Development and Validation of a Middle School Agricultural Literacy Instrument: Grades 6-8

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Introduction

An agriculturally literate citizenry is imperative to meet the demands of a growing global population. The National Research Council (NRC) recognized this in their recommendations that all students, urban, suburban, or rural, receive education about agriculture in their classes (NRC, 1988). Since the NRC recommendations, agricultural literacy efforts have been underway in grades K-12 (Kovar & Ball, 2013). However, these efforts have focused more on the early grades of K-6, and secondary grades of 9-12, with less focus on the middle grades of 6-8 (Kovar & Ball, 2013; Cosby et al., 2022). In their review of 49 agricultural literacy research studies spanning 1988 – 2011, Kovar & Ball (2013) found only four focused on students in grades 6-8. More recently, Cosby et al. (2022) found in their review of research assessing students' agricultural literacy, of the 12 studies which focused on K-12 students, six concentrated on grades 3-6, while the other six studies were aimed at grades 9-12. Additionally, of the nearly 500 lessons on the NAITC Curriculum Matrix, only 131 are indicated explicitly for grades 6-8. This evidence suggests a gap in understanding students' agricultural literacy in grades 6-8 and a lack of available educational resources. Thus far, agricultural literacy efforts have been primarily geared toward elementary and secondary grades. In contrast, those students in the middle school grades 6-8 have been potentially underserved in agricultural literacy efforts. This study aimed to lessen the gap by developing an assessment instrument that can identify agricultural literacy knowledge and subsequently use that information to determine programs and resources that meet areas of knowledge deficiency.

Purpose and Objectives

This study aimed to develop an age-appropriate instrument for grades 6-8 that could be used as a formative and summative assessment to measure agricultural literacy. This instrument could be used by agricultural stakeholders and educators when developing educational programming and instruction. The following research questions informed the process of this research study:

1. Is the Agricultural Literacy Instrument 6-8 (ALI 6-8) a valid and reliable measure of National Literacy Outcomes?
2. Does the Agricultural Literacy Instrument 6-8 (ALI 6-8) effectively distinguish between proficiency stages of agricultural literacy in the 6-8th grade band?

Methods

The theoretical framework marries Sadler and Zeidler's (2009) Programme for International Student Assessment (PISA), a science literacy evaluation with the National Agricultural Literacy Outcomes (NALOs). The NALOs are constructed from national common core scientific, health, and social science standards to provide standardized benchmarks for agricultural literacy in K-12 students (Spielmaker & Leising, 2013). Additionally, the study framework relies upon the use of assessment theory and the incorporation of proficiency levels. Proficiency levels show what a student can do in a range of development rather than a standardized score (OECD: Programme

for International Student Assessment, 2016). Most importantly, the study explicitly followed the methodology of previously completed Longhurst et al. (2019) and Judd-Murray et al. (2019) agricultural literacy assessments.

Phase One: Instrument Construction. The development of the Agricultural Literacy Instrument (ALI) 6-8 assessment items followed a modified Delphi format. The Delphi group comprised 18 education and agricultural content specialists selected nationwide. The iterative writing and ranking process resulted in 48 questions validated summatively by 8th-grade students (n = 375) in five states.

Phase Two: Instrument Validation. The validation analyses were determined using exploratory factor analysis (EFA), confirmatory factor analysis (CFA), item analysis (IA), and discriminant analysis (DA) through SAS (SAS Version 9.4). The analyses resulted in the validation and reliability of two 15-item agricultural literacy instruments.

Results

Research Question 1: Prior literature provides evidence that the standardized nature of the NALOs, measures using a proficiency scale, and Delphi instrument construction give the assumption of content and construct validity to the instrument items as they relate to NALO benchmark demands (Goodman, 1987; Jacobs, 1996; Messick, 1993; Sireci, 1998; Taylor & Judd, 1989). Based on these factors, the two instruments can effectively measure the 6-8th grade benchmarks of the NALOs.

Research Question 2: The maximum score determined the participant proficiency stages (max = 30, min = 6, M = 19.69, SD = 6.78, N = 372). Participants who scored ≥ 80% of the maximum score represented proficient participants; those between ≥ 50-79% represented factual literacy participants, and those below ≤ 49% were at the exposure level. The proficiency stage results defined the parameters for EFA, which then showed the relationships between stages and determined which survey items were in the correct proficiency stage. The CFA established the final items included in the instrument. A regression analysis was conducted to lend structural relevance to the linear model. There were enough items to produce two instruments, each with one assessment item for each proficiency level in the five NALO themes. Discriminant analysis was used to clarify the results of the CFA. Both instruments were sufficient in their classification accuracy and well within the range of $p < .05$, cross-validation results confirmed this information. Based on these outcomes, the proficiency stages were properly classified.

Conclusions and Recommendations

This study sought to develop a reliable and valid instrument to measure the agricultural literacy of students in grades 6-8, within the NALO themes. The instruments developed effectively measure agricultural literacy levels of 6-8th grade students in exposure, literate, and proficient levels. Given the dearth of agricultural literacy efforts targeting middle school grades of 6-8, further research should be conducted using the ALI 6-8 instruments to identify gaps in resources and knowledge of students in grades 6-8.

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