiar faces,

are very distracting at first, but become normalized over time (Devue & Brédart, 2008). However, Devue and Brédart (2008) found that this interference is only effective when the face is presented inside the focus of attention. Not only that, but they found that a person's face or name only are distracting in certain conditions and thus do not automatically attract the person's attention (Devue & Brédart, 2008). Interestingly, Riby and colleagues (2012) discovered that, while virtual faces are less physiologically arousing and thus draw less attention than live faces, they still act as potent distractors to task and memory performance.

One way to determine where someone's attention is focused is by tracking their eye-movements, as people's eyes tend to go to where their attention is (Fiebelkorn & Kastner, 2020). The majority of studies that look at eye-movement to measure attention use eye-tracking software or optical sensors (Cutmore & James, 2007). However, Müller and colleagues (2016) discovered that using an electrooculogram (EOG) was comparable to eye-tracking software for measuring the fixation of attention.

For the purpose of this study, eye-tracking software was used to determine where participants' overt attention is focused. Based the results of the studies on the effect of faces on attention, we hypothesized that the participants with their own videos on the screen would be distracted by them and would perform worse on the comprehension assessment.

Method

Participants

Participants were 66 undergraduate students (27 male, 39 female) attending a private liberal arts college on the West Coast. Participants' ages ranged from 18 to 22 years. Participants were recruited from several different classes, including general psychology courses, religious studies courses, cognitive psychology courses, and music courses. Participants were compensated with either extra credit, class credit, or a $5 gift card.

Materials & Apparatus

The GazeRecorder software was used to present the video and record the eye-movements of the participants (GazeRecorder, 2010). Quick Camera was used to present the live video of the participants in the experimental group (Version 1.4.1; Guest, 2013). A 21.5" iMac computer (OS X 10.13.6, 2.7 GHz Intel Core i5) was used for stimulus presentation and data collection.

Measures

The lecture and assessment were modified from Section 4 of the Law School Admission Council's Sample LSAT Test with questions added to assess familiarity of the subject and perceived difficulty of the assessment (*Section 4 | The Law School Admission Council*, n.d.). The question order was the same for all participants, but the order of the answer options were randomized. See Appendix A for the lecture transcripts and Appendix B for assessment questions.

Procedure

Participants were randomly assigned to either the control group or the live video group.

Control Group

Participants in the control group were told that the video would start automatically after calibration and that they would be redirected to the assessment after the video was completed. Participants completed the calibration, watched a 4-minute recorded lecture on the rift between poetry and fiction, then took the assessment. Upon completion, participants were debriefed and instructed on how to receive compensation.

Live Video Group

Participants in the experimental group were asked to click on the Quick Camera icon once the calibration was completed (Version 1.4.1; Guest, 2013). Participants were told that the video would start automatically after calibration and that they would be redirected to the assessment after the video was completed. Participants completed the calibration, opened the

Quick Camera app, watched a 4-minute recorded lecture on the rift between poetry and fiction, then took the assessment (Version 1.4.1; Guest, 2013). Upon completion, participants were debriefed and instructed on how to receive compensation.

Results

Independent samples t-tests and Pearson correlations were used to analyze the data. There was no significant difference between the scores for the experimental (M = .56, SD = .20) and control (M = .55, SD = .18) groups; $t(64)$ = .24, p = n.s. The experimental group (M = .7273, SD = .45227) scored significantly lower than the control group (M = .4545, SD = .50565) on Question 1; $t(64)$ = 2.309, p = .024. There was no significant difference between the average rating of familiarity for the experimental (M = 1.97, SD = 1.47) and control (M = 1.55, SD = .94) groups; $t(64)$ = -1.40, p = n.s. There was no significant difference between the average rating of difficulty for the experimental (M = 4.85, SD = 1.18) and control (M = 4.97, SD = 1.16) groups; $t(64)$ = .42, p = n.s. There was a significant correlation between the average score and the difficulty rating for all participants; $r(64)$ = -.409, p = .001. There was a significant correlation between the average score and the difficulty rating for the control group; $r(33)$ = -.40, p = .022. There was a significant correlation between the average score and the difficulty rating for the experimental group; $r(33)$ = -.43, p = .012. There was no significant difference between the amount of time participants looked at the participant in the experimental (M = 3.95, SD = 7.03) and control (M = 3.05, SD = 10.77) groups; $t(64)$ = -.41, p = n.s. There was no significant difference between the amount of time participants looked at the presenter in the experimental (M = 99.84, SD = 45.10) and control (M = 113.33, SD = 53.13) groups; $t(64)$ = 1.11, p = n.s. There was a significant difference in the control group between the amount of time participants looked at the participant (M = 3.04, SD = 10.77) compared to the presenter (M = 113.33, SD = 53.13) groups; $t(32)$ = -1.13, $p < .001$. There was a significant difference in the experimental

group between the amount of time participants looked at the participant (M = 3.95, SD = 7.03) compared to the presenter (M = 99.84, SD = 45.10) groups; $t(32) = -12.01$, $p < .001$. There was no significant correlation between the participants' scores and the amount of time they looked at the participant; $r(64) = .13$, p = n.s. There was no significant correlation between the participants' scores and the amount of time they looked at the presenter; $r(64) = -.21$, p = n.s. There was no significant correlation how long participants looked at the presenter and how long they looked at the participant; $r(64) = -.18$, p = n.s.

Discussion

Based on these results, we found that the presence of the participants' videos on the screen did not act as significant distractors. We also found that participants with their own live videos on the screen did not even look at that part of the screen more than the control group did. This points to the conclusion that, not only did the participants' faces not act as distractors, but they were not even looking at their own videos. Participants from both groups looked at the presenter significantly more than the area of the screen where the students video was or would have been and there was a correlation in both groups between how high they rated the difficulty of the assessment and their score. Additionally, the experimental group scored significantly lower on the first question of the assessment than the control group, but no other questions had significant differences in score (see Figure 1). As this question was asking about the main point of the video, it could be concluded that participants were directing covert attention towards the video which was distracting in such a way that the participants were able to remember specifics of the video but were unable to grasp the overarching point. Future research would have to be done measuring microsaccades in order to determine whether the participants' videos were affecting covert attention rather than overt attention.

These results were inconsistent with our hypothesis that the presence of a participant's live video on the screen would act as a distractor and cause a decrease in performance on a

comprehension assessment. While this was inconsistent with past research that faces are distracting regardless of the mental load or the modality of the information being presented, it may support other previous research showing that a person's face or name only are distracting in certain conditions and thus do not automatically attract the person's attention (Beaman et al., 1979; Devue & Brédart, 2008; Eitam et al., 2014; Riby et al., 2012).

While having their own videos on the screen did not produce a strong enough distraction to cause a significant difference in scores, the results of this study show that it is not merely the presence of the participants' own video on the screen that might cause distraction, but it could be the fact that in a real video call, there is someone else observing them. This study was limited by the length of the video, which was much shorter than most real-life lectures would be, the number of questions in the assessment, which may not have been enough to accurately assess differences in comprehension, the obvious calibration of the eye-tracking software, which could have drawn their attention to where they were looking, and the familiarity of all of the participants with online learning, as they had all been enrolled in online classes for the previous 12 months which could have led to them becoming accustomed to ignoring their own videos.

The study was also limited by the fact that it was a pre-recorded video, which may not have had the same effect as a live video of a speaker would have, and that the video of the participant's face was mirrored, which is different from the way that most virtual meeting programs present the videos. Future research could focus on the effect of a participant's video on the screen when in a real video call or lecture in order to discover whether having someone able to see them affects how much they look at themselves and whether that acts as a distraction. Other future research could present a longer lecture with more assessment questions, employ more discreet eye-tracking software, and utilize a more diverse subject pool with a variety of ages and backgrounds to counter experience effects.

The results of this study could provide insight into how to make online learning more effective and potentially lead to further research into how the COVID-19 pandemic has affected classroom learning.

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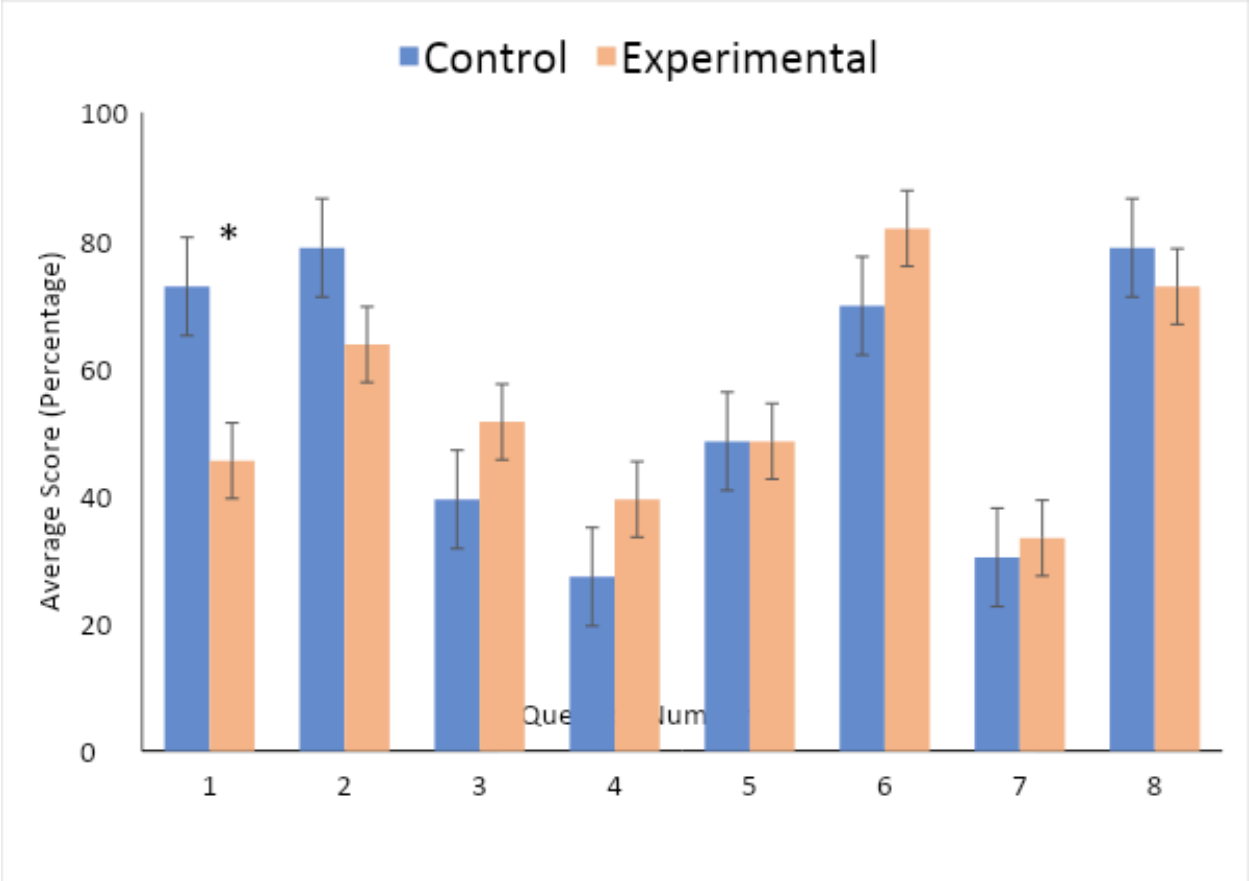
Figure 1

Average Score per Assessment Question



Note. These are the average scores for the experimental group and the control group for each question on the assessment. *$p < .05$

Appendix A

Transcript of Lecture

For decades, there has been a deep rift between poetry and fiction in the United States, especially in academic settings; graduate writing programs in universities, for example, train students as poets or as writers of fiction, but almost never as both. Both poets and writers of fiction have tended to support this separation, in large part because the current conventional wisdom holds that poetry should be elliptical and lyrical, reflecting inner states and processes of thought or feeling, whereas character and narrative events are the stock-in-trade of fiction.

Certainly it is true that poetry and fiction are distinct genres, but why have specialized education and literary territoriality resulted from this distinction? The answer lies perhaps in a widespread attitude in U.S. culture, which often casts a suspicious eye on the generalist. Those with knowledge and expertise in multiple areas risk charges of dilettantism, as if ability in one field is diluted or compromised by accomplishment in another.

Fortunately, there are signs that the bias against writers who cross generic boundaries is diminishing; several recent writers are known and respected for their work in both genres. One important example of this trend is Rita Dove, an African American writer highly acclaimed for both her poetry and her fiction. A few years ago, speaking at a conference entitled "Poets Who Write Fiction," Dove expressed gentle incredulity about the habit of segregating the genres. She had grown up reading and loving both fiction and poetry, she said, unaware of any purported danger lurking in attempts to mix the two. She also studied for some time in Germany, where, she observes, "Poets write plays, novelists compose libretti, playwrights write novels—they would not understand our restrictiveness."

It makes little sense, Dove believes, to persist in the restrictive approach to poetry and fiction prevalent in the U.S., because each genre shares in the nature of the other. Indeed, her poetry offers example after example of what can only be properly regarded as lyric narrative.

Her use of language in these poems is undeniably lyrical—that is, it evokes emotion and inner states without requiring the reader to organize ideas or events in a particular linear structure. Yet this lyric expression simultaneously presents the elements of a plot in such a way that the reader is led repeatedly to take account of clusters of narrative details within the lyric flow. Thus while the language is lyrical, it often comes to constitute, cumulatively, a work of narrative fiction. Similarly, many passages in her fiction, though undeniably prose, achieve the status of lyric narrative through the use of poetic rhythms and elliptical expression. In short, Dove bridges the gap between poetry and fiction not only by writing in both genres, but also by fusing the two genres within individual works.

Appendix B

Assessment Questions

1. Which of the following most accurately expresses the main point of the video?
    a. Rita Dove's work has been widely acclaimed primarily because of the lyrical elements she has introduced into her fiction.
    b. Rita Dove's lyric narratives present clusters of narrative detail in order to create a cumulative narrative without requiring the reader to interpret it in a linear manner.
    c. Working against a bias that has long been dominant in the U.S., recent writers like Rita Dove have shown that the lyrical use of language can effectively enhance narrative fiction.
    d. Unlike many of her U.S. contemporaries, Rita Dove writes without relying on the traditional techniques associated with poetry and fiction.
    e. Rita Dove’s successful blending of poetry and fiction exemplifies the recent trend away from the rigid separation of the two genres that has long been prevalent in the U.S.
2. Which one of the following is most analogous to the literary achievements that the author attributes to Dove?
    a. A chef combines nontraditional cooking methods and traditional ingredients from disparate world cuisines to devise new recipes.
    b. A professor of film studies becomes a film director and succeeds, partly due to a wealth of theoretical knowledge of filmmaking.
    c. An actor who is also a theatrical director teams up with a public health agency to use street theater to inform the public about health matters.

   d. A choreographer defies convention and choreographs dances that combine elements of both ballet and jazz dance.
   e. A rock musician records several songs from previous decades but introduces guitar solos into each one.

3. According to the passage, in the U.S. there is a widely held view that
   a. poetry should not involve characters or narratives
   b. unlike the writing of poetry, the writing of fiction is rarely an academically serious endeavor
   c. graduate writing programs focus on poetry to the exclusion of fiction
   d. fiction is most aesthetically effective when it incorporates lyrical elements
   e. European literary cultures are suspicious of generalists
4. The author's attitude toward the deep rift between poetry and fiction in the U.S. can be most accurately described as one of
   a. perplexity as to what could have led to the development of such a rift
   b. astonishment that academics have overlooked the existence of the rift
   c. ambivalence toward the effect the rift has had on U.S. literature
   d. pessimism regarding the possibility that the rift can be overcome
   e. disapproval of attitudes and presuppositions underlying the rift
5. In the passage the author conjectures that a cause of the deep rift between fiction and poetry in the United States may be that
   a. poets and fiction writers each tend to see their craft as superior to the others' craft

   b. the methods used in training graduate students in poetry are different from those used in training graduate students in other literary fields
   c. publishers often pressure writers to concentrate on what they do best
   d. a suspicion of generalism deters writers from dividing their energies between the two genres
   e. fiction is more widely read and respected than poetry

6. In the context of the video, the author's primary purpose in mentioning Dove's experience in Germany is to
   a. point to an experience that reinforced Dove's conviction that poetry and fiction should not be rigidly separated
   b. indicate that Dove's strengths as a writer derive in large part from the international character of her academic background
   c. present an illuminating biographical detail about Dove in an effort to enhance the human interest appeal of the passage
   d. indicate what Dove believes to be the origin of her opposition to the separation of fiction and poetry in the U.S.
   e. illustrate that Germany is better than the U.S.
7. It can be inferred from the video that the author would be most likely to believe which one of the following?
   a. Each of Dove's works can be classified as either primarily poetry or primarily fiction, even though it may contain elements of both.
   b. The aesthetic value of lyric narrative resides in its representation of a sequence of events, rather than in its ability to evoke inner states.
   c. Narrative that uses lyrical language is generally aesthetically superior to pure lyric poetry.

   d. Writers who successfully cross the generic boundary between poetry and fiction often try their hand at genres such as drama as well.
   e. Writers should all study in Germany to learn how to blend poetry and fiction.

8. If this video had been excerpted from a longer video, which of the following predictions about the near future of U.S. literature would be most likely to appear in that video?
   a. The number of writers who write both poetry and fiction will probably continue to grow.
   b. Because of the increased interest in mixed genres, the small market for pure lyric poetry will likely shrink even further.
   c. Narrative poetry will probably come to be regarded as a sub-genre of fiction.
   d. There will probably be a rise in specialization among writers in university writing programs.
   e. Writers who continue to work exclusively in poetry or fiction will likely lose their audiences.
9. On a scale from 1 to 7, with 1 being “completely unfamiliar” and 7 being “very familiar”, how much did you know about the rift between poetry and fiction prior to watching this video?
10. On a scale from 1 to 7, with 1 being “extremely easy” and 10 being “extremely difficult”, how difficult would you say this assessment was?