

Agricultural Education and Mathematics Performance among Secondary Students

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Introduction

Mathematics and science achievement of United States (U.S.) students continue to lag behind other technologically developed nations as revealed by The Third International Mathematics and Science Study, TIMSS (Mullis, Martin, Foy, & Arora, 2012). Several reasons for this lag include: unimaginative instructional methods, inexperienced teachers and lack of connection between school mathematics and the day-to-day life experiences of students. Mathematical literacy and knowledge is required for one to pursue most college degree programs and also to compete in the technology driven workforce. Most students will learn mathematics best when they see the connection between the concepts learned in school and their real life applications (Theriot, Kortlik, & Jabor, 2009). According to Ladson-Billings (1997), agricultural education provides a context in which students can explore key biological and mathematics concepts and skills. However, limited studies have been conducted looking at mathematics performance of high school agriculture, specifically as mathematics performance is related to FFA and Supervised Agricultural Experience (SAE). Anderson and Driskill (2012) indicated that agricultural education is a content area that is rich in mathematics concepts.

The purpose of this study was to determine if agricultural education, FFA involvement and SAE participation of high school students have any effect on students' performance in mathematics. The main research questions for this study were: 1) how does the mathematics performance of agricultural education students compare to non-agricultural education students? 2) What is the relationship between FFA and SAE participation and mathematics performance of agricultural education students?

Theoretical Framework

This study is grounded in Dewey's (1938) experiential learning theory, Doolittle's and Camp's (1999) constructivism theory, and Lave's and Wenger's (1991) situated learning theory. These theories support contextualized learning of mathematics. Experiential learning is learning in real-life contexts, and it involves learning by doing, solving problems or conducting projects. Constructivism posits that: learning should occur in genuine real life settings; learning should assimilate in social interactions; subject matter should be relevant to students; content should be connected with previous skills; students should become self-regulated learners in the process; teachers should act as facilitators; and teachers should encourage learners to represent content and learning in different ways. The essence of situated learning theory is that knowledge should be presented to learners in real context with settings and applications that would normally involve that knowledge.

Methodology

The research employed a posttest-only causal-comparative control group research design also known as *ex post facto* (Leedy & Ormond, 2005). The target population for this research was students from a large comprehensive urban high school. Data related to research questions were collected from two populations. The first population was students enrolled in Agricultural Education programs at the school while the second population was students who were not enrolled in Agricultural Education courses. A convenience sample of 139 participants was used in the study. The researcher-developed instrument contained questions addressing students'

demographics and a rating scale for SAE and FFA involvement. The instrument also included 25 mathematical questions that indicated competency on Mathematics Standards of the Common Core State Standards Initiative. The researcher-developed instrument was reviewed for content validity (Leedy & Ormond, 2005) by a panel of experts. The Cronbach's alpha for the 25 items was 0.7. IRB approval for the study was granted. Data were analyzed using SPSS software. Frequencies and percentage distributions were obtained for all data. Means and standard deviations were used to analyze and interpret data. The researcher then carried out t-tests for the second part of the survey to determine impacts of agriculture coursework, FFA, and SAE.

Findings

Overall mathematics scores ranged from a low of three to a maximum of 23 out of 25. The mean mathematics score for all participants was $M=11.53$, $SD=4.27$. There was a low, positive, and significant relationship between number of agriculture courses and math scores, $r(78) = .26$, $p < .05$. The average score for agricultural students was $M=12.15$, $SD=4.61$ while that of non-agricultural students was $M=10.67$, $SD=3.63$. An independent samples t-test showed that the difference between the two groups was statistically significant [$t(137) = 2.03$, $p=0.04$] at an alpha level of 0.05. There was a moderate, positive, and significant relationship between level of FFA involvement and math achievement, $r(78) = .35$, $p < .05$. FFA members had a mean of $M=15.77$, $SD=4.07$ while non-FFA agricultural students scored $M=11.45$, $SD=4.41$. There was a significant difference between the two means [$t(78) = 3.275$, $p=0.002$]. Results showed a low, positive, and significant relationship between SAE and math scores, $r(78) = .23$, $p < .05$.

Conclusions

This study supports Theriot, Kortlik, and Jabor (2009) as it determined that FFA, SAE, and number of agricultural education courses passed were related to mathematics performance of high school students. Agricultural education program embraces experiential learning concept which engages students with hands-on learning environments that are rich with real life applications of mathematics (Shinn et al., 2003). If improving mathematics is a goal, agricultural education courses should be viewed as a viable option, not a wasted course. Agricultural educators and other decision makers should encourage FFA and SAE participation as well.

Recommendations

This study has a great significance to agricultural education and the general school community, as it will help agricultural educators and others understand the potential for academic achievement in mathematics if students will enroll and then be fully engaged in a total program of agricultural education. This study will also help justify the importance of an Agricultural Education program, including FFA and SAE in the secondary school system.

The results of this study are limited to a comprehensive urban school in one state. Additional studies, with randomization, are recommended across that state and also across the nation. Since this was the first time the instrument was used, modification of the instrument is also recommended.

Additional research of a larger scope is suggested to examine the impact of specific agricultural education courses (i.e. agricultural mechanics, agriscience for science credit, etc.) on mathematics performance as well as academic achievement in other areas. Future research should also analyze student success on specific standards.

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