Emotional and Cognitive Interest: How Creating Situational Interest Affects Learning with Multimedia

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Abstract

Situational interest is the positive affect and sustained attention triggered by particular contexts (Hidi & Renninger, 2006). Some studies show interesting information enhances learning while others find it hinders learning, producing the seductive detail effect. Limited evidence suggests the seductive detail effect is weakened if emotionally interesting information is relevant to main ideas. The present research shows the seductive detail effect occurs only under certain conditions. Harp and Mayer (1997) proposed that generating cognitive, rather than emotional, interest is more effective for improving learning by cueing relationships among concepts for easier processing. Hidi and Renninger (2006) argue distinguishing between the emotional and cognitive might be artificial. Present research found benefits from cognitive interest but no support as to whether cognitive interest is necessarily a distinct type of interest from emotional interest. There were some challenges with operationalizing cognitive interest, as well as validating strategies utilized to manipulate cognitive interest levels.

Keywords: learning, instruction, situational interest, cognitive interest, seductive detail effect

Introduction

The idea of creating an interesting experience to enhance learning is at the forefront of educational issues, particularly with science, technology, engineering, and math (STEM) education and massive open online courses (MOOCs) (National Governor's Association, 2011; Norman, 2013). However, ensuring that interesting features are not detracting from the primary instructional purpose is difficult. This challenge of mediating a desire for interest and engagement with the need to produce effective learning outcomes is mirrored in educational and cognitive psychology, with research finding contradictory or mixed results for increasing interest levels in students (Rey, 2012).

Interest Learning Theory

Empirical support exists for interest learning theory – the idea that the more interesting learning material is the more likely a student is to learn and remember the information (Ainley, Hidi. & Berndorff, 2002; Schiefele, 1991; Schraw, Bruning, & Svoboda, 1995). This is especially true when measuring elaborative processing and comprehension, rather than simple recall or recognition (Schiefele, 1991). Statistically significant correlations have been found between interest and text order choice, interest and positive affect regarding the text, affect and time spent reading, and ultimately between persistence and test scores (Ainley et al., 2002). This implies that students' interests and enjoyment lead to more time and effort spent on a text, enabling them to learn more effectively.

Interest is typically divided into three categories: individual, topic, and situational (Ainley, Hidi, & Berndorff, 2002). Individual interest and topic interest, which both involve attributes of a person, are not considered here because the focus of the present research is to examine manipulations of learning material. Situational interest refers to environmental stimuli and the general structural features of a situation, such as organization of information, unexpectedness, text cohesion, use of concrete ideas, and intensity of triggered emotions (Ainley et al., 2002; Schraw et al., 1995). Situational interest is briefer in duration than the other forms of interest but is still characterized by positive affect and sustained attention toward the material.

Seductive Details

Not all research supports interest-based learning. Garner, Alexander, Gillingham, Kulikowich, and Brown (1991) found that efforts to artificially induce interest, particularly with extraneous details, divert the learner's attention and reduce the ability to recall relevant information. They termed these interesting but distracting details "seductive." These seductive details were highly memorable to participants on tests of learning compared to details that were of high importance but lower interest and also could lead to poorer recall and transfer scores (Harp & Mayer, 1991).

In a meta-analysis of findings on seductive details, nearly two-thirds of the studies included in the analysis supported fully or partially the detrimental effects of seductive details (Rey, 2012). The data in aggregate appear to demonstrate up to a small to medium effect size ($d = 0.3$) for the reduction in recall and a medium effect size ($d = 0.48$) for transfer of knowledge tasks.

Still one-third of the experiments seductive details did not hurt and sometimes even improved learning (Rey, 2012). These studies show that particular types of interesting detail, the learning domain, time limits, and amount of cognitive load can temper the distracting effects of seductive details. One example of how mitigating factors result in mixed data comes from the study by Garner et al. (1991). Researchers

found that moderately relevant and moderately interesting details were recalled more frequently by participants. Although the most important details, which were rated uninteresting, were not remembered as well, the finding that some of the germane details could be recalled if considered interesting gives interest learning theory some merit.

Studies considering illustrations that accompany text indicate that relevance is the key difference in determining whether details enhance or reduce learning. In the case of reading text, purely decorative illustrations do not benefit the understanding of the content of the text, but illustrations that depict the information, help to organize or interpret information, or provide memory devices for learning can moderately benefit the retention of that information (Carney & Levin, 2002). Any lack of enhanced learning with purely decorative images could possibly be moderated by other variables, such as the learner's prior knowledge (Magner, Schwonke, Aleven, Popescu, & Renkl, 2014). While decorative illustrations that incite situational interest can distract learners with little prior knowledge, illustrations can enhance learning for students with more prior knowledge.

Cognitive Interest

Instead of adding emotional interest with seductive details, Harp and Mayer (1997) suggest using cognitive interest as an alternative way to enhance learning. Harp and Mayer argue that emotionally interesting seductive details do little to help cognitively. To generate cognitive interest, instruction on a topic should signal the underlying structure of relationships of relevant concepts. Such strategies would include identifying main ideas, relating information to prior knowledge, and linking related topics. The idea is that, if topics are presented in a way that learners find easier to understand, the topics will seem more interesting. When comparing performance on both recall and problem-solving transfer, Harp and Mayer (1997) found that students scored higher marks if using text and illustrations that helped to organize and explain a topic (i.e. cognitively interesting details) than if the text and illustrations included extraneous, irrelevant content (i.e. seductive details).

A criticism of cognitive interest comes from a neuroscientific perspective (Hidi & Renninger, 2006). Separating affective from cognitive processes and, therefore, emotional from cognitive interest is arguably an artificial distinction because of the function of the lateral hypothalamus. The lateral hypothalamus plays a major role in seeking behavior and is responsible for inducing feelings of interest and curiosity (Panksepp, 1998). Hidi and Renninger (2006) claim that, regardless of the stimulus that triggers interest or regardless of whether the person is cognitively processing or affectively responding to the stimulus, the lateral hypothalamus is activated in the brain.

Current Investigation

The present study focused on multimedia, specifically educational videos. Video was selected as the educational medium because it would be more directly applicable and relevant to the growing use of technology in the classroom with MOOCs and other online formats. Participants in all conditions watched a video on human digestion that varied by condition.

Relevance of Interesting Details The purpose of the main study was twofold: to explore the mitigation of the seductive detail effect through increased relevance of interesting details to main ideas and to examine the distinction between cognitive and emotional interest.

Many of the previous studies have measured learning by using free recall after learners had been exposed to the learning material (Garner et al, 1991; Harp & Mayer, 1997; Harp & Mayer, 1998; Schiefele, 1991; Schraw et al., 1995). Free recall might not account for prior knowledge sufficiently or for variables, such as writing abilities or motivation to write large amounts of text, that could affec performance (Schiefele, 1991). Due to this possibility that free recall alone could be an insufficient measure, a post-test score also measured learning. A pretest score was used to explore the possibility of prior knowledge as a covariate for the experimental groups. Both the pre- and post-test consisted of multiple choice, fill-in-the-blank, and short answer questions, but the questions were different for the two forms. Some of the questions asked students to identify a concept through recall or recognition while other questions measured required students to explain causal relationships and make inferences. The variety of questions was used to overcome any potential issues with using only free response or essay questions.

By creating situational interest with statements that were emotionally engaging but less similar to the main idea of the video, the study was expected to replicate the findings of seductive detail effect researchers (Garner et al., 1991; Harp & Mayer, 1997; Mayer et al., 2008; Rey, 2012). However, performance was predicted to improve with emotionally interesting details if relevance to the content of the videos was controlled. When the interesting details did not contain less relevant additional information, but instead contained similar information as the main idea, the distracting effect seen with seductive details was not expected to be found.

Distinguishing Emotional and Cognitive Interests The second aim of this research was to examine whether emotional interest and cognitive interest are separate constructs. The distinction between cognitive and emotional aspects contradicts the definition of interest, which necessitates both affective and cognitive changes. Therefore, the phrase "cognitive interest" is used in the remainder of this document to refer to interest incited by strategies used by Harp and Mayer (1997) emphasizing the cognitive processes of interest. "Emotional interest" will refer to strategies emphasizing affective processes, as exemplified by most interest learning researchers, such as Schiefele (1991). The use of "cognitive interest" and "emotional interest" does not indicate necessarily a true differentiation between the cognitive and emotional processes of interest.

For the possibility to remain that emotional interest and cognitive interest are indeed the same phenomenon, as proposed by Hidi and Renninger (2006), there should not be any interactive effects with emotional interest conditions and cognitive interest conditions. Lack of interaction, however, would not necessarily indicate that cognitive and emotional interests are undeniably the same, but the hypothesis that they are the same would remain tenable. On the other hand, the presence of significant interactions possibly would suggest they are indeed different phenomena. Due to the evidence from Harp and Mayer (1997), learning outcomes were expected to demonstrate an interactive effect. Learning was predicted to improve with more cognitive interest compared to conditions with low interest material or material with seductive details by increasing the efficiency of processing the material. However, when there was emotionally interesting material that was also relevant to the learning material, adding cognitive interest should not produce any additional benefits relative to what was already provided by details that were emotionally interesting and relevant.

Methods

Participants were 93 undergraduates in introductory psychology courses. The experiment was a 3 x 2 factorial design with six videos total – one for each condition. Students were randomly assigned to each of the six conditions (Table 1). One hour-long session was required per participant.

Table 1: Participants in each experimental condition.

	Emotional Interest		
	Low	Relevant	Irrelevant (Seductive Details)
Low Cognitive Interest	16	16	16
High Cognitive Interest	15	15	15

During the experimental session, students completed a preliminary questionnaire and an exit questionnaire. The first questionnaire given before the video viewing contained basic demographic questions including age, year in school, major, GPA, and SAT scores; Likert-type items regarding interest levels on science, biology, and anatomy; and a prior knowledge assessment. The exit questionnaire completed after viewing that video was divided into two sections. The first section repeated the same Likert-type items from the preliminary questionnaire and included a free response prompt. The final section contained items about the content of the learning material. One such item was: "True or false: Chemical digestion begins in the mouth." Thirteen of the post-test questions required students to recall or recognize information presented directly in the videos. Twelve of the items required students to make inferences based on the information presented in the videos. The tests were piloted to determine validity and appropriate levels of difficulty.

Videos ranging from 11.5 to 12 minutes in length and involving screen capture and narration were used in each of the six conditions. The types of illustrations that were used in the screen capture for all conditions were representational pictures. Representational pictures are those that simply depict the concepts being described in the audio but do not provide any type of organizational support for the concepts (Carney & Levin, 2002). Three of the videos did not include any features that would add cognitive interest and manipulated only the amount and relevance of emotional interest. The first of these three videos for the low cognitive interest conditions contained only basic facts about human digestion and served as the control (Table 2). In the highly relevant emotional interest condition, the video narrative supplemented the information in the control video with facts that had been rated as more interesting and more relevant to the main ideas in a previous pilot study. The video for the irrelevant emotional interest condition – or the seductive detail condition – included anecdotes and facts that had been rated interesting but less relevant to the video's main idea.

Table 2: Sample texts from video scripts.

Control	Relevant Emotional Interest	Irrelevant Emotional Interest (Seductive Details)
In addition to producing bile, the liver functions to filter your bloodstream, store some vitamins and minerals, and help to breakdown some of the excess hormones in the blood.	Because its bile-producing and blood-filtering jobs are so important, the liver is the largest human organ by weight and regenerates all its cells within 30 days.	The liver produces bile and filters the blood. Because there is a shortage of donors and a great need for donated organs, researchers are experimenting with 3D-printed livers for use in transplant patients.

A second set of videos used the same scripts as the previous set emotional interest videos but also included explanative summaries to provide cognitive interest. Explanative summaries were used in the study by Harp and Mayer (1997) to create cognitive interest. These explanative summary paragraphs of 3-6 sentences highlighted major components of the human digestive system, important steps involving these components, and some of the causal processes that occur. Because all the information was presented aurally, the explanative summaries were also presented through narration at 6 different points within each video.

Learning was measured with a free recall exercise and a post-test. For the free recall assessment, participants were instructed to write everything they could remember from the video about the digestive process. Raters awarded a point for each complete and correct statement and 0.5 points for a partially correct or partially complete statement. The free recall assessments were scored by the researcher and a second rater. The interrater reliability for the scores was calculated to be $\alpha = 0.96$. For the pre- and post-tests, raters deducted a point for incorrect answers. No partial points were deducted.

The raw score was then converted to a percentage score for the post-test. The free recall score was not converted to a percentage because it is scored on a basis of accumulating points, unlike post-tests scored on a point-deduction basis. Even if an attempt was made to convert recall scores to percentages, comparisons would have been difficult with mean recall scores around 12% and mean post-test scores of 57%. Comparing patterns of results across the 2 dependent measures, rather than considering comparably scaled means, was more important to underscore the reasons for conflicting results in previous studies.

Results and Discussion

For the free recall exercise, SAT math scores ($F = 5.92$, $p = 0.02$), pre-test scores ($F = 8.54$, $p < 0.01$), and biology interest levels ($F = 7.13$, $p = 0.01$) were found to covary significantly with free recall scores. Pre-test scores ($F = 10.66$, $p < 0.01$) and interest in biology ($F = 7.87$, $p = 0.01$) also significantly covaried with the post-test scores. Once the indicated covariates were considered, MANCOVAs show main effects for both cognitive ($F = 9.32$, $p < 0.01$) and emotional ($F = 4.65$, $p = 0.02$) interest for free recall. A significant main effect for only cognitive interest ($F = 4.44$, $p = 0.04$) resulted for the post-test scores. Interactions were not significant for either the free recall scores ($F = 0.65$, $p = 0.53$) or post-test scores ($F = 0.30$, $p = 0.74$).

The results replicate the findings on cognitive interest of Harp and Mayer's 1997 study (Figure1). Compared to the conditions without cognitive interest, participants learning from the high cognitive interest materials had higher free recall ($M = 8.52$, $SD = 4.82$) and post-test scores ($M = 59.02$, $SD = 16.95$) when compared to free recall scores ($M = 6.84$, $SD = 3.40$) and post-test scores ($M = 55.83$, $SD = 17.66$) of those in the control condition (Figures 2 and 3).

Such results support the idea that material that is easier to process for learning also provides some level of situational interest – cognitive interest being a form of situational interest – and contributes to improved learning. One possible problem with this interpretation, however, is that adding explanative summaries to create cognitive interest consequently added a second opportunity to hear information that was being presented in the videos. Repeated exposure to learning material can improve performance on immediate recall (Tulving, 1967). Further studies investigating whether the improvement in learning can be attributed to the frequency of exposure or to the cognitive interest that arises from the clarity of organization and concepts is necessary.

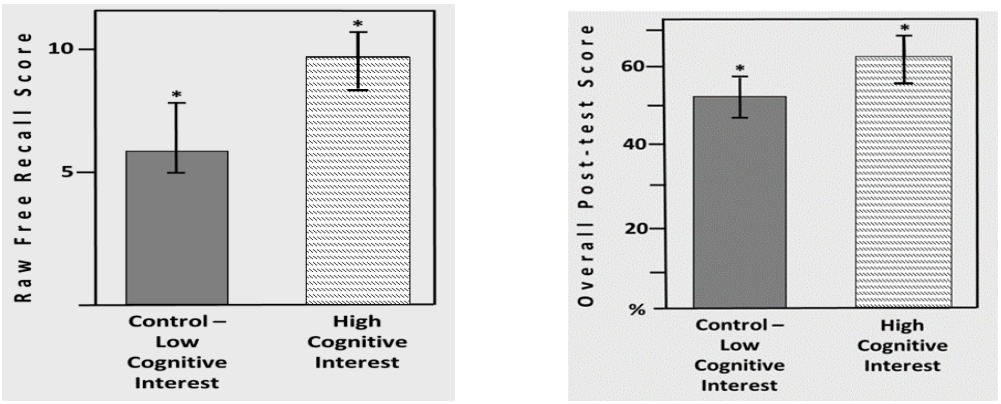

Figure 1: Effects of adding explanative summaries for cognitive interest on free recall scores and post-test scores.

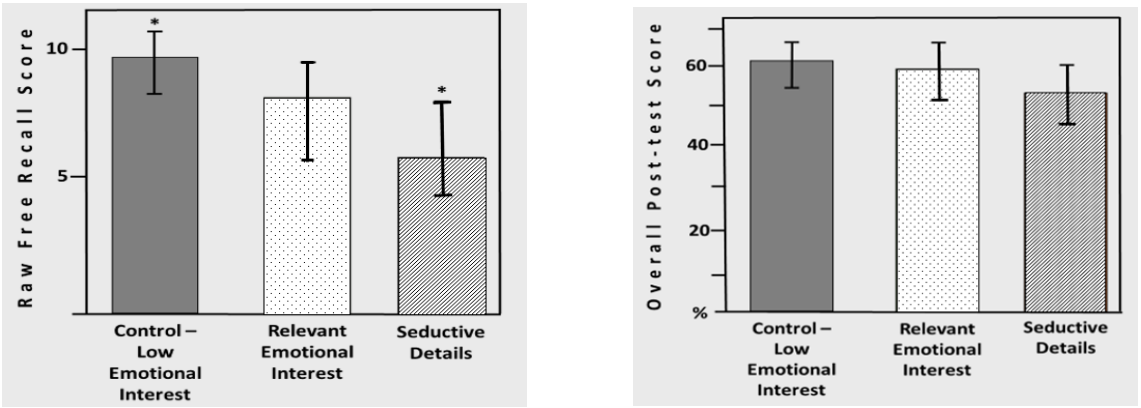

Figure 2: Effects of relevance of interesting material on free recall scores and post-test scores.

The results for emotional interest and the relevance of emotionally interesting details were mixed. Pairwise comparisons with Sidak-adjusted p values were statistically significant when comparing free recall results between the control groups and the seductive detail group (t = 2.80, p = 0.02) (Figure 2). The control group's scores (M = 8.10, SD = 5.38) were greater on average than the scores for the seductive detail condition (M = 7.00, SD = 3.77). This result lends additional support to the seductive detail findings of Garner et al. (1991), Harp and Mayer (2006), and Mayer et al. (2008). Details in learning material that are not relevant to the main learning object appear to be harmful for learning when learning is measured by the ability to recall information. However, there were no other significant differences (t = 2.00, p = 0.15) between the control and the relevant interest groups (M = 7.85, SD = 3.24) or between the seductive detail and relevant interest groups (t = 2.00, p = 0.74). These results could suggest that, while relevant emotional interest can compensate for any distracting aspects of seductive details, the amount of interest generated in the relevant emotional interest condition is not enough to be advantageous compared to low-interest learning material. However, due to the null results for relevant interest, making any conclusive statements is difficult.

Perhaps any effects of including such emotionally interesting information would have impacted affective states more so than cognitive processes. Further work using a variety of strategies to measure affect and cognition is necessary to determine what effects these details have.

As predicted, the format of assessment appears to affect the measure of learning outcomes (Figure 2). Recall assessments consisting of writing paragraphs tend to be more difficult to write, require more information to be encoded, and produce worse scores compared to assessments that rely on recognition (Tversky, 1973). Because the post-test questions relied on a combination of both recall and recognition items requiring only short answers or marking answer selections, the detrimental effects of seductive details were no longer observed. No discernible effects (F = 1.03, p = 0.37) were found for overall post-test scores across the control (M = 56.77, SD = 19.33), relevant emotional interest (M = 58.45, SD = 14.78), and seductive detail (M = 56.90, SD = 18.00) conditions. The difference between the free recall results and the post-test questionnaire could imply that seductive details are more harmful when deeper encoding is required. In contrast, when less encoding is needed for recognition tasks, seductive details seem to have less of an impact.

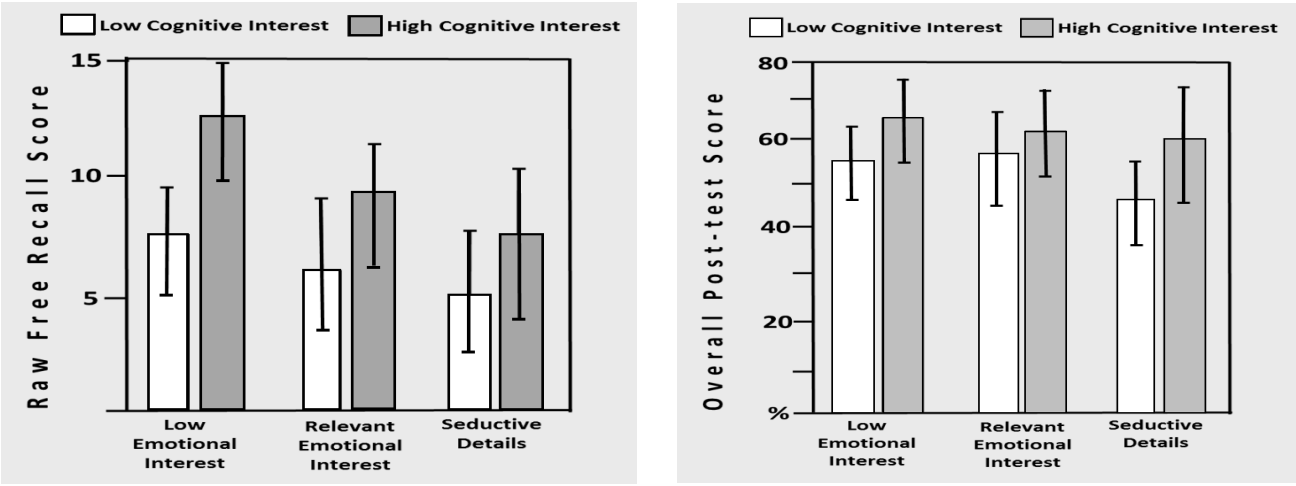

Figure 3: Effects of relevance of interesting material on free recall and post-test scores with and without cognitive interest.

Because interactions between cognitive and emotional interest were not statistically significant (Figure 3), the current study was unable to provide any further support to the idea that the two phenomena are distinct constructs. Firstly, the F values (F = 0.65, p = 0.53 for free recall; F = 0.30, p = 0.74 for post-test scores) were less than one for the interactions, suggesting other variables at play that could cause the relationships to appear nonlinear and lead to F values smaller than 1. Secondly, Hidi and Renninger's (2006) proposal that emotional and cognitive interests are part of the same construct remains tenable, as does Harp's and Mayer's (1997) idea that a dichotomy exists. However, reassessing the premise of the Harp and Mayer study (1997) provides some indications as to why finding a distinction would be difficult using their methods. While the positive results found by Harp and Mayer (1997) seemed promising for learning based on cognitive interest, the separation between cognitive and emotional interest is problematic. Interest is defined as having both affective and cognitive dimensions, according to Hidi and Renninger (2006). To distinguish the two components would suggest that either an entirely different construct is being studied or that an essential component was neglected when interpreting the results of the study.

The latter possibility could be the case for the Harp and Mayer study (1997). When participants were asked to rate how interesting the learning material was, the average rating for the passage containing cognitively interesting details was not significantly different from the passage with emotionally

interesting details, showing that both passages were enjoyed equally. The interest ratings in all the conditions were greater than 7 out of a possible 10 points. These results demonstrate that positive affect was experienced in the cognitive interest conditions equal to that in the emotional interest conditions. Even though the researchers conducted a subsequent experiment to have participants distinguish interest based on "entertainment" as an approximation of emotion and interest based on how much the text supported the learner's understanding, participants initially interpreted "interest" as encompassing both these dimensions. Due to the questionable premise of manipulating only cognitive components of interest, in addition to the previously discussed problems of repeated exposure with explanative summaries, finding nonsignificant results for the interaction between emotional interest and cognitive interest is unsurprising.

Conclusion

Although positive results for relevant interesting details and negative results for seductive details were expected, statistically significant differences were found only for seductive details. The seductive detail effect, however, did not appear with the post-test and could indicate that irrelevant details are problematic only when recall tasks require more encoding.

The current study was unable to demonstrate a distinction between the constructs of emotional and cognitive interest. Therefore, the lack of significant results for any interactive effects should not be interpreted as indicating that the two constructs are the same or different.

The difficulty in developing appropriate manipulations and measures serve to emphasize the importance of careful planning in the design of instructional material. Generating interest and possibly the right type of interest to increase learning outcomes is a challenge. The results of this experiment and the both corroborating and conflicting results in the literature illustrate the need for intentionality in the development of learning content. Failure to make the appropriate considerations can lead to unintended results or no effects for the attempts made to improve instruction.

There remains a need for a more substantive basis for beliefs that interest is a necessary motivating factor for learning. Additional studies with improved materials are needed to further explore whether the relevance of high-interest materials can mitigate the detrimental effects of seductive details and support interest learning theory. Finding more empirical evidence would support popular recommendations for stimulating interest in improving educational outcomes, especially for STEM subjects (National Governors Association, 2011). There would even be value to adding to a possible foundation for creating guidelines on how to select interesting information that is appropriate for a learning purpose, particularly with multimedia. If learning improvements cannot be consistently found, then perhaps this can deter misguided efforts in encouraging instruction that is interesting but ineffective.

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