

Are Teachers Equipped for Experiential Learning? Facilities and Equipment Access in School-Based Agricultural Education Programs

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Abstract

The availability of functional facilities and equipment is a cornerstone of effective school-based agricultural education (SBAE) programs. Therefore, access to functioning facilities and equipment is essential for SBAE teachers to further the knowledge of students as they pertain to agriculture, food, and natural resource (AFNR) standards. Beyond providing practical learning experiences, adequate facilities and equipment are crucial for meeting the diverse needs of students. Therefore, the purpose of this study was to assess the availability of facilities and equipment amongst SBAE teachers in the United States across National Association of Agriculture Educators (NAAE) Regions II, III, and IV using a descriptive, survey research design. While proper facilities and equipment are a crucial for facilitating experiential learning in SBAE, we found many teachers are not properly equipped to carry out such experiences for their students. While it is important for SBAE teachers to advocate for themselves and their programs, it is paramount that support systems be provided through teacher educators, agricultural education teacher associations, agricultural education state staff, and program advisory councils in order to obtain proper equipment and facilities and the knowledge to use them. Future research should explore the impact of resource (i.e., equipment and facilities) access on teacher satisfaction and career retention.

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Introduction and Problem Statement

The physical learning environment is a cornerstone of student learning (Arroyo et al., 2023; Dalinger et al., 2024), including the availability of functional facilities and equipment within school-based agricultural education (SBAE) programs (Phipps et al., 2008). These resources are a foundational component for agricultural educators to provide learning experiences that foster critical thinking, problem-solving, and practical skill acquisition (Parr & Edwards, 2004). As noted by Twenter and Edwards (2017), specialized facilities (i.e., greenhouses, mechanics labs, land laboratories) are essential for preparing students for careers in agriculture, food, and natural resource (AFNR) fields. These spaces allow teachers to simulate agricultural practices, providing students with a deeper understanding of the industry and its challenges, ultimately developing conceptual, procedural, and personal skills (Shoulders & Myers, 2012). Access to these facilities has been shown to increase overall knowledge of a topic compared to those without said facilities (Rothenberger & Stewart, 1995). Therefore, access to functioning facilities and equipment is essential for SBAE teachers to further the knowledge of students as it pertains to AFNR standards (McKim et al., 2025; Rothenberger & Stewart, 1995).

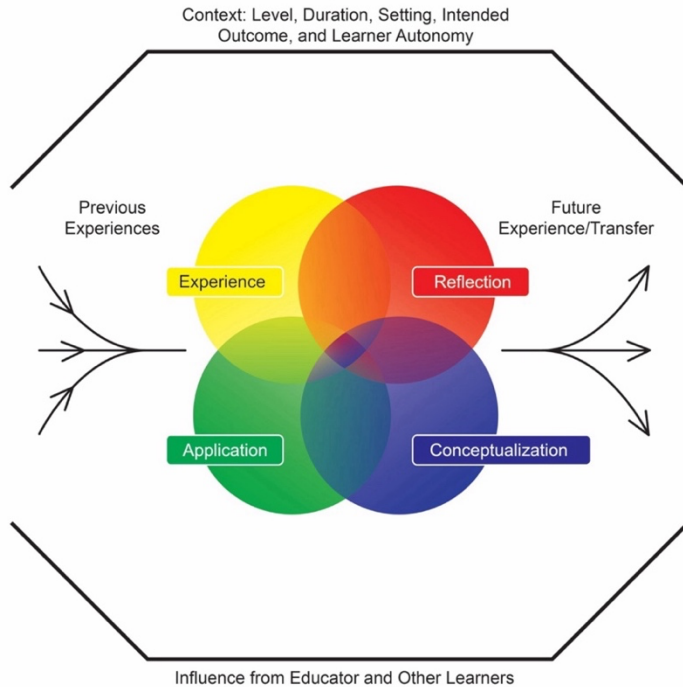
Access to proper facilities and equipment within SBAE serves to not only provide quality tangible resources, but also connect theoretical knowledge and practical, hands-on application, creating an environment that is conducive to critical thinking and constructivism, allowing students to think creatively and provide context to real-world problems (Manning et al., 2022). This becomes essential considering the need to develop a skilled and competent AFNR workforce (National Academies of Sciences, Engineering, and Medicine (NASEM), 2021). The proper facilities and equipment being provided by schools reflects their commitment to SBAE and exposes students to technological advancements in agriculture.

Theoretical and Conceptual Framework

Constructivist Learning Theory (CLT) posits that individuals construct their own understanding and knowledge of the world through experiencing new situations and reflecting on those experiences (Bereiter, 1994). Theorists have emphasized that learning is most effective when students are provided with concrete, meaningful experiences that allow them to explore, question, and develop their own interpretations of the world (Dewey, 1938; Fosnot, 2005; Piaget, 1952). In SBAE, this constructivist approach is reinforced by the inclusion of hands-on, manipulative materials and direct engagement with learning environments, as opposed to traditional reliance on textbooks and workbooks (Bada & Olusegun, 2015). However, these meaningful experiences hinge on access to the appropriate resources, such as specialized equipment and facilities, which provide the context necessary for constructing new knowledge (Coleman et al., 2024). Experiential learning, a process that aligns with CLT by placing students in direct contact with the realities being studied (Keeton & Tate, 1978), enhances this constructivist framework by emphasizing active engagement through experience. SBAE settings such as agricultural mechanics shops, welding machines, and science laboratories equipped with microscopes (Phipps et al., 2008) allow for these concrete learning experiences. Kolb's

(1984) Experiential Learning Cycle, which includes concrete experience, reflective observation, abstract conceptualization, and active experimentation, further demonstrates how experiential learning can effectively structure the learning process. However, as Baker et al. (2012) argued, the success of experiential learning is contingent upon the quality of the environment. Within SBAE, an essential component of the learning environment is access to the necessary equipment and facilities to teach AFNR (McKim et al., 2025; Rubenstein et al., 2020). Without these resources, students may struggle to make meaningful connections and fully engage in the learning process.

A model (see Figure 1), proposed by Coleman et al. (2024), provides a comprehensive look at experiential learning as well as how it can apply to SBAE classrooms. Many are familiar with the four core concepts of experiential learning, outlined by the four colored circles. However, incorporating brackets with overarching themes prove the importance of things such as setting and duration, among others, across all parts of experiential learning. Access to quality facilities and equipment directly enhance this process, allowing educators to enhance the experience through a quality level of experience, an interactive setting, and allowing the environment to influence the learner. Facilities and equipment give freedom to educators as to what they are able to do and still provide meaningful experiences conducive to experiential learning, such as service learning, laboratory experiences, and a multitude of other active learning experiences (Willems & Gonzalez-DeHass, 2012).

Figure 1**A Conceptual Model for Contextualized Experiential Learning**

Note. From “Experiential Learning in Agricultural Education: A Philosophical Discussion,” by Coleman, B. M., Bunch, J. C., & Roberts, T. G. (2024). Experiential learning in agricultural education: A philosophical discussion. *Journal of Agricultural Education*, 65(1), 283–302.

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Purpose

The purpose of this study was to assess the availability of facilities and equipment amongst SBAE teachers across the National Association of Agricultural Educators’ (NAAE) Regions II, III, and IV. Assessing such facilities and equipment will help to improve the preparation of pre-service and the support of in-service teachers, along with furthering the data available to SBAE stakeholders to lobby for and support local programs to further their impact on secondary students. Specifically, this study was guided by three research objectives:

1. Determine the current access to equipment and facilities by SBAE teachers,
2. Identify the alignment between AFNR pathways and access to equipment and facilities, and
3. Establish the level of interest in additional equipment and facilities.

Methods

This descriptive research study aimed to identify facilities and equipment resources of SBAE teachers across NAAE Regions II, III, and IV ($N = 8224$; Foster et al., 2024). Together, these three regions share similarities across production agriculture, with a variety of differences in SBAE

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programs (i.e., rural/urban, single/multi-teacher departments, and program size). To reach the population of interest, a researcher developed frame was established with 8,020 individual email addresses from publicly available email directories. The frame was established based on the current average response rate in agricultural education being lower than 20% (Doss et al., 2021, and a power analysis conducted in G*Power 3.1 to detect a small effect size ($r = 0.10$) with a significance level of $\alpha = 0.05$ and statistical power of 0.80, indicating the need for 782 participants. Following the recommendation of Dillman et al. (2014), an initial point of contact was made, followed by three reminder emails, each one-week apart to increase response rates during the Spring 2024 semester. The emails included an invitation to participate that was tailored to each state, along with the Qualtrics link. The questionnaire was designed to be compatible with mobile devices, aligning with best practices for electronic survey development (Dillman et al., 2014).

The 60-item, researcher developed questionnaire, was divided into five categories (i.e., facilities, equipment, facilities and equipment usage, additional resources, and personal and professional characteristics). The questionnaire was evaluated for face and content validity by a panel of experts with over 90-years of combined SBAE teaching experience. Data collection resulted in 695 responses, ranging from 23 to 72 years of age, with 44.5% ($n = 309$) being female. Sixty-six percent ($n = 459$) of responding SBAE teachers were traditionally certified and 39.0% ($n = 271$) held an advanced degree (i.e., M.S., Ed.D., or Ph.D.). Respondents also ranged from first year teachers to those with over 40 years of experience, with 45.6% representing multi-teacher programs.

While non-response was of concern, the respondents are representative of the current supply and demand project data (Foster et al., 2024), as nearly half of participating SBAE teachers were female (44.5%); aligning with the average across NAAE Regions II, III, and IV (i.e., 50.9% of SBAE teachers in NAAE Regions II, III, and IV are female; Foster et al., 2024). Additionally, the average program size across the three NAAE regions (1.6 teachers per program) reflects the typical staffing structure within agricultural education programs across those regions (Foster et al., 2024), mitigating potential bias. In addition, early respondents (those responding prior to the second reminder email, $n = 463$) were compared to late respondents ($n = 162$), on the variable of access to an agricultural education classroom, using a two-tailed independent samples t -test, resulting in no statistically significant difference between early and late respondents, $t(623) = -0.28$; $p = 0.78$. By demonstrating the representativeness of our sample in these key areas, we aim to mitigate the potential impact of non-response bias on the study's findings (Johnson & Shoulders, 2017; Lindner et al., 2001).

To answer the proposed research objectives, descriptive statistics were analyzed using SPSS Version 29. Specifically, frequencies and percentages were considered to describe the availability of facilities and equipment. In addition, the crosstabs function in SPSS and Pearson correlations were employed to compare AFNR pathways taught to corresponding facility and equipment access.

Findings

Research Objective 1: Determine the Current Access to Equipment and Facilities by SBAE Teachers

The majority of participating SBAE teachers reported having access to classrooms (95.8%), agricultural mechanics shops/laboratories (75.0%), and equipment/supply storage rooms (60.1%) in working conditions. Outside of these, the majority of facilities were in working condition for approximately 10-15% of teachers surveyed (see Table 2). The greatest reported facilities not in working condition were greenhouses (15.6%), equipment storage (11.9%), and agricultural mechanics shop/laboratory (6.8%). All but one value falls under 5.0%. Conversely from the first point, all but three of the facilities included in the survey were not had by the majority of educators (see Table 2). Food processing facilities, landscape facilities, nurse/shade houses, orchards, apiaries, equine facilities, and vineyards are not had by over 90% of teachers surveyed. Table 2 outlines access to the 20 SBAE facilities studied using a three-point scale, which included: having in working condition; having in non-working condition; and not having access to.

Table 2

Facility Access of SBAE Teachers in NAAE Regions II, III, and IV

Facility	Has – Working <i>f</i> (%)	Has – Not Working <i>f</i> (%)	Does Not Have <i>f</i> (%)
Classroom	599 (95.8)	20 (3.2)	6 (0.9)
Agricultural Mechanics Shop/Laboratory	466 (75.0)	42 (6.8)	113 (18.2)
Equipment/Supply Storage	370 (60.1)	73 (11.9)	173 (28.0)
Greenhouse	292 (47.1)	97 (15.6)	231 (37.3)
Livestock Facility	224 (36.1)	24 (3.9)	373 (60.0)
Land Laboratory/School Farm	199 (32.4)	27 (4.4)	389 (63.6)
Garden	177 (29.5)	37 (6.2)	387 (64.4)
Livestock Arena	90 (14.7)	8 (1.3)	515 (84.0)
Ponds/Tanks	84 (13.9)	27 (4.5)	492 (81.6)
Pastureland	83 (13.7)	12 (2.0)	512 (84.4)
Small Animal/Veterinary Laboratory	77 (12.6)	12 (2.0)	492 (85.5)
Biotechnology/Science Laboratory	65 (10.8)	7 (1.2)	528 (88.0)
Forestry Plot	57 (9.4)	12 (2.0)	535 (88.6)
Food Processing Facility	37 (6.1)	11 (1.8)	556 (92.0)
Landscape Facility	36 (6.0)	7 (1.2)	561 (92.9)
Nursery/Shade House	34 (5.6)	9 (1.5)	561 (92.9)
Orchard	29 (4.8)	8 (1.3)	562 (93.8)
Apiary	20 (3.3)	7 (1.2)	577 (95.5)
Equine Facility	7 (1.2)	2 (0.3)	590 (98.5)
Vineyard	4 (0.7)	2 (0.3)	596 (99.0)

The majority of SBAE teachers have access to eight of the 16 surveyed equipment categories in working condition, with the highest being hand tools (95.1%), followed by classroom instructional technologies (94.1%), and power tools (93.1%) The equipment in working condition to which SBAE teachers had the least access included apiary equipment (11.4%), equipment trailers (26.9%), and food processing equipment (37.7%). In regard to having equipment in unusable condition, greenhouse equipment (11.1%), and metal working equipment (9.5%) were the outlying high values. Table 3 outlines equipment access across the 16 items surveyed.

Table 3

Equipment Access of SBAE Teachers in NAAE Regions II, III, and IV

Equipment	Has – Working <i>f</i> (%)	Has – Not Working <i>f</i> (%)	Does not have <i>f</i> (%)
Welding Equipment	552 (90.7)	19 (3.1)	37 (5.0)
Metal Working Equipment	453 (74.5)	58 (9.5)	97 (16.0)
Wood Working Equipment	496 (81.5)	18 (3.0)	94 (15.4)
Hand Tools	578 (95.1)	13 (2.1)	17 (2.8)
Power Tools	567 (93.1)	16 (2.6)	26 (4.3)
Science Laboratory Equipment	464 (76.6)	9 (1.5)	133 (22.0)
Landscape/Garden Tools	461 (76.2)	17 (2.8)	126 (21.0)
Greenhouse Equipment	251 (41.5)	67 (11.1)	286 (47.3)
Large Farm Equipment	248 (41.6)	4 (.7)	345 (57.8)
Veterinary Science Equipment	294 (48.7)	8 (1.3)	302 (50.0)
Food Processing Equipment	222 (37.7)	4 (.7)	368 (61.7)
Apiary Equipment	67 (11.4)	7 (1.2)	537 (87.4)
Livestock Trailer	471 (44.9)	22 (3.6)	311 (51.5)
Ag Truck	278 (46.1)	11 (1.8)	314 (52.0)
Equipment Trailer	241 (26.9)	8 (1.3)	344 (58.0)
Classroom Instructional Technologies	570 (94.1)	16 (2.6)	20 (3.3)

Research Objective 2: Identify the Alignment Between AFNR Pathways and Access to Equipment and Facilities

The most taught pathways by participants were Animal Systems (79.1%), Plant Systems (64.0%), and Power, Structural, and Technical Systems (61.4%). Twenty-seven percent of SBAE teachers in the Plant Systems pathway reported having access to plant system-related facilities, including greenhouses, nurseries/shade houses, and gardens, among others. Significant positive correlations were found between programs offering Plant Systems and greenhouse facilities ($r = .308, p < .01$), gardens ($r = .188, p < .01$), equipment/supply storage ($r = .108, p < .01$), landscape facility ($r = .105, p < .01$), nursery/shadehouse areas ($r = .093, p < .05$), and school orchards ($r = .084, p < .05$). Only 65% of educators have access to functional plant system related equipment. The majority of Power, Structural, and Technical Systems teachers (82.7%) reported having access to working facilities, such as an agricultural mechanics shop, and 90.3%

have access to working equipment, including welding and wood-working equipment, power tools, and hand tools. Significant positive correlations were found between programs offering Power, Structural, and Technical Systems and agricultural mechanics shops ($r = .553, p < .01$), arenas ($r = .126, p < .01$), land labs/school farms ($r = .108, p < .01$), equipment/supply storage ($r = .134, p < .01$), and pastureland ($r = .083, p < .05$). In addition, significant negative correlations existed between Power, Structural, and Technical Systems teachers and forestry plots facilities ($r = -.132, p < .01$), apiaries ($r = -.116, p < .01$), and orchards ($r = -.115, p < .01$). Of the SBAE teachers who reported teaching the Animal Systems pathway, 31.1% of them have access to facilities in working condition and 51.7% reported having access to working equipment related to the Animal Systems pathway. Significant positive correlations were found within the Animal Systems pathway between teachers offering the pathway livestock facilities ($r = .220, p < .01$), greenhouses ($r = .165, p < .01$), equipment/supply storage ($r = .158, p < .01$), small animal/veterinary labs ($r = .144, p < .01$), agricultural mechanics shops ($r = .144, p < .01$), school farms ($r = .130, p < .01$), arenas ($r = .220, p < .01$), and pastureland ($r = .101, p < .01$).

Research Objective 3: Establish the Level of Interest in Additional Equipment and Facilities

The greatest reported interest in additional equipment and facilities included small animal/veterinary laboratories, livestock facilities, and food processing/meat laboratories, which had approximately one-quarter of participating SBAE teachers expressing interest. Veterinary science equipment (22.2%), ag trucks (21.3%), and greenhouse equipment (20.7%) were the most desired, and not had, equipment by participating SBAE teachers. Classroom instructional technologies, power tools, welding equipment, hand tools, and a dedicated classroom were the least desired, and not had, equipment and facilities. Table 4 outlines all the equipment and facilities considered within this study and participating SBAE teachers corresponding interest in the items if not currently part of their program.

Table 4*Interest in Additional Equipment and Facilities of SBAE Teachers in NAAE Regions II, III, and IV*

Equipment/Facility	<i>f</i>	%
Livestock Facility	194	27.9
Small Animal/Veterinary Laboratory	194	27.9
Food Processing Facility	167	24.0
Veterinary Science Equipment	154	22.2
Ag Truck	148	21.3
Land Laboratory/School Farm	145	20.9
Greenhouse Equipment	144	20.7
Large Farm Equipment	142	20.4
Garden	142	20.4
Food Processing Equipment	139	20.0
Apiary Equipment	135	19.4
Nursery/Shade House	135	19.4
Equipment Trailer	133	19.1
Livestock Arena	133	19.1
Greenhouse	129	18.6
Equipment/Supply Storage	121	17.4
Pastureland	97	14.0
Livestock Trailer	95	13.7
Ponds/Tanks	92	13.2
Orchard	88	12.7
Landscape Facility	85	12.2
Biotechnology/Science Laboratory	83	11.9
Apiary	83	11.9
Forestry Plot	71	10.2
Equine Facility	70	10.1
Science Laboratory Equipment	63	9.1
Landscape/Garden Tools	56	8.1
Vineyard	56	8.1
Metal Working Equipment	54	7.8
Wood Working Equipment	41	5.9
Agricultural Mechanics Shop/Laboratory	32	4.6
Classroom Instructional Technologies	17	2.4
Power Tools	15	2.2
Welding Equipment	13	1.9
Hand Tools	9	1.3
Classroom	4	0.6

Conclusions, Discussion, and Recommendations

While proper facilities and equipment are crucial for facilitating experiential learning in SBAE (Baker et al., 2012; McKim et al., 2025; Rubenstein et al., 2020), we found some teachers do not have the necessary equipment to carry out such learning experiences for their students. While it is important for SBAE teachers to advocate for themselves and their programs, it is paramount that support systems be provided through teacher educators, agricultural education teacher associations, agricultural education state staff, and program advisory councils in order to obtain proper equipment and facilities and the knowledge to use them. While the majority of teachers have access to a classroom, other facility access allows students to have direct engagement with their environment which enables a more constructivist approach to learning (Bada & Olusegun, 2015) and prepares them for 21st century AFNR workforce needs (NASEM, 2021).

SBAE teachers who teach the Power, Structural, and Technical Systems pathway have ample access to both proper equipment and facilities. However, this pathway is taught less commonly than both Plant Systems and Animal Systems, both of which have insufficient access to resources necessary to their success. SBAE teachers should take proper assessment of their current facilities and equipment and opt to use them accordingly to provide the proper context necessary for facilitating educative experiences (Coleman et al., 2024).

The majority of facilities and equipment that are desired by SBAE teachers, and not had, would most benefit teaching within the Animal Systems pathway, which is used by nearly 80% of teachers surveyed. Further research could be done to show a possible lack in student efficacy within the Animal Systems pathway when considering programs with and without access to essential facilities and equipment. As previous research has documented the ability of these spaces to simulate real-world agricultural practices, providing students with a deeper understanding of the industry and its challenges, ultimately developing conceptual, procedural, and personal skills (Shoulders & Myers, 2012).

It is recommended that teacher preparation faculty consider the findings of this study when providing pre-service teachers with access to advanced facilities and equipment during their teacher preparation program, as facility access is essential for refining skills pre-service teachers will later teach. However, it is equally important to prepare them for the possibility of limited resources in their future programs. Teaching methods that are adaptable to any level of functionality regarding facilities and equipment that still allow for quality experiential learning experiences (Baker et al., 2012) is essential.

Future research should explore the impact of resource (i.e., equipment and facilities) access on teacher satisfaction and career retention. In addition, research should consider the magnitude of facilities in non-working condition and their impact on student learning outcomes to better inform school administrators allocating funds for SBAE programs. Without such research, the lack of necessary resources is likely to continue. Research should include observational data collection through program visits, the collection of photographs highlighting equipment and

facilities in non-working condition, and qualitative interviews to learn more about the SBAE teachers perceptions of their facilities.

Agricultural educators should work to strengthen relationships between their program and community stakeholders as a way to supplement facility and equipment access. These relationships can foster financial support to finance new facilities and equipment, as well as opportunities for students to find hands-on application within businesses in the community. As an educator, this also provides an avenue to access service learning, which hold great power in effectively contextualizing information that compliments direct instruction (Willems & Gonzalez-DeHass, 2012). These relationships could also help establish stakeholders for SBAE advisory committees if programs do not already have them in place. As community stakeholders and industry professionals have the potential to serve as great assets to obtaining program needs.

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References

- Arroyo, Y. P. V., Peñabaena-Niebles, R., & Correa, C. B. (2023). Influence of environmental conditions on students' learning processes: A systematic review. *Building and Environment*, 231, 110051. <https://doi.org/10.1016/j.buildenv.2023.110051>
- Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, 5(6), 66–70. <https://doi.org/10.9790/7388-05616670>

- Baker, M. A., Robinson, J. S., & Kolb, D. A. (2012). Aligning Kolb's experiential learning theory with a comprehensive agricultural education model. *Journal of Agricultural Education*, 53(4), 1–16. <https://doi.org/10.5032/jae.2012.04001>
- Bereiter, C. (1994). Constructivism, Socioculturalism, and Popper's World 3. *Educational Researcher*, 23(7), 21–23. <https://doi.org/10.3102/0013189X023007021>
- Coleman, B. M., Bunch, J. C., & Roberts, T. G. (2024). Experiential learning in agricultural education: A philosophical discussion. *Journal of Agricultural Education*, 65(1), 283–302. <https://doi.org/10.5032/jae.v65i1.2479>
- Dalinger, T., Pulat, A., & Asino, T. I. (2024). The intersection of teachers' perceptions, physical classroom learning environment, and efficacy: An exploratory factor analysis. *Learning Environments Research*, 28, 45–64. <https://doi.org/10.1007/s10984-024-09521-0>
- Dewey, J. (1938). *Experience and education*. Simon & Schuster.
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method*. Wiley.
- Doss, W., Rayfield, J., Burriss, S., & Lawver, D. (2021). A quantitative content analysis of survey research methods over a 40-year time period in the Journal of Agricultural Education. *Journal of Agricultural Education*, 62(3), 310–328. <https://doi.org/10.5032/jae.2021.03310>
- Fosnot, C. T. (2005). *Constructivism: Theory, perspectives, and practice* (2nd ed.). Teachers College Press.
- Foster, D. D., Smith, A. R., Lawver, R. G., & Spiess, M. (2024). *National agricultural education supply and demand project* [data set]. American Association for Agricultural Education. <http://nsd.aaaeonline.org>
- Johnson, D. M., & Shoulders, C. W. (2017). Power of statistical tests used to address nonresponse error in the Journal of Agricultural Education. *Journal of Agricultural Education*, 58(1), 300–312. <https://doi.org/10.5032/jae.2017.01300>
- Keeton, M. T., & Tate, P. J. (1978). *Learning by experience: What, why, how*. Jossey-Bass.
- Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development* (1st ed.). Prentice-Hall.
- Lindner, J. R., Murphy, T. H., & Briers, G. E. (2001). Handling nonresponse in social science research. *Journal of Agricultural Education*, 42(4), 43-53. <https://doi.org/10.5032/jae.2001.04043>

- Manning, J. K., Cosby, A., Power, D., Fogarty, E. S., & Harreveld, B. (2022). A Systematic Review of the emergence and utilisation of agricultural technologies into the classroom. *Agriculture*, 12(6), 818. <https://doi.org/10.3390/agriculture12060818>
- McKim, A. J., Sorensen, T., Goodwin, C., & Ware Wilkinson, S. (2025). Exploring exemplary STEM lessons in agricultural education. *Journal of Agricultural Education*, 66(2), Article 4. <https://doi.org/10.5032/jae.v66i2.2906>
- National Academies of Sciences, Engineering, and Medicine (NASEM). (2021). *Creating the future workforce in food, agriculture, and natural resources*. The National Academies Press. <https://doi.org/10.17226/26065>
- Parr, B., & Edwards, M. C. (2004). Inquiry-based instruction in secondary agricultural education: Problem-solving-an old friend revisited. *Journal of Agricultural Education*, 45(4), 106–117. <https://doi.org/10.5032/jae.2004.04106>
- Phipps, L. J., Osborne, E. W., Dyer, J. E., & Ball, A. (2008). *Handbook on agricultural education in public schools*. Thompson Delmar Learning.
- Piaget, J. (1952). *The origins of intelligence in children*. International Universities Press.
- Rothenberger, B. H., & Stewart, B. R. (1995). A greenhouse laboratory experience effects on student knowledge and attitude. *Journal of Agricultural Education*, 36(1), 24–30. <https://doi.org/10.5032/jae.1995.01024>
- Rubenstein, E., Copenheaver, C. A., & Peake, J. B. (2020). Improving forestry secondary education: Identifying teachers' needs. *Advancements in Agricultural Development*, 1(3), 81–94. <https://doi.org/10.37433/aad.v1i3.71>
- Shoulders, C. W., & Myers, B. E. (2012). Teachers' use of agricultural laboratories in secondary agricultural education. *Journal of Agricultural Education*, 53(2), 124–138. <https://doi.org/10.5032/jae.2012.02124>
- Twenter, J. P., & Edwards, M. C. (2017). Facilities in school-based, agricultural education (SBAE): A historical inquiry. *Journal of Agricultural Education*, 58(3), 275–292. <https://doi.org/10.5032/jae.2017.03275>
- Willems, P. P., & Gonzalez-DeHass, A. R. (2012). School-community partnerships: Using authentic contexts to academically motivate students. *School Community Journal*, 22, 9–30. <https://www.adi.org/journal/2012fw/WillemsDeHassFall2012.pdf>

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