A Meta-Analysis of Agricultural Literacy Programs for Youth and Adults

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Introduction

Agricultural literacy, identified by *Priority 1: Public and Policy Maker Understanding of Agricultural and Natural Resources* of the *National Research Agenda* (Enns et al., 2016), is a pressing issue as a gap widens between consumers and the farmers that feed them (Cosby et al., 2022). Today, a majority of Americans lack sufficient agricultural literacy levels (Bradford et al., 2019). Agricultural literacy is one's ability to incorporate their foundational agricultural knowledge to process general agriculture information, critically think about local food and fiber systems, and be able to communicate about agriculture with ease (Spielmaker & Leising, 2013).

This project was supported by USDA Hatch project TEX 09890. The purpose of this meta-analysis project was to assess the impact of agricultural literacy programs on participants' knowledge of the farm to fork process. This study aimed to provide the scholarship of agricultural literacy with evidence of the effectiveness of current programs. Specifically, the following research questions guided the project:

1. Is there a measurable difference of participants in agricultural literacy levels after partaking in a program (pre/post test scores)?

2. What program features are associated with improvement of agricultural literacy levels?

Conceptual Framework

Spielmaker and Leising (2013) classified the national learning benchmarks for agricultural literacy into five major themes. The themes entail (a) agriculture and the environment, (b) plants and animals for food, fiber, and energy, (c) food, health, and lifestyle, (d) science, technology, engineering, and mathematics, and (e) culture, society, economy, and geography. This framework guided the determination of a program's agricultural literacy focus.

Methodology

Since the search process should be systematic, effective, and reproducible, it is imperative that comprehensive as well as rigorous databases be selected (Gusenbauer & Haddaway, 2020). Both ERIC and Web of Science were identified as meeting all the required criteria for accurate evidence synthesis to retrieve articles addressing agricultural literacy programs (Gusenbauer & Haddaway, 2020). The addition of Google Scholar was for its massive breadth of research articles; however, it is understood that the searches are not always reproducible. A manual citation search was conducted to collect any possible missed articles.

For an article to be considered, it had to be: (a) published from 2000-2022, (b) published in English, (c) be a research study assessing an agricultural literacy program, and (d) utilize quantitative methods in the research design. The initial search yielded 569 articles. A majority of studies were eliminated for not being an agricultural literacy program or possessing the wrong research design. The final stage consisted of 38 studies in the full-text screening process. Paired with the citation search, 9 articles were included for analysis.

Coding is an essential part of the meta-analysis procedure as it allows for the researcher to understand the scope, methods, and validity of each study (Pigott & Polanin, 2020). Each study was assessed and coded on six main constructs which were (a) article characteristics, (b) participant characteristics, (c) intervention (d) instrumentation, (e) research design, and (f) effect size information. The standardized mean gain of the treatment groups was calculated since a majority of studies did not possess a comparison group. Data was analyzed using Rstudio packages metafor, metaviz, and escalc.

Results

Nine articles assessing the effectiveness of an agricultural literacy program were analyzed (Bradford et al., 2019; Cannon et al., 2006; Fischer, 2017; Hutcheson, 2020; Marks et al., 2021; Pense et al., 2005; Riedel, 2006; Ryu et al., 2021; Vallera & Bodzin, 2020). A majority of the agricultural literacy programs were implemented in a classroom setting (n = 7) with elementary students (n = 5). Three (n = 3) of the studies dealt with populations that were agriculturally-related such as Future Farmers of America (FFA) and 4-H (Cannon et al., 2006; Hutcheson, 2020; Riedel, 2006). Unpublished data was included to assist in alleviating publication bias. There was visual asymmetry in the funnel plot for publication bias, the fail-safe N as well as can Egger's Regression test were conducted to further investigate publication bias. Both the fail-safe N (N = 693 < 70 = False) and Egger's Test (p = .45) depicted zero publication bias.

A random effects model was chosen to address the variation that we see across the included research studies. In this model, the null hypothesis tests a mean effect size of zero. Results indicate that the mean change effect size between participants' agricultural literacy levels before and after being enrolled in the program is -.59 (p= 0.16, CI = [-1.40, 0.23]). Thus, there was not a significant effect due to agricultural literacy programs from participants' pre to posttest scores. Cochran's Q and I^2 were employed to assess effect size homogeneity. The result of Cochran's Q indicates a significant degree of heterogeneity (Q = 285. 4, p < .01) exists. The I^2 for this study was 98.32 % which indicates there is a substantial heterogeneity in this meta-analysis. The between study differences were determined through performing two tests of moderator effects. The Q_{within} (Q_E) tests the homogeneity of effect sizes within groups. To understand the effect sizes across groups, the null hypothesis of $Q_{between}$ (Q_M) was tested. Both moderators, program setting and participants' relation to agriculture, were not significant.

Conclusions

The small number of eligible studies may have contributed to the lack of finding an overall impact of agricultural literacy programs. This study revealed an inherent lack of scientific evidence on the impact these programs have on improving consumers' literacy levels.

Implications/recommendations/impact on profession

These findings should be used as a driving force for practitioners to critically assess the current state of agricultural literacy programs to determine the adjustments that need to be made to programming to elicit change in participants agricultural literacy levels (Cosby et al., 2022). Researchers in the field of agricultural literacy should employ rigorous studies to gain a better understanding of the pitfalls and assets of current agriculture literacy efforts (Cosby et al., 2022).

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