What Technical Agriculture Skills Do Teachers Need to Teach Courses in the Environmental Science and Natural Resources Systems Pathway?

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Introduction, Conceptual Framework, and Purpose of the Study

Quality agriculture teachers must possess a range of competencies, including technical agriculture subject matter knowledge (Eck et al., 2019). Further, quality agriculture teachers should be able to effectively lead their programs and provide students with learning opportunities that prepare them for life in the 21st century (Best et al., 2025; Eck et al., 2019). As the complexities associated with local and global natural resource management continue to grow and diversify, it is imperative that those involved in teaching others about environmental science and natural resources, such as agriculture teachers, possess in-depth knowledge of the subject (Kaya & Elster, 2019). Currently, there is a lack of scholarly information that explicitly identifies the environmental science and natural resources-aligned technical skills that agriculture teachers require. Hence, we designed our study to address this gap in the literature.

We used Wells et al.'s (2021) model of agricultural teacher education and agricultural industry partnerships to conceptually frame our study. Our study relied upon the *Experienced Teachers' Perceptions of What is Important* component of their model. Experienced agriculture teachers provide insight regarding the technical agriculture skills most vital to the successful delivery of Agricultural Education programming (Wells et al., 2021). The purpose of our study was to identify the technical agriculture skills that teachers in Kentucky and Illinois need to successfully teach courses in the Environmental Science and Natural Resources Systems pathway. Our study aligns with the research value of '*Increasing Prosperity Through Innovation in AFNR Systems*' (American Association for Agricultural Education, 2023).

Methods

We designed our three-round Delphi study to build upon prior research related to the technical agriculture skills needed by agriculture teachers (e.g., Albritton & Roberts, 2020; Solomonson et al., 2022; Wells et al., 2023). We used a version of the data collection instrument Solomonson et al. (2022) previously employed to conduct our study throughout 2025. We used Qualtrics to collect our data and distribute e-mail contacts and utilized IBM® SPSS® software (Version 29.0) to analyze all data. To develop our initial list of panel members, we received a list of 59 teachers from nominators across the two states (e.g., agricultural teacher educators, state staff, and so forth). Our Round One instrument contained six items (i.e., two open-response items and four respondent characteristics items). Within Round One, we asked the 59 panel members to explicitly list the technical agriculture skills that teachers need to successfully teach courses in the Environmental Science and Natural Resources Systems pathway. Twenty-nine panel members responded, yielding a response rate of 49.2%. After removing duplicates, we used the 133 unduplicated skill items they provided to build our Round Two instrument.

Within our Round Two instrument, we presented the 133 unduplicated items back to the 29 panel members who participated in Round One. We asked these 29 panel members to use the following Likert-type scale to rate each item: 1 = *Strongly disagree*, 2 = *Disagree*, 3 = *Slightly disagree*, 4 = *Slightly agree*, 5 = *Agree*, and 6 = *Strongly agree*. Twenty-two panel members

responded, yielding a response rate of 75.9%. We determined *a priori* that a skill item met consensus if at least 75% of the responding panel members either *Agreed* or *Strongly agreed* with that item's importance. Sixty-five items met consensus, while 54 items fell between the 51% to 74% threshold of agreement. We excluded 14 items from further consideration. We re-presented the 54 items within our Round Three instrument back to the 22 panel members who participated in Round Two. Eighteen panel members responded, yielding an 81.8% response rate. Using the same consensus criteria we used in our Round Two instrument, nine additional items achieved consensus in Round Three. In total, 74 skill items achieved consensus. Per Dalkey et al.'s (1972) Delphi study panel size conclusions, we deemed our results to be reliable.

Results

The typical panel member had taught agriculture for 14.57 years (*SD* = 9.72) and had taught agriculture in their state for 14.43 years (*SD* = 9.78). We presented the nine technical agriculture skill items that met at least 95.5% consensus in Table 1 (below).

Table 1

Selected Round Two and Three Findings: Environmental Science and Natural Resources Systems Skill Items That Reached at Least 95.5% Consensus

Skill Item	*n*	Category	% Agreement
Identifying tree species using various characteristics (ex. bark, leaves, etc.)[a]	22	FO	100.0
Identifying differences between simple and compound leaves[a]	22	FO	95.5
Identifying physical characteristics of soil (ex. horizons, type, etc.)[a]	22	SRLM	95.5
Identifying essential nutrients for plant health[a]	22	SRLM	95.5
Using global positioning systems (GPS) (ex. field data collection, forest inventory, etc.)[a]	22	TETU	95.5
Performing water quality tests[a]	22	AQ	95.5
Identifying fish species[a]	22	AQ	95.5
Using various characteristics to identify wildlife species in an area (ex. tracks, scat, etc.)[a]	22	WL	95.5
Identifying endangered wildlife species[a]	22	WL	95.5

Note. [a]Item reached consensus in Round Two. Scale: 1 = *Strongly disagree*, 2 = *Disagree*, 3 = *Slightly disagree*, 4 = *Slightly agree*, 5 = *Agree*, 6 = *Strongly agree*. Key for Skill Categories: Tool, Equipment, and Technology Use skills = TETU, Aquatics skills = AQ, Forestry skills = FO, Soil Resources and Land Management skills = SRLM, and Wildlife skills = WL.

Conclusions and Recommendations

The 18 panel members who participated in all three rounds of our Delphi study identified 74 technical agriculture skills that agriculture teachers need to successfully teach courses in the Environmental Science and Natural Resources Systems pathway. We concluded that agriculture teachers in these two states require a comprehensive set of technical agriculture skills across multiple topics to effectively teach the courses associated with this pathway. We recommend that those involved in agricultural teacher education in these two states utilize our findings to inform the development of teacher competence processes there. Our findings are not generalizable beyond these two states.

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