High School Geometry: The Effectiveness of Traditional versus Computer-Aided Learning Environments (Poster)

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Introduction

Research on instructional strategies has found differences in learning effectiveness between technology-based and conventional delivery media (see Sivin-Kachala & Bialo**,** 1994, who reviewed 133 media comparison studies). Other researchers, however, have reported that much research in this field is flawed, rendering many of the conclusions questionable (see Joy & Garcia, 2000; Rachal, 1993; Reeves, 1993). We carried out a highly controlled experiment to determine if a modern, interactive, graphical software tool for teaching geometry did in fact achieve better learning outcomes than traditional methods. Specifically, we asked: What impact did instructional media have on students' levels of geometric thought and on their attitudes toward geometry?

Method

Participants were 36 9th grade, middle-class students from Nazareth, assigned randomly into two groups. Pre and post tests for geometric reasoning (van-Hiele, 1986) and attitudes toward geometry (פטקין, 1990) were administered. Two learning environments, employing the same instructional strategy, were created**.** Resources for each were:

1. Traditional: text, lectures, paper and pencil drill and practice.
2. Computer-aided: text, lectures, individual computer based drill and practice.

Participants' personal characteristics, such as prior subject-matter knowledge and academic ability, were equally distributed by random assignment. Procedural variables, such as instructional strategy, media familiarity and time-on-task were the same for both groups and thus controlled. The same teacher taught both groups, ensuring identical teacher characteristics for all participants, although this allowed for some degree of experimenter effects.

Findings

T-tests found no statistically significant differences in pre test scores for attitudes ($d = 0.16$) and geometric reasoning ($d = 0.46$), and in post test scores for attitudes ($d = 0.29$). However, a statistically significant difference ($p = .03$) was found for post test geometric reasoning: the computer-aided environment group did better ($M = 74.72$, $SD=11.04$) than the traditional environment group ($M = 66.67$, $SD=10.43$), $d = 0.75$. Given the initial difference between groups, the post test effect size may be misleading.

Conclusions

1. Higher post test scores in geometric reasoning may be associated with computer efficiency: students in the computer-aided group may have completed more exercises than their counterparts who used paper and pencil methodologies.

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2. Whether or not the difference in reasoning skills is of practical significance is open to debate.
3. Instructional designers should be wary of claims about the alleged efficiencies of learning technologies.
4. We have shown that not only quasi-experimental designs but also true experimental designs can be carried out in schools, generating valid data.

References

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