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An Exploration of Learning and Teaching Methods in Agricultural Extension

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Abstract. The Train-the-Trainer approach is widely used in Cooperative Extension education to efficiently disseminate research-based information to many clientele groups, including farmers. This paper compares the traditional Train-the-Trainer model to a comprehensive Collaborative Train-the-Trainer model and discusses weaknesses of the traditional model that are addressed in the Collaborative model. Sources of information used by farmers (growers) and overall effectiveness were measured through a survey instrument created and distributed to farmers in South and North Carolina. The Collaborative Train-the-Trainer model, which emphasizes peer-to-peer interaction and feedback loops, represents an enhanced approach for conceptualizing and implementing Extension educational programs.

INTRODUCTION

Cooperative Extension (CE) programs disseminate technologies and knowledge to farmers/growers through a variety of techniques, including training programs (virtual or in person), demonstrations at field days, workshops and trade association conferences, articles in technical bulletins and trade journals, and remote or on-site consultations (Franz et al., 2009).

CE programs commonly use the train-the-trainer model to communicate methods and techniques to growers (Piñero et al., 2018). This method is generally characterized as following a top-down approach, where researchers generate new information and technologies through scientific experiments, state Extension specialists learn about this new information, and then they pass it on to county and regional Extension agents or crop consultants, who distill this information and provide technical advice directly to growers (see Figure 1).

Since their inception, CE services have used info-centric research-based education programs that emphasize the transfer of knowledge and technology in one direction, from the source of the expertise to the growers (Kellogg Commission on the Future of State and Land-Grant Universities, 1999). The train-the-trainer approach has been instituted because it "creates a multiplier effect, expanding the overall impacts of the program to reach greater numbers of people" (Skelton & Josiah, 2003). It is typically seen as a cost-effective way to leverage program impact. This model can be enhanced by considering the communication "as a two-way or multiple-way process, in which several parties can be expected to contribute relevant insights, and which may have action implications for all parties (not only farmers, but also researchers, extensionists, policy makers, agricultural industries, etc.) involved in the process" (Leeuwis, 2004, p. 26).

Collaborative learning refers to a model where people with varied knowledge, perspectives on an issue, or capabilities work in small groups to reach a specific learning goal (Restrepo et al., 2014). "The learners are responsible for one another's learning as well as their own. Thus, the success of one learner helps other students to be successful" (Laal & Ghodsi, 2011, p. 2). Collaborative learning provides immense benefits for learners, including developing a learning community, building a diverse understanding among students and teachers, and promoting critical-thinking and problem-solving skills.

The collaborative model (see Figure 2) was developed to depict the preferred flow of information, including feedback vectors among all parties, encompassing peer-to-peer communication of growers and feedback loops that allow all parties to share their knowledge and experiences. The value of two-way knowledge transfer over the traditional top-down one-way-flow approach provides engaged partnerships with

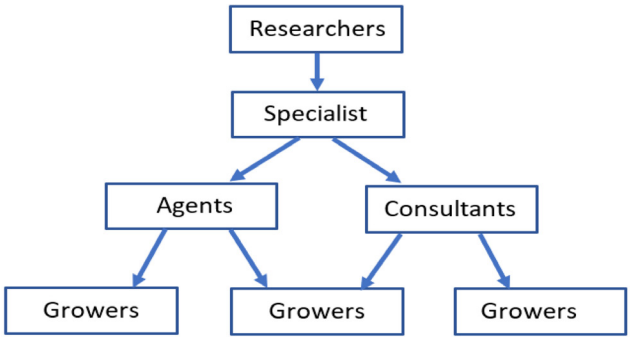

Figure 1. Traditional train-the-trainer model (arrows indicate flow of knowledge).

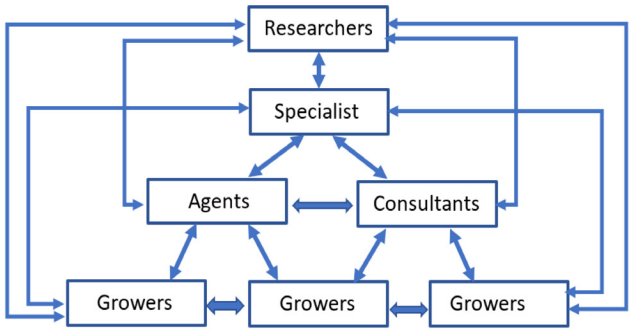

Figure 2. Proposed collaborative train-the-trainer model. Arrows indicate knowledge transfer.

"mutual respect among the partners for what each brings to the table" (Kellogg Commission on the Future of State and Land-Grant Universities, 1999, p. 27).

Information is generated by all levels in the collaborative train-the-trainer model, which integrates "knowledge production, adaptation, advice and education" (Poppe, 2012). In this model, growers have greater opportunities to communicate with researchers, specialists, agents, crop consultants, and their fellow growers. Additionally, agents and consultants have opportunities to interact with researchers. Researchers and specialists share their expertise with growers but should recognize that growers bring experience-based expertise to the discussion. The various groups develop better strategies when working together as peers (Stuiver et al., 2004). The collaborative model likely better recognizes a more complete reality of communication patterns that could potentially, and might already, exist.

These opportunities allow researchers and specialists to learn what issues need further research or training and how effective their solutions or recommendations are when applied in the field. Integration of growers with researchers gives the growers greater ownership of the solutions. These communication opportunities provide more efficient feedback and allow for issues to be resolved more effectively. The train-the-trainer approach is widely used, but there is little supporting literature on its effectiveness in leading to changes of behavior in terms of decision-making (Piñero et al., 2018). The effectiveness of the model varies and is likely correlated with quality design, skillful implementation, and the agent's two-way communication skills (Gott & Coyle, 2019).

This study aimed to expand on South Carolina grower perceptions of the Extension information systems designed to support them in their decision-making process. The purpose was to explore the sources of information used by growers and their relative importance in their decision-making process for management techniques. Specifically, three research questions guided this study:

1. What makes growers' level of trust and confidence in agents, crop consultants, and other farmers different?
2. Who is influencing farmers the most?
3. What are farmers' preferred learning techniques?

METHODOLOGY

This nonexperimental survey research design (Privitera, 2020) was used to implement a researcher-developed grower survey, which was distributed via Qualtrics as a pilot study to validate the survey instrument and the collaborative train-the trainer model. Ten questions were designed to obtain responses to the issues of grower information systems and the issues in the train-the-trainer model (i.e., 10 content questions and seven demographic questions). The survey was evaluated for face and content validity (Privitera, 2020) and was approved by the Clemson University Institutional Review Board.

The target population was growers in South and North Carolina. An accessible population (Privitera, 2020) was surveyed by using an email frame of four farming organizations: the South Carolina Specialty Crop Growers Association, the South Carolina New and Beginning Farmer Program, the Carolina Farm Stewardship Association (members from North and South Carolina), and the South Carolina chapter of the Farmer Veterans Coalition. All of their members were asked to participate in the survey, so for any member who was in more than one of these organizations, there was the potential for overlap. Because of this possible overlap, the survey asked these members to only submit their responses once. After the initial request to participate, three follow-up notices were sent, following the tailored-design method (Dillman, Smyth, & Christian, 2014). Despite these efforts, only 18 surveys were attempted, and only 16 were fully com-

Table 1. Survey Demographic Summary

Demographics		*f*
Gender	Male	11
	Female	4
	Non-binary	1
Highest level of education	4-year college	9
	2-year college	3
	Graduate degree	2
	Ph.D.	1
	High school	0
	Middle school	0
	Elementary school	1
	No formal education	0
Years of grower experience	0–1 year	5
	2–4 years	4
	5–10 years	2
	16+ years	5
Acres worked	1–49 acres	10
	50–99 acres	1
	200–499 acres	2
	500–999 acres	1
	1,000+ acres	2
State	South Carolina	15
	North Carolina	1
Professional membership		14
	Carolina Farm Stewardship Association	
	South Carolina New and Beginning Farmer Program	8
	South Carolina Specialty Crop Growers Association	
	Farmer Veterans Coalition (SC)	7
		1
Primary farming practice	Organic	7
	Conventional	4
	Sustainable	4

pleted. Although the sample size was relatively small, the information gathered is still worthy of reporting.

The farmers who completed the survey represented a wide range of farm sizes and crops. The respondents were from counties across South and North Carolina. The demographic characteristics of the survey participants are reported in Table 1.

FINDINGS

Farmers' level of trust/confidence toward other farmers regarding pest and disease advice was evaluated based on a 10-point Likert-scale question (with 10 indicating complete trust/confidence and 1 indicating no trust/confidence). Table 2 provides the mean and standard deviation for the trust/confidence in Extension agents, farmers, farm consultants, and agricultural product representatives.

In addition to trust/confidence in different sources, farmers were also asked about their communication with agents and consultants. Table 3 displays farmers' perception of the communication skills of Extension agents and consultants. The majority of respondents (n = 11) believed that they were definitely able to understand everything and apply it when communicating with Extension agents, but some commonly (n = 8) understood only some of what consultants communicated, as there was too much information to grasp (see Table 3).

Table 2. Farmers' Level of Trust/Confidence in Different Sources for Pest and Disease Advice

Source for advice	Mean	Std. deviation
Extension agents	8.22	1.99
Other farmers	7.17	2.59
Farm consultants	6.38	1.93
Agricultural product representatives	4.31	2.26

Table 3. Communication Skills of Extension Agents and Consultants

Communication	Specific item	*f* (%)
When seeking information from agents, do you feel they communicate information clearly and simply enough to understand?	Definitely yes, I was able to understand everything and apply it.	11 (68.75)
	I understood some, but there was way too much for me to grasp it all.	5 (31.25)
	I struggled to understand.	0
	I didn't understand anything.	0
When seeking information from consultants, do you feel they communicate information clearly and simply enough to understand?	Definitely yes, I was able to understand everything and apply it.	5 (31.25)
	I understood some, but there was way too much for me to grasp it all.	9 (56.25)
	I struggled to understand.	2 (12.50)
	I didn't understand anything.	0

When farmers were asked about the qualities they looked for in an agent/consultant, they responded with a variety of descriptions. One farmer wanted an agent who understood their operation and could explain things to them in layman's terms. Another was interested in someone who did not mind a lot of questions, was personable, and knew them on a first-name basis. Others preferred a consultant with whom they had lunch once every 6 months. Regardless, regular email communication and a willingness to make regular farm visits to provide advice based on specific needs were essential. To further understand the relationship between farmers, Extension agents, and consultants, farmers overarchingly felt confident (75%) in the Extension agent as a resource, although 52% of farmers reported little to no confidence in their crop consultant.

The second research question aimed to determine who was influencing the decision-making of farmers. Participants in this study most commonly (45%) reported asking other farmers for advice one to two times per year. The most influential people when making operational decisions were Extension agents (45%), followed by grower organizations (33%), and then other farmers (17%).

The final research question assessed farmers' preferred learning techniques by asking participants to rank four different learning techniques on a scale of 1 to 4 (i.e., 1 = least preferred, 4 = most preferred). The most preferred technique (mean = 3.25) was the top-down approach (see Table 4).

In addition to their learning preference, farmers were asked where they would spend money ($100) related to learning. A collaborative learning environment with other growers led by Extension agents received the highest mean dollar amount of $42.00, followed by hands-on learning ($30.27), online learning ($4.02), and casual discussion ($1.83). Table 5 outlines farmers' willingness to spend money on learning techniques.

CONCLUSIONS

The purpose of this study was to explore the sources of information used by growers and their relative importance in their decision-making process for management techniques. The study resulted in a variety of reported information exchange channels, which aligns with the developed collaborative train-the-trainer model (see Figure 2). Although growers valued information from other growers, their preferred information source was Extension agents. Additionally, growers reported a variety of preferred methods of gaining information but generally preferred agent-led teaching methods that

Table 4. Farmers' Preferred Learning Techniques

Preferred learning technique	Mean	Std. deviation
Top-down approach: e.g., classroom setting with lecturer	3.25	0.75
Self-paced learning: learner controls amount they want to learn at any given time	2.94	0.97
In a collaborative learning environment: learning through the use of a group	2.00	0.94
Observation learning: learning through watching others	1.81	1.07

Note. The range for preferred learning techniques was a scale of 1 to 4, where 1 indicated "least preferred" and 4 indicated "most preferred."

Table 5. Farmers' Willingness to Spend Money on Learning Techniques

Learning techniques	Mean	Std. deviation
Collaborative learning environment with other growers led by Extension agents	42.00	31.62
Hands-on learning technique	30.27	28.10
One-on-one direct technical assistance from Extension agents	23.83	25.72
Collaborative learning environment with other growers led by agricultural consultants	22.84	25.36
Field day	16.71	24.27
Demonstrations	15.77	16/37
Farm visits	14.58	12.95
One-on-one direct technical assistance from agricultural consultants	12.42	18.41
One-on-one meeting	10.58	24.42
Online learning	4.02	7.89
Casual discussion	1.83	4.15

Note. Farmers were allotted $100 to spend on their preferred learning techniques.

included hands-on experiences. These findings align with the CE in Land-Grant Universities role, which was established to facilitate the information flow to growers. The collaborative train-the-trainer model depicts information flow in multiple directions, which aligns with the findings of this study, as the preferred information exchange was between agents and growers. This relationship makes sense, as Extension agents typically are more connected to the growers than are researchers and specialists, although both of those experts also serve as key information sources for the agents.

Growers reported a high level of confidence in Extension agents, seeing them as valuable and trusted sources of information. Specifically, growers reported their ability to trust and understand the information provided by Extension agents, making them the most influential people in the decision-making process. Similarly, growers trusted other growers but did not reach out for advice from them as often as they would an Extension agent. The same could not be concluded about consultants in this study, as growers reported a lack of confidence in and an unlikeliness to reach out to consultants for information.

In addition to reaching out to Extension agents for advice, growers also preferred learning from the agents in a collaborative group environment with other growers (see Table 5). This method was preferred in a classroom workshop-type setting, where the Extension agent was the expert delivering essential content, but likely also playing a facilitating role. Considering the findings and conclusions of this study, Figure 3 depicts an updated collaborative train-the-trainer model that is recommended for use by Extension agents as they work with growers.

The updated train-the-trainer model has been validated through the data collection in this study; thus, the use of consultants within the complete model has been removed. Additionally, the dashed lines between researchers and growers and specialists and growers have not been validated within this study and need to be further explored. The primary interaction happens between agents and growers, followed by grower-to-grower interactions, and then the

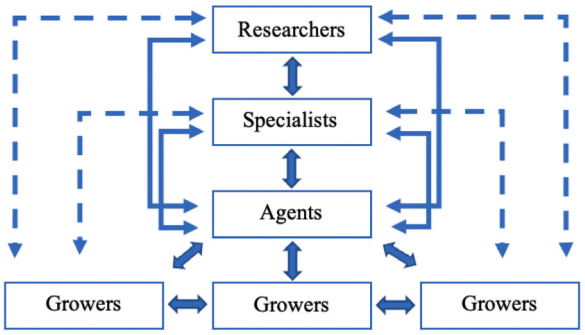

Figure 3. Collaborative train-the-trainer model.

occasional researcher or specialist interaction with the growers, although the information from the researchers and specialists flows through the agents to the growers.

DISCUSSION AND RECOMMENDATIONS

Growers indicated that they had a high level of confidence in other growers but that they had not, themselves, provided much advice to other growers. This circumstance could potentially be because there were only a few growers in each community whom growers trusted for advice and/or because many of the respondents were new farmers, which led to the low frequency of grower-to-grower interactions. Future research should consider ways to increase peer-to-peer interactions and how these could be fostered or enhanced with the help of the Extension system. Additionally, moving beyond this pilot study would expand the scope of growers to further understand the grower-to-grower interaction/relationship. The traditional train-the-trainer model recognizes the top-down information flow but does not recognize the importance of peer-to-peer or grower-to-grower interactions. Extension programs could be enhanced by strengthening the grower-to-grower relationships and building a grower community that allowed for open exchanges of information under the leadership or organization of an Extension agent, a component of the collaborative train-the-trainer model. This could be accomplished by state Extension programs organizing and facilitating peer-to-peer interactions among growers.

The proposed collaborative learning/training model includes interactions between researchers, specialists, agents, and growers. This pilot survey of growers explored only the relationships of growers with agents and consultants. Surveys or other means of gathering information from researchers, specialists, agents, and growers are necessary to help further validate the efficacy of the collaborative train-the-trainer model. This model's design includes direct information flows between each level and peer-to-peer information flows at all levels. Surveys at each level focused on the information flows of the collaborative train-the-trainer model would provide additional data to determine which processes in the model were or were not happening and which were most critical to growers' success.

This pilot study was limited by the low number of responses; therefore, its findings should be considered provisional. This survey could be replicated with other farming organizations, including repeated follow-ups to obtain more responses. Additionally, other survey instruments could be developed to further explore growers' interactions with agents, specialists, and other growers.

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