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Effects of instructor presence in video modeling examples on attention and learning

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ABSTRACT

Video modeling examples are videos in which an instructor explains and/or demonstrates how to perform a task or procedure. These examples have become increasingly prevalent in online and blended learning environments. Yet, specific guidelines for designing video modeling examples to optimize learning are scarce. One design aspect in which much variation is evident is whether the instructor is visible in the video. The instructor will attract learners' attention, at the expense of attention to what s/he is explaining and/or demonstrating. The question is whether that would affect learning. Therefore, this study investigated the effects of the mere presence of an instructor in a video example on attention allocation and learning. Participants' ($N = 54$) eye movements were recorded while they observed a video example on probability calculation that did or did not show the instructor. Subsequently, participants had to solve probability calculation problems like those presented in the video example. Results showed that learners in the 'instructor visible' condition looked at the instructor's face about 30% of the time while studying the video example, and there was no decline in attention to the instructor over time. However, there were no significant differences in learning outcomes among conditions.

1. Introduction

In recent years, the availability and use of instructional video has vastly increased, as videos have become much easier to create and distribute. Instructional videos have an important role in blended learning settings, such as flipped-classrooms, in which teachers create and assign video lessons or video examples to students as homework (Bergmann & Sams, 2012). In addition, students may decide to study instructional videos during homework or to learn new tasks or skills and may create and share videos online (e.g., Lenhart, 2012). One specific type of instructional video is video modeling examples, in which an instructor (the model) provides a step-by-step demonstration of how to perform a task, often —though not necessarily— accompanied by a verbal explanation. Such modeling examples have been shown to be very effective for learning, especially for students who have no or little prior knowledge of the demonstrated task (Renkl, 2014; Van Gog & Rummel, 2010).

However, the effectiveness of example-based learning may be affected by the example design and large differences are evident in the design of video modeling examples, while knowledge of how specific design choices affect viewing behavior and learning outcomes is limited. One aspect in which a lot of variation is evident is *whether* and, if so, *how* the instructor is visible in video modeling examples. For instance, the examples may not show the instructor, but merely contain a voice-over along with a recording of an instructor's actions on a computer screen (e.g., typing, drawing, writing, clicking, dragging; see e.g., Khan Academy: www.khanacademy.org; Hoogerheide, Loyens, & Van Gog, 2014; Kostons, Van Gog, & Paas, 2012). *If* an instructor is present, s/he can be either entirely or only partly visible. For instance, in a demonstration involving object manipulation, the instructor can be shown entirely (Van Wermeskerken and Van Gog, 2017; Hoogerheide et al., 2014; Van Gog, Verveer, & Verveer, 2014) or partly (e.g., only the instructor's hands; Van Wermeskerken and Van Gog, 2017; Fiorella & Mayer, 2015; Groenendijk, Janssen, Rijlaarsdam, & Van den Bergh, 2013; Van Gog et al., 2014). Similarly, in a "lecture-style" video example, the instructor may be fully visible, standing next to a screen on which a slideshow or writing is presented to visualize each step of the procedure (e.g., Fiorella &

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Mayer, 2015; Hoogerheide, Van Wermeskerken, Loyens, & Van Gog, 2016; Ouwehand, van Gog, & Paas, 2015), or only a "talking head" may be shown by using a picture-in-picture overlaid on the lecture slide (Wang & Antonenko, 2017). This wide variety of possibilities raises the question of whether presence of an instructor in the video modeling example matters for attention allocation and learning. Therefore, in the current study, we investigate the effects of instructor presence in lecture-style video modeling examples on attention allocation and learning outcomes.

1.1. Effects of instructor presence in video modeling examples

According to the cognitive theory of multimedia learning, learning from video modeling examples requires that students *attend to* the instructor's verbal explanation and the visual representation of the task (*selection*), then *organize* this information into coherent mental representations, and *integrate* the verbal and visual representations with each other and with available prior knowledge (Mayer, 2014). These processes are dependent on each other: if information is not attended or not attended at the right moment, organization and integration are hampered. The question addressed here, is how the presence of the instructor affects attention and learning.

On the one hand, one could argue that overall attention is heightened by presence of the instructor in video modeling examples, as social presence (Gunawardena, 1995) would prime a social response in learners that leads to deeper cognitive processing and better learning outcomes (Mayer, 2014). However, findings from multimedia research suggest that learning is not necessarily fostered when the learning material contains an image of the instructor as compared to when the instructor's image is not provided (i.e., the 'image principle'; Mayer, 2014).

On the other hand, because social stimuli quickly and automatically capture our attention, presence of the instructor might potentially hamper learning. Humans are strongly inclined to look at other people's faces and tend to engage in eye-contact even when they observe other people on photo or video (e.g., Gullberg & Holmqvist, 2006; Langton, Watt, & Bruce, 2000). Hence, the instructor, and particularly the instructor's face, is likely to attract students' attention, resulting in a kind of 'split attention effect' (Ayres & Sweller, 2014),[1] as learners have to divide their attention between the instructor and the demonstration, which might result in working memory capacity being devoted to processes that do not contribute to learning (i.e., extraneous cognitive load; Sweller, Ayres, & Kalyuga, 2011). When attention paid to the instructor would go at the expense of paying sufficient attention to what the instructor is demonstrating, this might hamper learning. Moreover, because information in video examples is often transient, it is important for learning that students attend to the part of the demonstration that the instructor is referring to in a timely manner, as they need to integrate what is being visually demonstrated with what is being verbally explained, for learning to occur (Mayer, 2014).

In many lecture-style video modeling examples (e.g., those of the Dutch 'math academy': www.wiskundeacademie.nl) the instructor stands next to the slides, looks straight into the camera, and uses a 'clicker' to present each next step in the solution procedure, but does not otherwise interact with the content on the slides (i.e., no gestures or gaze cues). A recent study by Ouwehand and colleagues showed that when the instructor stands next to the slides and looks straight into the camera, students spent a substantial proportion of their time looking at the instructor (over 40% on average), and attended very little (on average about 12%) to the areas of the task that the instructor was referring to (Ouwehand et al., 2015). That study did not include a 'no instructor' control condition, but these findings do suggest that learners might have attended more to the relevant task areas (i.e., those being referred to in the explanation) had the instructor not been present. 'Might have', because it is not a given that learners are able to rapidly locate the relevant information even when their attention is not distracted by the presence of the instructor. After hearing the instructor refer to a part of the task, learners have to engage in visual search to locate the referred part, and how quickly they are able to do so, will depend on the complexity of the visual information that is present (e.g., the number and type of competing objects; Davis, Shikano, Peterson, & Michel, 2003) and the ambiguity of the verbal information in relation to the visual information (e.g., if the reference is unspecific or the learner lacks the prior knowledge to know what the instructor is referring to, s/he might take some time to locate the referent, if at all; Louwerse & Bangerter, 2010). If students would indeed be faster to locate the referred information when the instructor is not present in the video, they would have more time to process it and integrate it with the verbal explanation, which might foster learning. When the instructor is present, s/he is likely to attract students' attention as a result of which they would be slower to locate the referred information, and consequently may run the risk of not being able to integrate the visual and auditory information, which, in turn, might hamper learning (Mayer, 2014).

However, another study showed that the presence of the instructor in a lecture-style video modeling example on math, with the instructor being shown as a small picture-in-picture overlay on the lecture slides (a "talking head"), may have beneficial effects on learning – at least for easy tasks (Wang & Antonenko, 2017). In this study, students were presented with two video modeling examples on mathematics, one on an easy topic and one on a difficult topic, that did or did not include a small picture-in-picture overlay of an instructor on the lecture slides (i.e., the instructor took up 7% of the video area). Students in the instructor present condition spent a substantial amount of time looking at the instructor (i.e., 22–26%). They also gave higher satisfaction ratings on both the easy and difficult topics, reported to invest less effort on the difficult topic, and attained higher recall performance on the easy topic than students who did not see the instructor. Thus, these findings might suggest that the instructor presence (presumably through social/affective processes) can have a beneficial effect on learning – at least for easy tasks. Note though, that caution is warranted in interpreting these findings as they may have been a result of differences in the video modeling example contents and layout (i.e., the instructor present and instructor absent modeling examples stemmed from different websites; Wang & Antonenko, 2017).

In sum, the few studies available thus far have shown that the instructor in lecture-style video modeling examples will attract a substantial amount of learners' attention (Ouwehand et al., 2015; Wang & Antonenko, 2017), but it is still largely an open question whether and how this would affect their learning. Although Wang and Antonenko (2017) found a beneficial effect of seeing the instructor's face on learning outcomes for easy tasks, with more complex tasks it seems more likely from a theoretical point of view that attention paid to the instructor would go at the expense of attending sufficiently and in a timely manner to the task, and consequently, would hinder the information selection, organization and integration processes required for learning.

Another interesting question that has not been addressed yet, is

[1] It is 'a kind of' because in contrast to the split attention effect, in which learners have to integrate two mutually referring sources of information, the instructor's physical presence is not a relevant information source for the learning task (only the instructor's voice is).

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