Clark Vs. Kozma: Method Or Media?

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Richard Clark and Robert Kozma hold conflicting views on the effect of media on learning. While Clark argues that teaching methods, rather than the medium of delivery is what determines student learning outcomes, Kozma asserts that under the correct conditions, media will, in the future, influence learning.

Overview of Clark and Kozma's arguments

Clark (1994) draws a distinction between delivery technologies (media) and design technologies (method). It is the design technologies, he argues, that determine student achievement. The instructional methods and environments chosen in the design phase can be delivered through a variety of media. The delivery technology enables timely access to instruction, and also effects efficiency (speed) of learning and cost. For example, Clark cites Kulik's 1985 study on computer-based instruction (CBI). Gains in test scores by students taught with CBI were attributed to the machines, but Kulik found that the difference was due to differences in teaching methods between the computer programs and the teachers delivering live instruction. Clark further argues that media does not increase students' motivation; rather, students' beliefs about their ability to be successful with different media is the determining factor in their motivation, rather than the media itself.

Kozma (1994) suggests that rather than "*do* media effect learning," we should be asking "*will* media affect learning?", and under what conditions? Whereas Clark (1994) views methods and media as separate entities, Kozma (1994) argues,

> Medium and method should have a more integral relationship. Both are part of the instructional design. In good designs, a medium's capabilities enable methods and the methods that are used take advantage of these capabilities…Media must be designed to

> give us powerful new methods, and our methods must take appropriate advantage of a medium's capabilities (p. 20).

Kozma views learning as a result of the interaction between the learner and the learning environment, including the media used to deliver instruction; the design and delivery cannot be separated. Media can also be used to reduce the cognitive processing load on students, freeing up mental resources to handle advanced problem solving:

> Had text been used instead of video, the construction of these mental models would rely less on information in the text and more on information in the students' heads…text also places more demands on reading ability…with these demands preempted by the video, the students can use their cognitive resources to learn the target problem solving strategies (Kozma 1994, p.11).

Computer and video-based instruction allow for greater scaffolding and support for students, enabling them to handle more complex thinking than if the instruction were delivered via text alone.

Cognitive Theory of Multimedia Learning and Cognitive Load Theory

The work of two other researchers may help to resolve this debate: Sweller's cognitive load theory (1994) and Mayer's cognitive theory of multimedia learning (2014). Cognitive load theory relates to why learners find certain materials difficult and how to help students learn challenging material. According to Sweller (1988, 1994), learning is facilitated when extraneous cognitive load is eliminated. For example, text might not need to accompany a diagram, as the diagram can be interpreted without the text, and reading the words may overload students' cognitive capacities. Likewise, it may help to place text and visuals close together to eliminate the need to look back and forth at related, but physically separated information.

Mayer (2014) considers cognitive load in his cognitive theory of multimedia learning. Mayer posits that media does effect learning, and that design of multimedia instructional materials should be compatible with how people learn. Similar to Kozma, he assumes that both design as well as delivery effect learning. There are three assumptions of a cognitive theory of multimedia learning: dual channels (humans process visual and auditory information separately), limited capacity (humans can process a limited amount of information in each channel, typically 5-7 chunks, and active processing (humans do not learn everything that is presented to them; rather, students must select relevant information, organize that new information into mental representations, and integrate new knowledge with existing knowledge structures). The dual channel theory implies that media does, in fact, affect learning, as the amount of information one can take in is doubled by including both visual and auditory input. Likewise, limited capacity and cognitive load theory is important, as it guides how instructional materials should be designed, and the amount of information that should be presented at one time.

These two theories support Kozma's assertion that media affects learning, as the choice of medium (written text vs. spoken text vs. visual) directly affects the student's ability to process information, particularly for students with learning difficulties. Mayer's (2014) multimedia principles of coherence (eliminate the extraneous), signaling (highlight the essential), spatial contiguity (place corresponding text and graphic together) and temporal contiguity (present corresponding graphics and spoken text simultaneously) provide guidelines for instructional design.

Current Research

Although there is increased access to technology in schools, it is not being used to revolutionize education in the ways innovators expected (Cuban 2001, Christensen et al 2017).

Perhaps that is due, as Clark suggests, to inherent issues with instructional design. Media can influence learning, due to the unique capabilities of computers, the internet, and videos, but only when designed carefully, such as with Mayer's principles for multimedia instruction. Some studies have found limited positive educational outcome attributed to the use of technology, which I will discuss below.

1:1 Computing Settings

Some positive results have been found in studies of schools with 1:1 computing settings. In the second year of a 1:1 program, 7th grade students made statistically significant gains on ELA state assessments compared to non-1:1 students. In another study comparing fourth graders in a 1:1 setting with non 1:1 students in the same school district, the 1:1 students had higher gains on ELA assessments than the comparison group (Bebell et al. 2010).

Interactive whiteboards

Although interactive whiteboards (IWBs) are increasingly popular in schools, studies on their impact on student learning have yielded mixed results. One study found positive effects of IWBs at the elementary and high school level, but a low effect at the middle school level. Overall, the group receiving instruction with IWBs outperformed the control group, but the gains in achievement were dependent on several factors. Specifically, the best results were found when the teacher had at least 10 years of teaching experience and two years using the IWB, used the technology for 75-80% of class time, and was highly confident in his or her technology skills (Lemke et al 2009). Other researchers found that over a two-year period, teachers with IWBs changed their teaching methods, increasing classroom interactivity and the use of effective questioning techniques, but also moving toward more whole class instruction and fewer small group activities. Their findings on the effect on student achievement were mixed: in math, the

boards benefitted high performing students but had a small effect on lower achieving students, while in science, the boards benefitted all students except high-performing goals, with the greatest benefit for low-achieving boys (Higgins et al. 2007). While IWBs are purported to increase student engagement, the same researchers found only temporary increases in student motivation with IWB use. A third study focusing on Native American students found greater gains in test scores for students taught with IWBs than students whose teachers did not. IWB students had an average gain of 20.76 points while the control group's mean gain was 11.48 points (Zittle 2004).

Interestingly, it was noted that IWBs can be used as a tool to support learning as well as tool to enhance teaching. The teaching-enhancement attributes of IWBs may help to save time and streamline lesson prep, but does not directly affect student achievement. As teachers determine when, how, and to what extent technology is used in the classroom, training in instructional strategies is paramount to ensure the learning-support capabilities of IWBs are realized:

> In order to ensure that the IWBs are used as a tool to support learning, teachers must be properly equipped not only with the technical capability with IWBs but also with a clear understanding of interactivity, active learning strategies, scaffolding of student learning, and engagement facilitated in whole-class and small group instruction. (Lemke et al. 2009, p. 9)

Conclusion

Although there is an abundance of research that concludes that technology use results in instructional gains, much of it falls short of proving the media is the cause, rather than the

teaching. Clark (1994) issues the following question to consider when evaluating educational media:

> Whenever you have found a medium or set of media attributes which you believe will cause learning for some learners on a given task, ask yourself if another (similar) set of attributes would lead to the same learning result…ask yourself what is causing these similar results…the cause of the results can be found in a method which the two treatments share in common. (p. 8)

The studies I reviewed in the previous section probably would not stand up to this high level of scrutiny. However, Clark is arguing that the very attributes that make a medium unique be stripped away in the analysis of its educational utility. Bates (2016) writes,

> Different media have different educational effects or affordances. If you just transfer the same teaching to a different medium, you fail to exploit the unique characteristics of that medium. Put more positively, you can do different and often better teaching by adapting it to the medium. (p.239)

While I agree with Clark that teaching methods matter, I also agree with Bates that the unique attributes of different media help students to learn in different ways. Removing the unique affordances of television to compare a TV lecture with a classroom lecture, for example, fails to account for what can be accomplished better through television than traditional classroom interaction (Bates, 2016). Furthermore, the use of several types of media in a class allows for greater differentiation of instruction, accommodating learners with different preferences, strengths and weaknesses, and making the instruction more accessible to all, “leading to deeper understanding or a wider range of skills in using content” (Bates 2016, p. 241).

In conclusion, I believe that media, when used well, does affect learning outcomes. It is essential that teachers be trained in how to create and used media-enhanced materials (for example, with Mayer's principles of multimedia learning), in addition to receiving robust technical training and support for the devices used by the school. It is not enough to simply invest millions of dollars to acquire technology for students and teachers to use in the classroom, as the technology alone will not improve learning outcomes. Rather, technology purchases need to be combined with ongoing professional education regarding how to best take advantage of the unique educational features afforded by computers, tablets, the internet, and other media so that teachers and students can utilize the available technological resources to their full potential.

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