# Ninth Grade Physical Science Students' Achievements in Math Using a Modeling Physical Science Curriculum

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**Action Research Summary, submitted in June 2006**
**for the Master of Natural Science degree at Arizona State University**

**Abstract**
The purpose of this paper is to share the results of a one-year study on the achievements in mathematics of 9th grade physical science students who were taught physical science using a modeling curriculum. The curriculum used was Methods of Physical Science Curriculum and portions of the 1st semester modeling physics curriculum that originated in the Modeling Instruction Program (2006) for high school teachers at Arizona State University. The students were assessed using the Math Concepts Inventory[1] (MCI) at the beginning and the end of the school year. The students were also asked to take a survey on their readiness to learn math. This paper will share the findings of this study that look at the gains in mathematics of students enrolled in a modeling curriculum during their freshman year versus their peers in the traditional lecture, quiz, test classroom in which the curriculum was taught from a textbook.

**Introduction**
AIMS testing forced many schools in Arizona to dispose of 9th grade math as part of their course offerings. Because the AIMS math test is composed of mostly basic algebra and geometry concepts, high schools across the state began enrolling freshman students who did not have honors algebra in 8th grade into 9th grade algebra I. Since the AIMS math test is administered at the end of the sophomore year, schools have two years to work toward proficiency. After a year or so it became apparent that in our 2500+ student body, our freshman algebra classes were experiencing close to 50% failure rates in first year algebra. Because of this sizeable failure rate, our school instituted second year algebra one and began using the program known as ALEKS[2] (Assessment and Learning in Knowledge Spaces). As a modeling teacher, I immediately hypothesized that if modeling science were to be taught along with first year 9th grade algebra then many students would probably begin achieving in math and on standardized tests at higher levels. Most students were having trouble with the tasks from the higher levels of the cognitive domain, primarily application and analysis, etc. that required the use of recently taught concepts. In my regular modeling physics class, one of the first labs I do with students is the density lab using blocks of wood and aluminum. It was the rare student in each class who recognized that I was having them find the density by finding the slope of the mass versus volume graph. This realization was telling to me. It meant that students had never really been asked to apply simple algebra 1 concepts in real situations. Most of these students come into physics I with very high grade point averages and are considered the brightest in the school, yet their science and math application skills are minimal in many cases. The popularity of modeling physics has grown at our school, but I still start off the year spending more time than I should on labs like the density lab. This means that students are not mastering basic science methods in previous courses.