

ASSESSMENT OF SECONDARY STUDENT ATTITUDES AND ACHIEVEMENT IN MARINE SCIENCE USING ArcView® GIS TECHNOLOGY

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ABSTRACT

This multi-disciplinary study explored the cognitive and pedagogical implications of integrating ArcView® GIS technology into secondary science classrooms. Two middle and high school earth/environmental science teachers implemented an 8-week marine science unit into their curriculum by following an experimental design that incorporated two different instructional methods. Four hundred seven (407) students were introduced to marine science concepts using ArcView® GIS technology and traditional methods of teaching at different times during implementation and then tested to identify significant effects on students' performance of content skills, cognitive skills, and spatial skills. Data were collected via the administration of pre-, mid-, and post-implementations of a 50-question multiple choice test and a 38-question attitude survey. The results of the repeated measures ANOVA analyses suggested that both teacher and condition showed statistically significant effects on middle school student performance of content, cognition, and spatial skills, but only the effect of teacher showed significance on high school student performance. Although condition showed significance in middle school performance, the similarities between condition patterns for both middle and high school groups suggested there was not enough convincing evidence to prove that either ArcView® GIS or traditional instructional methods had any effect on middle or high school students' content, cognition or spatial skills. Attitude survey data indicated that high school group attitudes may have some relationship to shifts in content scores; again however, there was no convincing evidence that suggested that middle or high school student attitudes improved as a result of ArcView® GIS implementation. Lack of implementation procedures, attrition rate and pre-existing group differences contributed to weaknesses in the validity of the study. The implications of this study include contributions to teacher professional development, to increasing content and grade level appropriate GIS-based curriculum, and to the knowledge-base of theoretical research that will help foster effective and improved instruction and learning in both the geosciences and in GIScience research.