The Media Effects Question: "Unresolvable" or Asking the Right Question

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☐ When I reviewed the Kozma article, I wondered if a rejection recommendation would be similar to some high commission in the dark ages suggesting that we have already discovered all knowledge and there was no need to pursue additional avenues. Instead, the reviewers felt Kozma had a valid view that should be openly debated to further the knowledge and theory of the field.

Kozma has suggested that Clark's "Do media influence learning?" question should be reframed to ask ". . . *will* media influence learning?" After reading Kozma's article several times, Clark's reply, Clark's original article (Clark, 1983), and Knowlton's (1964) article, I have concluded that Kozma is asking a different question than Clark to the extent that the two are only tangentially related.

KOZMA'S EXAMPLES

To support his reframing of Clark's question, Kozma describes two environments to illustrate his point. The first is *ThinkerTools* (White, 1984, 1993) and the *Jasper Woodbury Series* (Cognition and Technology Group at Vanderbilt, 1992). These two studies, however, suggest that the issue is not reframing Clark's question, but asking a different question.

According to Kozma, *ThinkerTools* allows students to manipulate computer objects that behave according to rules derived from Newtonian mechanics. The study Kozma cites (White, 1993) compared sixth-grade students who used *ThinkerTools* to a similar group of sixth graders studying a standard curriculum unit on inventions. The experimental group was also compared to a high school physics class who had studied Newtonian mechanics using traditional methods and a high school class who had not studied the topic. The results support the effectiveness of *ThinkerTools* to teach Newtonian mechanics as measured by a posttest. The study, however, is inappropriately designed for interpretation as a basic research study to provide evidence for the contribution of the media to learning. Kozma suggests that it was the ability of the computer to present motion and react to the learners' input. One must ask, however, what would have been the result if the instructor had taken the control sixth-grade class to a billiard parlor and allowed them to conduct similar experiments? Might the more concrete hands-on experience in the billiards parlor also produce the same effect? If similar results are obtained, are the results due to the medium or the strategy?

In the *Jasper Woodbury Series* the students viewed a math problem which required several calculations to determine if the story character could return to the place of origin. Both the experimental and control groups viewed the presentation of the problem, however, the experimental group received additional interactive video instruction on problem-solving using the problem context. The control group received only structured word problems without the context of the Jasper story. The experimental group scored significantly higher than the control group on problems related to the boat episode and the same as the control group on problems similar to the control group's practice items. Kozma attributed this superior performance to the additional video instruction which provided a rich context for the instruction. This conclusion that the video was the key factor in the superior performance of the

experimental group is highly suspect considering that other research has shown that story problems rich in contextual information improve performance (e.g., Ross & Anand, 1987; Dorsey-Davis, Ross, & Morrison, 1991).

In both of the above studies, the control group received a different instructional strategy (e.g., manipulation of objects vs. traditional instructional, and contextual examples versus abstract examples). As a result, neither study is appropriate to answer the question proposed by Kozma, nor does either support his contention that media affects learning. The studies simply show that the instructional materials are effective for achieving the objectives. In addition, the studies do not allow the researchers or one interpreting the results to determine how much of the variability is due to the strategy and how much is due to the medium.

THE INTERDEPENDENCE OF STRATEGY AND MEDIA

Kozma identifies five capabilities of the medium in the studies that he interprets as facilitating learning. First is the ability to represent moving objects on the screen. Second is allowing students to manipulate objects (e.g., a microworld). Third is the ability to present complex contexts which generated dynamic mental images. Fourth is the ability to search and display information. Fifth is the ability to present a visual and social context for the story. Not one of these attributes is unique to the investigated media. For example, moving objects were represented in film and video in both concrete (actual objects) and abstract (artistic representations) forms long before the invention of the computer. The "Newtonian" objects could be manipulated on a billiard table in a highly enactive mode. Data searching is by no means limited to the computer, although the computer is often faster and more efficient. And, rich context for instruction could also be created in many different media formats.

I would suggest that it is not the capabilities of the media that facilitated the learning, but the creative development of the instructional strategy which actively engaged the learners. One could argue that it was the design of the strategy that created an environment for the student to test the Newtonian laws and it was the scripting that created the rich context. In the final instructional unit, the strategy and the media are so interdependent that it is almost impossible to separate them. In two recent studies (Morrison, Ross, & Baldwin, 1992; Ross, Morrison, & O'Dell, J.K., 1989) we found no difference in achievement scores when students were taught math problems using familiar contexts (e.g., sports, animals, business, education, etc.). Unlike the Jasper program, our materials were text-based. If we were to repeat our study and use the attributes identified by Kozma as facilitating the Jasper program (e.g., pictures and increased amount of information) we would need to completely redesign our instructional strategy since mere implementation of the medium's attributes would not be feasible in the existing design.

IS REFRAMING THE QUESTION THE ISSUE?

Rather than reframing Clark's question, it seems more productive to consider the effectiveness of the whole unit of instruction rather than the individual components. Richey (in press) describes this type of research as developmental research which focuses on the "production of knowledge based on situation-specific problem solving." Richey makes a distinction between those studies that investigate the product and those that investigate the process used to develop the product. Of interest are the Type 1 studies which are both context and product specific and the Type 2 studies which are context specific. Both address the issue of the effectiveness of the instructional product. The two studies described by Kozma are context and product specific and serve to produce knowledge about problem solving skills in a specific situation. The evaluation methodology used by the studies is also similar to the evaluation Briggs (1977) proposed as a step of instructional systems development model. That is, the final version of the instruction should be compared with an alternate form if available to determine its effectiveness. Similarly, *ThinkerTools* was compared to a

group who studied scientific invention and to a group who learned Newtonian physics by a traditional teaching method.

This developmental research perspective, then, is used to study the impact of the product on student learning. Issues of determining variability as related to strategy and medium are unimportant because the emphasis is on the synergism created through the interaction of the components and the instructional environment. Although context specific, the results would be of value to other designers when designing strategies for similar content structures.

A related issue is the use of a media replication design proposed by Ross and Morrison (1989). Each of these studies could be repeated using a media replication design that would use different media to deliver equivalent content with an instructional strategy designed to exploit the capabilities of the medium. For example, the White (1993) *ThinkerTools* study could be replicated using billiard parlor strategy for the control group. Similarly, the Jasper study could be replicated using a design similar to Ross and Anand (1987), Morrison, Ross, and O'Dell (1988) and Ross, Morrison, and O'Dell (1988) by presenting the same materials in two different formats such as interactive video and television or interactive video and print. A difference between groups would then suggest further research to determine *why* a particular strategy was more effective in a particular medium.

Answers to developmental research questions and those questions derived from media replication studies should produce more fruitful information for the instructional designer. Practitioners, it would seem, would be more interested in which strategies work and with what media such strategies are (a) most easily implemented, (b) most efficient, and (c) most cost-effective. Knowing the effectiveness of a manipulative strategy such as used in *ThinkerTools* or the use of context-rich environment, as in *Jasper*, would probably provide more of a creative stimulus for a designer than the knowledge that a computer allows for learner input, can animate objects, and that a video disc can be paused and reviewed.

The research suggested by Kozma provides additional support to the argument against media comparison studies. As the interdependence of instructional strategy and utilization of a medium's capabilities (e.g., immediate feedback, user input, animation, controllable objects) increases in strength with interactive technologies like computer-based instruction, such research has less and less relevance. When controls are added to separate the effects of the strategy and medium, the resulting instructional strategy may be compromised to the point of being meaningless and/or artificial. I would suggest that instructional technology researchers continue with basic, applied, and developmental research to determine the most effective strategies for accomplishing a given task. □

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