Teaching Enhancement through Agricultural Laboratories Workshop: Effects on Self-Efficacy towards and Intent to Teach Simulated Laboratories

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Introduction

Researchers have documented the many barriers preventing teachers from effectively engaging students in learning experiences within agricultural laboratories (Lambert, Stewart, & Claflin, 2018; Shoulders & Myers, 2012; Williams & McCarthy, 1985). Among these barriers are funding, accessibility, and safety (Lambert, et al., 2018; Ma & Nickerson, 2006; Shoulders & Myers, 2012), leading to innovations designed to overcome these barriers. One of these such innovations is the simulated laboratory, designed to offer students the learning outcomes of a traditional laboratory through a scenario that is analogous to that in the traditional laboratory, but conducted outside the lab (Ma & Nickerson, 2006). The use of analogy-based examples within simulated laboratory experiences has been shown to offer a myriad of positive learning outcomes while overcoming some of the barriers to traditional laboratory experiences (Pyatt & Sims, 2007). The theory of planned behavior (Ajzen, 1991), in the context of curricula, suggests that teacher motivation to teach specific topics are dependent upon their attitudes, perceived control, and subjective norms regarding these topics. Researchers (Johnson & Wardlow, 2017; Paulsen, Han, Humke, & Olde, 2014) have found that teachers who participate through teacher workshops have a progressive impact on enhancing self-efficacy in teaching STEM topics, leading to a positive outcome of incorporating these topics into the curriculum. The purpose of this study was to determine the effects simulated laboratories have on teachers' self-efficacy towards and intent to teach simulated laboratories.

Methods

The population for this study included agriculture teachers, science teachers, and extension agents ($N = 19$) participating in a one day inservice workshop in the fall of 2018. Participants spent the day being actively engaged in the simulated laboratory experiences. Participants first went through a session containing information about simulated laboratory experiences and analogies. University undergraduate pre-service teachers then facilitated participants' experiences as they performed each of four simulated laboratory experiences: animal dissection, genetic inheritance in animals, blood collection, and identifying parasites in animal feces. Each of these simulated laboratory experiences was designed to meet the cognitive ability and facility access common to high school agriculture programs. At the conclusion of the workshop, educators completed an adapted version of the Science Teaching Efficacy Beliefs Instrument (Enochs & Riggs, 1989) measuring their self-efficacy and intent to teach with simulated laboratories. Each instrument contained nine Likert-type items with a retrospective pretest (Gouldthorpe & Israel, 2013) and a traditional post-test. Eight summated items measured pre- and post-workshop self-efficacy towards simulated laboratories and one stand-alone item measured teachers' intent to teach simulated laboratories in the next school year. Nineteen participants (100%) completed the evaluation instruments. Data were analyzed using descriptive statistics; Cohen's *d* (Cohen, 1988) was used to describe the magnitude of changes in attitude towards and intent to teach simulated laboratories.

Results

Throughout the workshop, participants developed increased levels of self-efficacy toward and intent to teach simulated laboratories (Table 1). Mean scores for self-efficacy in teaching

simulated laboratories and intent to teach simulated laboratories moved from essentially agree to strongly agree on the four-point scale. The self-efficacy scores indicated a large effect size via Cohen's *d*, while their intent to teach indicated a small effect size via Cohen's *d* (Cohen, 1988). The pretest means indicated teachers agreed they would teach simulated laboratories prior to completing the workshop; workshop participation only slightly increased their level of agreement.

Table 1. *Effects of Workshop Participation on Teachers' Self-Efficacy towards and Intent to Teach Simulated Labs*

	Pretest		Posttest		
Attitude toward teaching:	*M*	*SD*	*M*	*SD*	Cohen's *d*
Simulated Lab Self-Efficacy	2.97	0.43	3.34	0.35	1.27
Intent to teach	2.78	0.78	3.26	0.73	0.46

Note. Based on a four-point (1 = strongly disagree and 4 = strongly agree) Likert-type scale.

Conclusions & Recommendations

The one day workshop was effective in enhancing participants' attitudes towards and intent to teach simulated laboratories. As a slight increase in self-efficacy and intent to teach was found, we conclude that simulated laboratories can have a positive impact on student learning within the agricultural education program. We recommend other programs conduct similar workshops when introducing teachers to specific simulated laboratory experiences. Further, intent to teach also increased, suggesting the workshop may have addressed participants' perceptions of social norms regarding integrating simulated laboratories, as they conversed with one another during the workshop. Alternatively, perhaps the workshop increased participants' perceived behavioral control over integrating simulated laboratories. Both of these implications align with the theory of planned behavior, suggesting the increased intent to teach can be interpreted as an increased likelihood in a behavioral change (Ajzen, 1991).

In addition to increased self-efficacy towards and intent to teach simulated laboratories, this workshop also provided participants with both instructional materials and a professional network to assist in their progression of simulated laboratories. The labs conducted the day of the inservice are available to be check out by educators to use in their curriculum through the [University] website for free. Future research will be conducted with the participants to determine the extent to which they have incorporated simulated laboratories into their local programs and the effectiveness of the simulated laboratories within the classroom.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211. doi: 10.1016/0749-5978(91)90020-

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum

Enochs, L. G., & Riggs, I. M. (1990). Further development of an elementary science teaching efficacy belief instrument: a preservice elementary scale. *School Science and Mathematics, 90*(8), 694-706.

Gouldthorpe, J. L., & Israel, G. D. (2013). *Capturing change: comparing pretest-posttest and retrospective evaluation methods.* Publication WC135, University of Florida Cooperative Extension Service. Retrieved from http://edis.ifas.ufl.edu/wc135

Johnson, D. M., & Wardlow, G. W. (2017). Effects of an applied workshop on teacher self-efficacy and intent to teach hydraulics. *Journal of Agricultural Systems, Technology, and Management, 28*(2017), 15-24. Retrieved from http://jastm.org/index.php/ jastm/article /view/48

Lambert, M. D., Stewart, J., & Claflin, K. (2018). Understanding characteristics, uses, perceptions, and barriers related to school farms in Oregon. *Journal of Agricultural Education, 59*(2), 197-214. doi: 10.5032/jae.2018.02197

Ma, J., & Nickerson, J. V. (2006). Hands-On, Simulated, and Remote Laboratories: A Comparative Literature Review. *ACM Computing Surveys (CSUR),38*(3), 1-24. doi:https://doi.org/10.1145/1132960.1132961

Paulsen, T. H., Han, G., Humke, S. J., & Ohde, N. R. (2014). Teacher self-efficacy as a result of an agriculture-based renewable energy professional development workshop. *Journal of Agricultural Systems, Technology, and Management, 25*(2014), 44-60. Retrieved from http://jastm.org/index.php/jastm/article/view/29/44

Pyatt, K., & Sims, R. (2007). Learner performance and attitudes in traditional versus simulated laboratory experiences. *Proceedings of the Ascilite Conference, Singapore.*

Shoulders, C. W., & Myers, B. E. (2012). Teachers' use of agricultural laboratories in secondary agricultural education. Journal of Agricultural Education, 53(2), 124- 138. doi: 10.5032/jae.2012.02124

Williams, D. L., & McCarthy, D. A. (1985). Student benefits from school farm activities as perceived by administrators and instructors. Journal of the American Association of Teacher Educators in Agriculture, 26(2), 17-23. doi: 10.5032/jaatea.1985.02017