Mathematics + Agriculture: Adding Community Type to the Equation

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Introduction

Mathematic skills are essential for success in school, work and everyday life; however, many students experience "math anxiety," take fewer mathematics courses and have decreased ambition and ability to learn mathematical concepts (Maloney & Beilock, 2012). Additionally, a large majority of students achieve below proficient marks on national mathematics assessments (Kuenzi, 2008), a situation exacerbated by achievement gaps amongst various demographic groups (Gonzalez & Kuenzi, 2012) and school community types (i.e., rural, suburban, and urban) (Graham & Provost, 2012).

School-based agricultural education (SBAE) alone cannot solve mathematics underperformance or replace general mathematics courses; however, efficient and effective programs can serve to supplement the teaching of mathematical concepts by illuminating the implicit connections between mathematics and agriculture (Roberts, Harder, & Brashears, 2016; Stripling & Roberts, 2013; Stubbs & Myers, 2015), thus engaging students in the application of mathematics within topics of their interest. Current research has produced one study which records intentions to teach mathematics across curricular offerings of SBAE (Wells & Anderson, 2015), though it is unknown if mathematics teaching intentions vary across community type. The acquisition of such knowledge would inform efforts to provide students from all communities with equal access to mathematics learning within SBAE. Thus, the purpose of this study was to explore the relationship between school community type and mathematics teaching intentions within SBAE.

Methods

A simple random sample of 950 teachers was requested and received from the frame of SBAE teachers housed by the National FFA Organization during the 2015-2016 school year. Due to frame error (e.g., incorrect email addresses), the number of potential respondents was reduced to 830. After a maximum of five email requests, a total of 212 completed surveys were submitted using the online survey tool Qualtrics (i.e., response rate = 25.60%). Data were downloaded into the Statistical Package for the Social Sciences (SPSS) for analysis where non-response bias was checked by comparing on-time respondents (n = 168) to late responders (n = 44) in the areas of community type and intentions to teach mathematics. No statistically significant differences evidenced a lack of non-response bias (Lindner, Murphy, & Briers, 2001; Miller & Smith, 1983). Data collected are part of a larger research project.

Within the survey, relevant data included community type and mathematics teaching intentions. Community type was collected categorically, with respondents self-identifying teaching within either a rural, suburban, or urban community. Mathematics teaching intentions were measured across eleven curricular offerings (i.e., eight career pathways, FFA, SAE, and General Agriculture) in which respondents indicated the percentage of curriculum that met the following definition, "purposeful inclusion of grade appropriate mathematics (e.g. algebra, functions, modeling, geometry, and statistics) concepts and/or practices." Data analysis yielded average percentages of mathematics intended within the eleven curricular offerings among teachers who identified teaching in rural, suburban, and urban SBAE programs. Intentions to teach

mathematics were ranked within each community type grouping to support comparisons between rural, suburban, and urban teachers.

Findings

Comparison of intentions to teach mathematics by community type revealed teachers of all community types intended to teach most mathematics within agribusiness systems and power, structure and technology systems pathways, and the least amount of mathematics within natural resource systems and FFA pathways (see Table 1). Comparisons also revealed suburban teachers intended to teach more mathematics in seven of the eleven pathways than their rural and urban teaching peers; whereas, urban teachers intended to teach the least mathematics in eight pathways.

Table 1

Comparing Intentions to Teach Mathematics among Rural, Suburban, and Urban Teachers

	Rural		Suburban		Urban	
Pathway	Rank	Mean	Rank	Mean	Rank	Mean
Agribusiness Systems	1	42.47	1	53.64	1	40.50
Power, Structure, and Technology	2	37.55	2	45.24	2	34.44
SAE	3	31.03	3	31.84	4	26.07
Biotechnology Systems	4	26.58	4	26.25	5	23.13
Food Products and Processing Systems	5	23.99	7	22.35	3	26.88
Plant Science Systems	6	22.14	6	24.35	8	20.36
Animal Systems	7	21.92	5	25.50	7	21.57
General Agriculture	8	21.08	8	22.12	9	19.29
Environmental Service Systems	9	21.06	9	19.38	6	21.88
Natural Resource Systems	10	20.54	10	17.92	10	18.50
FFA	11	14.43	11	17.24	11	13.93

Note. Means represent average intentions to teach mathematics within curriculum.

Discussion, Implications, and Conclusions

The purpose of this study was to explore the relationship between school community type and mathematics teaching intentions within SBAE. Findings support the illumination of mathematics within SBAE, allowing students to practice the application of mathematical concepts and skills across agricultural pathways (Roberts et al., 2016; Stripling & Roberts, 2013; Stubbs & Myers, 2015). However, disparity of mathematics teaching intentions amongst community types, especially favoring suburban communities, has the potential to widen pre-existing achievement gaps (Graham & Provost, 2012); therefore, the SBAE community must increase intentions to teach mathematics within SBAE curriculum in rural and urban communities. Increased engagement of students from these historically-underachieving communities (Graham & Provost, 2012) in practical applications of mathematical concepts and skills will serve the agriculture industry and society by producing a diverse group of graduates interested in mathematics and prepared to succeed in the workforce.

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