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South Carolina Master Naturalist Program Evaluation: A Mixed Methods Approach

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Abstract. The South Carolina Master Naturalist Program provides nature-based education to citizen volunteers who will promote environmental stewardship and is offered at six host sites across the state. We conducted a mixed-methods evaluation (the integration of qualitative and quantitative data) of the South Carolina Master Naturalist Program. Overall, the South Carolina Master Naturalist Program is achieving its mission but there were some differences between host sites. We identified where there were differences and why those differences may exist. We make recommendations to help strengthen the program across all host sites in the areas of program fidelity, delivery, and administration.

INTRODUCTION

Cooperative Extension Services across the country have programs that enjoy longevity and popularity, such as the Master Naturalist Program. However, longevity does not necessarily imply effectiveness or positive impact, and program evaluation is necessary to provide evidence of these attributes (Newcomer et al., 2015; Rossi et al., 2019).

Many evaluations focus only on whether a program is fulfilling its mission or participant satisfaction (e.g., Patton, 2008; Stufflebeam, 2013). However, understanding where and why program differences exist is important to program improvement (Goodrick & Rogers, 2015). The South Carolina Master Naturalist (SCMN) Program provides nature-based education that inspires citizen volunteers to promote environmental stewardship within their community. We conducted a mixed-methods evaluation, which integrates qualitative and quantitative data, of the SCMN Program to identify differences in learning and service outcomes and why those differences exist. We also wanted to gauge long-term impacts of the program and determine whether it was fulfilling its mission. The questions we were trying to answer were as follows:

1. Are SCMN participants satisfied with their experience?
2. Are the host sites around the state equally effective in training SCMN participants by using their current process?
3. Is the SCMN Program achieving its stated vision, mission, and goals?

LITERATURE REVIEW

The Master Naturalist Program was first introduced in Texas in 1998, and since that time, other states have initiated their own versions of the program (Main, 2004; Savanick & Blair, 2005). Some states have conducted needs assessment prior to initiating or for improving Master Naturalist Programs (e.g., Larese-Casanova, 2018; Savanick & Blair, 2005), and other states have conducted evaluations to determine program outcomes, impacts, and participant satisfaction at the state level (e.g., Broun et al., 2009; Cunningham et al., 2021; Hildreth & Mengak, 2016; Merenlender et al., 2016; Van Den Berg & Dann, 2008). However, these evaluations only measured short-term impacts by using quantitative methods and presented differences in knowledge levels by using pre- and post-tests (e.g., Van Den Berg & Dann, 2008) or formative post-program evaluations (e.g., Broun et al., 2009; Hildreth & Mengak, 2016). An evaluation of the Utah Master Naturalist program focusing on long-term impacts showed that the program continued to influence participants (Larese-Casanova, 2018). However, the study only presented means for item responses at a statewide level and did not explore site-specific differences in responses or potential reasons for those differences (Larese-Casanova, 2018).

Although these types of evaluations are important to maintaining program support, they do not identify

differences in outcomes between host sites and with regards to program fidelity within a statewide program. The use of a mixed-methods approach allows for the integration of quantitative (closed-ended) and qualitative (open-ended) methods to discover where and why any differences in a program may exist (Creswell, 2015). This study fills a gap in the literature by measuring participant satisfaction and program goals achievement but also by seeking to understand why differences exist across host sites in a statewide program.

SC MASTER NATURALIST PROGRAM HISTORY AND IMPLEMENTATION

The SCMN Program was started in 2000, became a statewide program in 2007, and has more than 2,100 graduates as of 2020. The SCMN Program is offered only in person across the state and is overseen by an SCMN state director. SCMN participants are required to complete 22 hours of volunteer service and 8 hours of advanced training (in addition to the initial in-person program) to earn the designation of SCMN graduate.

There are six SCMN host sites; four of the sites offer the program once a year, and two sites offer the program twice a year. A general curriculum must be followed, but each host site has some autonomy in program development and delivery. For example, because each host site is situated within different biogeographical regions of the state, they tailor their programs around the local floral and faunal components. Further, although there is some consistency in general concepts taught, the amount of time per concept varies widely. Also, most host sites conduct post-program evaluations, but they are not consistent across the sites, and results are not always shared with the SCMN state director.

METHODS

A mixed-methods approach was used to answer the evaluation questions. This methodology integrates quantitative and qualitative data to guide the interpretation of results and findings and, thus, draw conclusions. A mixed-methods approach helps identify differences and explain why they may exist. An explanatory sequential mixed-methods design was used to answer the evaluation questions and was divided into three phases (Figure 1; Creswell, 2015). Each phase was guided by previous phases, and the data were integrated to provide evidence for the learning outcomes, determine the impact of the SCMN Program, and explain differences between host sites, if any.

PHASE 1: SCMN EVALUATION PREPARATION

The first phase of the evaluation project involved preparing the SCMN Program to be reviewed. The SCMN state director and the SCMN state advisory board participated in a process to clarify the SCMN Program's vision, mission, and four goals that could be evaluated. Metrics were then developed to measure the success of the SCMN Program for each of the four goals, which were as follows:

1. Goal 1—Training and Education: Engage citizen volunteers through science-based training and place-based, experiential environmental education.
2. Goal 2—Natural Resources Awareness: Promote awareness of natural resources by teaching the geological, ecological, floral, and faunal components of ecosystems.
3. Goal 3—Human Impacts: Foster stewardship of natural systems by connecting ecology and the impacts of humans on the landscape.
4. Goal 4—Community Service: Encourage community servce by providing training on how to protect, preserve, and restore biodiversity through volunteer experiences.

Metrics were also developed to gauge SCMN participants' satisfaction with the program's administration, such as volunteer services/reporting, program costs, and registration (Program Administration).

Surveys had four types of questions: (1) 43 Likert-type ordinal closed-ended questions, (2) 10 Yes/No questions, (3) four check-all-that-apply questions, and (4) three open-ended questions developed to assess program goals and program administration. Likert-type questions are statements presented to a survey respondent that allow them to indicate their degree of agreement/disagreement. Two of the three open-ended questions asked graduates to share (1) how the SCMN Program inspired them to change the way they think about natural resources (Goal 3) and (2) why they did not report volunteer hours to the SCMN state director so community service could be more accurately tracked (Goal 4). The third open-ended question asked graduates to share other comments or suggestions related to the SCMN Program that were not addressed in the evaluation. Finally, there were nine sociodemographic indicator questions.

PHASE 2: SCMN GRADUATE EVALUATIONS AND HOST SITE SURVEYS

The second phase of the project started with cognitive interviews with 11 SCMN graduates to help refine the questions' clarity and wording for the final evaluation instrument (see Appendix A for program administration and sociodemographic items and Appendix B for the final evaluation instrument, arranged by program goal). Cognitive interviews can contribute to the validity and the reliability of an evaluation instrument, thus helping ensure that the evaluation items are measuring the intended construct (DeVellis, 2017).

Figure 1. South Carolina Master Naturalist Program evaluation, mixed-methods design.

The final evaluation instrument was sent to 2,149 SCMN graduates to survey on the state level. The evaluation instrument was developed by following the tailored design method (Dillman et al., 2014) and deployed by using Qualtrics®. An email invited SCMN graduates to participate in the survey, and three reminder emails were sent before the survey was closed. Simultaneously, another Qualtrics® survey was sent to the six host site coordinators, asking for information related to program implementation. We requested syllabi, reading materials, quizzes/tests, number of instructors, and maximum number of students per class. Email reminders with a link to the survey instrument were sent directly to the host site coordinators who had not responded after 2 weeks.

Program R was used to analyze quantitative data and identify any differences between host sites and demographic indicators. The qualitative data from the SCMN graduate evaluation were analyzed by using a conventional content analysis methodology. This type of content analysis does not use preconceived themes but instead allows themes to emerge from the data based on common threads in the responses that provide a higher level of abstraction (Hsieh & Shannon, 2005). The themes were used to help answer the evaluation questions but to also provide complementary evidence to support, or to show divergence from, the results of the quantitative questions (Morgan, 2022).

PHASE 3: SCMN GRADUATE ONE-ON-ONE INTERVIEWS AND SECONDARY DOCUMENT REVIEW

The third phase started once the SCMN graduate evaluation was closed and data were analyzed. SCMN graduates who had completed the SCMN Program at two different host sites were identified and contacted for one-on-one interviews. The SCMN graduates selected for one-on-one interviews had attended the SCMN Program at the host site that had the highest mean score for the evaluation items and the host site that had the lowest mean score for the evaluation items. This choice allowed us to identify the primary reasons for differences in responses. The one-on-one interviews were semistructured. SCMN graduates were asked to describe their experiences at both host sites, their favorite part of the program at both host sites, and their least favorite part of the program at both host sites. The one-on-one interviews were recorded, and responses were analyzed to identify why differences existed between host sites.

The host site documents collected in Phase 1 were also analyzed to help determine differences in program implementation, answer evaluation questions related to program administration and fidelity, and provide a wealth of information without the expense and time of other traditional evaluation methods (Mogalakwe, 2006). Secondary documents were analyzed to determine the amount of time that was dedicated to course concepts; learning tools, such as quizzes and written materials; and experiential activities.

RESULTS, FINDINGS, AND DISCUSSION

Invitations to participate in the SCMN Program evaluation were sent to 2,149 SCMN graduates, and 326 emails bounced, failed, or were not delivered for various reasons. There were 683 responses, for a response rate of 37.4%. SCMN graduates were asked to provide the location of their first SCMN class. Some of the SCMN graduates took the course in multiple locations, so we asked that they respond to the survey based on their experience at their first SCMN class. Sociodemographic data and the distribution of respondent's demographics and location/sites are presented in Appendix A.

PHASE 2: SCMN GRADUATE EVALUATION

The SCMN evaluations showed that graduates were generally satisfied with their experience, based on responses across all questions (see Appendix B for item means and SD). Further, the evaluation items collectively showed that the SCMN Program was effective in meeting the stated goals and, thus, appears to be achieving its mission.

However, when the evaluation items were compared among sites, some differences indicated that host sites may not be equally effective in training SCMN participants. Differences are discussed by program goal.

Goal 1—Training and Education

Quantitative Results

Goal 1 (Training and Education) was assessed by using 13 Likert-type, ordinal, closed-ended questions and one check-all-that apply question. The question topics included utility of the reading materials supplied (e.g., field guides), amount of reading materials read, knowledge increases from classroom instruction, knowledge gained from hands-on activities, knowledge of program instructors, presentation of materials at an understandable level, instructor teaching methods, and instructor verbal communication skills. Across all 13 questions, there were 27 between-site differences. Overall, one site (Site #6) tended to receive higher-than-average responses, and another site (Site #3) tended to receive lower responses than did the other host sites.

Discussion

These results indicate that the reading materials supplied by the host sites were not being fully used by the participants, instructors, or both. Written materials in adult programming are important for understanding and applying concepts taught (Badarudeen & Sabharwal, 2010). However, the reading materials supplied to and read by SCMN participants may not have been at appropriate levels for some of the graduates, thus leading to differences in results related to the utility of the materials and knowledge increases. Assessing which materials were supplied by host sites and the use of the materials was deemed critical to further understanding the Training and Education component of the SCMN Program.

Differences in program instructors' effectiveness may be explained simply by differences in teaching pedagogical approaches (Corney & Reid, 2007). However, we did not attempt to assess host site instructor teaching pedagogies because this undertaking was outside the scope of our evaluation. But one point to consider, although unsubstantiated, is that the differences in teaching pedagogies may have influenced SCMN graduate responses concerning knowledge gained through hands-on or classroom instruction. Differences in teaching pedagogies between host sites may be an area for further study.

Goal 2—Natural Resources Awareness

Quantitative Results

Goal 2 is to teach the geological, floral, and faunal components of ecosystems. Understanding these components is critical to SCMN graduates being able to volunteer and instruct others about the environment. Overall, evaluation items related to Goal 2 showed that SCMN graduates believed that they were adequately trained in this area (see Appendix B for means and SD), but again, there were between-site differences.

Analysis of questions related to Goal 2 showed a significant difference in learning concepts between host sites related to knowledge of SC native animals, basic biological concepts, basic ecological concepts, basic geological concepts, and how to read a landscape. Between-site differences in mean response are presented in Figure 2. For example, note the left-most cluster of lines in the top panel of Figure 2. The segment with the square in the center conveys that the difference in mean response between Sites #2 and #1 was positive with respect to geological concepts. No part of this segment crosses over the horizontal line at zero, which is interpreted as a significant difference in mean response between Sites #2 and #1 (values are reported as mean of Group 2 minus mean of Group 1, with positive values indicating that the mean of Group 2 is larger than that of Group 1), with respect to basic geological concepts. Participants at Site #2 had greater knowledge of geological concepts than Site #1 participants, on average (95% Confidence Interval: 0.06, 0.84), with a point estimate of 0.45. Any line segments not crossing the horizontal zero line should be interpreted as significant between-site differences in mean response for the indicated items. We found 13 of these between-site differences to be significant. A sixth learning concept, knowledge of SC native plants, was not significantly different between sites and was not included in Figure 2 to save space.

Discussion

Although Goal 2 showed that geological, floral, and faunal components of the ecosystem were being effectively relayed overall, there were between-site differences in five of the six concepts taught. Some of the differences may have been related to the issues found in Goal 1. For example, an instructor may have dedicated more classroom time to teaching basic geological formations and concepts, whereas another instructor may have elected to spend more time in the field identifying various geological formations. However, simple differences in verbal communications skills may have been an influencing factor in understanding the lesson of an instructor.

Another possible explanation for the results may have been the amount of time dedicated to each concept. Because host sites have some autonomy in program delivery, instructors may elect to spend more time on one concept than another concept.

Regardless, the fact that there were significant differences, particularly that Site #6 consistently scored higher than other host sites, warranted further investigation to found out why these differences existed.

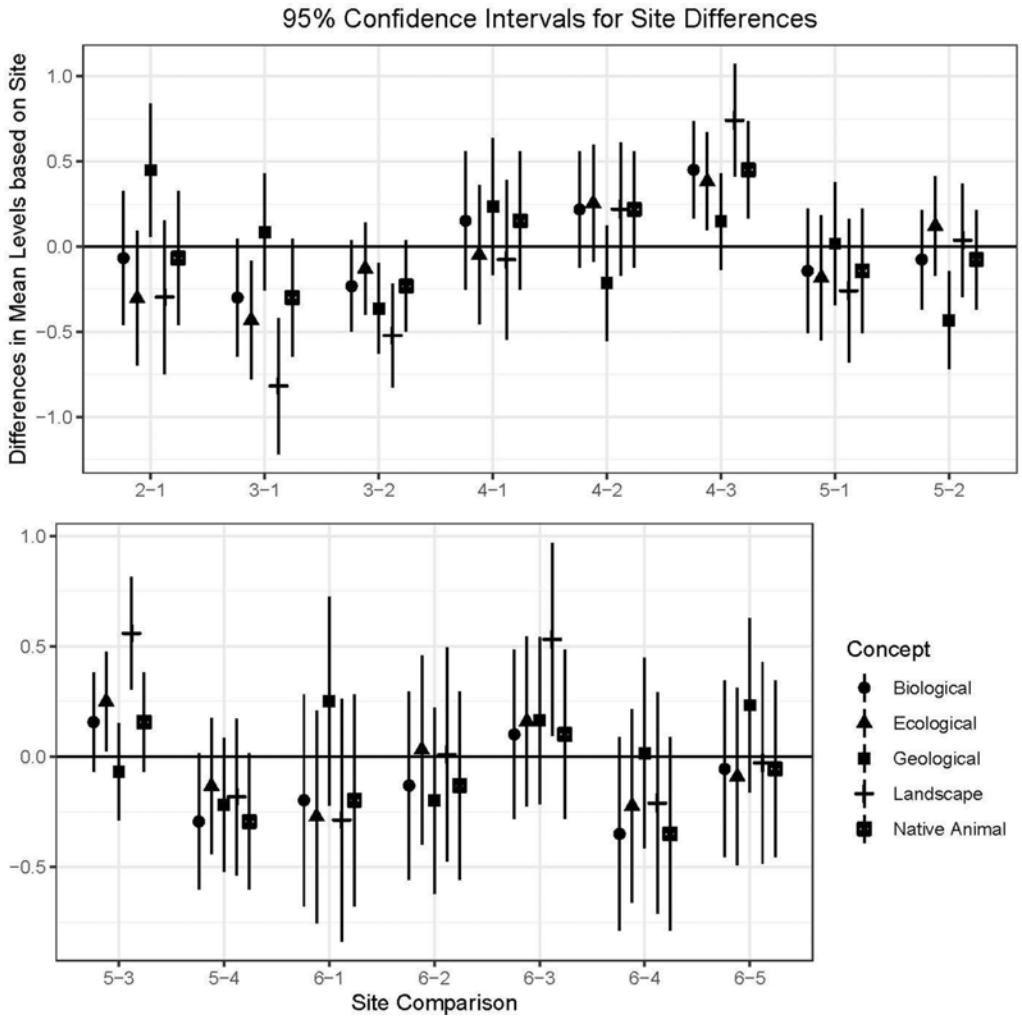

Figure 2. Pairwise comparisons for between-site mean responses with respect to indicated learning concepts. The plotted characters and line segments correspond to the difference in mean response and associated confidence intervals between sites (indicated on the x-axis) for the concepts indicated (identified by different plotting characters). Confidence intervals that do not cross the horizontal line at zero imply significant differences in mean response between the two sites for the indicated concept. There were six total concepts. Native Plants are not included in the figure due to lack of significant differences.

Goal 3—Human Impacts

Quantitative Results

Four questions were related to Goal 3 (Human Impacts). Three questions were Likert-type, ordinal, closed-ended questions, and one was an open-ended question. These questions served as proxies for connecting ecology and the impacts of humans on the landscape. The SCMN Program was successful in changing Goal 3 behavior in most graduates (see Appendix B for means and SD), and there were no between-site differences for these questions. Results also showed that SCMN graduates were inspired to volunteer for projects and teaching.

Qualitative Findings

The Human Impacts (Goal 3) open-ended question stated, "Please describe how the South Carolina Master Naturalist course inspired you to change the way you think about your use of natural resources." This question was intended to probe deeper into behavioral modifications. Many of the responses revealed that participants were simply more aware of natural resources and the complex human-nature interaction. This increased awareness was apparent in such statements as "It made me more aware of what was going on around me and how what I do effects [*sic*] the environment" and "I was more aware of the interaction of humans with their surroundings

and was more careful of my impact on my surroundings." The increased use of native plants and decreased use of herbicides were also inspired by the SCMN Program. For example, one respondent stated, "For me one of the most immediate changes I made was planting native plants and learning more about natives. I had no understanding that many of the imported plants do nothing for the native species." Another respondent wrote, "Awareness and knowledge led to practical application including use of native plants in landscaping, natural fertilizers, discontinued use of insecticides or use of more natural alternatives, carefully planned/discontinued trimming near wetlands or rookeries, etc."

However, novel moments for individuals also caused behavioral modifications, although they were still within the same themes, such as human-nature interactions and herbicide reduction. For instance, one SCMN graduate wrote, "Class that included storm water runoff was an eye opener and inspired me to change habits of water use, herbicide use, etc." Another participant wrote:

> I was inspired and motivated to be more mindful of my footprint on the natural environment and to take some specific steps toward conservation and protection (specifically composting, recycling, greater use of native plants, avoiding use of non-native invasive plants, reducing or eliminating use of pesticides and other chemicals).

Discussion

Results from the quantitative analysis and findings from the qualitative analysis converged to indicate that the SCMN Program was effectively helping participants link human actions to environmental consequences. This benefit was evidenced by SCMN graduates feeling that the program enhanced their own self-awareness of their personal use of natural resources (between Strongly Agree and Agree; see Appendix B), and many of the written responses indicated ways in which SCMN graduates self-identified areas for increased conservation actions.

Goal 4—Community Service

Quantitative Results

Goal 4 (Community Service) items revealed that 60% of SCMN graduates volunteered after completing the program; they volunteered in the areas of Citizen Science (82%), Ecological Services (86%), and Education/Interpretation (75%). However, we observed significant between-site differences in the number of participants volunteering as Master Naturalists between Sites #3 and #2 (95% CI, 0.18, 0.371), with participants at Site #2 volunteering more. Similarly, Site #5 had a larger proportion of individuals reporting volunteer hours than did Site #3 (95% CI, 0.030, 0.404).

Of the SCMN graduates who did not volunteer, the primary reasons given were lack of time (19.12%), lack of confidence in their knowledge (13.82%), or completion of the class only to enhance their own knowledge (13.24%). Participants were also allowed to select "Other" and write in a reason they did not volunteer. Medical conditions and having moved out-of-state were two other primary reasons for SCMN graduates not volunteering, according to qualitative data from the "Other" category (see Appendix B).

Qualitative Findings

We also asked participants to answer this Yes/No question: "Do you report your volunteer service hours in the SCMN Program Online Volunteer Hour Reporting System?" If participants selected "No," they were presented a follow-up, open-ended question: "Would you please share with us any reason(s) you have for not reporting your SC Master Naturalist volunteer service hours?" The primary reasons that emerged for not reporting volunteer hours were cumbersome reporting system, lack of importance, and time required to report. Table 1 provides example statements for each reason for not reporting.

Discussion

The results for Goal 4 indicate that the majority of SCMN graduates were motivated to volunteer in different capacities for the conservation of natural resources. Although time constraints were the most common reason for not volunteering (19.12%), this result is not surprising because time constraints are often listed as a barrier to participation in many contexts (e.g., leisure, education, health care). However, an SCMN graduate not having confidence in their knowledge (13.82%) could be the result of several compounding factors, although we have no evidence to confirm or dismiss any reason(s). However, this result may again have been related to differences found in Goals 1 and 2 that showed between-site differences in teaching and learning and in mastery of concepts taught.

PHASE 3: ONE-ON-ONE INTERVIEWS AND SECONDARY DOCUMENTS

One-on-One Interview Findings

One-on-one interviews were conducted to help identify why differences may have existed between host sites. Five individuals completed the SCMN Program at both host sites that had the highest and lowest mean scores. Of those five SCMN graduates, four agreed to one-on-one interviews. In general, the one-on-one interviews revealed that class size, differences in amount of attention devoted to topics, and differences in experiential learning versus classroom learning appeared to be the primary reasons for differences between host site learning effectiveness (Table 2). These

Table 1. Example Statements for Why SCMN Graduates Do Not Report Volunteer Hours

Reason for not reporting	Example statements
Cumbersome reporting system	"I find the reporting system cumbersome."
	"My experience with the system was that it was cumbersome."
Lack of importance	"Doesn't seem important. . . . [V]olunteering and doing the work is what matters to me."
	"Didn't think important"
Time required to report	"Time"
	"Just can't find time or energy for paperwork. Rather spend the time I have helping and learning. Lazy, I guess, when it comes to paperwork."

findings confirmed quantitative data that found significant differences related to Goals 1 and 2.

Host Site Secondary Document Review Findings

Secondary documents, documents that were produced related to or in support of a program, such as a program curriculum, can provide valuable information that complements, and in some cases explains, traditional evaluation methods and outcomes (see Table 3 for list of secondary documents; Mogalakwe, 2006). A key finding from secondary documents reviewed for the SCMN Program showed differences in average days per concept (see Table 4) and great variance in class size between sites (6–24 participants per class). The differences in time spent on teaching concepts were an issue related to program fidelity (Rossi et al., 2019). In addition, the type and quantity of reading materials varied across sites. The differences in reading materials and potential impacts on program delivery were confirmed in quantitative data for Goal 1 (see Appendix B).

Phase 3 Discussion

Findings from the one-on-one interviews and the review of secondary documents appear to explain some of the differences between host sites. During the one-on-one interviews, some of the respondents alluded to the difference in the number of instructors between host sites, and a review of secondary documents confirmed that this number varied between one and four. Having more instructors for the program could have helped explain differences in learning outcomes because of increased specialized knowledge of concepts taught. Further, with more instructors, there were likely to be some differences in teaching pedagogy, thus resulting in improved learning outcomes.

Analysis of secondary documents related to how much time was spent on each concept found a noticeable difference between sites. For example, some host sites may have only spent 0.2 day teaching about mammals, whereas some host sites may not have taught about mammals at all. Discrepancies in the amount of time concepts were taught may have also contributed to significant differences between host sites for Goals 1, 2, and 4. For example, the significant difference between Sites #3 and #4 in SC native animals (Figure 2) may have been attributed to differences in the amount of time spent on faunal concepts. This finding was also supported by responses from the one-on-one interviews, which discussed differences in topics taught (see Table 2 for example statements).

The class size between host sites was another finding from the one-on-one interviews that converged with the findings from the review of secondary documents. The smallest class size of the host sites was six, and the largest class size of the host sites was 24. Class size coupled with the number

Table 2. Example Statements of Findings From One-on-One Interviews About Site Difference

Host site difference	Example participant statement
Class size	"I would think that the biggest difference, the difference that jumped out at me the most was class size."
Topics taught	"The thing that struck me the most was the [Site #3] it was more focused on the natural environment, location. The trees, the birds, the plants, the seashore. A lot of the [Site #6] base was focused on environmental impacts."
Experiential vs. classroom learning	"There was a big difference in the 2 courses [sites]. . . . The [Site #6] class, we spent very little time in a class setting."

Table 3. SCMN Program Secondary Documents Reviewed

Secondary document	Source
SC Master Naturalist Vision, Mission, and Goals	SC Master Naturalist state office
SC Master Naturalist Program Impact Reports	SC Master Naturalist state office
SC Master Naturalist Program Standards of Behavior/Conduct	SC Master Naturalist state office
SC Master Naturalist Website	SC Master Naturalist state office
SC Master Naturalist Training Information	Retrieved from SC MN website
SC Master Naturalist Advanced Training	Retrieved from SC MN website
SC Master Naturalist Program Definition and Requirements for Volunteer Projects for Master Naturalist Graduates	Retrieved from SC MN website
SC Master Naturalist Program Training General Release of Liability, Waiver of Claims, Express Assumption of Risks, and Hold Harmless Agreement	SC Master Naturalist state office
General Rules of Conduct between the SC Master Naturalist Program and Host Sites	SC Master Naturalist state office
SC Master Naturalist Syllabus	Host sites[a]
SC Master Naturalist Instructors	Host sites
SC Master Naturalist Field Guides	Host sites
SC Master Naturalist Written Materials	Host sites
SC Master Naturalist Quizzes/Exams	Host sites
SC Master Naturalist Program Evaluations	Host sites
SC Master Naturalist Partner Organizations	Host sites

[a] Only five of six host sites provided a syllabus.

Table 4. Average Days per Concept Across All Host Sites for the SCMN Program

Concepts	Average days per concept[a]	SD[b]
Faunal		
Birds	1	0.7
Insects/Invertebrates	0.9	0.3
Fish	0.8	0.4
Herpetofauna	0.5	0.4
Mammals	0.2	0.2
Floral		
Plants	1.3	0.8
Forests	0.9	0.3
Invasive species	0.1	0.3
Geology	1	0.7
Area ecology	0.8	0.4
Human impact		
Urban	0.1	0.3
Culture/History	0.2	0.2
Water	1.3	0.7

[a] One day is a class session.

[b] Standard deviation

of instructors, differences in teaching pedagogies, and time spent on teaching concepts may have explained many of the differences between host sites. Additional confirmation of class-size impacts came from the one-on-one interviews with SCMN graduates, who stated that differences in class size between the host sites stood out the most to them (see Table 2).

Although class size was important, there was conflicting evidence regarding its impacts on student learning, which may have been predicated on the use of technology in the classroom (Shi, 2019). However, experiential learning is derived from experience and interaction with an environment (Kolb, 2015). Larger class sizes could negatively affect experiential learning by preventing a participant from hearing an instructor and interacting with the environment through such activities as viewing and/or examining a particular concept (e.g., Carolina Bays) or species (e.g., cone flower). So, although classroom instruction may or may not be affected by class size, experiential learning may suffer from large class sizes.

STUDY LIMITATIONS

Our study was limited by a few factors. First, as noted at the beginning, the SCMN Program was started more than 20 years ago, so respondents may have had recall issues that could influence results. However, because we did not attempt to control for recall issues, interpretation of results may not be applicable to similar evaluations with study populations in programs with shorter time frames (Tarrant et al., 1993). Second, there was disparity in the distribution of SCMN graduate participants by host site, although this difference could be overcome by using various statistical analysis techniques (Tabachnick & Fidell, 2007). However, responses by host site were similar to host site graduate numbers.

Finally, qualitative data analysis cannot be generalized to other populations (Goodrick & Rogers, 2015). Regardless of generalizability, qualitative data provide rich information that can identify, confirm, or complement other quantitative results and, as such, were crucial in helping identify why differences existed between host sites (Plano-Clark & Badiee, 2010).

RECOMMENDATIONS

The mixed-methods evaluation results and findings of the SCMN Program highlight some areas for improvement. Recommendations for program improvement are based on the results and findings of the SCMN Program evaluation when considered holistically. The results and findings for each phase of the evaluation are presented as being independent, but in reality, some of the concepts measured that related to the four SCMN goals were most likely intertwined.

Therefore, the recommendations for program improvement are arranged based on the Extension program development model that includes development, delivery, and accountability (Seevers & Graham, 2012). The recommendations include program fidelity, statewide program delivery, and statewide program administration. Program fidelity is solely related to the SCMN Program being offered consistently across the state to ensure that it is meeting its vision, mission, and goals. Statewide program delivery is focused on the actual implementation of the SCMN Program, as described. Finally, statewide program administration is focused on statewide administrative aspects of the SCMN Program, such as recruitment and enrollment.

PROGRAM FIDELITY

1. Cap class size (not to exceed 16–18 people per class).
2. Standardize the number of instructional hours for each goal and component. For example, some sites spent a great deal of time on bird identification, whereas other sites spent only a minimal amount of time.
3. Standardize the experiential learning experience hours across sites. Field trips and hands-on experiences should be standard across sites.
4. Have more homogeneity in the syllabus with specific terms.
5. Standardize written materials across sites. Although species and ecosystems vary across sites, standard materials appropriate for each location are recommended to ensure that participants receive the same level and type of reference materials (e.g., field guides).

STATEWIDE PROGRAM DELIVERY

1. Offer "basic" information for each ecosystem component in an online, asynchronous format. This online component would also allow time for more experiential learning for in-person classes.
2. Increase the number of written materials provided or made available. These may be electronic (online) or "further suggested materials" that may be purchased independently.

STATEWIDE PROGRAM ADMINISTRATION

1. Write student learning outcomes for the SCMN syllabus that can be used as part of a standard evaluation tool.
2. Create and require a standard post-program evaluation. Although host sites may wish to include additional questions, a standard post-program evaluation could provide data across time and host site to identify trends and issues that need to be addressed.
3. Increase communication with SCMN graduates to improve the likelihood of their participating in continuing education programs and volunteering.
4. Redefine (or clarify) what counts as "MN Volunteer Service."
5. Improve the current SCMN reporting system.
6. Provide an option for SCMN participants to purchase materials.

CONCLUSIONS

By using a mixed-methods approach, qualitative and quantitative data were analyzed from the SCMN graduate evaluation and host site evaluation to draw inferences about the SCMN Program. Overall, SCMN participants across all sites were satisfied with their experience (Evaluation Question #1), based on collectively considering the means

of all the quantitative and qualitative data analysis. Although overall the ratings of the SCMN participants were good, some differences between site ratings were explained through qualitative data analysis.

All six host sites were effective in training Master Naturalists, but there were some differences in learning outcomes (Evaluation Question #2), including the materials taught, knowledge gained by the participants, and differences in instructors, which may have been partially related to program fidelity. Further, SCMN graduate evaluations showed inconsistency in some of the materials provided across host sites. Many of these differences were explained by a lack of program fidelity across sites, which was the major finding for this evaluation question.

The overall conclusion of the evaluation of the SCMN Program is that it is achieving the stated vision, mission, and goals (Evaluation Question #3). Some goals are being met more consistently than others, and some can be improved upon.

Additionally, some areas for improvement related to program fidelity could help improve the achievement of the program's vision, mission, and goals.

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APPENDIX A: SCMN PROGRAM ADMINISTRATION AND SOCIODEMOGRAPHIC QUESTIONS

#	Question	Count	%	M	SD
Q19	Please check each category of tests or assessments that were administered at the site where you took your **first** SC Master Naturalist course. Please check all that apply.			N/A	N/A
	Quizzes	303	21.3		
	Reports (oral or written)	151	10.6		
	Final identification exam	453	31.9		
	Final written exam	364	25.6		
	We did not have any tests, exams, or reports during the Master Naturalist class.	69	4.9		
	Other	81	5.7		
Q70	I think the Master Naturalist registration fee was:			1.94	0.35
	Too high (1)	57	8.35		
	About right (2)	543	79.5		
	Too low (3)	22	3.22		
	No response	61	8.93		
Q71	Please check each box for the books or field guides that you received when you registered for the SC Master Naturalist course. Please check all that apply.			N/A	N/A
	SC Master Naturalist Manual	531	12.01		
	Reptile and amphibian field guide	520	11.76		
	Bird field guide	529	11.97		
	Wildflower field guide	524	11.86		
	Insect field guide	497	11.24		
	Tree field guide	527	11.92		
	Fern field guide	250	5.66		
	Seashore field guide	284	6.43		
	Geology field guide	157	3.55		
	Mammal field guide	170	3.85		
	Fish field guide	138	3.12		
	Mushroom field guide	43	0.97		
	Other	120	2.71		
	Don't remember	130	2.94		
Q72	Please check all the items that you received when you registered for the SC Master Naturalist course.			N/A	N/A
	Hand lens	553	43.3		
	Master Naturalist lanyard	537	42.05		
	Other	86	6.73		
	Don't remember	101	7.91		

#	Question	Count	%	M	SD
Q74	Please tell us the year that you completed your SC Master Naturalist course. If you completed courses or classes at more than one location, please tell us when you completed the **first** course. Please use a four-digit format, such as 2015.	[Open-ended]			
Q75	Location of first SC Master Naturalist class			N/A	N/A
	Site 1	44	6.44		
	Site 2	84	12.3		
	Site 3	243	35.58		
	Site 4	71	10.4		
	Site 5	143	20.94		
	Site 6	35	5.12		
	No response	63	9.22		
Q76	Education level				
	Less than high school	0	0		
	High school graduate	2	0.29		
	Some college	33	4.83		
	2-year degree	27	3.95		
	4-year degree	221	32.36		
	Master's degree	226	33.09		
	Professional degree (i.e., MD, DDS, DVM)	73	10.69		
	Doctorate	40	5.86		
	Prefer not to answer	2	0.29		
	No response	59	8.64		
Q77	Please tell us in which county in South Carolina you live. If you no longer live in South Carolina, please tell us which state you reside in now.	[Open-ended]			
Q78	What year were you born? Please use a four-digit format, such as 1970.[a]			N/A	N/A
	20–29	7	1.02		
	30–39	23	3.37		
	40–49	28	4.1		
	50–59	69	10.1		
	60–69	174	25.48		
	70–79	255	37.34		
	Over 80	37	5.42		
	No response	90	13.8		
Q79	Please tell us your current income level.			N/A	N/A
	Less than $20,000	11	1.61		
	$20,000–$39,999	39	5.71		
	$40,000–$59,999	61	8.93		
	$60,000–$79,999	82	12.01		
	$80,000–$99,999	47	6.88		
	$100,000–$119,999	39	5.71		
	Over $120,000	148	21.67		
	Prefer not to answer	180	26.35		
	No response	76	11.13		

#	Question	Count	%	M	SD
Q80	What is your gender?			N/A	N/A
	Male	239	34.99		
	Female	363	53.15		
	Prefer not to answer	13	1.9		
	No response	68	9.96		
Q81	What is your race?			N/A	N/A
	White	560	81.99		
	Black or African American	7	1.02		
	American Indian or Alaska Native	1	0.15		
	Asian	1	0.15		
	Native Hawaiian or Pacific Islander	1	0.15		
	More than one race	4	0.59		
	Prefer not to answer	44	6.44		
	No response	65	9.52		
Q82	What is your ethnicity?			N/A	N/A
	Hispanic or Latino	1	0.15		
	Non-Hispanic or Non-Latino	545	79.8		
	Prefer not to answer	54	7.91		
	No response	83	12.15		
Q83	Please share with us any other comments or suggestions related to the SC Master Naturalist course or classes that we did not ask about.	[Open-ended]			

Note. Question numbers are not sequential because instructions to respondents are counted as questions.

[a] Respondents were asked to enter the year they were born. We created the age-range categories based on the responses.

APPENDIX B: SCMN PROGRAM GRADUATE EVALUATION INSTRUMENT, MEANS, AND STANDARD DEVIATIONS, BY PROGRAM GOAL

#	Question Stem	Question Response	M	SD
Goal 1: Engage citizen volunteers through science-based training and place-based, experiential environmental education.				
Q3	Overall, the reading materials, not including the field guides, supplied to you for your SC Master Naturalist course were:	Too technical (1), A little technical (2), About right (3), A little basic (4), Too basic (5), I was not provided with any materials other than the field guides (6), Don't remember (7)	3.05	0.65
Q4	Please rate your agreement or disagreement with the following statement: The reading materials supplied to me for my SC Master Naturalist course, not including the field guides, provided a basic understanding of the topics that would be covered.	Strongly agree (1), Somewhat agree (2), Neither agree nor disagree (3), Somewhat disagree (4), Strongly disagree (5), I was not provided with any materials other than the field guides (6)	1.36	0.78
Q5	By the end of your SC Master Naturalist course, how much of the material had you read, not including the field guides?	All of the materials (1), Most of the materials (2), Some of the materials (3), Very little of the materials (4), None of the materials (5), I was not provided with any materials other than the field guides (6)	1.83	0.85
Q7	The SC Master Naturalist course instructor(s) demonstrated knowledge of the topics presented.	Strongly agree (1), Agree (2), Disagree (3), Strongly disagree (4)	1.06	0.24
Q8	The SC Master Naturalist course instructor(s) presented the material at a level I could understand.	Strongly agree (1), Agree (2), Disagree (3), Strongly disagree (4)	1.12	0.33
Q9	There was a positive interaction between the class participants and the SC Master Naturalist course instructor(s).	Strongly agree (1), Agree (2), Disagree (3), Strongly disagree (4)	1.08	0.28
Q10	The SC Master Naturalist instructor(s)'s teaching methods helped me understand the course material.	Strongly agree (1), Agree (2), Disagree (3), Strongly disagree (4)	1.18	0.40
Q11	The SC Master Naturalist instructor(s)'s verbal communication skills helped me understand the course material.	Strongly agree (1), Agree (2), Disagree (3), Strongly disagree (4)	1.17	0.38
Q12	The SC Master Naturalist instructor(s) were effective teachers.	Strongly agree (1), Agree (2), Disagree (3), Strongly disagree (4)	1.13	0.34
Q14a	What do you think about the amount of time spent in the classroom during the SC Master Naturalist course?	Far too much time (1), Slightly too much time (2), About the right amount of time (3), Slightly too little time (4), Far too little time (5), Don't remember (6)	2.96	0.50
Q14b	What do you think about the amount of time spent in the outdoors during the SC Master Naturalist course?	Far too much time (1), Slightly too much time (2), About the right amount of time (3), Slightly too little time (4), Far too little time (5), Don't remember (6)	3.24	0.51
Q15	To what extent, if any, did the classroom instruction increase your knowledge of the topics presented during the SC Master Naturalist course?	A great deal (1), A lot (2), A moderate amount (3), A little (4), None at all (5)	1.65	0.80
Q16	To what extent, if any, did the outdoor field trips increase your knowledge of the topics presented during the SC Master Naturalist course?	A great deal (1), A lot (2), A moderate amount (3), A little (4), None at all (5)	1.16	0.41

#	Question Stem	Question Response	M	SD
Q17	What do you think about the number of active, hands-on learning opportunities, either inside or outdoors, during the SC Master Naturalist course?	Far too many hands-on learning opportunities (1), Slightly too many hands-on learning opportunities (2), About the right number of hands-on learning opportunities (3), Slightly too few hands-on learning opportunities (4), Far too few hands-on learning opportunities (5)	3.25	0.50
Q18	To what extent, if any, did the active, hands-on learning opportunities increase your knowledge of the topics presented during the SC Master Naturalist course?	A great deal (1), A lot (2), A moderate amount (3), A little (4), None at all (5)	1.61	0.83
Q24	Please tell us if you think SC native plants need more or less instruction during the SC Master Naturalist course, or if it is about right.	More instruction (1), Was about right (2), Less instruction (3)	1.68	0.48
Q25	Please tell us if you think SC native plants need more or less written materials provided to participants during the SC Master Naturalist course, or if it is about right.	More written materials (1), Was about right (2), Less written materials (3)	1.72	0.47
Q30	Please tell us if you think SC native animals need more or less instruction during the SC Master Naturalist course, or if it is about right.	More instruction (1), Was about right (2), Less instruction (3)	1.73	0.44
Q31	Please tell us if you think SC native animals need more or less written materials provided to participants during the SC Master Naturalist course, or if it is about right.	More written materials (1), Was about right (2), Less written materials (3)	1.75	0.44
Q36	Please tell us if you think basic biological concepts need more or less instruction during the SC Master Naturalist course, or if it is about right.	More instruction (1), Was about right (2), Less instruction (3)	1.82	0.41
Q37	Please tell us if you think basic biological concepts need more or less written materials provided to participants during the SC Master Naturalist course, or if it is about right.	More written materials (1), Was about right (2), Less written materials (3)	1.84	0.40
Q42	Please tell us if you think basic ecological concepts need more or less instruction during the SC Master Naturalist course, or if it is about right.	More instruction (1), Was about right (2), Less instruction (3)	1.8	0.41
Q43	Please tell us if you think basic ecological concepts need more or less written materials provided to participants during the SC Master Naturalist course, or if it is about right.	More written materials (1), Was about right (2), Less written materials (3)	1.82	0.40
Q48	Please tell us if you think basic geological concepts need more or less instruction during the SC Master Naturalist course, or if it is about right.	More instruction (1), Was about right (2), Less instruction (3)	1.77	0.44

#	Question Stem	Question Response	M	SD
Q49	Please tell us if you think basic geological concepts need more or less written materials provided to participants during the SC Master Naturalist course, or if it is about right.	More written materials (1), Was about right (2), Less written materials (3)	1.78	0.45
Q54	Please tell us if you think how to read the landscape needs more or less instruction during the SC Master Naturalist course, or if it is about right.	More instruction (1), Was about right (2), Less instruction (3)	1.62	0.51
Q55	Please tell us if you think how to read the landscape needs more or less written materials provided to participants during the SC Master Naturalist course, or if it is about right.	More written materials (1), Was about right (2), Less written materials (3)	1.67	0.50
	Goal 2: Promote awareness of natural resources by teaching the geological, floral, and faunal components of ecosystems.			
Q21	Did the SC Master Naturalist course teach SC native plants?	Yes (1), No (2), Don't remember (3)	1.1	0.42
Q22	Please rate your knowledge of SC native plants **BEFORE** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	3.83	0.90
Q23	Please rate your knowledge of SC native plants **AFTER** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	2.5	0.70
Q27	Did the SC Master Naturalist course teach SC native animals?	Yes (1), No (2), Don't remember (3)	1.13	0.48
Q28	Please rate your knowledge of SC native animals **BEFORE** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	3.37	0.85
Q29	Please rate your knowledge of SC native animals **AFTER** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	2.38	0.74
Q33	Did the SC Master Naturalist course teach basic biological concepts?	Yes (1), No (2), Don't remember (3)	1.18	0.55
Q34	Please rate your knowledge of basic biological concepts **BEFORE** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	3.29	1.00
Q35	Please rate your knowledge of basic biological concepts **AFTER** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	2.48	0.78
Q39	Did the SC Master Naturalist course teach basic ecological concepts?	Yes (1), No (2), Don't remember (3)	1.08	0.37
Q40	Please rate your knowledge of basic ecological concepts **BEFORE** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	3.28	0.92
Q41	Please rate your knowledge of basic ecological concepts **AFTER** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	2.39	0.76
Q45	Did the SC Master Naturalist course teach basic geological concepts?	Yes (1), No (2), Don't remember (3)	1.16	0.52

#	Question Stem	Question Response	M	SD
Q46	Please rate your knowledge of basic geological concepts **BEFORE** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	3.82	0.83
Q47	Please rate your knowledge of basic geological concepts **AFTER** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	2.83	0.79
Q51	Did the SC Master Naturalist course teach you how to read the landscape?	Yes (1), No (2), Don't remember (3)	1.5	0.81
Q52	Please rate your knowledge of how to read the landscape **BEFORE** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	3.96	0.91
Q53	Please rate your knowledge of how to read the landscape **AFTER** taking the SC Master Naturalist course.	Extremely knowledgeable (1), Very knowledgeable (2), Moderately knowledgeable (3), Slightly knowledgeable (4), Not knowledgeable at all (5)	2.91	0.93
Q56	Please share with us how the SC Master Naturalist course has impacted you personally.	[Open-ended question]		
	Goal 3: Foster stewardship of natural systems by connecting ecology and the impacts of humans on the landscape.			
Q57	The SC Master Naturalist course inspired me to think about my own use of natural resources.	Strongly agree (1), Agree (2), Neither agree nor disagree (3), Disagree (4), Strongly disagree (5)	1.38	0.63
Q58	Please describe how the South Carolina Master Naturalist course inspired you to change the way you think about your use of natural resources.	[Open-ended question]	N/A	N/A
Q59	The SC Master Naturalist course inspired me to volunteer for projects that help protect, preserve, and restore the environment.	Strongly agree (1), Agree (2), Neither agree nor disagree (3), Disagree (4), Strongly disagree (5)	1.67	0.79
Q60	The SC Master Naturalist course inspired me to teach others about nature and the environment.	Strongly agree (1), Agree (2), Neither agree nor disagree (3), Disagree (4), Strongly disagree (5)	1.66	0.78
	Goal 4: Encourage community service by providing training on how to protect, preserve, and restore biodiversity through volunteer opportunities.			
Q62	Do you volunteer as a Master Naturalist?	Yes (1), No (2)	1.4	0.46
Q63	Would you please tell us the reason(s) that you do not volunteer as a SC Master Naturalist? Please check all that apply.	There are no volunteer opportunities in my area (1), I do not feel that I have time to volunteer (2), I do not feel confident about my understanding of the topics (3), I no longer have a desire to volunteer (4), I only took the class to enhance my own knowledge, not to volunteer (5), Other. Please tell us other reasons you don't volunteer. (6)	1 5/4.41%) 2(65/19.12%) 3(47/13.82%) 4(19/5.59%) 5(45/13.24%) 6(149; 43.82%)[a]	
Q64	Do you participate in each of the following community service projects?			
	Citizen science	Yes (1), No (2)	1.18	0.39
	Ecological services	Yes (1), No (2)	1.14	0.34
	Education/Interpretation	Yes (1), No (2)	1.25	0.43
Q65	I have the skills necessary to help with community service projects.	Strongly agree (1), Agree (2), Disagree (3), Strongly disagree (4)	1.5	0.53

#	Question Stem	Question Response	M	SD
Q66	Do you participate in any of the following Master Naturalist program services opportunities?			
	Serve on a board of a Master Naturalist Association	Yes (1), No (2)	1.86	0.34
	Serve on a committee of a Master Naturalist Association	Yes (1), No (2)	1.86	0.34
Q67	Do you report your volunteer service hours in the SC Master Naturalist Program Online Volunteer Hour Reporting System?	Yes (1), No (2)	1.37	0.48
Q68	Would you please share with us any reason(s) you have for not reporting your SC Master Naturalist volunteer service hours?	[Open-ended question]	N/A	N/A

Note. Question numbers are not sequential because instructions to respondents are counted as questions.

[a] Data for this question provide number and percentage of responses and do not have a mean and standard deviation.