Administrators View of Mathematics Integration in the Agricultural Education Programs

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Abstract
This study was conducted to determine the perceived attitudes and perceptions of Kentucky secondary school administrators on the barriers to integrating Mathematics in Agricultural Education curricula, and administrator support for their Agricultural Education program. The researcher's utilized a Modified Version of Thompson's Integrating Science Instruments. The population for this study included all administrators (n=875) of Kentucky secondary schools. An important finding of the study indicates the administrators felt that mathematics integration would result in more program support across the board. The administrators indicated that the agricultural education teachers would receive more support from their math counterparts, more industry support, and more support from the administration. Ultimately, it is the individual agricultural education instructor's responsibility to remove the barriers that exist and break down the inaccurate perceptions that may exist amongst the administration. If the perceptions identified in the study are an accurate reflection of the local program, then the agricultural education instructor must make an effort to correct those issues before their program faces elimination from the secondary curriculum for not providing the rigor, relevance, and relationships needed to be successful in the eyes of administrators.

Introduction

The study was designed to determine the perceptions of Kentucky secondary administrators on the barriers to integrating Mathematics into the agricultural education curriculum. Curriculum integration is not a new concept, the 20th century educational reformer John Dewey believed in the importance of curriculum integration and the consequences of separating knowledge from application (Young, et al. 2009). Myers and Thompson (2009) examined the barriers to integrating science into the agricultural education curriculum. Their findings indicated insufficient time and support to plan for implementation was the greatest barrier to integration. They also presented data that suggested administrative support was not a barrier to science integration.

Agricultural Education curriculum that has been integrated with Mathematics has been shown to have a positive effect on student achievement (Young, et al., 2009). Barriers to integrating Mathematics exist, preventing schools from fully integrating Mathematics into the agricultural

education curriculum. Smith, et al., (1990) indicated several problem areas for school-based agricultural educator teachers. Increased high school graduation and college entrance requirements in West Virginia secondary schools had become a barrier to administrating agricultural education programs. Another finding of the study was the failure of school administrators to recognize the unique characteristics of vocational agriculture, such as experience programs (Smith, et al, 1990).

Researchers for the National Assessment of Educational Progress (NAEP) stated in a study of high school seniors across the nation that the performance of 17-year-olds on the 2008 Reading and Mathematics assessments was not significantly different from the students' performance in 1971. The study also showed no significant changes in assessment scores during the years of 2004 and 1973 (National Center for Educational Statistics, 2010). This data indicated no significant change in assessment scores in either direction, which also indicated no great improvement in the pedagogy of the curriculum.

The Digest of Education Statistics (2010) studied mathematic scores of 4th, 8th, and 12th grade students, separated by demographics, and compared from 1990 to 2009. The data for 12th grade students was from the period of 1990 through 2000, and the most interesting data was related to the parent's highest level of education. Students raised by parents who did not graduate high school scored between 30 and 40 points lower than those whose parents graduated from college (US Department of Education, 2009). There was no evidence to indicate exactly the cause of this noteworthy difference in testing scores between these groups of students, other than educational background. Other factors such as income level, rural versus non-rural locales, or demographic information could have had an influence on the student's achievement.

Darrow and Henderson, (1987) identified the human acceptance of ideas and innovation as the real carriers of change, and human resistance to these ideas as the real barrier to change. This idea suggested educators had become a barrier to a change in curriculum due to the educators' own resistance to the process. Several possible factors were evident in the study regarding reasoning for the resistance. Low teacher knowledge of new subject matter, limited administrative support, and limited student interest all had played an important role in the perception of barriers to integration (Conroy, 1999).

Myers & Washburn (2008) surveyed school-based agricultural education teachers, who indicated a general lack of sufficient time and support to plan for implementation of integration as a major barrier to integrating curricula into Agricultural Education. Furthermore, the respondents suggested insufficient funding, concern over large class sizes, and personal lack of experience with integrating curricula were also barriers to integration. Data regarding school-based agricultural educators' perceptions and theories concerning curriculum integration of core principles had been discussed for their correlation to this study and had been deemed relevant to understanding how one group views school-based agricultural education. However, administrators represented another vital segment of the educational equation. The authors needed to focus on administrator's attitudes and opinions regarding Mathematics integration into the agricultural education curriculum in order to fully understand how improvements to curriculum and teacher relations can further benefit agriculture programs and ultimately benefit the students.

The attitudes and perceptions of these administrators are crucial in understanding the dynamic relationships that are created in secondary schools in Kentucky between administrators and educators (Hallinen, 2015). A study by Dodson (2009) examined administrators' perceptions of the role of school counselors in the Rocky Mountain region of the United States. The research pointed out that many administrators have little to no opportunity to understand the re-conceptualization of their role. The Agricultural Educators' support network of guidance counselors, principals, vice-principals, superintendents and professional development personnel aid in the process of selecting curriculum for each school system. These administrators are instrumental in assisting the School-Based Agricultural Educators in creating a relevant and relatable curriculum based on logical principles and contextual learning methods. As cited in a study by Thompson (2001), principals are key decision makers in the curriculum at their respective schools and are influential in the continuation of the agricultural education program. Although they do not have full control over curriculum, their influence has great impact and their perceptions of Agriscience courses determine its success (Johnson & Newman, 1993).

Administrators are significant in supporting or eliminating agricultural education curriculum from school systems based on relevancy and/or student and community interest. If administrators have an accurate perception of the school counselor role, administrators and the counseling department can move in a new direction with regard to the counselor's role (Dodson, 2009). Agricultural education and the agricultural education curriculum hinge on the notion that secondary schools will always offer students the option of taking agricultural education courses as part of their career path. Without the support of these administrators, agricultural education could be removed from secondary education all together. Administrators' involvement is essential in the agricultural education curriculum, as well as being involved in the classrooms, to understand that CTE courses are a viable source for core curriculum reinforcement.

Dyer & Osborne (1999) researched the influence of Illinois guidance counselors at a student-teaching center in regard to agricultural education, including how students plan for an education and career. The researchers stated, equally important is knowledge of the attitudes of counselors toward some of the best agriculture programs. Counselors denoted a positive attitude toward Agriculture as a career path, believed to be highly technical, and school-based agricultural education programs are beneficial in preparing students for college agriculture courses. These findings are contradictory to Dyer & Osborne (1994), which found guidance counselors from general secondary schools in Illinois indicated uncertainty as to whether there was any benefit to agricultural education programs.

Although the concept of local agricultural education supervisors is not widespread, school-based agricultural education teachers are supervised by others at the local level, including principals, superintendents, head teachers and/or others (Barrick, 1986). The study concluded that there were misconceptions concerning teachers' views of the current and expected roles of the Agricultural Educator's supervisor, either principal or CTE director, which could lead to conflicts between the educators and administrators (Barrick, 1986). Barrick's study also found local CTE supervisors estimated spending 60% of the time improving the curriculum. Martin (1986) however, indicated communication levels between administrators and teachers do not seem to be open, there was a need for candid and clear communication between principals and teachers about the true essence of vocational Agriculture. Martin further suggested principals

supported their agriculture program, while Agricultural Education teachers felt principals exaggerated the interest in Agricultural Education (Martin, 1986).

The conceptual framework for this study was provided by Greenwald (1989). The study concluded that when certain individuals favor a situation or a subject with a positive attitude, they tend to evaluate them positively. Using this framework, administrators' support could be measured by analyzing their beliefs on the subject of integrating Mathematics into agricultural education. If these administrators have a positive attitude toward the integration of Mathematics into agricultural education curriculum, they will most likely support the efforts of the school-based agricultural educator teachers and also most likely support the concept of integrating Mathematics into the curriculum.

Theoretical Framework

Fishbein and Ajzen's theory of reasoned action was utilized to guide this study, a description of attitude is explained as a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object. Fishbein and Ajzen (1975) describe four classifications which categorize predispositions:

- Affect (feelings, evaluations): A favorable or unfavorable evaluation of an object. (attitude)
- Cognition (opinions, beliefs): Information a subject has of an object, thus linking a belief of the object to an attribute.
- Conation (behavioral intentions): A subjects intention to perform various behaviors, based on strength of intention.
- Behavior (observed overt acts): Observable act, reaction, or response.

Any response to a questionnaire or verbal survey is considered a behavioral instance. The responses can be used to aid in creating inferences regarding beliefs, intentions or attitudes. The fourth category, however, is used to measure a particular overt behavior in order to understand the details relating to it (Fishbein & Ajzen, 1975). This theory suggests prior exposure to a subject would have an effect on the perceptions of respondents. Positive experiences would tend to lead researchers to infer positive attitudes, and negative experiences would lead to negative attitudes. Knowledge of a subject, the respondent's own belief system, and personal opinions all serve to guide the respondent behaviors in regards to completing the survey instrument.

Greenwald (1989) supported this theory by concluding that individuals, who showed a positive favor towards a situation or an issue, also tend to evaluate the situation in a positive manner. This concept suggested that if an administrator had a positive attitude in relation to the integration of Mathematics in the agricultural education curriculum, administrators would tend to be more supportive of school-based agricultural educator teachers' efforts to integrate Mathematics into the curriculum. In theory, changing a person's attitude regarding a subject could change the level of support that would be offered for that subject.

Purpose/Objectives

The purpose of this study was to provide an assessment of the attitudes and perceptions of administrators of Kentucky secondary schools regarding Mathematics integration in the agricultural education curriculum. The research objectives of the study were:

1. Determine the demographic features and characteristics that the responding administrators possessed.

2. Determine the Administrators attitudes toward Agricultural Education Instructors Teaching Integrated Mathematics

3. Determine attitudes of administrators regarding barriers to integrating mathematics into the Agricultural Education curriculum.

Procedures

The population for this quantitative study consisted of Kentucky secondary administrators. The researchers collected electronic contact information for all administrators in the school districts that offered agricultural education. A total of 130 superintendents, 78 assistant superintendents, 170 principals, 369 guidance counselors and 128 professional development coordinators were identified for a total of 875 participants. A census study was utilized to reduce sampling errors and to describe the entire population.

Instrumentation

The data collection instrument was developed by Thompson (2000) and was modified by the researchers to collect mathematics integration data electronically. The instrument was divided into two sections the first section asked respondents to answer 71 statements regarding different aspects of Mathematics integration and the agricultural education curriculum. Their responses were measured using a five point Likert-type scale where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The second section asked the participants to answer a series of 17 demographic questions designed for a greater understanding of background information and school population characteristics.

The reliability and face validity were examined through the field study. The reliability of the instrument was found to be "very good" according to DeVellis (1991) with the Cronbach's alpha coefficient score falling between .80 and .90 from the results of the study yielding an (α=.895). Murray State University pre-service agricultural education teacher candidates and selected faculty members served as the panel for review of the instrument due to their background in agricultural education. The student and faculty panel was asked to review the instrument to establish face and content validity.

Methods

Dillman's (2007) data collection methods were utilized for this study. After five contact attempts, a response rate for individual administrative positions included superintendents having 31.53%, assistant superintendents with 28.21%, principals with 28.82%, professional development coordinators having 28.13%, and guidance counselors indicating a 9.21% response rate. The guidance counselors' response rate was responsible in lowering the overall response rate to 20.80% (n=182). The response rate prior to inclusion of this administrative group indicated a rate of 29.24%. Non-response error was a concern; therefore, the researchers utilized Lindner, et al., (2001) recommendations by comparing early to late respondents to find no significant differences. Data was analyzed using PSAW 24.0.

Findings

Respondent demographic data was analyzed through a series of 17 questions. The age range of the respondents was between 41 and 60 years old (77.46%). A majority of the respondents had less than ten years of experience as an administrator (73.57%). The results revealed a high majority of administrators were relatively new to administration, while only 26.43% of administrators of Kentucky secondary schools had more than 10 years employed as an administrator. However, they indicated 47.13% had been employed in their current school district for more than 16 years. Over 93% of the respondents had at least a Masters plus thirty credit hours as their indicated level of education.

Gender of secondary school administrators was nearly evenly distributed, with male administrators a slight majority (52.02%). Nearly half (45.67%) of Kentucky secondary administrators indicated having grown up on a farm. Less than 30 % (28.90%) grew up in a town/city, while the rest (25.43%) grew up in a rural/non-farm location. Administrators' enrollment in agricultural education during high school was questioned, indicating 86.21 % of Kentucky secondary administrators indicated not taking agricultural education as a high school student. When asked of involvement in 4-H as a youth, 51.46 % indicated having been involved. The largest frequency of administrators currently lived in a rural/non-farm area (41.71%), while a majority of respondents currently lived in a town smaller than 10,000 residents (53.26%).

Kentucky secondary school demographics showed the highest percentage of students enrolled in the schools were between 501 and 1,000 students (38.86%), while most agricultural education programs were between 101 and 150 students (32.56%). Two agricultural education teacher departments were the most frequently reported (45%). Over 64% of the administrators reported attending three or more in-service workshops related to academic integration.

Six statements regarding agricultural education program support were identified as favorable in improving program support. Overall, the administrators felt that mathematics integration would result in more program support across the board. The administrators indicated that the agricultural education teachers would receive more support from their math counterparts (M= 3.97; SD 0.68), more industry support (M= 3.85; SD 0.74), and even more importantly additional support from the administration (M= 3.60; SD 0.80), guidance counselors and parents (M= 3.57; SD 0.78, 0.83 respectively) if agricultural education teachers increased their efforts to integrate mathematics as outlined in table #1.

Table 1
Agricultural Education Program Support (n=182)

	M	SD
Mathematics teacher support will increase if Agriculture teachers integrate more Mathematics into the Agricultural education curriculum.	3.97	0.68
Agriculture industry support will increase if Agriculture teachers integrate more Mathematics into the Agricultural curriculum.	3.85	0.74

My support as an administrator will increase if Agriculture teachers integrate more Mathematics into the Agricultural curriculum.	3.60	0.80
School counselor support will increase if Agriculture teachers integrate more Mathematics into the Agricultural curriculum.	3.57	0.78
Parental support will increase if Agriculture teachers integrate more Mathematics into the Agricultural education curriculum.	3.57	0.83
Community support will increase if Agriculture teachers integrate more Mathematics into the Agricultural education curriculum.	3.54	0.83

Note. Scale 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree.

Ten statements regarding *Barriers to the integration of Mathematics into the secondary Agricultural Education curriculum* were identified in this study. Respondents indicated a lack of in-service workshops for school-based agricultural education teachers was the statement administrators most agreed with from this section, with a mean score of 3.69 (SD 0.88). The administrators also indicated that a lack of integrated curriculum (M= 3.67, SD 0.88) and educational materials (M= 3.63, SD 0.93) were two of the top three barriers identified.

Administrators indicated the lack of a helpful Mathematics teacher, with a mean score of 2.95 (SD 0.93), and the lack of an institute of higher learning in close proximity, with a mean score of 2.67 (SD 1.05), were the least supported statements of the section. Administrators rated both of these statements with a neutral rating, indicating no definitive positive or negative opinion of either statement. The administrator's responses the barriers regarding mathematics integration into the agricultural education curriculum can be found in Table #2.

Table 2
Barriers to Integrating Mathematics (n=182)

	M	SD
The lack of Agriscience in-service workshop(s)/course(s) for Agricultural Education teachers is a barrier to integrating Mathematics into the Agricultural education program.	3.69	0.88
The lack of an available integrated curriculum is a barrier to integrating Mathematics into Agricultural education programs.	3.67	0.90
The lack of appropriate educational material is a barrier to integrating Mathematics into the Agricultural education program.	3.63	0.93
The lack of adequate funding from federal, state or local government is a barrier to integrating Mathematics into the Agricultural education program.	3.52	1.00

The lack of Agricultural competence or background in Agriculture among Mathematics teachers is a barrier to integrating Mathematics into Agricultural education programs.	3.44	0.97
The lack of competence in Mathematics among Agriculture teachers is a barrier to integrating Mathematics into Agricultural education programs.	3.42	0.95
The lack of student preparation in Mathematics (prior to enrolling in Agricultural education courses) is a barrier to integrating Mathematics into Agricultural education programs.	3.37	0.97
The philosophical differences between the Mathematics and the Agricultural education department have been a barrier to integrating Mathematics in the Agricultural education program.	3.23	0.93
The lack of a Mathematics teacher who is willing to help integrate mathematical concepts has been a barrier to integrating Mathematics into Agricultural education programs.	2.95	0.93
The lack of higher education institutions in close proximity to our school is a barrier to integrating Mathematics into the Agricultural education program.	2.68	1.05

Note. Scale 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree.

Conclusions

The purpose of this study was to provide an assessment of the attitudes and perceptions of administrators of Kentucky secondary schools regarding Mathematics integration in the agricultural education curriculum. School-based agricultural education teachers' perceptions and theories concerning curriculum integration of core principles have been well documented on how one group views agricultural education. However, administrators represented another vital segment of the educational equation. A focus needed to be placed on administrator's attitudes and opinions regarding Mathematics integration into the agricultural education curriculum in order to fully understand how improvements to curriculum and teacher relations can further benefit agriculture programs and ultimately benefit the students. The results of this study indicates that the administration is willing to provide more support to the agricultural education program if the agricultural education instructor invested the additional time and effort necessary to integrate more mathematics into the agricultural education curriculum. This may require the school-based agricultural education teachers to improve their own mathematics content knowledge (McNall & Rice, 2020)

The researchers cannot not stress enough about how the administrators are significant in supporting or eliminating agricultural education curriculum from school systems. School-based agricultural education and the agricultural education curriculum hinge on the notion that secondary schools will always offer students the option of taking agriculture education courses as part of their career path. Without the support of these administrators, school-based agricultural education could be removed from secondary education all together.

The school-based agricultural education teacher's support network of guidance counselors, principals, vice-principals, superintendents and professional development personnel aid in the process of selecting curriculum for each school system. These administrators are instrumental in assisting the school-based agricultural education teachers in creating a relevant and relatable curriculum based on logical principles and contextual learning methods. As cited in a study by Thompson (2001), principals are key decision makers in the curriculum at their schools and are influential in the continuation of the agricultural education program. Although they do not have full control over curriculum, their influence has great impact, and their perceptions of school-based agricultural education courses determine its success (Johnson & Newman, 1993). At a time when administrators are being forced to cut programs for both academic and budgetary reasons it is essential to work with administration and the mathematics department to ensure that the local agricultural education program is answering the demand to improve student academic learning. With this in mind, it is essential that school-based agricultural education teachers need to be proactive in working with their respective administrators to ensure they have an accurate perception of the efforts being made to integrate mathematics.

School-based agricultural education teachers have indicated that they do indeed make an effort to integrate mathematics into their curricula. One of the content areas that are rich in mathematics is agricultural mechanics; this is especially highlighted in the agricultural mechanics career development event. Perhaps there is a disconnect between perception in the administrative offices and the reality in the agricultural education classroom. If this disconnect exists, then it is the researchers recommendation that you invite your administration to assist you in judging the next local or state agricultural mechanics career development event. This activity should result in several benefits for agricultural education instructors and their programs. First and foremost this activity provides the administrators with much needed exposure to a career development event rich in mathematics that showcases rigor. Secondly, the activity highlights the academics that are overseen in a "vocational" content area that is loaded in relevancy. Last, but not least this activity allows your administrators to observe how your students develop relationships, enhance their team building skills, and fine-tune their problem-solving abilities.

It should be important to note that the administrators identified several barriers that exists that could infringe on the school-based agricultural education teachers' ability to integrate mathematics. They identified *The lack of Agriscience in-service workshop(s)/course(s) for Agricultural Education teachers is a barrier to integrating Mathematics into the Agricultural education program* the biggest barrier. It is the researcher's opinion that there are three sectors responsible for reducing this barrier; the post-secondary institutions, the state staff, and most importantly the state agricultural education teachers association. Each of these three entities could put additional effort towards developing courses, workshops, and professional development activities which aligns to the recommendations of McNall and Rice (2020).

The administrators also indicated that *The lack of an available integrated curriculum is a barrier to integrating Mathematics into Agricultural education programs* and *The lack of appropriate educational material is a barrier to integrating Mathematics into the Agricultural education program.* One of the more popular agricultural education teacher's mottos has always been "why reinvent the wheel"; with that said, it is vital that successful agricultural education teachers make more of an effort to share additional lessons, activities, and other materials more frequently on

the National Association of Agricultural Educators *Communities of Practice* website. The researchers also recommend that NAAE COP facilitators highlight outstanding materials each month. The researchers would also point out the availability of the CASE curriculum as a potential avenue for local schools to pursue as well. We recommend that administrators and school-based agricultural education teachers place an emphasis on enrolling the agricultural education teacher in CASE courses. School-based agricultural education teachers could explore additional opportunities adopt inquiry-based learning. Thoron and Myer (2011) found students experienced higher levels of achievement in inquiry-based learning courses.

Ultimately, it is the individual agricultural education instructor's responsibility to remove the barriers that exist and break down the inaccurate perceptions that may exist amongst the administration. If the perceptions identified in the study are an accurate reflection of the local program, then the agricultural education instructor must make an effort to correct those issues before their program faces elimination from the secondary curriculum for not providing the rigor, relevance, and relationships needed to be successful in the eyes of administrators. We recommend promoting the STEM-based skills that agricultural education students are learning through their classes, supervised agricultural experiences, and FFA activities through social media and traditional media outlets to inform administrators, teachers, and industry stakeholders as recommended by Hallinen (2015)

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