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Examining U.S. Military Veteran Farmers' Learning Needs Relevant to Agricultural Education

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Abstract

Despite growing recognition of military veterans' involvement in agriculture, much of the existing literature emphasized the therapeutic and mental health benefits of farming, rather than veterans' educational needs as agricultural producers. As the United States (U.S.) faces a critical labor shortage in agriculture, understanding the learning preferences and content needs of veteran farmers is essential to support their successful integration into the food production system. Addressing this gap can help educational institutions and policymakers develop targeted programs that equip veterans with the technical and business skills necessary to contribute meaningfully to agricultural productivity. This study, part of a larger research project, applied self-directed learning (SDL) theory to describe military veterans who engage in agricultural education through nonformal learning environments. Previous SDL research typically focused on formal higher education using qualitative methods; however, this study employed a quantitative approach to collect data. A survey instrument, adapted from academic and governmental sources, was distributed through nonprofit organizations supporting veteran farmers. Results revealed significant associations between age and preferred educational delivery methods, including formal and experiential learning formats, as well as technology modalities such as asynchronous learning, static videos, podcasts, chat threads, and open educational resources. This study provides recommendations that agricultural education program leaders can implement to reach this audience and meet their continued education needs.

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Introduction and Problem Statement

Starting 2018, United States Department of Agriculture (USDA) allocated federal funding to educational outreach programs supporting military veterans entering agriculture, recognizing this group as a vulnerable population with distinct needs (USDA Natural Resources Conservation Service, n.d.). Many such programs emphasize the therapeutic benefits of agricultural engagement, noting positive effects on veterans' mental health, including reduced symptoms of post-traumatic stress disorder (PTSD), depression, and anxiety (Davenport et al., 2020). While valuable, this therapeutic focus often overshadows veterans' potential to develop agricultural production capacity through targeted education, representing a missed opportunity to facilitate their transition from farming as therapy to economically sustainable livelihoods.

Self-directed learning (SDL) theory, which highlights learners' autonomy, motivation, and responsibility for their learning, has long guided adult education research (Garrison, 1997; Knowles, 1975). However, most SDL studies have focused on formal higher education settings and relied heavily on qualitative approaches (Lizier et al., 2018; Mayombe, 2025). Consequently, little is known about how SDL operates within nonformal contexts such as agricultural training programs for adult learners. Understanding learner characteristics is essential to contextualize self-directed behavior and inform effective program design (Merriam & Bierema, 2014).

Identifying veteran farmers' learning preferences, including content areas, instructional formats, and delivery methods, provides a necessary empirical basis for developing evidence-informed agricultural education and outreach programs. These insights can advance research, guide program design, and enhance veterans' personal growth and economic viability as agricultural producers, particularly within underexamined populations and emerging fields (Boote & Beile, 2005).

Theoretical and Conceptual Framework

Self-directed learning (SDL) theory has been a cornerstone of adult education, shaping contemporary approaches to curriculum design, instructional delivery, and learner autonomy. Knowles (1975) defined SDL as a process in which individuals take the initiative, with or without external assistance, to diagnose their learning needs, set goals, identify resources, select strategies, and evaluate outcomes. This framework marked a shift from instructor-centered models toward learner-centered paradigms that emphasize autonomy, motivation, and responsibility in learning (Garrison, 1997; Merriam & Bierema, 2014).

SDL has become increasingly relevant in nonformal adult education as technological innovation expands access to flexible, learner-driven opportunities beyond traditional classrooms (Merriam et al., 2007). In these environments, adults engage in self-managed learning by determining what, how, and when they learn. For educators and program designers, understanding learner preferences, such as favored content areas, instructional formats, and

delivery methods, offers valuable insight into how individuals engage with and regulate their learning processes (Lounsbury et al., 2009). Research has demonstrated that when learners' preferences are considered in instructional design, they exhibit greater motivation, persistence, and application of knowledge, which are central tenets of SDL (Lounsbury et al., 2009; Panadero, 2017).

Despite its longstanding influence, most SDL research has been conducted in formal higher education settings and has relied heavily on qualitative methods (Finn et al., 2025; Murad et al., 2010; Murad & Varkey, 2008). Consequently, quantitative studies examining SDL within nonformal learning contexts remain limited. Extending SDL into applied fields such as agricultural education allows for the empirical measurement of learner characteristics and preferences, thereby aligning educational interventions with learners' actual needs and readiness. Quantitative assessments can also offer generalizable findings that inform the design of scalable, evidence-based outreach programs.

Emerging research has been applying SDL principles to agricultural extension and adult education. Studies indicate that incorporating learner preferences into program design, such as hands-on instruction, peer-based learning (Franz et al., 2010) or online modules enhances engagement and self-regulation. Tremblay and Associates (2021) similarly found that farmers participating in self-paced, customizable training reported higher satisfaction and greater adoption of new practices. These findings underscore the utility of SDL in agricultural learning environments, where adult learners often balance diverse motivations, prior experiences, and learning goals.

The SDL framework is particularly applicable to military veterans transitioning into agriculture. This population possesses unique experiences, and learning needs distinct from those of traditional farmers shaped by military structure, discipline, and service-related challenges. Applying SDL principles to veteran-focused agricultural education supports the design of programs that respect learners' autonomy while accommodating diverse skill levels and preferred learning modes. By extending SDL into this under-researched context, educators and policymakers can develop responsive, evidence-based programs that foster both the personal growth and economic success of veteran farmers.

Purpose

The purpose of this study was to describe how military veteran adult learners actively seek nonformal agricultural education to maximize their agricultural production potential. The research objectives were to:

1. Describe respondents' highest level of formal education
2. Identify preferred methods of educational delivery and educational technology modalities
3. Determine agricultural topics of greatest learning interest
4. Analyze relationships between age, education level, and preferred educational delivery methods,

5. Analyze relationships between age, education level, and preferred educational technology modalities.

Methods

This study is part of a larger research project. The methods section is condensed and refers readers to the supplementary study (Weiler et al., 2026) to reduce redundancy and allow space for discussion relevant to veteran farmers' learning preferences. The study employed a quantitative, cross-sectional survey design to describe the learning characteristics of military veterans involved in nonformal agricultural education. Cross-sectional surveys are well-suited for capturing participants' beliefs and behaviors at a single point in time (Fraenkel et al., 2019). This design was chosen for its efficiency, cost-effectiveness, and suitability for descriptive research, as it does not require follow-up and accommodates convenience sampling (Wang & Cheng, 2020). The survey was distributed electronically via email due to the logistical advantages of online delivery, including broad reach, reduced cost, and ease of use (Story & Tait, 2019). The survey was designed and distributed using Qualtrics software. IRB approval was obtained before recruitment or data collection began.

The instrument items were adapted from previous sources (Iles et al., 2023; United States Department of Agriculture National Agricultural Statistics Service [USDA NASS] Census of Agriculture, 2022) to capture agricultural production, land use, and military service background, and learning preferences of veteran farmers. The instrument was pilot tested at the 2024 Farmer Veteran Coalition Conference and revisions were made to improve clarity, usability, and data consistency. Closed-ended questions, neutral wording, and randomized item order were used to reduce fatigue and response bias. Because most variables were nominal or ordinal, Cronbach's alpha was not appropriate; instead, revisions focused on improving construct alignment and minimizing measurement error. Face, content, and construct validity were supported through expert review, alignment with prior instruments, and feedback from veteran outreach organizations who deliver agricultural education. Limitations of this study include a nonrepresentative sample, potential survey fatigue, the cross-sectional design, and anonymous data collection that prevented follow-up.

Data were analyzed using the IBM SPSS Statistics software package. Descriptive statistics, specifically frequencies and percentages, were calculated to summarize respondent characteristics. Cross-tabulation analyses were conducted to examine relationships among categorical variables. Chi-square tests of independence were performed to interpret whether statistically significant associations existed between variables. The strength of significant associations was evaluated using Cramer's V and interpreted according to Rea and Parker's (1992) guidelines.

Target Population & Sampling

The study targeted U.S. military veterans engaged in agricultural education through nonformal programs. Weiler et al. (2026) provide additional details regarding respondents' military and agricultural characteristics. Respondents were primarily male (f = 405, 78.94%). The largest

proportion of respondents (*f* = 160, 31.18%) were between 45-54 years of age (see Table 1). Age categories with low response frequencies were combined to ensure adequate cell sizes to meet the assumptions of the chi-square test of independence.

Table 1

Summary of Veteran Farmers' Age Categories (N =513)

Age	*f*	%
18-34 years	85	16.56
35-44 years	139	27.09
45-54 years	160	31.18
55-64 years	106	20.66
65 years or older	22	4.28

Findings

Table 2 presents the respondents' highest level of education completed. Most of the respondents (*f* = 213; 41.52%) indicated they received a minimum of a bachelor's degree while the next largest representation (*f* =131; 25.53%) advanced to obtain graduate or professional degrees.

Table 2

Veteran Farmers' Highest Completed Education Level (N =513)

	f	%
Some High School	5	0.97
High School or GED	42	8.18
Some Higher Education, No Degree	60	11.69
Vocational or Associate's Degree	60	11.69
Bachelor's Degree	213	41.52
Graduate or Professional Degree	131	25.53
Prefer Not to Say	1	0.42

Respondents were asked to consider how they prefer to learn with several options; they could select all that apply. The provided educational delivery options were online synchronous, online asynchronous, experiential, community-based, and formal learning. Most of respondents preferred online synchronous delivery (*f* = 331; 64.52%), followed by field training or experiential learning (*f* = 290; 56.53%), and online asynchronous (*f* = 262; 51.07%). Fewer participants preferred learning in community-based environments (*f* = 229, 44.63%) or formal settings (*f* = 114, 22.22%).

Respondents were then asked about the specific technology-based learning resources they use and were asked to select their top five (see Table 3). Online video (*f* = 346; 67.44%), general

browsing (*f* = 310, 60.42%), social media (*f* = 288; 56.14%), live video collaboration (*f* = 260; 50.68%), and open education (*f* = 240; 46.78%) were the top 5 reported modalities. Table 3 presents the respondents' preferred modalities.

Table 3

Veteran Farmers' Top 5 Preferred Educational Technologies (N = 513)

	f	%
Online Video (e.g., YouTube, Vimeo)	346	67.44
General Browsing (e.g., Google, Firefox)	310	60.42
Social Media (e.g., Facebook, Instagram)	288	56.14
Live Video Collaboration (e.g., Zoom, Teams)	260	50.68
Open Education (e.g., MOOCs)	240	46.78
Static Webpage (e.g., websites hosted by private orgs or government)	202	39.37
Chat Threads (e.g., Reditt, Quora, Discourse, StackExchange)	192	37.42
Simulation Tools (e.g., FarmVR, drone flying)	166	32.35
Streaming Audio (e.g., Audible, podcasts)	157	30.60
Digital Texts (e.g., Kindle, Goodreads)	92	17.93
Databases with third-party links (e.g., Slashdot)	39	7.60
Other technology not listed	10	1.9
No Technology	10	1.9

Note. Respondents were able to select five choices. Total does not equal 100%.

Table 4 displays the educational topics respondents reported were the most important to learn; they were asked to select their top five. The most frequently reported topics were: Local, state, federal programs that assist military veterans to start, operate, and sustain a farm (*f* = 355; 69.20%); Access to land acquisition and financial resources (*f* = 245; 47.75%); Access to labor issues (*f* = 234; 45.61%); Access to farm equipment (*f* = 231; 45.02%); Marketing strategies (*f* = 225; 43.85%); and Business management practices (*f* = 222; 43.27%).

Table 4

Veteran Farmers' Top 5 Preferred Agricultural Educational Topics (N =513)

Educational Topics	*f*	%
Local, state, federal programs that assist military veterans to start, operate, and sustain a farm	355	69.20
Access to land acquisition and financial resources	245	47.75
Access to labor issues	234	45.61
Access to farm equipment	231	45.02
Marketing strategies	225	43.85
Business management practices	222	43.27
Environmentally sustainable farming practices	204	39.76
Local, state, federal programs that assist beginning farmers to start, operate, and sustain a farm	182	35.47
Local and state regulations and rules about farming	165	32.16
Resources for disabled veterans	136	26.51
Networks for farmers	127	24.75
Other, topic not listed	6	1.16

Note. Respondents were able to select 5 topics. Total does not equal 100%.

Table 5 presents the results of Chi-square analyses examining the association between educational attainment and preferred educational delivery methods. To meet the assumptions of the Chi-square test, categories with low responses were removed from analysis (i.e., Less than High School, and Prefer not to Respond), resulting in 506 responses for relationships between education and preferred educational delivery and 511 for age and preferred technologies.

Table 5

Relationship Between Education Level, Age, and Preferred Educational Delivery

Variable Pair	χ^2	df	p	V	Magnitude
Education Level (*n* = 506)					
Education × Asynchronous	62.63	4	.01	0.35	Strong
Education × Experiential	23.51	4	.01	0.22	Moderate
Education × Synchronous	18.91	4	.01	0.19	Weak
Education × Community	14.11	4	.01	0.17	Weak
Age Category (*n* = 511)					
Age × Experiential	82.24	4	.01	0.40	Very Strong
Age × Asynchronous	63.11	4	.01	0.35	Strong
Age × Synchronous	40.64	4	.01	0.28	Moderate
Age × Community	31.27	4	.01	0.25	Moderate

Note. Magnitude of association interpreted using Rea and Parker (1992): 0.00 to < .10 = negligible; .10 to < .20 = weak; .20 to < .40 = moderate; .40 to < .60 = relatively strong; .60 to < .80 = strong; .80 to 1.00 = very strong.

A chi-square test of independence found statistically significant associations between education level and age category and all the preferred educational delivery methods. A statistically significant association between the education level category and preference for asynchronous online learning, $\chi^2(4, n = 506) = 62.63$, $p = 0.01$, with a strong association ($V = 0.35$). Education level also had a statistically significant association with experiential learning, $\chi^2(4, n = 506) = 23.51$, $p = 0.01$, with a moderate association ($V = 0.22$).

As Table 5 displays, age had a statistically significant association with asynchronous online learning, $\chi^2(4, n = 511) = 63.11$, $p = 0.01$, with a moderate association ($V = 0.35$). Age was also had a statistically significant association with experiential learning, $\chi^2(4, n = 511) = 82.24$, $p = 0.01$, with a very strong association ($V = 0.40$).

Table 6 presents the results of chi-square analyses examining the relationships between education level and educational technologies. To meet the assumptions of the Chi-square test, categories with low responses were removed from analysis (i.e., Less than High School and Prefer not to Respond). A chi-square test of independence found statistically a significant association between education level and preference for social media, $\chi^2(4, n = 506) = 19.59$, $p = 0.01$, with a weak association ($V = 0.20$). A statistically significant association was also found between education level and preference for podcasts, $\chi^2(4, n = 506) = 34.23$, $p = 0.01$, with a moderate association ($V = 0.26$).

Table 6

Relationship Between Veteran Farmers' Education Level and Preferred Educational Technologies

	X^2	*df*	*p*	*V*	Magnitude
Podcasts	34.23	4	0.01	0.26	Moderate
Digital Textbooks	29.20	4	0.01	0.24	Moderate
Social Media	19.59	4	0.01	0.20	Weak
Static Website	16.91	4	0.01	0.18	Weak
General Internet Browsing	16.76	4	0.01	0.18	Weak
Open Educational Sources	16.08	4	0.01	0.18	Weak
Virtual Simulation	14.46	4	0.01	0.16	Weak
Chat Threads	10.39	4	0.03	0.14	Weak
Live Video	7.54	4	0.11	0.12	Not significant
Database with 3rd Party Links (Slashdot)	6.24	4	0.18	0.11	Not significant
Static Video	5.48	4	0.24	0.10	Not significant
No Technology	1.70	4	0.79	0.06	Not significant

Note. Magnitude of association interpreted using Rea and Parker (1992): 0.00 to < .10 = negligible; .10 to < .20 = weak; .20 to < .40 = moderate; .40 to < .60 = relatively strong; .60 to < .80 = strong; .80 to 1.00 = very strong.

Conclusions, Discussion, and Recommendations

Historically, self-directed learning (SDL) research has emphasized formal education environments, often neglecting the relevance of non-institutional learning for diverse populations (Garrison, 1997; Stockdale & Brockett, 2011). However, this study's findings reinforce the growing importance of online learning among adult learners, particularly veteran farmers (Besterman-Dahan et al., 2018). In terms of challenges veteran farmers face in their operations, Weiler et al. (2026) found finding enough time was the top challenge.

Distance education offers valuable solutions to the economic, temporal, and logistical constraints many adult learners face (Garrison, 1997; Lin, 2023). The USDA provided feedback about the results of the study and expressed an interest in the participants' willingness to embrace technology in their learning because it allows for a wider reach that is cost effective. Aviv et al. (2003) noted that asynchronous learning formats can include features such as online discussion boards, transcript-embedded media, and peer collaboration, all of which enhance learner engagement. For farmers whose schedules are often inflexible, asynchronous learning provides the autonomy necessary for self-directed learning (Lin & Gao, 2020), enabling them to participate without sacrificing other responsibilities.

As education level changed, so too did respondents' preference for asynchronous learning, potentially due to the time constraints they reported (Weiler et al., 2026). Collaborative and community-driven learning approaches remained popular despite underscoring a continued appreciation for hybrid formats that blend in-person and distance education. Clarifying which topics are best suited to each delivery mode can enhance the design of veteran-focused agricultural training. Consistent with prior literature, this study found that farmers value training not only in technical skills but also in financial and risk management (Kilpatrick, 2008). The respondents' top five topics of interest emphasized access to information and marketing resources, suggesting a dual focus on production and business acumen.

Technology represents a critical resource to support self-directed learning (SDL) in adult education (Siemens, 2005). Participants identified their five preferred educational technology modalities as online video platforms (e.g., YouTube and Vimeo), general web browsing (e.g., Google and Firefox), social media platforms (e.g., Facebook and Instagram), live video collaboration tools (e.g., Zoom and Microsoft Teams), and open educational resources (e.g., MOOCs). These findings suggest participants favored flexible, low-cost, and easily accessible digital learning environments that support independent information seeking and asynchronous learning.

Chi-square analyses indicated that age and education level was associated with the use of several educational technology modalities (e.g., static video, podcasts, chat threads, open educational resources, and static websites). These statistically significant relationships suggest that technology preferences differ across educational level and age groups, indicating that adult learners are not a homogeneous population with respect to digital learning choices. Specifically,

variation in educational technology selection may reflect generational differences in familiarity, comfort, or perceived usefulness of specific technologies for learning purposes. While correlations can suggest associations, they do not establish causation, and findings are limited by the adequacy of the sample (Wang & Cheng, 2020). Collectively, the findings imply that educational programming should incorporate multiple technology formats to accommodate educational backgrounds and age-related differences in learning preferences and to enhance accessibility and engagement among diverse adult learner populations.

Despite these insights, there is a notable lack of research regarding the unique structural barriers that small-scale and veteran farmers face, particularly in the U.S. market that should be considered in program design. While Carlisle et al. (2019) and Weiler et al. (2026) discussed challenges related to accessing land, labor, and capital, identifying these barriers remains an under-researched area. Because veteran farmers reported facing equipment access issues (Weiler et al. 2026), they may also face exclusion from essential loan programs because farm equipment is often required as collateral for farm loans. This issue warrants targeted investigation to promote equitable access to agricultural resources and pathways to farm ownership.

As more veterans transition into agricultural careers, understanding their learning preferences, content priorities, and delivery needs is essential for program effectiveness. Conducting learning needs assessments is critical to refining educational content and delivery (Donoghue et al., 2014), particularly when targeting specific groups such as veteran farmers. Such assessments can identify priority topics and align them with preferred delivery methods (Daffron & Caffarella, 2021). By tailoring educational strategies to the needs of veteran farmers, this research contributes to a broader effort to diversify and strengthen the agricultural workforce by empowering a highly motivated but underrepresented population segment.

This study employed a convenience sample, which limits the generalizability of its findings, which should be addressed in future research using more representative sampling methods. Nonetheless, the descriptive and inferential data presented here provide initial insights that may inform policymakers, educators, and program developers regarding funding allocation, curriculum development, and program recruitment strategies tailored for veteran farmers.

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