

Visual versus Auditory Processing Preference and Mode of Presentation:
Differences in Confidence, Attention, and Recall Performance in Online Learning

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Abstract

This study examined three styles of presentation (audio, video, and text) instructors commonly use in online classrooms in relation to two learning preferences (visual and auditory), on free-recall performance, confidence in answers, and attention to lecture. Each participant ($N = 40$) had their learning preference assessed using the Style of Processing scale (SOP; Childers, Houston, & Heckler, 1985). To account for order effects, 36 conditions were generated using a Qualtrics survey and participants were then randomly assigned to view all presentation styles. It was predicted that visual learners would outperform auditory learners on recall performance, confidence in answers, and attention to the video lecture. It was also predicted that auditory learners would outperform visual learners on recall performance, confidence in answers, and attention to the audio and text lectures. However, an analysis of variance revealed no significant main effect for either learning preference or mode of presentation. No significant interaction was found either.

Keywords: learning preference, memory, online learning, style of processing, confidence

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In the fall of 2014, 5.8 million students were reported to have been enrolled in at least one online course, and 44.5% of those students completed their coursework exclusively online (Allen, Seaman, Poulin, & Straut, 2016). The number of students who enroll in online courses will likely continue growing, further restricting the styles of presentation an instructor can choose from. Thus, it is of great importance to study the mechanisms and efficacy of online learning.

An online class is defined as having 80% or more of its work completed online. These courses give students opportunities that they would not find in a traditional setting. Online learning provides time and location flexibility, granting more students the opportunity to enroll; course material is electronic so that it can be updated around the clock and students have unlimited access to its content (Zhang, Zhou, Briggs, & Nunamaker, 2006); and several online courses are offered for the sole purpose of accommodating a wide range of student needs. Thirty-seven percent of Americans agree that these courses offer an equivalence to the high-quality education found in university lecture halls. With online enrollment rates increasing along with its universal acceptance, many institutions are expanding their online platform even with on-campus enrollments decreasing (Allen et al., 2016).

Despite its convenience, online education lacks physical interactions. The minimal, if not absent, social interactions may make students feel disconnected from their classmates and instructors (Cassidy, 2004). Some learners may also have poor experiences with online education because they do not have the motivation that is required to succeed. Cimermanová

(2018) suggests that the lack of face-to-face communication between students and their instructors could lead to lower enrollment and a higher dropout rate for online classes.

In traditional classroom settings, not only do instructors provide nonverbal conversational cues that are essential to everyday interactions, they also increase the students' overall satisfaction with the material in the course and their perception of learning the material successfully (Wang & Antonenko, 2017). Studies examining the relationship between instructor presence and recall performance are inconclusive as to whether or not instructor presence positively influences recall performance (Homer, Plass, & Blake, 2008; Kizilcec, Papadopoulos, & Sritanyaratana, 2014). The instructors can provide both verbal and nonverbal clues as to what information is to be regarded as the most important, perhaps accounting for an increased perception of learning. Despite the potential promise offered by online learning, its effectiveness is still of great concern.

Modes of Presentation

Unlike a typical educational setting that primarily utilizes lectures and textbooks, online classes involve self-regulated methods of learning where students are usually asked to read texts, listen to audio recordings, and watch videos covering the course material. Here, the instructor is no longer the focus of the class; instead, they help from a distance.

Several instruction methods used in online education lack professor-student and student-student interactions. Moreover, having the perception of an instructor's presence by the illusion of physical proximity, eye contact, and smiling can invoke a student to feel as if they have had a social interaction. The gestures of an onscreen instructor promote a high social affinity, motivating better learning of the material, therefore, resulting in increased learning outcomes (Mayer & DaPra, 2012). However, if the instructor is presented as a stagnant image instead of

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an interactive video, it causes more distractions and impedes learning rather than providing an illusion of social presence (Mayer and DaPra, 2012). These findings also support the embodiment and voice principles, which state that students learn better when online presentations contain a human-like agent that is capable of displaying body language, and that students learn better when the instructional method uses a human voice to speak rather than an artificial one (Mayer & DaPra, 2012).

Some students report difficulties maintaining attention when using online methods of learning. Therefore, the methods for creating online material should be designed to focus on the most relevant aspects of information, avoiding redundancy, in order to allow students to devote the highest amount of cognitive effort with as little distraction as possible (Homer et al., 2008). A student's level of attentiveness to an instructor's method teaching is related to their ability to maintain high levels of attention throughout the presentation. From this, instructors should use methods associated with the most student engagement since maintaining high levels of attention is directly related to a positive learning outcome.

Reading is a complex task involving high levels of cognition and applied effort. Furthermore, tasks that demand high levels of cognition result in less mind-wandering and better attention to the task at hand (Grodsky & Giambra, 1990; Jackson & Balota, 2012), which has motivated researchers to believe that instructional methods demanding more from learners have better memory recall associated with them. However, most electronic forms of reading involve scrolling through blocks of text, and some readers may focus on the movement of the page instead of the text, which reduces reading performance and comprehension. Also, reading on a screen does not provide readers with a sense of where information is located regarding the text as a whole (Chen & Lin, 2016).

Passive methods of multimedia instruction (e.g., listening to an audio recording) require less mental effort from the learner, and can often be done in simultaneity. A lower level of engagement would result in less attention to the task and an association with poor memory recall. A video presentation is not as passive as an audio recording because of the additional visual stimuli one can attend to, however it is not as demanding as reading text. If the video is interactive, research suggests that the multi-sensory method may increase a learner's interest in a subject, motivation to learn, and ability to retain information (Cimermanová, 2018). Boucheix and Lowe (2010) found that animations in video presentations can re-direct learners' attention back to the video and that the animations in a video help direct the learners' attention by providing assumptions of where and when to look. According to Zhang et al. (2006) (7,19), video-based methods in online education support the same level of teaching and learning outcomes found in traditional methods.

Information Processing and Memory

There are two fundamental features of information processing that comprise the learning process. The first is one's cognitive abilities or coding efficiency, and the second is one's style of processing or coding preference (Homer et al., 2006). The most significant part of how information gets processed is the coding preference or style of processing, which depends on the strategy an individual chooses to employ over another (Richardson, 1978).

A student's ability to properly regulate what they focus on and for how long significantly affects their aptitude for deploying effective learning methods (Steinmayr, Ziegler, & Trauble, 2010; Chen & Huang, 2014). The process of learning can be defined as the absorption of information through various processes "to be further transformed into knowledge, skills,

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behavior, and attitudes” (Shuib & Azizan, 2015, p. 104). Memory formation is not possible without sustained attention, and therefore learning would not possible either.

Memory has a limited capacity for holding information, insofar as, what one attends to is what is encoded for further processing (Chen & Huang, 2014). This involves the learner holding onto specific information they choose to encode and retain while disposing of the other information they consider to be useless or unhelpful. The encoding of information relies on whether or not the individual effectively processed the material.

Further down the line of information processing research is the dual coding theory (DCT; Clark & Paivio, 1991), which suggests that all cognitive processes are composed of two smaller systems, a verbal system, and a nonverbal or visual system. The verbal system solely deals with language, and the visual system deals with nonverbal things, only combining with the verbal system when it is not sufficient on its own (Clark & Paivio, 1991). Visual learners are the most prominent and dominant types of learners among web-based learners, regardless of their major, gender, background, etc. (Chen, Jones, & Xu, 2018).

Learning Preferences

In recent decades, the amount of educational research on learning styles has steadily grown in an attempt to discover the most optimal way of enhancing a student’s learning experience. A learning style is a general term that refers to the set of methods or strategies used when approaching a cognitive task (Dunn, 1984; Wilkinson, Boohan, & Stevenson, 2014).

There are several other definitions of a learning style provided in contemporary literature, as well as the many scales used to categorize learners into these different learning styles (Cassidy, 2004).

A learning preference is selected through the process of an individual adopting and

implementing one learning style over another, whether conscious of the process or not (Wilkinson et al., 2014).

Two approaches are used when assessing individual learning styles: the automated and collaborative approach. The automated approach assesses the patterns of behavior a learner displays while they are using a mode of online learning, whereas the collaborative approach uses a questionnaire to identify a learning style (Ahmad & Afthanorhan, 2014).

A scale that is commonly used to assess learning styles is the Felder-Silverman model (1988), which classifies different learning styles along four dimensions. One of the most prominent dimensions is the visual-verbal scale, which is concerned with how material is presented to an individual (Cela, Sicilia, & Sánchez, 2016). The visual-verbal dimension is what the Style of Processing scale (Childers et al., 1985) was developed to assess, and the classification of being a visual or verbal learner is based on one's "tendencies, indicating that learners with a high preference for [a] certain behavior can also act sometimes differently" (Graf, Viola, Leo, & Kinshuk, 2007, p. 81). On the other hand, if the individual's learning preference is strong enough and the instructor's method of presentation is not the same as their learning style, they may face difficulties related to academic performance (Felder & Silverman, 1988).

Individuals who learn more efficiently from instructors that present information using charts, films, diagrams, etc. are said to have a *visual* preference for the presentation of information (Felder & Silverman, 1988), whereas individuals with a *verbal* presentation preference would instead prefer to learn with words—both spoken and written. Verbal learners can and do learn better from auditory presentations (lectures) or visual representations of auditory information (symbols), not just a verbal presentation of information. Gerě and Jaušvec (1999) findings support the conventional assumption in that text presentations are primarily

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associated with cognitive processes having to do with verbal mechanisms, while visual processes interdepend on visual presentations.

Newer research has found that there is not a significant difference between students' learning styles assessed in a traditional classroom versus an online classroom (Chen et al., 2018). Although if the learning style of the student matches the instructor's style of teaching, the student will be more likely to enjoy the experience of the course—whether online or not (Wang & Antonenko, 2017). The insignificant differences for learning styles found in both classroom settings should be noted because it is common to think that a preference for online learning is due to experience or comfort with presentation style of the course. Instead, perhaps the preference is due to the convenience a student has that allows them to learn whenever and wherever they would like.

Overview of the Current Study

Since the world is in a digital era, degrees in higher education are beginning to be offered by institutions in a format that is entirely online. A shift in this direction provides more convenience to the 'customers' or students of the organization. Past research has identified that passive tasks (e.g., listening to a podcast) are associated with lower performance in memory recall when compared to a task that demands more mental effort (e.g., reading a blog; Wang & Antonenko, 2017). Watching a video lecture incorporates both auditory and visual components, having it fall somewhere in the middle between the two as a more extreme method of learning (Chen & Wu, 2015). Online courses can reach a larger group of people because students are not required to live near an institution and be present for the traditional style of teaching found in classrooms. Without instructor-student or student-student interactions, new ways of teaching

will have to be developed and assessed to implement the best strategies for maximal learning for the generation to come.

The current study focused on the visual-verbal dimension found in the Felder-Silverman model (1988) and the inventory of learning styles (ILS; Felder & Soloman, 2004). A combination of the Felder-Silverman model and the ILS provided the definitions used when classifying one as a visual or verbal learner. A verbal learner is an individual who prefers information to be presented in an auditory style (e.g., a lecture) or a visual style that is representational of auditory information (e.g., math symbols). A visual learner is an individual who prefers information to be presented to them in all things other than words (e.g., pictures, diagrams, etc.). The Style of Processing scale (SOP) was used to assess participants' preference for a visual or verbal learning style. Participants with a verbal learning preference are classified as an *auditory learner* and participants with a visual learning preference are classified as a *visual learner*.

Furthermore, based on a thorough literature review, it is to the present researchers' best knowledge that no studies compare individual learning preferences (visual or auditory) with free-recall memory performance across three modes of presentation (video, audio, and text). This led to two research objectives. The first is to see if there is a relationship present for memory, as measured by a free-recall task, when an individual's learning preference (visual or auditory) matches with the corresponding lecture type (video, audio, and text). The second objective is to see if there is a relationship present for confidence in answers when an individual's learning preference (visual or auditory) matches with the corresponding lecture type (video, audio, and text).

Two hypotheses have also been formulated. Based on past research findings (e.g., Chen & Wu, 2015; Chen et al., 2018; Wang & Antonenko, 2017) it is predicted that individuals who have a visual learning preference will have a higher free-recall score, higher self-reported attention, and a higher confidence level for the video lecture than individuals who have an auditory learning preference. This is because a video incorporates both visual and auditory presentations of information.

The second hypothesis is that individuals who have an auditory learning preference will have a higher free-recall score, a higher self-reported attention, and a higher confidence level for the audio and text lectures than individuals who have a visual learning preference. An auditory learner is an individual who prefers and learns best from spoken words (i.e., audio lecture) and a visual style of presentation representing auditory concepts (i.e., text lecture; Felder & Silverman, 1988; Felder & Soloman, 2004). Therefore, it is predicted that due to a preference for learning in this manner, attention will be maintained at a higher rate and confidence level will be reported higher because this is their forte.

Method

Participants

A group of 40 undergraduates (24 female, 16 male) at the University of Missouri was conveniently sampled for voluntarily participation in this study. Participants had an age range from 18 to 33 ($M = 21.8$, $SD = 2.28$). Regarding ethnicity, 5% listed themselves as Hispanic or Latino, 92.5% non-Hispanic, and 2.5% unsure. As for race, 82.5% of the participants were White, 7.5% Black or African American, 5% Asian, 2.5% Native Hawaiian or other Pacific Islander, and 2.5% Other.

Materials

Informed consent form. All participants received an informed consent form and acknowledged their participation was voluntary and could be suspended upon request at any moment during the study (see Appendix A).

Demographic questionnaire. Each participant was asked to complete a demographic questionnaire that assessed biological sex, age, race, and ethnicity (see Appendix B).

Style of Processing Scale (SOP). The Style of Processing scale (SOP) was administered to evaluate participants' learning preference and classify it as either verbal or visual (Childers et al., 1985). The SOP (see Appendix C) is a 22-item questionnaire used to assess the conventional manner utilized in the processing of information. Each item is a statement about performing a mental task a certain way (e.g., "I do a lot of reading."), and participants respond by selecting 1 of 4 items on a Likert scale ranging from 1 (*always true*) to 4 (*always false*). The SOP scale is superior to previous scales that have been used to assess information processing preference (e.g., "Vividness of Visual Imagery Questionnaire (VVIQ) developed by Marks (1973); as cited in Childers et al., 1985, p. 127). The superiority of the SOP is independent of test length. Nunnally (1978) reported the SOP to have an observed Cronbach's alpha of 0.88 (p. 243; as cited in Childers et al., 1985). The verbal component of the SOP scale has a coefficient alpha of 0.81 and the visual component has a coefficient alpha of 0.86. A single, overall score was calculated from the SOP instead of two different scores (i.e., verbal and visual). Participants with a score lower than 2.49 are verbal learners and have an auditory processing preference. Participants with a score higher than 2.5 are visual learners and have a visual processing preference (Chen & Wu, 2015). Participants who favored both styles of processing are said to have no preference.

Modes of presentation. Three modes or styles of presentation (i.e., audio, visual, and text) were presented to all forty participants. Three history lectures were selected from TED-

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Ed's YouTube channel and are each narrated by Addison Anderson. Each lecture was formatted as an audio recording, a video, and a transcript found on TED.com. Each instruction style was presented in a random order to counterbalance and account for possible order effects. The lectures ranged from 5:31-6:07 in length. The lectures were titled 'History vs. Che Guevara' (see Appendix D for transcript), 'The great conspiracy against Julius Caesar' (see Appendix E for transcript), and 'How did Polynesian wayfinders navigate the Pacific Ocean?' (see Appendix F for transcript)

Free-recall tests. Participants were asked to assess their confidence about their retention of the material presented for each mode of presentation (i.e., audio, video, and text; see Appendices G, H, & I). The confidence scale ranges from 0 (*not at all confident*) to 10 (*very confident*) and was created by the researchers of the present study. Participants took a total of three free-recall tests throughout the study. Each test was administered after the confidence scale for the corresponding lecture type (see Appendices G, H, & I). The tests were made free-recall association by the researchers of the present study to prevent guessing of correct answers. Each test is composed of 10 fill-in-the-blank questions in chronological order of the way information was presented in the lecture. The questions were taken verbatim from lecture material to avoid confusion of multiple possible correct answers and were easily assessed as correct or incorrect.

Posttest. The posttest consisted of five questions, created by researchers of the present study (see Appendix J). The first three questions assessed the participants perceived attention to the three modes of presentation using a Likert scale that ranges from 0 (*no attention*) to 10 (*full attention*). Questions four and five assessed the participants' previous familiarity with the three history topics. If question four was answered yes, question five asked the participant to explain how their previous knowledge influenced their performance on the free-recall test.

Procedure

Once research participants reviewed the informed consent form and agreed to be a part of the study, they completed the demographic questionnaire. The study was conducted through a Qualtrics survey and began with the Style of Processing scale (Childers et al., 1985) to assess individual learning preference. Instructions were presented on screen and guided participants through the experiment. Thirty-six combinations of lecture type and lecture material were created and randomly presented to the participants. After each lecture, a confidence scale was administered, followed by a free-recall test. The posttest was completed after the participant had experienced all three conditions. An additional information sheet (see Appendix K) was presented on screen, and a physical copy was given to each participant thanking them for their time spent being a participant in the present study. The researchers gave instructions to participants that were not present in the Qualtrics survey from a prewritten script (see Appendix L). No time limit was imposed in the study, but time to complete ranged from 20 to 35 min.

Results

Two independent and three dependent variables were analyzed in this study. The between-subjects variable was the visual-verbal dimension of learning preferences found in the Felder-Silverman model and was assessed using the SOP. The within-subjects variable was the three modes of presentation of the lecture (i.e., audio recording, video, and text). The dependent variables were the free-recall score, confidence level of retention, and perceived attention to the lecture.

Recall scores were graded by the researchers at the same time and each participant was assigned a percentage based on the correct number of answers out of ten questions. Confidence level and perceived attention were both assessed using a Likert scale that ranges from 0 to 10.

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A single score was calculated for the SOP. Most of the responses categorized participants as having no learning preference for either auditory or visual presentation, so the researchers transformed the data by adjusting the scale. A participant with a score ranging from 1 to 2.49 was classified as an auditory learner ($n = 7$), and a score ranging from 2.5 to 4 classified a participant as a visual learner ($n = 30$).

Data from 37 of the 40 participants was used in the statistical analysis. Of the three excluded responses, one had a patterned answer to the SOP, and the other two had completed only the SOP. The statistical analyses were performed using IBM SPSS (Statistical Package for Social Sciences) v. 25.

Recall Score

A 2 (Learning Preference: visual vs. auditory) x 3 (Mode of Presentation: audio, video, vs. text) analysis of variance (ANOVA) was conducted on each of the three dependent variables (recall performance, confidence level, and perceived attention). For recall performance, no significant main effect of processing preference was found, $F(1, 35) = .79, p = .38, \eta_p^2 = .02$. The ANOVA also showed no significant main effect of mode of presentation, $F(2, 70) = .84, p = .44, \eta_p^2 = .02$. There was no significant interaction between processing preference and mode of presentation either, $F(2, 70) = .54, p = .58, \eta_p^2 = .02$. Table 1 shows the average recall scores in percentages across the three modes of presentation for auditory and visual learners. Auditory learners accounted for seven responses and visual learners accounted for 30 responses.

To illustrate the difficulty of each lecture, an overall score was calculated for each of the corresponding recall tests. The means indicated no significant difference of recall scores for the Julius Caesar lecture ($M = 40.00, SD = 25.50$), Polynesian wayfinders lecture ($M = 40.27, SD =$

23.74), and Che Guevara lecture ($M = 39.46$, $SD = 26.24$). From these results, one can infer the level of difficulty was relatively uniform across the three lectures.

Confidence in Recall Score

Due to an error in the creation of the Qualtrics survey, 10 participants responded to all three confidence scales. For confidence in retention of lecture material, an ANOVA revealed no significant main effect of processing preference, $F(1, 8) = .38$, $p = .55$, $\eta_p^2 = .05$. There was also no significant main effect of mode of presentation, $F(2, 16) = .16$, $p = .86$, $\eta_p^2 = .02$.

Additionally, there was no significant interaction found between processing preference and mode of presentation, $F(2, 16) = .67$, $p = .53$, $\eta_p^2 = .08$. Table 2 shows the means and standard deviations of confidence scale responses from the Likert scale. Auditory learners accounted for two responses and visual learners accounted for eight responses.

Attention to Lecture

For attention to lecture type, an ANOVA revealed no significant main effect of processing preference, $F(1, 33) = 1.70$, $p = .20$, $\eta_p^2 = .05$. There was also no significant main effect of mode of presentation, $F(2, 66) = 1.01$, $p = .37$, $\eta_p^2 = .03$. The ANOVA further indicated no significant interaction between processing preference and mode of presentation, $F(2, 66) = 1.96$, $p = .15$, $\eta_p^2 = .06$. Table 3 ($n = 35$) shows the means and standard deviations for auditory and visual learners and their perceived attention responses from the Likert scale. Auditory learners accounted for seven responses and visual learners accounted for 28 responses.

Discussion

The main objective of this study was to determine whether individual learning preferences of students (visual or verbal) and presentation styles used by instructors (audio,

video, and text) interact to produce an effect on learning performance, confidence of learning, or attention to the material presented.

As mentioned previously, the results of the 2 x 3 mixed ANOVA revealed that the interaction between the mode of presentation and learning preference on recall performance was not significant. These results do not support the first hypothesis (Visual learners will outperform auditory learners in the video-based lecture condition by having a higher recall score, higher confidence in answers, and a higher perceived attention), nor the second hypothesis (Auditory learners will outperform visual learners in the audio and text-based lecture conditions by having a higher recall score, higher confidence in answers, and a higher perceived attention). Based on the findings, hypotheses 1 and 2 have been rejected.

In addition, these findings are in line with the findings of Ishak and Awang (2017) which found no significant relationship between individual learning preferences and academic performance based on history lectures. Learning preference was examined using a scale (i.e., Grasha-Riechmann Learning Style Scale) that prompts responses on a Likert scale that is very similar to the SOP. Thirty-six items are used when assessing learning preference instead of twenty-two, and the Likert scale has the same response options that are found on the SOP with an additional option in the middle allowing for an *undecided* choice.

Furthermore, the results from the present study are in accordance with findings such as Ahmed, Safee, and Afthanorhan (2014), Johari and Ahmad (2016), Yazici (2017), and Cimermanová (2018), which all found no significant effect of learning preference on academic performance. Cimermanová (2018) also found that the presentation style an instructor implements in a classroom has no significant effect on academic performance, regardless of whether the classroom is in a traditional or online setting. The two previous findings lead

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Cimermanová (2018) to infer that there was no significant interaction present for learning preference and mode of presentation on academic performance level.

The findings from the current study suggest that a majority of learners do not have a strong preference for the way in which information is presented to them, perhaps giving rise to the similar difficulty scores of the three lectures. Difficulty scores were calculated based on the lecture topic, regardless of whether the information was presented in a video, audio, or text format.

Implications

Online learning is not fully understood. The results indicate that there is no significant difference in learning outcomes for auditory and visual learning preferences. There is also no significant effect of presentation style on memory performance, confidence in answers, or perceived attention to various tasks. Learners should not be hesitant to try online learning or an instructional method different from the one preferred.

Strengths

The present study combined the most commonly used measures for assessing learning outcomes in a way that had not been done before. Confidence, perceived attention, and memory recall in the form of free association were measures used to see if a relationship was present when individual learning preference (visual and auditory) matched with the corresponding instructional method (audio, video, and text).

Limitations

Participants in this study represent a proper sample of undergraduates that would be needed to examine the relationship between learning preference and style used in the presentation of lecture material. At the same time, this sample does not represent the population

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that is routinely involved in the learning process, which includes professors and graduate students to name a few. The sample also does not represent the population that primarily relies on multimedia modalities to learn. A representational or large enough sample size is not only a limitation of this study—it is a limitation commonly found in the area of research focusing on learning styles or preferences (Cook, 2005).

A possible explanation for the results of the current study can be explained by the way the Style of Processing scale was used. The SOP scale developed by Childers, Houston, and Heckler in 1985 focuses on the visual-verbal learning preference dimension that was further expanded on by Richard Felder and Linda Silverman in 1988. During this time, the scales developed were meant to be used in a traditional classroom setting instead of an online one—which is what they are mainly used for today (Graf et al., 2007). According to Coffield, Moseley, and Hall (2004), and Pashler, McDaniel, Rohrer, and Bjork (2008) analyses of the literature, very few studies have used proper methodology when assessing learning preference and education because there is a limited number of instruments capable of meeting the minimum requirements to ensure test re-test reliability, construct validity, and internal consistency. Moreover, the studies that have used the best available methods have found results contradicting the leading hypotheses.

Four questions on the recall tests may have been confusingly worded or may not have been provided with enough context, despite being taken verbatim from the lectures. The Julius Caesar lecture had two of these questions. Question 1 asked, “Which tyrannical king did Lucius Junius Brutus help expel? Tarquin the ____.” Four people provided the correct answer, “proud”, and the remaining responses to the question were all the same, “great”, which is incorrect. Julius Caesar Question 9 says, “After the assassination of Caesar, Rome went into a

_____ because of a power vacuum.” The correct answer is “civil war”, but the question was interpreted in various ways. Question 5 on the Polynesian wayfinders recall test was asking for a numerical response, hence the reason for putting “oar(s)”, but several participants responded with “wooden”. The question reads as follows, “The voyages relied on double-hulled canoes that were steered with _____ oar(s)”. The last question of concern was Question 10 on the Che Guevara recall test, “In the end, Che was killed in _____.” Several participants incorrectly responded with a year, and several participants also responded correctly with a country.

As a final question on the survey, participants were asked if their previous knowledge about any of the lecture topics had influenced their recall score. Thirteen participants reported some familiarity with at least one topic, but this did not influence their performance on the recall test. Three participants reported they had great deal of background knowledge on Julius Caesar and performed significantly better on this lecture topic. Their scores were kept in the analysis because their recall scores were among average on the other two lectures.

Conclusion

This study explored the influence of the mode of presentation used by instructors and student’s individual learning preference on memory recall performance, confidence in answers, and attention to lecture material. Findings suggest that there is no significant difference in recall performance, confidence in answers, or perceived attention to a video, audio, or a text lecture, whether one has a visual or auditory preference for the presentation of information. However, no significant results were observed, this is the first study conducted assessing three styles of presentation found in online lectures compared to a visual-auditory processing preference.

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Future research could use a different scale to assess the learning preference of students, perhaps one that assesses preference on a dimension other than visual-verbal. Learning styles could also be better understood if the individual's major was considered, or gender and age differences were taken into account. For example, Chen, Jones, and Xu (2018) found that male students have a stronger visual learning preference ($N = 166$) and that accounting majors are more likely to be verbal learners. A larger sample size could also be used to perhaps discover differences that are not present in a smaller sample. As society inevitably continues to progress in the digital age, millions of students representing different ages and backgrounds will continue to enroll in online courses. It is essential for individual learning preferences to be understood so online learning environments can be optimized to meet the needs of all types of learners, resulting in the highest rate of learned material and the greatest satisfaction with the course at hand.

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Table 1

Processing Preference and Memory Recall of Video, Text, and Audio Lectures

		<i>n</i>	<i>M</i>	<i>SD</i>
Auditory Processing Preference	Video	7	47.71	28.78
	Text	7	48.57	25.45
	Audio	7	44.29	25.73
Visual Processing Preference	Video	30	44.00	24.01
	Text	30	38.33	25.47
	Audio	30	33.00	24.68

Note. Memory recall score values are shown as percentages.

Table 2

Processing Preference and Confidence in Memory Recall of Video, Text, and Audio Lectures

		<i>n</i>	<i>M</i>	<i>SD</i>
Auditory Processing Preference	Video	2	3.50	2.12
	Text	2	5.00	2.83
	Audio	2	4.00	0.00
Visual Processing Preference	Video	8	5.13	1.81
	Text	8	4.63	1.92
	Audio	8	5.50	3.21

Note. Confidence in memory recall values are determined from a Likert scale that ranges from 0 (*not at all confident*) to 10 (*very confident*).

Table 3

Processing Preference and Perceived Attention of Video, Text, and Audio Lectures

		<i>n</i>	<i>M</i>	<i>SD</i>
Auditory Processing Preference	Video	7	6.29	2.93
	Text	7	7.14	3.02
	Audio	7	6.57	2.64
Visual Processing Preference	Video	28	6.36	2.79
	Text	28	5.39	2.28
	Audio	28	4.64	2.77

Note. Perceived attention values are determined from a Likert scale that ranges from 0 (*no attention*) to 10 (*full attention*).

Appendix A

Dear Participant,

You are invited to participate in a study conducted as part of the requirements for a class project in the Psychological Sciences department at the University of Missouri - Columbia. For this project, we will be presenting three separate learning conditions to examine the relationship between information presentation and cognitive processing. The purpose of this research project is to help beginning researchers analyze information recall in relation to learning methods. Information obtained will be confidential.

To begin, you will complete a demographic survey assessing age, biological sex, race and ethnicity. You will be asked to complete the Style of Processing Scale consisting of 22 questions to evaluate your learning style (Childers, Houston, & Heckler, 1985). You will be presented with 3 history lessons. After completion of the three conditions, you will be asked to answer a series of questions about the study.

VISUAL VERSUS AUDITORY PROCESSING

This experiment will take approximately 40 minutes. You must be 18 years of age or older to participate. You are free to withdraw your participation at any time. All information disclosed in this study will be kept confidential. If you have any questions or concerns, feel free to contact one of us at garc68@mail.missouri.edu (Genny Ragan), lmb2x5@mail.missouri.edu (Lucas Burns) or rkrqm2@mail.missouri.edu (Rohit Rao). Thank you for your help.

Sincerely,
Genny Ragan, Lucas Burns, and Rohit Rao

Please sign both copies, keep one copy and return one to the researcher.

Signature of Researcher / Date

Signature of Researcher / Date

Signature of Researcher / Date

Signature of Participant / Date

For questions or problems regarding this study, please email Dr. Lisa Bauer at bauerlm@missouri.edu.

Appendix B

Please complete the following:

What is your biological sex?

- Male
- Female
- Other: _____

Age: _____

VISUAL VERSUS AUDITORY PROCESSING

What do you consider your race to be?

- American Indian or Alaska Native
- Asian
- Native Hawaiian or Other Pacific Islander
- Black or African American
- White
- Prefer not to answer
- I do not know
- Other: _____

What is your ethnicity?

- Hispanic or Latino/a
- Not Hispanic or Latino/a
- Prefer not to answer
- I do not know

Appendix C

Style of Processing Scale

Please read carefully. The aim of this exercise is to determine the style or manner you use when carrying out different mental tasks. Your answers to the questions should reflect the manner in which you typically engage in each of the tasks mentioned. There are no right or wrong answers, we only ask that you provide honest and accurate answers. Please answer each question by circling one of the four possible responses. For example, if I provided the statement, “I seldom read books,” and this was your *typical* behavior, even though you might read say one book a year, you would circle the “Always True” response.

Always True	Somewhat True	Somewhat False	Always False
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VISUAL VERSUS AUDITORY PROCESSING

1	I enjoy doing work that requires the use of words.	1	2	3	4
2	There are some special times in my life that I like to relive by mentally “picturing” just how everything looked.	1	2	3	4
3	I can never seem to find the right word when I need it.	1	2	3	4
4	I do a lot of reading.	1	2	3	4
5	When I’m trying to learn something new, I’d rather watch a demonstration than read how to do it.	1	2	3	4
6	I think I often use words in the wrong way.	1	2	3	4
7	I enjoy learning new words.	1	2	3	4
8	I like to picture how I could fix up my apartment or a room if I could buy anything I wanted.	1	2	3	4
9	I often make written notes to myself.	1	2	3	4
10	I like to daydream.	1	2	3	4
11	I generally prefer to use a diagram rather than a written set of instructions.	1	2	3	4
12	I like to “doodle”.	1	2	3	4
13	I find it helps to think in terms of mental pictures when doing many things.	1	2	3	4

VISUAL VERSUS AUDITORY PROCESSING

14	After I meet someone for the first time. I can usually remember what they look like, but not much about them.	1	2	3	4
15	I like to think of synonyms for words.	1	2	3	4
16	When I have forgotten something, I frequently try to form a mental "picture" to remember it.	1	2	3	4
17	I like learning new words.	1	2	3	4
18	I prefer to read instructions about how to do something rather than have someone show me.	1	2	3	4
19	I prefer activities that don't require a lot of reading.	1	2	3	4
20	I seldom daydream.	1	2	3	4
21	I spend very little time attempting to increase my vocabulary.	1	2	3	4
22	My thinking often consists of mental "pictures" or images.	1	2	3	4

Appendix D

History vs Che Guevara

His face is recognized all over the world. The young medical student who became a revolutionary icon. But was Che Guevara a heroic champion of the poor or a ruthless warlord who left a legacy of repression?

“Order, order.”

“Hey, where have I seen that guy before?”

“Ahem, your Honor, this is Ernesto Che Guevara.”

In the early 1950s, he left behind a privileged life as a medical student in Argentina to travel through rural Latin America. The poverty and misery he witnessed convinced him that saving lives required more than medicine. So he became a terrorist seeking to violently overthrow the region's governments.

“What?”

The region's governments were brutal oligarchies. Colonialism may have formally ended, but elites still controlled all the wealth. American corporations bought up land originally seized from indigenous people and used it for profit and export, even keeping most of it uncultivated while locals starved.

“Couldn't they vote to change that?”

“Oh, they tried, your Honor.”

In 1953, Che came to Guatemala under the democratically-elected government of President Árbenz. Árbenz passed reforms to redistribute some of this uncultivated land back to the people while compensating the landowners. But he was overthrown in a CIA-sponsored coup.

The military was protecting against the seizure of private property and communist takeover. They were protecting corporate profits and Che saw that they would use the fear of communism to overthrow any government that threatened those profits.

So he took the lessons of Guatemala with him to Mexico. There, he met exiled Cuban revolutionaries and decided to help them liberate their country.

“You mean help Fidel Castro turn a vibrant Cuba into a dictatorship.”

Dictatorship was what Cuba had before the revolution.

Fulgencio Batista was a tyrant who came to power in a military coup. He turned Havana into a luxury playground for foreigners while keeping Cubans mired in poverty and killing thousands

VISUAL VERSUS AUDITORY PROCESSING

in police crackdowns. Even President Kennedy called it the worst example of "economic colonization, humiliation, and exploitation in the world."

Whatever Batista's faults, it can't compare to the totalitarian nightmare Castro would create. Forced labor camps, torture of prisoners, no freedom to speak or to leave.

"But this isn't the trial of Fidel Castro, is it?"

Che Guevara was instrumental in helping Castro seize power. As a commander in his guerilla army, he unleashed a reign of terror across the countryside, killing any suspected spies or dissenters. He also helped peasants build health clinics and schools, taught them to read, and even recited poetry to them.

His harsh discipline was necessary against a much stronger enemy who didn't hesitate to burn entire villages suspected of aiding the rebels. Let's not forget that the new regime held mass executions and killed hundreds of people without trial as soon as they took power in 1959.

The executed were officials and collaborators who had tormented the masses under Batista. The people supported this revolutionary justice.

"Which people?"

An angry mob crying for blood does not a democracy make. And that's not even mentioning the forced labor camps, arbitrary arrests, and repression of LGBT people that continued long after the revolution. There's a reason people kept risking their lives to flee, often with nothing but the clothes on their backs.

"So was that all this Che brought to Cuba?
Just another violent dictatorship?"

"Not at all."

He oversaw land redistribution, helped establish universal education, and organized volunteer literacy brigades that raised Cuba's literacy rate to 96%, still one of the highest in the world. Which allowed the government to control what information everyone received.

Guevara's idealistic incompetence as Finance Minister caused massive drops in productivity when he replaced worker pay raises with moral certificates. He suppressed all press freedom, declaring that newspapers were instruments of the oligarchy. And it was he who urged Castro to host Soviet nuclear weapons, leading to the Cuban Missile Crisis that brought the world to the brink of destruction.

He was a leader, not a bureaucrat. That's why he eventually left to spread the revolution abroad. Which didn't go well. He failed to rally rebels in the Congo and went to Bolivia even when the Soviets disapproved.

VISUAL VERSUS AUDITORY PROCESSING

The Bolivian Government, with the help of the CIA, was able to capture and neutralize this terrorist in 1967, before he could do much damage. While doing plenty of damage themselves in the process

“So that was the end of it?”

“Not at all.”

As Che said, the revolution is immortal. He was publicly mourned in cities all over the world. Not by the Cubans who managed to escape. And his story would inspire young activists for generations to come. A trendy symbol of rebellion for those who never had to live under his regime. Symbols of revolution may become commodified, but the idea of a more just world remains.

Che Guevara was captured and executed by government forces in Bolivia. His remains would not be found for another 30 years. But did he die a hero or had he already become a villain? And should revolutions be judged by their ideals or their outcomes? These are the questions we face when we put history on trial.

Appendix E

The great conspiracy against Julius Caesar

What would you do if you thought your country was on the path to tyranny? If you saw one man gaining too much power, would you try to stop him? Even if that man was one of your closest friends and allies? These were the questions haunting Roman Senator Marcus Junius Brutus in 44 BCE, the year Julius Caesar would be assassinated.

Opposing unchecked power wasn't just a political matter for Brutus; it was a personal one. He claimed descent from Lucius Junius Brutus, who had helped overthrow the tyrannical king known as Tarquin the Proud. Instead of seizing power himself, the elder Brutus led the people in a rousing oath to never again allow a king to rule. Rome became a republic based on the principle that no one man should hold too much power. Now, four and a half centuries later, this principle was threatened. Julius Ceasar's rise to the powerful position of consul had been dramatic. Years of military triumphs had made him the wealthiest man in Rome. And after defeating his rival Pompey the Great in a bitter civil war, his power was at its peak. His victories and initiatives, such as distributing lands to the poor, had made him popular with the public, and many senators vied for his favor by showering him with honors. Statues were built, temples were dedicated, and a whole month was renamed, still called July today.

More importantly, the title of dictator, meant to grant temporary emergency powers in wartime, had been bestowed upon Caesar several times in succession. And in 44 BCE, he was

made *dictator perpetuo*, dictator for a potentially unlimited term. All of this was too much for the senators who feared a return to the monarchy their ancestors had fought to abolish, as well as those whose own power and ambition were impeded by Caesar's rule. A group of conspirators calling themselves the liberators began to secretly discuss plans for assassination. Leading them were the senator Gaius Cassius Longinus and his friend and brother-in-law, Brutus. Joining the conspiracy was not an easy choice for Brutus. Even though Brutus had sided with Pompey in the ill-fated civil war, Caesar had personally intervened to save his life, not only pardoning him but even accepting him as a close advisor and elevating him to important posts. Brutus was hesitant to conspire against the man who had treated him like a son, but in the end, Cassius's insistence and Brutus's own fear of Caesar's ambitions won out.

The moment they had been waiting for came on March 15. At a senate meeting held shortly before Caesar was to depart on his next military campaign, as many as 60 conspirators surrounded him, unsheathing daggers from their togas and stabbing at him from all sides. As the story goes, Caesar struggled fiercely until he saw Brutus. Despite the famous line, "Et tu, Brute?" written by Shakespeare, we don't know Caesar's actual dying words. Some ancient sources claim he said nothing, while others record the phrase, "And you, child?", fueling speculation that Brutus may have actually been Caesar's illegitimate son. But all agree that when Caesar saw Brutus among his attackers, he covered his face and gave up the fight, falling to the ground after being stabbed 23 times.

Unfortunately for Brutus, he and the other conspirators had underestimated Caesar's popularity among the Roman public, many of whom saw him as an effective leader, and the senate as a corrupt aristocracy.

Within moments of Caesar's assassination, Rome was in a state of panic. Most of the other senators had fled, while the assassins barricaded themselves on the Capitoline Hill. Mark Antony, Caesar's friend and co-consul, was swift to seize the upper hand, delivering a passionate speech at Caesar's funeral days later that whipped the crowd into a frenzy of grief and anger. As a result, the liberators were forced out of Rome. The ensuing power vacuum led to a series of civil wars, during which Brutus, facing certain defeat, took his own life. Ironically, the ultimate result would be the opposite of what the conspirators had hoped to accomplish: the end of the Republic and the concentration of power under the office of Emperor. Opinions over the assassination of Caesar were divided from the start and have remained so. As for Brutus himself, few historical figures have inspired such a conflicting legacy. In Dante's "Inferno," he was placed in the very center of Hell and eternally chewed by Satan himself for his crime of betrayal. But Swift's "Gulliver's Travels" described him as one of the most virtuous and benevolent people to have lived. The interpretation of Brutus as either a selfless fighter against dictatorship or an opportunistic traitor has shifted with the tides of history and politics. But even today, over 2000 years later, questions about the price of liberty, the conflict between personal loyalties and universal ideals, and unintended consequences remain more relevant than ever.

Appendix F

How did Polynesian wayfinders navigate the Pacific Ocean?

Imagine setting sail from Hawaii in a canoe. Your target is a small island thousands of kilometers away in the middle of the Pacific Ocean. That's a body of water that covers more than 160 million square kilometers, greater than all the landmasses on Earth combined. For thousands of years, Polynesian navigators managed voyages like this without the help of modern navigational aids. Ancient Polynesians used the Sun, Moon, stars, planets, ocean currents, and clouds as guides that allowed them to see the ocean as a series of pathways rather than an obstacle.

Their voyages began around 1500 B.C. when the people who would settle Polynesia first set sail from Southeast Asia. Early Polynesians eventually settled a vast area of islands spread over 40 million square kilometers of the Pacific Ocean. Some historians believe the voyagers moved from place to place to avoid overpopulation. Others, that they were driven by war. Voyages became less frequent by around 1300 A.D. as Polynesian societies became more rooted in specific locations.

VISUAL VERSUS AUDITORY PROCESSING

During the voyaging period, successful journeys depended on a number of factors: well-built canoes, the skill of navigators, and weather being some of the biggest. Voyages relied on sturdy wa'a kaulua, or double-hulled canoes, which were powered by sails and steered with a single large oar. Canoe building involved the whole community, bringing together the navigators, canoe builders, priests, chanters, and hula dancers. Navigators were keen observers of the natural world. They were abundantly familiar with trade wind-generated ocean swells, which typically flow northeast or southeast.

By day, navigators could identify direction by the rocking motion of their canoes caused by these swells. But sunrise and sunset were even more useful. The Sun's position indicated east and west and created low light on the ocean that made it possible to see swells directly.

At night, navigators used something called a star compass, which wasn't a physical object, but rather a sort of mental map. They memorized the rising and setting points of stars and constellations at different times of the year. They used those to divide the sky into four quadrants, subdivided into 32 houses, with the canoe in the middle. So, for example, when they saw the star Pira'atea rising from the ocean, they knew that to be northeast.

They had some other tricks, too. The Earth's axis points towards Hokupa'a, or the North Star, so called because it's the one fixed point in the sky as the Earth rotates and always indicates north. However, it's not visible south of the Equator, so navigators there could use a constellation called Newe, or the Southern Cross, and some mental tricks to estimate where south is. For instance, draw a line through these two stars, extend it 4.5 times, and draw another line from there to the horizon. That's south. But the sky also contains navigational aids much closer to Earth, the clouds. Besides being useful weather cues, under the right conditions, they can indicate landmasses. For instance, the lagoons of Pacific atolls can actually be seen reflected on

VISUAL VERSUS AUDITORY PROCESSING

the underside of clouds, if you know what to look for. And high masses of clouds can indicate mountainous islands. Once navigators neared their destination, other clues, such as the flight patterns of birds, floating debris or vegetation, and types of fish in the area helped determine the proximity of land. For example, the Manu-O-Ku had a known flight range of 190 kilometers, and could be followed back to shore.

So how do we know all of this? Partially through evidence in petroglyphs, written observations of European explorers, and Polynesian oral traditions. But also by trying them out for ourselves. In 2017, a voyaging canoe called Hokulea completed a worldwide voyage using only these techniques. If that seems remarkable, remember the ancient Polynesians, who through close study and kinship with nature, were able to forge these paths across an unfathomably vast, vibrant living ocean.

Appendix G

History vs Che Guevara

Part A:

How confident are you in your retention of the material presented? Circle one:

Not at all confident 0 1 2 3 4 5 6 7 8 9 10 *Very confident*

Part B:

- 1 In Che's younger years, he was a _____ student before he became a revolutionary icon.
Answer: Medical
- 2 Che was originally from _____.
Answer: Argentina
- 3 Corporations bought land and kept most of it _____, while profiting from the rest.
Answer: Uncultivated
- 4 Che arrived in Guatemala in the year _____.
Answer: 1953
- 5 In _____ Che met exiled Cuban revolutionaries and decided to help liberate Cuba.
Answer: Mexico

VISUAL VERSUS AUDITORY PROCESSING

- 6 Che was a ____ in Fidel Castro's guerilla army.
Answer: Commander
- 7 Che helped increase Cuba's _____ to 96%, one of the highest in the world.
Answer: Literacy rate
- 8 Che suppressed all press freedoms, declaring that _____ were instruments of the oligarchy.
Answer: Newspapers
- 9 Che went to the _____ where he failed to gather rebels.
Answer: Congo
- 10 In the end, Che was killed in _____.
Answer: Bolivia

Appendix H

The great conspiracy against Julius Caesar

Part A:

How confident are you in your retention of the material presented? Circle one:

Not at all confident 0 1 2 3 4 5 6 7 8 9 10 *Very confident*

Part B:

- 1 Which tyrannical king did Lucius Junius Brutus help expel? Tarquin the ____
Answer: Proud
- 2 Caesar was permanently granted the position of a _____ in 44 BCE.
Answer: Dictator
- 3 Caesar became the wealthiest man in Rome due years of _____.
Answer: Military triumphs
- 4 The group of conspirators that planned Caesar's assassination were called the _____.
Answer: Liberators
- 5 Brutus' main co-conspirator and brother-in-law was named _____.

VISUAL VERSUS AUDITORY PROCESSING

Answer: Cassius

6 Caesar was stabbed _____ times, which resulted in his death.

Answer: 23

7 Caesar was assassinated in the year _____ BCE.

Answer: 44

8 Mark _____. Caesar's friend and co-consul delivered a passionate speech at Caesar's funeral that whipped the crowd into a frenzy of grief and anger.

Answer: Antony

9 After the assassination of Caesar, Rome went into a _____ because of a power vacuum.

Answer: Civil war

10 In Dante's Inferno Brutus was placed in the _____ of hell.

Answer: Center

\Appendix I

How did Polynesian wayfinders navigate the Pacific Ocean?

Part A:

How confident are you in your retention of the material presented? Circle one:

Not at all confident 0 1 2 3 4 5 6 7 8 9 10 *Very confident*

Part B:

1 The Pacific Ocean hosts an area that is _____ million square kilometers.

Answer: 160

2 The Polynesian voyages began around the year _____ BCE.

Answer: 1500

3 The Polynesians left _____ to set sail.

Answer: Southeast Asia

4 The Polynesian voyages ended around the year _____ AD.

Answer: 1300

VISUAL VERSUS AUDITORY PROCESSING

- 5 The voyages relied on double-hulled canoes that were steered with ____ oar(s).
Answer: One
- 6 During the day, they relied on the rocking of their boats and the ____ to determine direction.
Answer: Sun
- 7 At night, navigators relied on a ____ ____ to travel.
Answer: Star compass
- 8 To use this, they divided the night sky into ____ quadrants.
Answer: Four
- 9 High masses of clouds can be used to indicate ____ islands.
Answer: Mountainous
- 10 To indicate the proximity of land, they used the flight patterns of birds, floating debris or vegetation, and types of ____.
Answer: Fish

Appendix J

- 1 How well were you able to pay attention to the Polynesian wayfinders lesson? Circle one of the following:

No attention 0 1 2 3 4 5 6 7 8 9 10 *Full attention*

- 2 How well were you able to pay attention to the history of Che Guevara lesson? Circle one of the following:

No attention 0 1 2 3 4 5 6 7 8 9 10 *Full attention*

- 3 How well were you able to pay attention to the conspiracy of Julius Caesar lesson? Circle one of the following:

No attention 0 1 2 3 4 5 6 7 8 9 10 *Full attention*

- 4 Did you have previous knowledge about any information on the 3 subjects?

YES NO

- 5 If yes, did your familiarity with the topic influence your performance on the recall test? Explain.

Appendix K

Information Sheet

Learning Modes and Recall Performance

Dear Participant,

Thank you for participating in this study. This study examined the relationship between modes of online information presentation and recall performance. Past research has shown little difference in recall performance across in-class and online learning (Jensen, 2011). The evolving shift to more online instruction influenced us to compare recall performance across different types of online mediums. Further, previous research has determined a positive relationship between level of attention and performance on recall tasks (Chen & Wu, 2014). As well, a positive relationship between self-reported confidence and cognitive recall performance has been identified by previous researchers (Stankov & Lee, 2008).

In this study, we expanded on the existing research by combining each of these variables into a single study as comparisons of learning style, attention, confidence and recall have yet to be conducted in relation to online learning. We are examining the relationship between preferred learning style and performance on recall tests when tested through use of three differing online mediums. By using the Style of Processing scale (Childers, Houston, & Heckler, 1985), we were

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able to categorize your preferred learning style as either verbal or visual. This variable allowed us to examine whether preferred learning style has an effect on recall ability across the three mediums. We also assessed your reported confidence level through the use of a 10-point scale. We expect to see a difference in recall performances across learning mediums between the two participant categories (verbal vs visual). Your recall performance was tested through the use of fill-in-the-blank questions. Overall, we expect to see positive correlations between learning style preference and recall performance and positive relationships between attention reports, confidence reports, and recall performance.

As you know, your participation in this study is voluntary. If, as a result of your participation in this study, you experienced any adverse reaction, this is a reminder that you have access to free counseling at the University of Missouri Counseling Center. If you have any further questions or concerns about your participation in this study, feel free to contact one of us: Genny Ragan - garc68@mail.missouri.edu; Lucas Burns – lmb2x5@mail.missouri.edu; or Rohit Rao - rkrqm2@mail.missouri.edu

Thank you for your participation,
Genny Ragan, Lucas Burns, and Rohit Rao

Appendix L

(Participants sit down at a computer)

Hello!

My name is _____ (Genny/Lucas/Rohit). My fellow researchers are _____ (Genny/Lucas/Rohit) and _____ (Genny/Lucas/Rohit). We are senior psychology students here at the University of Missouri. Thank you so much for participating in our experiment.

Our study will consist of a couple surveys and three five-minute history lectures. At the end of each lecture, you will be asked to answer some questions.

Before we start the study, please fill out this consent form. Read the material on the form carefully. You are free to withdraw from the experiment at any time, and your information will be kept confidential.

(Hand out and collect informed consent forms)

Do you have any questions?

Once you are finished, please fill out the demographic form.

(Hand out and collect demographic forms)

When you are finished, please continue to the Qualtrics survey.

We would like to remind you that participation is voluntary, and if at any point you want to discontinue the study, please let one of us know.

Let us know if you have any questions. Thank you!