

**Does an Applied Agricultural Calculations Course Increase Self-Efficacy in Mathematics of Pre-Service Agricultural Educators at Clemson University?**

Catherine DiBenedetto  
Jesse Blount  
Callie Sluder  
Phil Fravel

Clemson University

251 McAdams Hall  
Clemson, SC 29634-0310  
(864-656-0296)  
cdibene@clemson.edu

## **Introduction & Literature Review**

Agricultural educators are often in a unique environment to incorporate mathematical concepts in several applied settings. Unfortunately, numerous students arrive in agricultural education classrooms with an ingrained perception of their mathematical aptitude. Math anxiety, that students face and may impact their willingness to integrate math in instruction, is comprised of two parts, emotional and cognitive. The emotional component consists of nervousness, dread, and uneasiness felt when doing math-related tasks, while the cognitive component is comprised of worrying about one's performance and any affects that may occur (Vance & Watson, 1994). Along with core academic subjects, the curricula in school-based agricultural education programs has responded to better support mathematics (Stripling & Roberts, 2013). Accompanied by low math scores, Stripling and Roberts (2013) have found that personal mathematics self-efficacy was low among preservice teachers. Future research should look further into personal mathematics efficacy and investigate the factors that influence self-efficacy with pre-service agricultural educators (Stripling & Roberts 2013). By design, agricultural education can give meaning to mathematics for students. The next step is to assure future agricultural educators have the confidence to incorporate mathematics into their courses.

## **Theoretical Framework**

The theoretical framework used for this study was Bandura's (1977) self-efficacy theory. Per Bandura (1977), one's self-efficacy is their beliefs regarding his/her ability to accomplish a given task or behavior. Self-efficacy influences the decisions a person makes and the course of action they take, as well as influences the expected outcomes of a situation or circumstance. Students with an increased self-efficacy of their skills expect high grades on assessments while those who doubt their ability envision low grades before they even begin the assessment. Bandura (1977) identified four ways through which self-efficacy can be learned and modified: 1) performance accomplishments, 2) various learning or modeling, 3) verbal persuasion, and 4) emotional arousal.

## **Methodology**

This multi-year study utilizes a descriptive, non-experimental design using a one-group pre-test post-test design. During the fall semesters of 2006-2012, students enrolled in an Applied Agricultural Calculations course at Clemson University were identified as the population for this study. The students were official college sophomores, juniors, seniors, and/or graduate students that were required or approved to enroll in the course. A pre and post questionnaire was completed by all students who were present on the days the questionnaires were administered. The students did not receive any incentives for completing the tests and questionnaires. The questionnaire used throughout this study was the Mathematics Self-Efficacy Scale (MSES) (Betz, N. E., & Hackett, G. 1983). The Cronbach's alpha coefficient, was reported by Betz and Hackett (1983) to be 0.96 for the complete scale, and 0.92 for the Tasks and Courses subscales individually. Validity reported for total MSES scores were related as follows; math anxiety ( $r=0.56$ ), confidence in doing math ( $r=0.66$ ), perceived usefulness for math ( $r=0.47$ ), and reflectance motivation in math ( $r=0.46$ ). The questionnaire was comprised of Likert scale questions and Likert-type scale questions asking the students' confidence and comfort level pertaining to mathematics. A Likert scale was used to ask students how comfortable they felt they were with mathematics in general, along with a perceived level of ability on a variety of math concepts. Demographic information of the students' major, year, and what mathematical

concepts were incorporated into their high school agricultural education courses was also collected. The instrument was administered annually during the first week of class. The researchers gave each student the pre-questionnaire and explained how the nine point Likert scale. Students were informed that their participation in the study would not affect their grade in the course. Once every student completed the questionnaire it was immediately returned to the researchers. On the last day of class, the researchers administered the post-test and post-questionnaire in the same manner as the pre-test and pre-questionnaire. If requested by the students, the researcher could further explain how to complete the tests and questionnaires; but the researcher was not permitted to help the students answer the questions. Data were analyzed through descriptive statistics with the Statistical Package for the Social Sciences (SPSS) version 24 personal computer program. Data were analyzed using paired samples t- tests to determine if a significant difference existed in personal mathematics efficacy from before and after student enrollment in the Applied Agricultural Calculations course at Clemson University. Each questionnaire was given a total score by finding the average of the responses provided by the students. The mean score of the Likert scale and Likert-type scale total scores from the pre- and post-questionnaires were evaluated. Per year, each question was analyzed to determine mean scores in self-efficacy. If a respondent decided they were between two numbers on the scale and proceeded by responding with both numbers, the lesser number was used when compiling data.

### **Results & Findings**

The total enrolled number of students included in this multi-year study was 100, of those there were three Agricultural Mechanization majors, one General Engineering major, one Political Science major, one Animal and Veterinary Sciences major, and the remaining 94 students were Agricultural Education majors. The six students in other majors were included in this study. The data analysis was conducted every three years over a six-year period, 2006, 2009 and 2012. The results indicate that pre-service teachers in this study showed high mean scores for self-efficacy of their mathematics ability. A total mean score for the pre-questionnaires was 5.80 (SD = 1.14) and the total mean score of the post-questionnaire was 6.36 (SD = 1.17). The p-value was .000 with an alpha of .05. Results indicated a significant difference between the pre and posttests which measured the self-efficacy in math of preservice educators when they participated in an Applied Agricultural Calculations course.

### **Conclusions & Implications**

We concluded that pre-service teachers who are enrolled in the Applied Agricultural Calculations course at Clemson University from 2006-2012, increased their self-efficacy of mathematical concepts. Aligning with previous research, we believe pre-service teachers' increased self-efficacy will encourage them to confidently incorporate mathematical concepts into the agricultural education courses they will teach in the future.

### **Recommendations**

A possible continuation of this study would be to compare the self-efficacy of male versus female pre-service agricultural educators. It is recommended to continue administration of the MSES in future Applied Agricultural Calculations courses at Clemson University to determine if similar results persist. The instructor should utilize the results of this study to determine which mathematical concepts should be a focus to improve math self-efficacy of future students.

### References

- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215. doi:10.1037/0033-295x.84.2.191
- Betz, N. E., & Hackett, G. (1983). Mathematics Self-Efficacy Scale. PsycTESTS Dataset. doi:10.1037/t01563-000
- Stripling, C., & Roberts, G. (2013). Investigating the Effects of a Math-Enhanced Agricultural Teaching Methods Course. *Journal of Agricultural Education JAE*, 54(1), 124-138. doi:10.5032/jae.2013.01124.
- Vance, W., & Watson, S. (1994). Comparing anxiety management training and systematic rational restructuring for reducing mathematics anxiety in college students. *Journal of College Student Development*, 35, 261-266.