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Student Participants' Views of Mathematics Content Representation within Selected Alabama State FFA Career Development Events

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Abstract

This study sought to examine students' perceptions of mathematics content integration in one of the most popular activities offered to agricultural education students, Career Development Events (CDEs). Data were collected from students participating in the Alabama State FFA Agricultural Mechanics, Forestry, Floriculture, and Nursery/Landscape CDEs (n = 160). Participants indicated positive attitudes toward utilizing agriculture as a context for teaching mathematics content. Conceivably, a "saturation point" of mathematics integration into agricultural education curricula may not have yet been reached. The researchers recommend that math and agricultural education teachers form communities of practice to enhance student achievement in mathematics and agricultural education. This study should be replicated utilizing students participating in national-level CDEs to determine if congruency exists with these results. Real-world competition coupled with enhanced academics in agricultural curricula can help to prepare a competent and capable agricultural workforce equipped to face tomorrow's challenges.

***Keywords*:** FFA, agricultural education, agricultural mechanics, mathematics integration

Introduction

According to Norton, Barlow, Prout, and Bidwell (1998), much "dissatisfaction [exists] with the shortcomings of our educational system…[t]oo many students graduate from high school without learning how to solve problems or apply their knowledge in the workplace" (p. 9). Data and literature have indicated that criticism of the public education system is alive and well, particularly in regard to student achievement (National Center for Education Statistics, 2010). In response to these findings, Grubb (1995), Norton et al., (1998), and Parnell (1999) have suggested that perhaps contextualized learning could increase student achievement in academic classrooms. Researchers (Conroy & Walker, 2000; Edney & Murphy, 2010; Parr, 2004; Parr, Edwards, & Leising, 2006; Parr, Edwards, & Leising, 2008; Parr, Edwards, & Leising, 2009; Young, 2006; Young, Edwards, & Leising, 2009) have indicated that academic material taught within a career and technical education (CTE) context (in these cases, agriculture) has led to improved student understanding of academic material and its applications in the real world. Additionally, academic content integration has been shown to have no inhibition on students' technical skill acquisition (Parr, 2004; Parr et al., 2008; Young et al., 2009), thereby helping to avert fears that curriculum integration is harmful to career and technical education programs and students' workforce preparation.

With regard to contextualized learning, the Center for Occupational Research and Development (CORD) has acknowledged that "students discover meaningful relationships between abstract ideas and practical applications in the context of the real world; concepts are internalized through the process of discovering, reinforcing, and relating" (2010, ¶ 7). Parnell (1999) stated that "[f]or teaching to be truly effective, the student must be motivated to connect the content of knowledge with the context of application" (p. 20). In addition, interactions with real-world phenomena and events seem to indicate an increase in reasoning and thinking abilities amongst students (Gerber, Marek, & Cavallo, 1997). With application of this knowledge, a curriculum that often utilizes contextualized learning, such as career and technical education, can be utilized to help prepare students for entrance into the real-world "without sacrificing academics" (Grubb, 1995, p. 1). Upon examining the appropriate literature concerning teaching and learning styles, human neurological system function, and various curriculum models, it stands to reason that perhaps curriculum models emphasizing contextualized learning can offer something more (Parnell, 1999).

To reach the goal of optimal student educational benefits, the concepts behind contextualized learning must include a prescription for combining both the academic and CTE curricula (Prescott, Rinard, Cockerill, & Baker, 1996). In order to create a firm foundation for the retention of knowledge, contextualized learning must provide realized and observable benefits to the learning efforts of students (Parnell, 1999). Researchers (Parr, 2004; Parr et al., 2008; Young, 2006; Young et al., 2009) have suggested that for students to enhance their knowledge of academic concepts embedded within CTE instruction, practical learning situations must be presented (e.g., hands-on learning experiences). To this end, Parnell (1996) stated that "[t]he basis for good teaching is combining an information rich subject matter content with an experience rich context of application" (p. 1). Academic education organizations such as the National Council of Teachers of Mathematics (NCTM) have expressed support for educational reform through the utilization of contextualized learning (NCTM, 2013).

In addition to the support offered by academic content teachers, changes within the educational environment across the nation potentially hold significant implications for the advancement of CTE instruction. The recent implementation of the Common Core State Standards (CCSS) mathematics curriculum has worked to change the face of mathematics instruction nationally (Common Core State Standards Initiative, 2015), possibly also affecting ways that contextualized teaching and learning is delivered in CTE, including secondary agricultural education. Moreover, such alterations in other curriculum areas have not been unaccounted for in agricultural education, ultimately allowing opportunities for professional advancement through new and meaningful methods (National Council for Agricultural Education, 2012), including contextualized learning. Such changes dictate the need for positive receptivity on stakeholders' parts toward continuous advancements in education.

Further, due to ever-changing technological requirements, as well as economic and education competition abroad, the need to advance CTE is apparent (Doerfert, 2011). This is particularly true in the realm of agricultural education, where traditional curricula have undergone extensive changes, such as academic content integration, in order to provide a workforce that is literate and technically competent and prepared to face the challenges of tomorrow (Doerfert, 2011). Priority Three of the American Association for Agricultural Education's (AAAE) National Research Agenda (Doerfert, 2011) details the need for a "Sufficient scientific and professional workforce that addresses the challenges of the 21st century" (p. 18). Furthermore, "individuals must be well prepared for… science, technology, engineering, and mathematics (STEM) integration, and application for innovation in public, private, and academic settings" (Doerfert, 2011, p. 19). To help address these challenges, it is imperative that agricultural education become an instrument that is capable of providing not only training in technical agriculture concepts but the underlying academic principles that provide the necessary method for advancement of the industry as a whole (Doerfert, 2011; Parr, Edwards, & Leising, 2009).

The discovery of a significant level of mathematics content embedded within the Alabama FFA Agricultural Mechanics Career Development Event (CDE) (Wells & Parr, 2011) has prompted a need to explore participants' perceptions pertinent to the value of mathematics concept comprehension toward performance within CDEs as well as their own beliefs concerning the effectiveness of contextualized mathematics instruction. CDEs serve as a practical context for emphasizing classroom and laboratory instruction within a competitive setting (Phipps, Osborne, Dyer, & Ball, 2008), and they can also serve as a method of enhancing students' knowledge of practical mathematics application (Wells & Parr, 2011). Demands for an agricultural workforce that is knowledgeable in both technical and academic content dictate the need to explore methods of enhancing the agricultural education experience (Doerfert, 2011). Perhaps students perceive that a more comprehensive approach toward combining theory and application is warranted.

Academic concepts, particularly mathematics, are inherently located within much of the CTE curriculum (Stone, Alfeld, Pearson, Lewis, & Jensen, 2006; Young, 2006). CTE has been identified as having content areas that provide active, real-world demonstrations of the applications of academic concepts through the use of contextualized learning (Stone, Alfeld, & Pearson, 2008). In relation to this, academic curriculum integration within CTE curricula has been suggested as a practical means of enriching students' understanding of academic concepts through the approach of real-world problems, a method that has garnered academic teacher support (Layfield, Minor, & Waldvogel, 2001; Roberson, Flowers, & Moore, 2001; Warnick & Thompson, 2007). In addition, students perceive that positive benefits of teaching academic concepts are inherent to the agricultural curriculum (Conroy & Walker, 2000).

For students to fully realize the benefits of academic integration within their CTE classes (i.e., improved academic performance), they must be able to experience real-world phenomena that emphasizes the blending of academic and technical skills (Parr, 2004; Stone et al., 2006).

According to the National FFA Organization (2012), CDEs aim to "develop individual responsibilities, foster teamwork and promote communication while recognizing the value of ethical competition and individual achievement" (p. 3) through realistic, career field-based experiences. CDEs "are activities that allow students to apply classroom knowledge in a context that encourages them to learn more about their areas of interest" (Phipps et al., 2008, p. 406). Therefore, CDEs connect the activities learned in the classroom to the real world through competitive activities in which students must apply a wide variety of skills (Phipps et al., 2008).

Content found within mathematics classrooms is represented through agricultural education courses in a variety of ways (Stone et al., 2008; Young et al., 2009), including CDEs (Wells & Parr, 2011). Previous research (Wells & Parr, 2011) examining the Alabama FFA Agricultural Mechanics CDE revealed that an abundance of mathematics concepts were aligned with several agricultural mechanics activities (e.g., concrete calculation and building construction) incorporated into the Alabama FFA Agricultural Mechanics CDE (Alabama FFA Association, 2009). As a result of this finding, Wells and Parr (2011) concluded that students participating in the Alabama FFA Agricultural Mechanics CDE were exposed to an array of applied mathematics concepts through CDE practice sessions and competitive events. In addition, Anderson and Anderson (2012) reported that agricultural education teachers in Virginia acknowledged that mathematics content was highlighted in various CDE activities, such as in the Forestry CDE. This literature supports the notion contextualized teaching and learning of mathematics is possible through a competitive CDE context.

Inherent to several studies (Nolin, 2011; Pearson et al., 2010; Stone et al., 2006; Stone et al., 2008; Young et al., 2009) that have shed light on the importance of utilizing CTE as a context is the importance of connecting the academic and CTE instruction in such a manner that the students understand they are in fact applying concepts that have traditionally been delivered through an academic course, e.g. geometry. Further, this connection must be built by a teacher who understands the link between his or her content to the academic subject and who was able to confidently and adequately communicate this connection to the students. A recent study by Nolin and Parr (2013) revealed that agricultural education students in Alabama achieved higher performance on the state-administered standardized math exam than their counterparts. This study was designed on the premise that math skills should be transparent to both students and teachers.

Conceptual Framework

This study's conceptual framework revolved around Dunkin and Biddle's (1974) model for the study of classroom teaching as adapted by Parr, Edwards, and Leising (2006) (see Figure 1 below). Dunkin and Biddle (1974) described four types of variables that must be examined in an educational setting. For the purposes of this study, *Presage Variables* described an instructor's teaching style, beliefs, and philosophy. *Context Variables* designated agricultural education coursework. *Process Variables* were defined as the interactions that occur between students and teachers during preparation for and participation CDE activities. Finally, *Product Variables* demarcated student achievement in the CDEs. Most applicable to this study was the category of context variables. These variables include student and teacher attitudes and knowledge concerning embedded mathematics within agricultural education coursework.

This model was selected based upon the notion that student achievement within a CDE is framed by each of the aforementioned concepts. As teacher beliefs and instructional strategies (*Presage Variables*) interact within the context of agricultural education coursework (*Context

Variables), explicit instruction about embedded mathematics in agriculture may be used for training participants for competition. As this process unfolded, teachers and students would have hopefully gained different understandings and perceptions of the agricultural content as preparation activities ensued (*Process Variables*). As a result of each interaction, student achievement in the CDEs (*Product Variables*) would ideally be positively affected; such attainment could be based upon previously-held beliefs and training bestowed during teacher-led instruction. In particular, the researchers posited that students who perform better in these CDEs may also hold more positive views regarding mathematics education in the context of agriculture. However, this notion was not addressed in the current study.

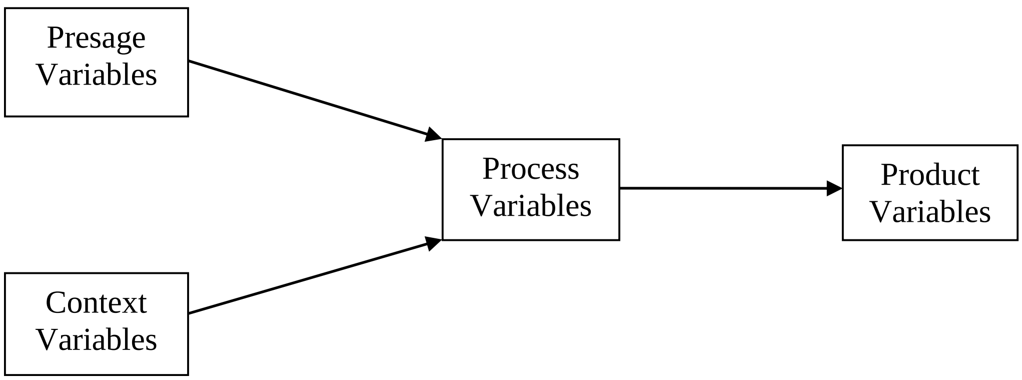

Figure 1. Adapted version of Dunkin and Biddle's (1974) model for the study of classroom teaching (as cited in Parr et al., 2006).

Purpose and Research Objectives

The purpose of this study was to examine student participants' perceptions related to the embedded academic content inherently within selected Alabama FFA CDEs. The authors of this study proposed that the students' perceptions on the embedded mathematics content may yield data describing their perceptions of mathematics content representation. The research questions that guided this study were:

1) How did state-level participants in the selected CDEs identify themselves in regard to agricultural education coursework performance?
2) How did state-level participants in the selected CDEs identify themselves in regard to mathematics coursework performance?
3) How did participants perceive mathematics content within the selected CDEs?
4) What were participants' perceptions concerning the value of mathematics instruction in preparation for participation in the selected CDEs?

Methods

This study was part of a larger research effort to assess students' and teachers' views of mathematics content representation within selected CDEs in Alabama. The population for this study consisted of students who participated in the 2012 Alabama State FFA Agricultural Construction and Maintenance, Agricultural Mechanics, Forestry, Nursery/Landscape, Small Engines, and Floriculture CDEs. These CDEs were selected by a panel of experts with backgrounds in CDE participation, design, and implementation as well as mathematics integration within agricultural education curricula. The panel determined that these CDEs contained a variety of mathematics concepts within portions of the events' activities. The CDEs were all conducted during the week of the annual Alabama State FFA Convention, allowing for convenient data collection. To begin this study, the researchers developed population-specific questionnaires (i.e., teacher and student versions) to be distributed to the participants. The surveys consisted of items designed to address personal characteristics (grade level, FFA membership longevity, and mathematics class enrollment) as well as perceptions regarding the mathematics content representation within the selected CDEs. These questionnaires were evaluated by the panel of experts in secondary agricultural education for face and content validity. This panel determined that the questionnaires appropriately addressed the objectives of this study and were thus deemed valid. The researchers utilized Cronbach's alpha to determine reliability for these instruments. Post-hoc analysis established reliability at the 0.796 level ($\alpha = .796$). In accordance with DeVellis (1991), this internal consistency reliability is regarded as "respectable" (p. 85). Thus, the questionnaires were deemed apt for this study. It should be noted that the instrument employed in the present study was not field tested prior to use.

To recruit teachers and students, the researchers developed a packet containing the following items: an information letter for teachers that addressed the research methods, objectives, potential benefits to participation, the method to decline participation, and a parental consent/information form to be given to CDE participants' parents. The parental consent/information form described the research methodology, objectives, potential benefits to participation, and the method to decline participation; in this case, passive consent for student participation (e.g., sign the form only if you do not wish for your child to participate) was used. Prior to participant recruitment, the aforementioned documents (i.e., letter, instruments, etc.) and Institutional Review Board (IRB)-specific documents were prepared and sent to the Auburn University IRB office. Upon obtaining approval, these documents were distributed to teachers who had CDE teams that had placed in the top four in each of Alabama's three FFA districts. Distribution occurred roughly one month before the state-level competitions.

The appropriate teachers each received the respective packet of materials by way of postal mail service. Upon receipt, the teachers distributed the parental consent/information letters to the appropriate student participants. The parental form instructed parents/guardians to mail the form back to the researchers at Auburn University only if he/she did not wish for his/her child to participate in the selected research activities. No such forms were received by the investigators and thus all students were eligible to participate in this study. The teacher information letters detailed that teacher consent to research activities would result by providing usable data to the researchers during the data collection at the Alabama State CDEs.

Prior to the commencement of the CDEs, the superintendents of the selected events were given packets containing the student and teacher versions of the questionnaires as well as student consent forms. Each packet contained a letter detailing the research activities, procedures, a student consent form, as well as a word of gratitude from the investigators. The student consent form was distributed to students, allowing them to decide if they wished to participate. These forms were collected by the respective event superintendents and returned to the researchers. Only students who gave their consent (i.e., signed and returned the form to the superintendents) were allowed to complete the questionnaires. The superintendents distributed the questionnaires prior to the start of event activities. The superintendents of two CDEs (the Agricultural Construction and Maintenance and the Small Engines CDEs, respectively) declined to distribute the questionnaires, thus removing these students and teachers from the research population.

After the questionnaires were issued by the superintendent of each CDE, the participating students and teachers were allowed approximately 15 minutes to complete the questionnaires. However, additional time was granted if needed. The questionnaires for students included 15 questions and the teachers' version was slightly longer with 18 questions. The math perceptions questions were designed to be CDE-specific while still seeking the same basic information (i.e., the same question simply had a specific CDE name). Upon completion of the questionnaires, the event superintendents gathered the surveys from the respondents at each CDE site. The CDEs then proceeded as usual. Afterward, the researchers collected the completed questionnaires from the superintendents and initiated the analysis of the data.

The responses were analyzed to establish percentages amongst respondents in both populations (teacher and student groups). The responses were categorized by both CDE and population (e.g., teacher or student) to examine the potential differences in each group's responses to the questionnaires.

Results

A total of 160 (n = 160) out of a possible number of 163 (n = 163) students participated in this study, yielding a response rate of 98.2%. Due to a distribution error, five teachers inadvertently answered the student version of the Forestry CDE questionnaire, bringing the total number of responses to 165 (n = 165). This error was identified by the researchers based on the exceeding of the officially reported number of student participants in the CDE. Further, because the instruments did not utilize any identifying information, the instruments completed by the teachers were unable to be removed from the data set. Thus, results for the Forestry CDE were removed from this manuscript due to sampling error. Due to the small number of teacher responses (n = 14), final data yielded from the teacher survey instruments were not included in the final results of this study. The lack of usable teacher data resulted from unanticipated absences due to other duties related to the annual Alabama State FFA Convention. The final student data are detailed below and arranged according to the CDE in which each student participated.

Table one reported data from students who participated in the Agricultural Mechanics CDE. Thirty-six out of 38 students completed the questionnaires, yielding a response rate of 94.7%. Eighty-three percent of participants agreed or strongly agreed that mathematics content is represented in the CDE while 86.2% reported that they could correctly identify math concepts within the CDE. Ninety-one percent of participants felt that their agricultural education teachers could teach math through an agricultural mechanics context while 77.2% positively identified their math teachers as being knowledgeable in everyday math applications. Additional data are detailed below.

Table 1. Students' Views on Mathematics Content Representation in the Agricultural Mechanics CDE (n = 36)

Item	*Agree*	*Unsure*	*Disagree*
Mathematics classroom content is represented within the FFA Agricultural Mechanics CDE.	83.2%	8.3%	8.2%
I can correctly identify math concepts within the FFA Agricultural Mechanics CDE.	86.2%	11.1%	2.7%
I do well in my high school math class(es).	83.2%	5.5%	11%
I do well in my high school agriculture class(es).	97.1%	0%	2.9%
My agriculture teacher(s) can teach me math through agricultural mechanics.	91.4%	5.7%	2.9%
My math teacher(s) is/are knowledgeable in ways that math is used in everyday life.	77.2%	14.3%	8.6%
Good math skills are important to doing well in the FFA Agricultural Mechanics CDE.	91.2%	2.9%	5.8%
My math knowledge and skills have been enhanced through my participation in the FFA Agricultural Mechanics CDE.	55.9%	23.5%	20.5%

Note: Strongly agree and agree were reported in the agree column and strongly disagree and disagree were reported in the disagree column.

Table two reported data from students who participated in the Floriculture CDE. Thirty-nine out of 40 students completed the Floriculture CDE questionnaires, yielding a response rate of 97.5%. Seventy-nine percent of participants agreed or strongly agreed that mathematics content is represented in the CDE while 90% reported that they could correctly identify math concepts within the CDE. Ninety-seven percent of students agreed or strongly agreed that they did well in their math classes while 97.4% agreed or strongly agreed that they did well in their agricultural education classes. Eighty-six percent of participants felt that their agricultural education teachers could teach math through a floriculture context while 94.4% positively identified their math teachers as being knowledgeable in everyday math applications. Additional data are detailed below.

Table three reported data from students who participated in the Nursery/Landscape CDE. All students completed the Nursery/Landscape CDE questionnaires, yielding a response rate of 100%. Eighty-one percent of participants agreed or strongly agreed that mathematics content is represented in the CDE while 83.3% reported that they could correctly identify math concepts within the CDE. Over ninety-seven percent of students agreed or strongly agreed that they did well in their math classes while 100% agreed or strongly agreed that they did well in their agricultural education classes. 95.1% of participants felt that their agricultural education teachers could teach math through a nursery/landscape context while 90.2% positively identified their math teachers as being knowledgeable in everyday math applications. Additional data are detailed below.

Table 2. Students' Views on Mathematics Content Representation in the Floriculture CDE (n = 39)

Item	*Agree*	*Unsure*	*Disagree*
Mathematics classroom content is represented within the FFA Floriculture CDE.	79.4%	15.4%	5.1%
I can correctly identify math concepts within the FFA Floriculture CDE.	90%	10%	0%
I do well in my high school math class(es).	97.3%	0%	2.7%
I do well in my high school agriculture class(es).	97.4%	2.6%	0%
My agriculture teacher(s) can teach me math through floriculture.	86.1%	5.6%	8.3%
My math teacher(s) is/are knowledgeable in ways that math is used in everyday life.	94.4%	2.8%	2.8%
Good math skills are important to doing well in the FFA Floriculture CDE.	86.1%	13.9%	0%
My math knowledge and skills have been enhanced through my participation in the FFA Floriculture CDE.	80.5%	11.2%	8.3%

Note: Strongly agree and agree were reported in the agree column and strongly disagree and disagree were reported in the disagree column.

Table 3. Students' Views on Mathematics Content Representation in the Nursery/Landscape CDE (n = 42)

Item	*Agree*	*Unsure*	*Disagree*
Mathematics classroom content is represented within the FFA Nursery/Landscape CDE.	81%	14.2%	4.8%
I can correctly identify math concepts within the FFA Nursery/Landscape CDE.	83.3%	11.9%	4.8%
I do well in my high school math class(es).	97.6%	0%	2.4%
I do well in my high school agriculture class(es).	100%	0%	0%
My agriculture teacher(s) can teach me math through nursery and landscape management and maintenance.	95.1%	4.9%	0%
My math teacher(s) is/are knowledgeable in ways that math is used in everyday life.	90.2%	7.3%	2.4%
Good math skills are important to doing well in the FFA Nursery/Landscape CDE.	95.1%	4.9%	0%
My math knowledge and skills have been enhanced through my participation in the FFA Nursery/Landscape CDE.	80.5%	14.6%	4.9%

Note: Strongly agree and agree were reported in the agree column and strongly disagree and disagree were reported in the disagree column.

Table four details students' perceptions related to the level of mathematics integrated into each CDE. The data below illustrated these students perceived that not too much math existed in these CDEs (79.7%). However, a larger percentage of students participating in the Agricultural Mechanics CDE reported that they viewed too much math was included in the CDE (29.4%) versus students in the other CDEs.

Table 4. Students' Perceptions Regarding the Amount of Current Mathematics Integration in the Selected CDEs (n = 160)

Item	*Yes*	*No*
Is there too much math in the FFA Agricultural Mechanics CDE?	29.4%	70.6%
Is there too much math in the FFA Floriculture CDE?	16.7%	83.3%
Is there too much math in the FFA Nursery/Landscape CDE?	17.1%	82.9%
Overall percentage of students' perceptions	20.3%	79.7%

Conclusions, Discussion, & Implications

This study sought to provide insight into students' perceptions regarding mathematics integration into four selected state-level CDEs in Alabama. These students were selected based on their previous performance at the district-level events in the CDEs. Each team of students had to place in the top four in their respective district's particular CDE event to advance to the state competitions.

These students identified themselves as high-performing within their math and agricultural education classes. Similar to agricultural education teachers (Anderson, 2012; Anderson & Anderson, 2012; Anderson & Driskill, 2012), the students could detect embedded math content in classroom-based agricultural education curricula. These students also indicated that they could detect embedded math content within the CDEs in which they participated. They also indicated positive benefits to the inclusion of mathematics instruction in preparation for CDEs. These student participants believed that not too much mathematics content integration was occurring within the CDEs, indicating that perhaps a math content integration "saturation point" had not been reached. The researchers advise caution to retain the CDEs' emphases on the technical agriculture content and not transforming the CDEs into "math contests" in which the problems are based on agricultural content only.

Referring to Dunkin and Biddle's (1974) model, it was interesting to look upon student participants' perceptions of mathematics content as a type of final *Product Variable* that may have been influenced by previously-held beliefs as well as exposure to the mathematical constructs during preparation and contest activities (*Process Variables*). It is apparent that the participants within the current study held positive perceptions about mathematics content within the selected CDE activities. Perhaps appealing agricultural content activities in the form of CDEs (*Context Variables*) coupled with teacher-led instructional beliefs and philosophies (*Presage Variables*) ultimately influenced the perceptions reported within this research.

The researchers recognize that had the questionnaires been distributed after the conclusion of the CDE activities instead, the results might have been somewhat different. The students might have experienced differing levels of embedded mathematics content in the state events than what they had experienced previously during practice sessions and at district-level events, thus possibly influencing their perceptions of math content representation. Perhaps further research should be conducted to address potential changes in perceptions of math content representation prior to and after students' participation in state-level CDEs. However, the researchers elected to collect data prior to the CDE. They feared that if a change in methodology occurred, the population might have resulted in a significantly smaller response rate. This would be due to the structure of the CDEs where participants would be able to depart the event area as soon as all activities had concluded, thus potentially undermining the research effort. In addition, the researchers acknowledge that these findings are not generalizable to the entire population of secondary agricultural education students in Alabama, much less the entire nation's agricultural education student group. However, as these students represented the highest performing students in the Agricultural Mechanics, Floriculture, and Nursery/Landscape CDEs during the 2011-2012 academic year in Alabama, this population served as the most reliable sample regarding student participants' perceptions of math integration in the selected CDEs.

The results of this research also help to establish that CDE preparation sessions can serve as a valuable venue for mathematics instruction to occur. Researchers (Nolin, 2011; Stone et al., 2008; Young et al., 2009) have indicated that CTE can serve as an appropriate context through which academic instruction, particularly mathematics, can occur. By serving as a method for contextualized math instruction, CDEs can serve as a two-fold approach to increasing student math achievement by providing a practical context through which math and technical content instruction can occur side-by-side as well as helping to raise student CDE scores and increasing their likelihood of performing well in the FFA competitions (Edney & Murphy, 2010). With the need to raise student math scores apparent (National Center for Education Statistics, 2010), teachers, event superintendents, and students should be prepared to embrace mathematics content representation in CDEs as a method of enhancing student achievement that is complementary to the purposes of the FFA-sanctioned events. As secondary mathematics instruction is changing due to the implementation of CCSS across the country (Common Core State Standards Initiative, 2015), agricultural education stakeholders should be prepared to take advantage of this opportunity to advance students and programs at large.

To help increase students' mathematical abilities during event preparation sessions, agricultural education teachers collaborate with the math teachers in their schools and create methods of increasing student understanding of applied and basic mathematics (Edney & Murphy, 2010). Such collaboration should be extended throughout the entire agricultural education curriculum (i.e., the Math-in-CTE model) (Stone et al., 2006; Parr et al., 2006; Young et al., 2009) to provide all agricultural education students the opportunity to improve their student achievement in mathematics (Parr et al., 2009; Stone et al., 2006; Pearson et al., 2010). As a result, students' comprehension of mathematics could increase, which may better prepare them for CDE activities as well. Moreover, agricultural education teachers should be encouraged to examine the possibilities of working with their math teachers in developing practice sessions that highlight the use of mathematics content within various event-based activities (Edney & Murphy, 2010).

Further research should be conducted regarding additional academic integration (i.e., science and language arts) within CDEs as well as students' and teachers' perceptions regarding academic integration. Research should highlight embedded academic concepts within CDEs (Wells & Parr, 2011) as well as professional development needs of teachers desiring to integrate academics into the preparation for CDE participation. Such designs could yield higher student event scores as well as improved comprehension of academic curricula. Agricultural education teachers should continue to inform program stakeholders of the opportunities to improve student achievement through the context of agriculture (Parr et al., 2009), such as CDE participation (Edney & Murphy, 2010; Wells & Parr, 2011). Perhaps such research could strengthen administrator support of local agricultural education programs by providing a view of the potential enhancement of student achievement that agricultural education could provide, such as improved performance on standardized tests (Nolin, 2011).

CDEs serve as a way to expose students to the various career paths in the agricultural industry (Phipps et al., 2008). As a result, students interact with real-world content in a competitive atmosphere, allowing them to experience work-based settings that may help to guide them toward a particular career path (Phipps et al., 2008). With the need for a more technically-competent workforce becoming more apparent with each passing day, "individuals must be well prepared for… science, technology, engineering, and mathematics (STEM) integration" (Doerfert, 2011, p. 19). Thus, it is imperative that agricultural education teachers, math teachers, and CDE superintendents collaborate to provide the comprehensive academic and technical training that can help students to solve challenging real-world problems they will face in the agricultural workforce and their world more broadly.

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