Evaluating Michigan’s FARM Science Lab as a Modality for Agricultural Literacy

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Introduction

Michigan's FARM Science Lab is a 40-foot trailer equipped to host 30 students at 10 learning stations teaching standards-based, agricultural-themed lessons to grade K-5 students (L. Grasman, personal communication, May 22, 2017). Nine similar mobile agricultural labs operate nationwide, reaching an average of 40,000 students per unit annually (Miller & Spielmaker, 2018). While these and other science-focused mobile laboratory programs exist, very little published literature about their effectiveness or impacts exists (Jones & Stapleton, 2017). This study analyzed the data collected from students and teachers to determine the effectiveness of the FARM Science Lab as a means for increasing agricultural literacy.

Theoretical Framework

The Logic Model for Agricultural Literacy was used to operationalize Kolb and Dewey's experiential learning theory through interventions (inputs) leading to desired agricultural literacy outcomes (Kolb, 1984; Spielmaker, Pastor, & Stewardson, 2014). In this context, a program was an intentional use of specific resources put into specific activities to produce a desired outcome within a specific context (McLaughlin & Jordan, 2004).

Purpose/Objectives

The purpose of this study was to evaluate the effectiveness of the FARM Science Lab as a modality for increasing agricultural literacy among third- through fifth-grade students and teachers. This research addressed the American Association for Agricultural Education National Research Agenda Priority 1 concerning "what methods, models and programs are effective for informing public opinions about agricultural and natural resources issues?" (Roberts, Harder, A., & Brashears, M. T., 2016, p. 10).

Methods

This quasi-experimental study tested short-term knowledge gain through a one-group pretest-posttest design. In this repeated measure design, each of the four lesson's assessment contained a mixture of multiple choice or true and false questions unique to the specific objectives of each lesson aligned with Next Generation Science Standards (NGSS, Lead States, 2013) and the National Agricultural Literacy Outcomes (NALOs) (Spielmaker & Leising, 2013). The curriculum, pretest/posttest, and teacher evaluation were reviewed by the researcher, industry experts, and university professors to ensure content curricular validity and criterion-related validity between the student agricultural literacy outcomes and the teacher perceptions. The teacher evaluation consisted of 10 questions: five Likert scale, four yes or no, and one free response question—all evaluating the appropriateness of the lesson, connection to classroom learning, overall quality of the presentation, teachers' perceptions of student learning during the lab session, effectiveness of agriculture as an example to contextualize science principles, and the likelihood of teachers to use Agriculture in the Classroom materials in the future. All lessons and questions in the instrument were developed by Michigan Agriculture in the Classroom staff. Assessments and the teacher survey were distributed via Google Forms then exported into Microsoft Excel and SPSS for analysis. Unique identifier numbers were used to pair pretest and posttest responses.

Results

Table 1
Mean Pretest and Posttest Statistical Differences for all Michigan FARM Science Lab Lessons
[a] Only one group per grade level.

			Pretest		Posttest				
Lesson	Grade level group	*n*	*M*	*SD*	*M*	*SD*	Mean differences	*t*	Cohen's d
Extraction of Life (score out of 7)	Fourth, Group 1[a]	10	5.70	0.48	6.30	0.48	-0.6	-3.67*	1.64
	Fifth, Group 1	109	5.04	1.21	5.65	1.00	-0.62	-5.49*	-0.66
	Fifth, Group 2	46	4.35	1.58	5.22	1.26	-0.87	-4.29*	0.90
Field Plastic (score out of 6)	Third, Group 1[a]	45	1.31	0.87	2.27	1.03	-0.96	-5.59*	1.18
	Fourth, Group 2[a]	53	1.83	1.19	4.00	1.07	-2.17	-10.09*	1.96
	Fifth, Group 1	18	1.28	0.96	4.39	0.7	-0.19	-13.53*	4.89
	Fifth, Group 2	27	1.59	1.05	3.52	1.12	-1.93	-7.53*	2.05
Parts per what (score out of 5)	Third, Group 2[a]	150	1.61	1.13	4.05	1.05	-2.43	-20.18*	2.33
	Fourth, Group 2[a]	130	2.73	1.29	4.26	0.95	-1.53	-11.67*	1.45
Resourceful bean (score out of 5)	Third, Group 1	133	3.26	1.22	4.06	1.01	-0.81	-6.84*	0.84
	Third, Group 2	82	2.56	1.34	3.34	1.36	-0.78	-4.45*	0.70
	Fourth, Group 1	148	3.55	1.21	4.20	0.95	-0.64	-5.90*	0.69
	Fourth, Group 2	71	2.97	1.22	2.90	0.42	-0.66	-3.84*	0.64
	Fifth, Group 1	34	3.32	1.07	4.65	0.54	-1.32	-6.73*	1.63
	Fifth, Group 2	67	2.15	1.49	4.51	0.68	-2.36	-12.75*	2.20

*$p < .05$.

In addition to student assessments, 72 teachers (48%) completed a survey; 28% (n = 20) third-grade, 34% (n = 25) fourth-grade, 25% (n = 18) fifth-grade, and 12% (n = 9) selected "I don't see my grade here." Teachers agreed the lessons addressed appropriate educational outcomes for their grade level (M = 4.08) and their students' understanding of agriculture increased as a result of the experience (M = 4.13). The questions were measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). On average, these teachers believed agriculture could be very effectively used to contextualize science concepts. Teachers had a neutral response (M = 3.39) about their own increase in understanding about agriculture. These teachers indicated interest in seeking additional Agriculture in the Classroom resources.

Conclusions/Recommendations

The FARM Science Lab is making a difference in students' agricultural understanding—at a basic knowledge level—after a short intervention. Based on Bloom's Taxonomy or Webb's Depth of Knowledge Taxonomy, the assessment questions are only reaching a basic level of knowledge, recall, and remembering (Perkins, 2008). The 2014 definition of an agriculturally literate person suggests changes are not only needed in knowledge but also in attitudes, skills, behaviors, and practices in order to apply this agricultural knowledge to daily life (Spielmaker et al., 2014). The focus of lessons and assessment questions could be narrowed and aligned more closely with NALOs, to further measure this higher-order comprehension of the agricultural concepts (Spielmaker & Leising, 2013). This depth could push students beyond simple knowledge-based recall toward further application of a concept. Teachers who responded to the survey had positive feedback about their experiences. Further follow-up should be conducted with teachers who did not respond to investigate their views of the program. Teachers indicated interest in using resources from the Michigan Agriculture in the Classroom website. Continued follow-up with these teachers through newsletters, mail, professional development, or social media could promote use of agriculture examples within their own lessons, extending the reach of the Michigan Agriculture in the Classroom program.

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