

Instructional efficiency of mathematical learning using Geometer's Sketchpad and graphing calculator: technology tools versus traditional chalk and talk

ABSTRACT

In this study, two technological tools in teaching and learning mathematics namely Geometer's Sketchpad and graphing calculator were investigated. The purpose of this research was to compare instructional efficiency of utilizing Geometer's Sketchpad and graphing calculator versus traditional approach for a secondary level topic -Quadratic Function. A total of 134 students aged 16-17 years participated in this study. The students were randomly assigned to three groups and undergo three different treatments. Four phases were conducted: 1) Introduction to Software, 2) Induction to Quadratic Functions, 3) Integrated teaching and learning using Software, 4) Testing using Achievement Test and the Paas Mental Effort Rating Scale. The data were analyzed using ANOVA and post-hoc analyses. The findings from this study showed that there is no significant difference in performance between the technology-assisted instruction as compared to conventional chalk and talk instruction. However findings indicated that students in the geometer sketchpad group and the graphing calculator group performed better than students in traditional group in their procedural knowledge. Using Paas Mental Effort Rating Scale (2004) however indicated that instructional efficiency of using graphing calculator condition is significantly efficient [$F(2, 131) = 9.888; p = 0.000 < 0.05$] compared to the geometer sketchpad and conventional chalk and talk condition. Graphing calculator condition thus far imposed relative low mental effort with high performance. Geometer sketchpad condition imposed high mental effort with low performance. Hence the use of technology within short period of time induce high mental effort in solving traditional assessment questions thus affects performance. This findings provide empirical evidence and confirmed earlier studies about the advantages of using graphic calculator as facilitative tool for improving students' performance and provide explanation for the benefit of graphic calculator as a tool of learning from the cognitive load theory. However the use Geometer Sketchpad as facilitative technological tools has yet to be explored.

Keyword: Technology in mathematics learning; Mental load; Instructional efficiency index; Graphing calculator; Geometer sketchpad