POLICY STUDIES ASSOCIATES, INC.

4-H SCIENCE EVALUATION
YEAR 3 IMPLEMENTATION STUDY

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Executive Summary

With the support of the Noyce Foundation, National 4-H Council has contracted with Policy Studies Associates (PSA) to evaluate the implementation of the 4-H Science Initiative. In 2006, the Science Initiative was introduced as a way to focus 4-H programming on teaching science, technology, engineering, and applied math content to the more than six million youth who participate in 4-H annually. The Science Initiative aims to increase science interest and literacy among youth, the number of youth pursuing post-secondary education in science, and the number of youth pursuing science careers.

The goals of this evaluation are to measure the implementation of science programming at the state and local levels, and to inform 4-H leaders at the national level of the initiative's progress. In addition, the evaluation seeks to determine what effects the national promotion of the Science Initiative and science professional development for state leaders may have had on county-level 4-H staff and local 4-H programming.

This report focuses on the local-level implementation of 4-H science programming, and is based on a survey of a nationwide sample of county-level 4-H agents. The survey was designed to answer the following questions:

- To what extent are counties prioritizing the development and implementation of science programming?
- What strategies are counties using to implement 4-H science programming with respect to:
  - program content and pedagogy,
  - staff and volunteers,
  - youth recruitment,
  - professional development,
  - partnerships and resource support,
  - evaluation?
- What support and resources from state offices and from the national 4-H office do counties use to implement 4-H science programming?
- What additional resources would help counties implement 4-H science programming more effectively?

Youth development agents in a nationally representative sample of counties, randomly selected by the evaluation team, were asked to complete the survey. A total of 372 agents responded to the survey, for a response rate of 52 percent.

County Implementation Strategies

County youth development agents, in their survey responses, described an overall picture of science programming that had several of the strengths that the 4-H Science Initiative has sought to cultivate. The survey results also suggest ways in which 4-H can continue to work at the national, state, and local levels to expand and improve youth experiences in science.

Program content. When looking for curricula and programming ideas, county agents tended to stay within their network of 4-H professionals and resources. Most counties had used curricula developed by 4-H at the national level (79 percent) or by their LGU (65 percent) in their science programs.

Counties reported offering a broad range of science content to youth. Almost all counties (93 percent) had programs that address newer, non-traditional content as well as programs that address traditional content.

However, more could be done to infuse standards-based science content and science skill mastery into programming. Only 55 percent of counties reported that they integrated intentional science learning into traditional 4-H content areas. Fewer than half of county agents reported that they always or almost always worked to align science programming with state science standards (38 percent), and just 21 percent reported striving to make science programs Science Ready as described by the 4-H Science Checklist. Finally, relatively few county agents reported encouraging staff and volunteers to consider benchmarks for science skill mastery when planning programming (28 percent). In order to focus programs on building participants' mastery of science skills, 4-H could encourage county agents to consider setting program-specific benchmarks for mastering particular science skills.

Experiential and inquiry-based learning. While experiential learning was reportedly widespread (incorporated into programs in 73 percent of counties), inquiry-based learning was less so (54 percent of counties). Inquiry-based learning may be more difficult for county staff and volunteers to understand and to implement in programming. Indeed, 82 percent of county agents said that their staff and volunteers needed professional development in inquiry, at least to some extent.

Staff and volunteer recruitment. Counties most often looked to 4-H networks, such as parents of 4-H participants and former 4-H participants, as sources of staff and volunteers. About half of counties recruited science expert staff from local science-related business, such as a veterinary practice. At the same time, most counties indicated that finding experts in science to facilitate science programming posed challenges, with 53 percent calling this a major challenge. More outreach to college or university departments or to local businesses with a science focus could help address this challenge.

Counties also experienced significant challenges in the recruitment of youth development staff: 48 percent said finding qualified youth development staff and volunteers to lead programs was a major challenge.

Youth recruitment. Counties most often reported that they recruited youth into science programs by informing current 4-H participants about science opportunities (a strategy used at least to some extent by 84 percent of counties) and connecting with schools (78 percent). Fewer used social media (56 percent), despite its ubiquity among youth.

One of the goals of the 4-H Science Initiative is to increase diversity in the science fields. Overall, counties could be doing more to focus on recruiting and supporting youth from underrepresented groups. For example, only 17 percent of county agents reported that they were strengthening outreach efforts to recruit girls or youth from underrepresented groups to a great extent; 37 percent of counties reported doing so to some extent.

Professional development. Most county agents felt that the youth development training needs of their staff and volunteers were being met. On the other hand, county agents overwhelmingly reported that staff and volunteers who led science programs needed at least some professional development in science content (86 percent of agents) and in how to teach science concepts to youth (84 percent). Only one-third of county agents reported that they or someone else in their county had provided professional development in these areas for staff or volunteers during the past year.

Partnerships and resource support. Most counties reported having partnerships with school districts, small businesses, and local government agencies. Partners most often contributed volunteers or mentors, or donated facilities, space, materials, or supplies. Willing partners were not hard to find: only 20 percent of county agents said that an inability to find partners to support science programming was a major challenge.

County 4-H offices received resources and support from their state 4-H offices (located in LGUs) as well as from 4-H at the national level (such as National 4-H Council). Overall, counties relied on their state office for a broad array of resources and supports, and on national 4-H mainly for curricula and marketing materials (Exhibit E1). More than half of counties (56 percent) reported consulting with staff at their state office in order to support science programming in their county.

Exhibit E1
State- and national-level supports for science programming

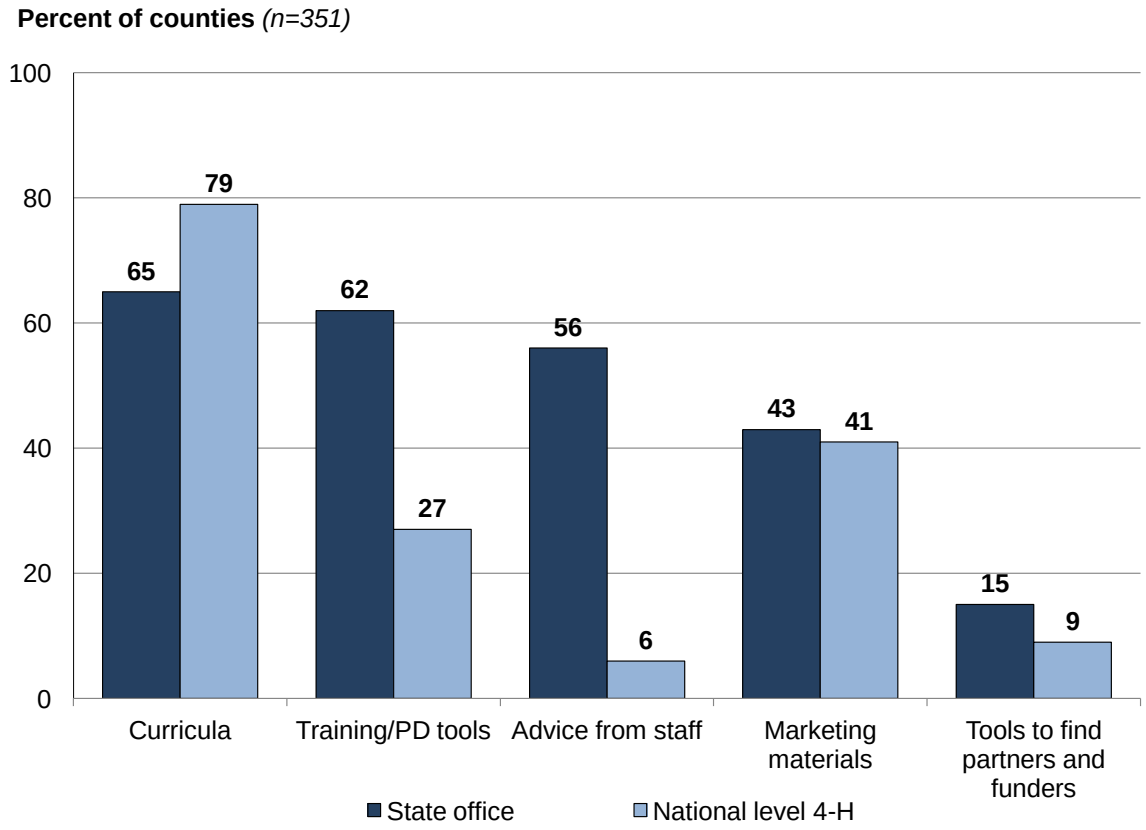

Exhibit reads: Sixty-five percent of counties reported using curricula developed by their state office or LGU.

Evaluation. Almost two-thirds of counties reported evaluating at least some of their science programs, most often gathering data through youth surveys. Counties most often conducted evaluations for two very different reasons: because they wanted data to help improve science programs, or because they were required to. More than three-quarters of counties said that they used evaluation data to guide programming decisions (83 percent) or to fulfill reporting requirements not related to grants (76 percent).

Among counties that did not evaluate science programming, collecting consistent data from programs and a lack of staff time most frequently posed major challenges. For greater efficiency, it would be possible for more counties to use existing youth surveys rather than developing their own.

Overall Challenges to Implementation

When county agents looked across all of the areas affected by their efforts to implement science programming, the three biggest challenges they faced in implementing science programming all related to staffing. Roughly half of counties reporting that finding science content expert staff, finding youth development staff, and maintaining enough support staff in the county office were major challenges (Exhibit E2). More than half of counties felt that each of the elements listed in the graph below posed at least a minor challenge.

Exhibit E2
Challenges to implementation

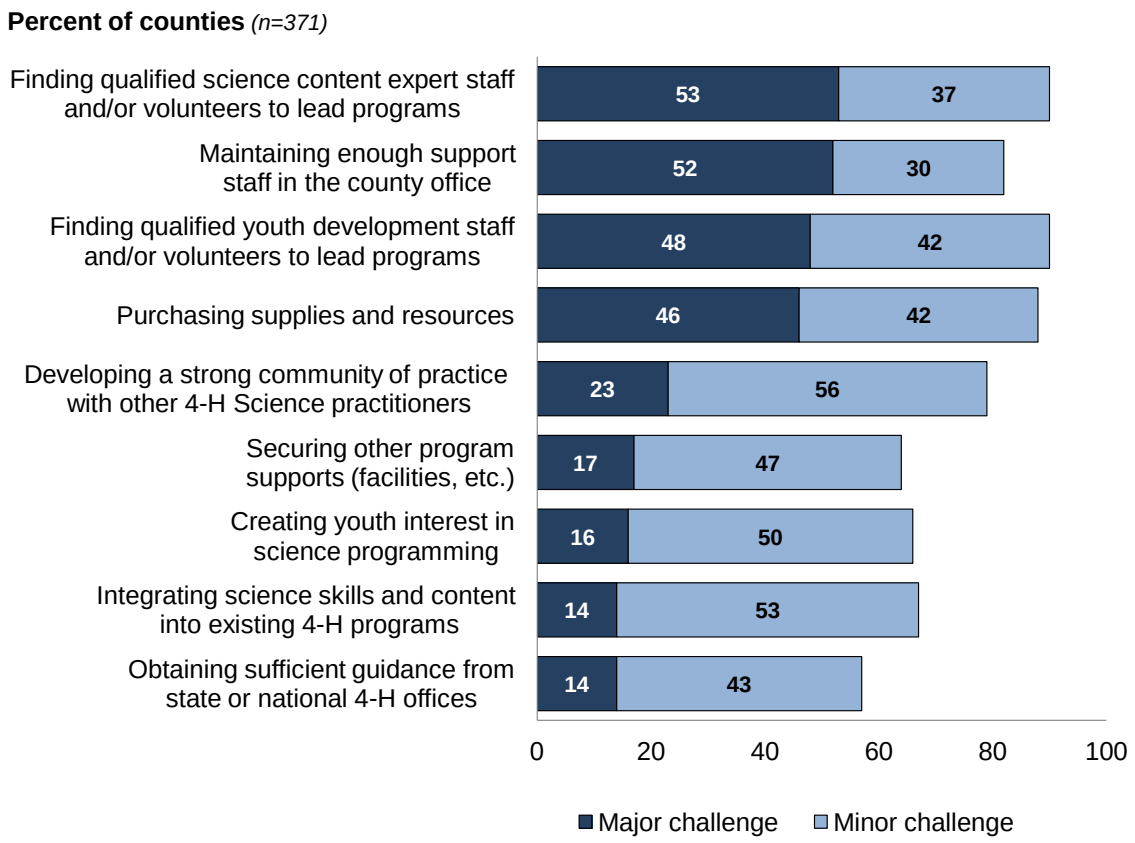

Exhibit reads: Fifty-three percent of county youth development agents said that finding qualified science content expert staff and/or volunteers is a "major challenge"; 37 percent of agents said this is a "minor challenge".

Counties reported fewer major challenges with other aspects of implementing programming, including creating youth interest in science programming, integrating science content into traditional 4-H programs, and acquiring program supports.

4-H Science as a State and County Priority

As one of the three mission mandates, 4-H Science is a very high priority for 4-H at the national level. One goal of this survey was to determine the extent to which the science emphasis at the national and state levels has made its way to counties nationwide. About one-third of county agents surveyed (37 percent) said that science programming was a high priority in their county, while almost twice as many (66 percent) reported that science was a high priority in their state (Exhibit E3).

Exhibit E3
Science as a priority at state and county levels

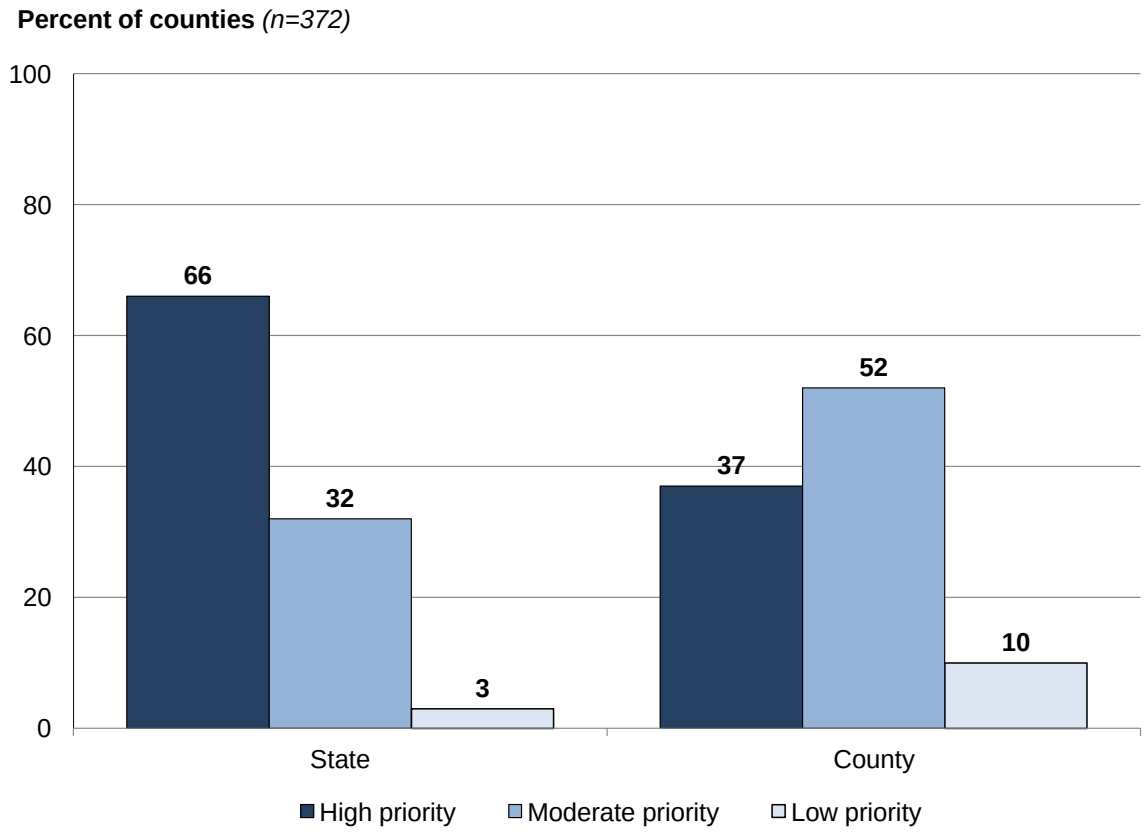

Exhibit reads: Sixty-six percent of respondents reported that science is a high priority in their state. Thirty-seven percent of respondents indicated that science is a high priority in their county.

Growth in science priority since 2006. The county-level focus on science is generally increasing. Among the staff members who had been working in their position as youth development agent in their county since before 2006, 73 percent said that their county now places more emphasis on establishing and maintaining science programming than it did before 2006. (Almost three-quarters (73 percent) of county staff reported that they had been in their position as their county's youth development agent since at least 2006, the initiative's launch year.)

Pacesetting Counties

Counties more often followed recommendations of the 4-H Science Initiative when the county placed a high priority on science. It is possible that a county made a decision to prioritize science and then implemented the recommended practices, or that implementing these practices sparked a greater commitment to science as a core component of 4-H programming. Although our survey does not reveal *how* priorities and practices developed, it does show that in 37 percent of counties—those that reported placing a high priority on science—program design and support activities showed significant differences from those found in other counties.

The 37 percent of counties where science was said to be a high priority were setting the pace for 4-H Science implementation. The following practices were reported in at least two-thirds of counties that placed a high priority on science, and were reported at a rate significantly higher than in other counties:

- Programs incorporated experiential learning in curriculum (88 percent)
- Programs incorporated inquiry-based science learning (74 percent)
- Curricula were connected to issues directly affecting the county or region (73 percent)
- County youth development agents worked to ensure each of the following additional program features:
  - Science programming that would help youth build science skills (84 percent)
  - Programs facilitated by well-trained adults (77 percent)
  - Programming that addressed the Essential Elements of Positive Youth Development (67 percent)
- Youth recruitment and support were designed to target underrepresented groups in each of the following ways:
  - Increasing youth interaction with mentors or role models (68 percent)
  - Strengthening outreach efforts to recruit girls and/or youth from underrepresented groups (68 percent)
  - Implementing programs that aimed to increase engagement and/or youth from underrepresented groups (67 percent)
- Partners contributed volunteers or mentors to support science programming (88 percent)

- Experts in science content were recruited from local science-related businesses to serve as staff or volunteers (68 percent)

- At least some science programs were evaluated (82 percent)

Opportunities for Expanding and Improving 4-H Science in Counties

Although most counties reported the challenge of lack of staff time, some counties were doing more than others in science despite this barrier. This suggests that 4-H can build on what has already been accomplished, showing the way to strengthen science programming efficiently. Examples of leading-edge practices can both inspire and support improvement efforts, especially with detailed "how-to" materials. Useful examples could be found in the work that many counties are doing in each of several areas: intentional science learning incorporated into traditional programming, inquiry-based science, outreach that uses social media or youth ambassadors or that targets underrepresented youth, staff training, recruitment of partners from science-rich settings, and practical program evaluation.

Sources of support within 4-H were known and used by counties. Support for the county implementation of the 4-H Science Initiative can continue to come from both the state and the national levels, taking into account the types of help that counties are most accustomed to receiving from each level: widely usable materials from the national level; and both materials and tailored advice from the state.

The program approaches and supports that counties reported in the survey provide evidence that can be useful in further developing the 4-H Science Initiative. This report describes the types of progress being made in implementing the initiative, the areas where further work may be most needed, and the types of support that counties have received from 4-H and their local partners. As 4-H builds on the strengths and continues to offer support, 4-H Science can continue to grow.

Contents

Introduction

With the support of the Noyce Foundation, National 4-H Council has contracted with Policy Studies Associates (PSA) to evaluate the implementation of the 4-H Science Initiative. In 2006, the Science Initiative was introduced as a way to focus 4-H programming on teaching science, technology, engineering, and applied math content to the more than six million youth who participate in 4-H annually. The Science Initiative aims to increase science interest and literacy among youth, the number of youth pursuing post-secondary education in science, and the number of youth pursuing science careers.

4-H is facilitated by 106 Land-Grant Universities and Colleges (LGUs) in more than 3,000 counties as a part of the Cooperative Extension System. National programmatic leadership is provided by 4-H National Headquarters at the National Institute of Food and Agriculture, USDA. National 4-H Council, which is the national nonprofit partner of 4-H and the Cooperative Extension System, focuses on fundraising, branding, communications, and legal and fiduciary support to 4-H programs.

The goals of this evaluation are to measure the implementation of science programming at the state and local levels, and to inform 4-H leaders at the national level of the initiative's progress. In addition, the evaluation seeks to determine what effects the national promotion of the Science Initiative and science professional development for state leaders may have had on county-level 4-H staff and local 4-H programming.

Since the Science Initiative began, state-level 4-H leaders report having supported a range of science programming, both by integrating science pedagogical techniques into traditional science-related 4-H programming such as animal science, and by beginning new technology-focused programs such as robotics (LaFleur, Sanzone, Butler, and Mielke, 2010; Mielke, Butler, and LaFleur, 2009). The amount of science programming varies from state to state, as does states' ability to track and report information about their programs, but state leaders agreed that science programs have a unique potential to connect science learning to youths' everyday lives. In interviews, county- and state-level 4-H leaders highlighted features of 4-H science programs they believed were promising, including:

- youth-centered content delivery
- experiential learning
- a focus on the real-world applications of science
- opportunities for youth to contribute to their communities through science
- positive youth development strategies, and
- a focus on moving youth through the educational pipeline toward science-related careers (LaFleur et.al., 2010).

In this report, the evaluation focus shifts to the local-level implementation of 4-H science programming. It is based on a survey of a nationwide sample of county-level 4-H agents. The survey was designed to answer the following questions:

- To what extent are counties prioritizing the development and implementation of science programming?

- What strategies are counties using to implement 4-H science programming with respect to:
  - program content and pedagogy,
  - staff and volunteers,
  - youth recruitment,
  - professional development,
  - partnerships and resource support,
  - evaluation?

- What support and resources from state offices and from the national 4-H office do counties use to implement 4-H science programming?

- What additional resources would help counties implement 4-H science programming more effectively?

Youth development agents in a nationally representative sample of counties, randomly selected by the evaluation team, were asked to complete the survey. A total of 372 agents responded to the survey, for a response rate of 52 percent.

Methods

Survey sampling. Evaluators received a list from National 4-H Council containing the names of county-level youth development agents from the LGUs established in 1862. From this list, evaluators drew a stratified random sample of 200 counties for each of the four geographic regions, for a total of 800 sampled counties. Any agent without valid contact information was excluded from the sample. Agents who were known to work in more than one county were asked to consider all counties they oversee when completing the survey.

For the 17 LGUs established in 1890 (historically Black colleges and universities), evaluators asked the 4-H program leaders for the contact information of youth development agents affiliated with each university. Six program leaders responded to the outreach effort and gave us the names of 31 agents. Some of these agents worked in counties that were already in the survey sample; others were disqualified from the survey because they said they were not the correct youth development agent. The remaining 24 agents were added to the overall sample of 800 counties.[1]

A total of 372 county youth development agents responded to the survey from each of the four geographic regions and the 1890s LGUs (Exhibit 1).[2] The overall response rate was 52 percent.

[1] The low number of responses among 1890s LGUs did not allow for statistical comparison against other regions. We cannot assume the data are representative of 1890s agents overall.

[2] Due to the low response rate in the South, we conducted analyses to determine whether Southern respondents differed significantly from respondents from other regions. Analysis revealed very few significant differences.

Exhibit 1
Regional response rates

Region	Number of county agents surveyed	Number of respondents	Response rate
Northeast	153	89	58
North Central	170	102	60
South	182	67	37
West	186	110	59
1890	24	4	17
Total	*715*	*372*	*52*

Exhibit reads: Of 153 agents surveyed in the Northeast region, 89 county-level youth agents responded to the survey. The regional response rate for the Northeast was 58 percent.

Among the responding counties, 27 percent were in urban areas, 42 percent in suburban areas, and 31 percent in rural areas (Exhibit 2).

Exhibit 2
Urbanicity of responding counties

Level of urbanicity	Percent of counties *(n=372)*
Urban	27
Suburban	42
Rural	31

Exhibit reads: Twenty-seven percent of responding counties were located in an urban area.

Forty-five percent of the urban counties sampled responded to the survey, as did 49 percent of suburban counties and 41 percent of rural counties.

Statistical tests employed. All differences noted in this report between the responses of two or more groups of respondents have met two types of statistical tests: first, a test of statistical significance (indicating they are not likely to result from chance); and, second, a test of the size of the difference. Evaluators explored the associations between various county agent responses using chi-square tests for categorical variables. Where statistically significant differences were found (using the threshold of $p<0.05$), we computed an effect size to measure the magnitude or strength of the finding. For analyses of the effect size in categorical variables we calculated a Cramer's *V* effect. Conventions for educational research suggest that effect size values between 0.10 and 0.20 indicate a "small but meaningful" association, between 0.21 and 0.50 an "important" association, and 0.51 or higher an "impressive" association (Cohen, 1988; Lipsey,

1990). This report focuses on findings with an effect size of at least 0.20; comparisons or associations below this threshold were considered too weak to warrant reporting.[3]

Implementation of 4-H Science: County Staff Perspectives

In this evaluation, we analyzed county staff perspectives on the following aspects of science program design and implementation:

- the content of science programs,
- the curricula that counties use in these programs,
- how science programs are staffed,
- how youth are recruited,
- what professional development staff and volunteers utilize,
- how partnerships to support science programs are formed and sustained,
- and the extent to which science programs are evaluated.[4]

Program Content and Pedagogy

The 4-H Science Logic Model emphasizes the inclusion of inquiry-based activities and other learning methods in science programming. The desire to incorporate these non-traditional learning methods is also emphasized in the 4-H Science Checklist, which specifies that science programs should include experiential elements and should foster creativity and curiosity in participating youth.[5]

4-H science programs may both integrate science concepts into established programming, and adopt new science-focused curricula. However, previous reports produced for this evaluation have suggested that the integration of science content into traditional 4-H content areas such as agriculture or animal science is a challenge for 4-H staff and volunteers who design programs. We therefore sought to assess the extent to which different types of science programming are present in counties, how curricula are selected, and what steps agents take to help support high-quality science programs.

Many counties provided a broad range of science activities for youth, and almost all had both traditional and non-traditional content. About half of counties said that they design and/or adapt curricula by incorporating science into traditional 4-H content areas. When looking for

[3] When analyzing a categorical variable with more than two categories against a continuous variable, evaluators used ANOVA tests to find significant differences between categories. Where statistically significant differences were found (using the threshold of $p<0.05$), we computed the effect size η^2 (*eta* squared). Since *eta* squared is calculated differently from Cohen's d, the threshold we used to determine whether an association was strong enough to report was $\eta^2=0.09$. However, no ANOVA analyses uncovered associations strong enough to report.

[4] All of the survey results are available in Appendix A of this report.

[5] Both the Logic Model and the Checklist are reproduced in Appendix B.

curricula and programming ideas, county agents tended to stay within their network of 4-H professionals and resources.

Content areas. Counties responding to the survey reported implementing youth programs in a diverse set of content areas. Traditional 4-H content areas such as animal science, gardening, and food science were widely reported, with less traditional content areas such as engineering and computer technology reported somewhat less often. On average, counties reported programming in over nine content areas, and 93 percent of counties offered programming in both traditional and non-traditional content areas (Exhibit 3).[6]

Exhibit 3
4-H Science content areas

	Percent of counties *(n=367)*
Large animal science	81
Gardening	75
Small animal science	74
Food science	67
Environmental science	63
Horticulture	61
Consumer and family sciences	58
Veterinary science	56
Robotics	53
Aerospace/rocketry	53
Plant science	51
Technology	45
Environmental stewardship	43
Engineering	34
Geospatial technology (GPS/GIS)	31
Earth science	30
Weather and climate	27
Computer technology	29
Physical sciences	28
Other	7

Exhibit reads: Eighty-one percent of responding counties offer large animal science programming.

When the content areas listed above were grouped into five categories (Animal Science, Earth Science, Horticulture, Engineering/Technology, and Food Science), half (49 percent) of counties had programs in all five categories, and an additional 26 percent had programming in

[6] For this analysis, we labeled the following content areas as "traditional": large animal science, small animal science, veterinary science, food science, and consumer and family sciences. We labeled the remaining choices as "non-traditional" content areas.

four areas.[7] These data suggest that while counties still placed significant focus on traditional content areas, many also provided a broad range of activities for their youth.

Curriculum selection and development. About two-thirds (64 percent) of county youth development agents were in charge of selecting the science curricula used in their county, while 28 percent of agents said that curriculum selection was done at the state level. The remaining eight percent of counties indicated that someone else in their county was responsible for curriculum selection or that they did not use any science curricula. Among youth development agents who were responsible for selecting their county's science curricula, the vast majority (81 percent) sought out curricula that incorporated experiential science learning into lessons. Most agents also looked for curricula that related to local or regional needs and issues (75 percent) and curricula that were readily available (72 percent).

The survey asked all county youth development agents – not just those responsible for curriculum selection – how they designed new curricula or adapted existing curricula or programming for use in their county. About three-quarters (73 percent) said they incorporated experiential science learning into programming, but fewer (54 percent) said they incorporated inquiry-based learning (Exhibit 4). Most (72 percent) reported collaborating with educators and volunteers in their county in the process of curriculum design or adaptation. Just over half (55 percent) said they integrated science into traditional 4-H content areas.

Exhibit 4
Methods for designing or adapting curricula

Methods for designing or adapting curricula	**Percent of counties** *(n=369)*
I incorporate experiential science learning	73
I collaborate with educators and volunteers in my county	72
I look for outside materials to supplement curricula	69
I try to connect curricula to issues directly affecting my county or region	58
I integrate intentional science learning into traditional 4-H content areas	55
I incorporate inquiry-based science learning	54

Exhibit reads: Seventy-three percent of county agents reported that they incorporate experiential science learning when adapting established curricula or designing their own curricula or programming.

[7] The five categories were grouped as follows:
Animal Science – Large animal science, small animal science, veterinary science
Earth Science – Earth science, weather and climate, physical sciences, environmental science, environmental stewardship
Horticulture – Gardening, horticulture, plant science
Engineering/Technology – Robotics, computer technology, engineering, technology, aerospace/rocketry
Food Science – Food science, consumer and family sciences

To look for science curricula or programming ideas, county staff tended to use their network of 4-H colleagues and 4-H online resources. Sixty-six percent of county staff said that they looked to other 4-H professionals for ideas, 64 percent said they used the National 4-H Council website, 61 percent used another state's 4-H website, and 60 percent made use of their own state's 4-H website. Comparatively few county staff used resources from outside of the 4-H network; 10 percent said they found ideas from a website not associated with 4-H, and 6 percent said they used a collaborative website for youth development educators.

Experiential and inquiry-based learning. While the value of "hands-on" learning is understood well throughout the 4-H system, other pedagogical strategies such as inquiry-based learning may be more difficult to implement. Among county staff and adults who lead science programs, there may be greater understanding and use of experiential learning than of inquiry. For example, 73 percent of county staff said that they incorporate experiential learning when designing or adapting curricula or programming, compared to 54 percent of staff who said they incorporate inquiry-based science learning.

Fostering high-quality programming. In order to foster high-quality science programming, 4-H seeks to provide learning environments that support both informal science learning and positive youth development. In particular, 4-H believes that certain elements should be present in its science programs, such as the facilitation of inquiry- and experiential-based program activities, the promotion of science skills, youth leadership, and positive youth development practices (specifically, the Essential Elements of Positive Youth Development: mastery, independence, belonging, and generosity).

The qualities that 4-H seeks to have in science programming are supported by a growing body of research. This research examines features of informal science learning that improve youth content knowledge and engagement in the STEM fields: hands-on, investigation-based activities (Minner, Levy, and Century, 2010) and opportunities to link content to the daily lives of participants (Peterson, 2007; Tai, 2006). Elements of informal science learning that may increase youth engagement and content knowledge in the STEM fields include:

- active learning and hands-on activities
- gathering, analyzing, interpreting, and presenting data
- inquiry-based learning practices such as posing questions, making predictions, and responding to questions
- connecting activity content to the real world, and
- discussing STEM careers and their educational pathways.

In addition, practices found to be associated with high-quality informal learning programs include the presence of clear goals, engaging activities, activity sequencing that supports skill-building, and a youth-focused environment (Eccles & Gootman, 2002; McLaughlin, 2000; Noam, 2008; Vandell et al., 2006). Youth-centered content delivery, which 4-H encourages for its science programs, can contribute to positive youth outcomes. By providing opportunities for youth to contribute their ideas and experiences, informal science programs can help participants develop increased interest in science learning, knowledge of science content, and improvements in science achievement (Institute for Learning Innovations, 2007). Through youth-centered content delivery, youth and adults become equal partners in the learning process.

County-level youth development agents most commonly reported supporting high-quality science programming by encouraging their staff and volunteers to include experiential learning elements in their science programming, with 83 percent of respondents reporting that they did this "always" or "almost always" (Exhibit 5). Most county agents also encouraged activities focused on inquiry, creativity, and curiosity (78 percent).

Past 4-H evaluation reports have identified other practices that may promote high-quality 4-H science programming. For example, in surveys of youth and the adult educators leading their programs, educators' regular use of lesson plans was positively associated with youth reports of their enthusiasm for science. Programs that offered youth more opportunities to practice science-related skills had a positive association with youths' self-reported science skills (Mielke, LaFleur, Butler, & Sanzone, 2011).

Well-planned programs that include skill-building activities have the potential to positively affect youth. Approximately two-thirds of county agents reported that they ensured that the science programming they oversee helps youth build science skills "always" or "almost always" (68 percent). Program planning could involve lesson plans, or aligning programming with state or national education standards. Twelve percent of county agents reported that they "always" or "almost always" require volunteers and staff to submit lesson plans or activity guides for the science activities they lead. More county agents reported aligning programming with state standards (38 percent) or with national science standards (21 percent).

Although positive youth development techniques are stressed throughout 4-H programming – not just in science – only 59 percent of county agents reported that they "always" or "almost always" design (or help design) programming that addresses the Essential Elements of Positive Youth Development (mastery, independence, belonging, and generosity). It could be the case that county agents did in fact expect these elements to be present in programs in their counties, but they did not design programs themselves.

Exhibit 5
Supports for high-quality programming

	Percent of counties who do this "always" or "almost always" *(n=362)*
I encourage activities that include experiential learning elements	83
I encourage activities that focus on youth inquiry, creativity, and curiosity	78
I ensure that programs are facilitated by adults who are well-trained	69
I ensure that science programming helps youth build science skills	68
I design, or help design, programming that addresses the Essential Elements of Positive Youth Development (mastery, independence, belonging, and generosity)	59
I work to align science programming with state science education standards	38
I work to align science programming with national science education standards	21
I strive to make science programs in my county Science Ready as described by the 4-H Science Checklist	21
I require volunteers and staff to submit lesson plans or activity guides for the science activities they lead	12

Exhibit reads: Eighty-three percent of county agents surveyed said they "always" or "almost always" encourage activities that include experiential learning.

Guidance for staff and volunteers who lead science programs. When asked what program elements they encouraged staff to consider when planning science programming, three-quarters (75 percent) of county agents said that they encourage staff and volunteers to consider how program activities give participants opportunities for experiential learning. Fewer county agents said that they want staff to consider how program activities engage participants in scientific inquiry (59 percent).

Considering 4-H's goal to build science skills in youth, relatively few county agents reported encouraging staff and volunteers to consider activity sequencing (in other words, how an activity will build on a previous activity), or skill mastery in their activities. About half of county agents (52 percent) said that they encourage staff and volunteers to consider activity sequencing. Twenty-eight percent of county agents encouraged staff and volunteers to consider benchmarks for science skill mastery when planning programming. In order to focus programs on building participants' mastery of science skills, 4-H could encourage county agents and 4-H

educators to think about how activities build from one session to the next, and to consider setting program-specific benchmarks for mastering particular science skills.

Additional resources. To help inform 4-H planning for assistance to counties, the survey asked agents to identify areas in which they needed additional support or resources in the areas of program content, curriculum, and pedagogy. Sixty-one percent of counties reported needing assistance with identifying curricula; fewer (44 percent) needed help with designing or adapting curricula, apparently indicating greater interest in locating ready-to-use curricula than in building their own curricula.

Just over half (56 percent) of counties also needed assistance with supporting staff who deliver science programming. Fewer than half of counties reported needing guidance on inquiry-based learning (44 percent), and fewer still (34 percent) expressed a need for guidance on experiential learning.

Science Staff and Volunteers

As described in the 4-H Science Checklist, science programs should be facilitated by a staff member who is well trained in both youth development and science content. Prior evaluations revealed the LGUs' view that finding qualified staff posed a significant challenge for local programs, and that inadequate training budgets also posed a major challenge (Mielke et al. 2009). Counties' sources for staff and volunteers who are experts in youth development and/or in science content is therefore a topic of interest for national 4-H.

Counties tended to rely heavily on parents of 4-H participants and former 4-H participants to lead science programming. Parents of 4-H youth participants were the primary source of expert staffing, with 79 percent of counties reporting that they recruit parents for youth development expertise, and the same percent of counties reaching out to parents who are science content experts. Counties also relied heavily on former 4-H participants; 65 percent of counties recruit former participants to be science experts, while 71 percent recruit former participants as youth development experts. About half (48 percent) of counties recruited science expert staff from local science-related business, such as a veterinary practice (Exhibit 6).

Exhibit 6
Sources of staff and volunteers

Sources of staff and volunteers	Percent of counties *(n=369)*	
	Experts in science content	Experts in youth development
Parents of 4-H participants	79	79
Former 4-H participants	65	71
Other community members	53	65
Local businesses with a science focus (e.g., a veterinarian, a biologist)	48	25
High school or college students	44	40
Local college or university departments	34	32
Online or newspaper advertisements	12	20
Local businesses without a science focus	11	20
I have not recruited such staff or volunteers	14	10

Exhibit reads: Seventy-nine percent of counties recruit parents of 4-H youth participants as science content experts; the same percentage of counties recruit parents of youth participants as youth development experts.

Across all counties, more than half (53 percent) said that finding qualified science content expert staff and volunteers was a major challenge, with an additional 37 percent reporting that this posed a minor challenge. Counties also experienced significant challenges in the recruitment of youth development staff: 48 percent said finding qualified youth development staff and volunteers to lead programs was a major challenge, while 42 percent said this was a minor challenge.

The ability to find and recruit different types of staff from multiple sources appears to be beneficial to counties, as it may allow the county to provide more programming for youth in a broader range of content areas. County staff who said that finding qualified staff (either youth development experts or science content experts) was a major challenge reported having programming in significantly fewer content areas than counties where finding qualified staff was not a major challenge. Counties in which finding qualified youth development staff was a major challenge had programming in an average of 8.7 content areas, compared with 10.5 content areas for counties where finding qualified youth development staff was not a major challenge. Similarly, counties in which finding qualified science content expert staff was a major challenge offered programming in an average of 8.7 content areas, compared with 10.5 content areas in counties for whom finding science content experts was not a major challenge.

Youth Recruitment

One of the goals of the 4-H Science Initiative is to increase the number of youth pursuing education and careers in science fields. It is therefore important for 4-H at the national level to know how LGUs and counties are recruiting youth into science programs and where opportunities for growth may lie.

Previous evaluation reports found that LGUs were marketing their science programs to local school districts and within their LGUs. In an evaluation survey of adults who facilitate science programs, over half said that youth were recruited to their program via word-of-mouth, while just under half of youth found out about the program through their school or through participation in another 4-H program.

Current survey results indicate that counties recruited youth through a variety of sources, most often through existing 4-H participants as well as school partners. Less often, they used 4-H youth ambassadors to recruit youth. In general, counties could be doing more to focus on recruiting and supporting youth from underrepresented groups.

Counties utilized several methods to recruit youth to join science programs. Most commonly, counties either informed current 4-H participants about science programs or worked with school partners to recruit youth (Exhibit 7). Less often, counties used the internet or social media, flyers, or recruiting events to encourage youth to join science programs. Very few counties (12 percent) made use of 4-H youth ambassadors to a great extent to share information about 4-H science programs with their peers.

Exhibit 7
Youth Recruitment

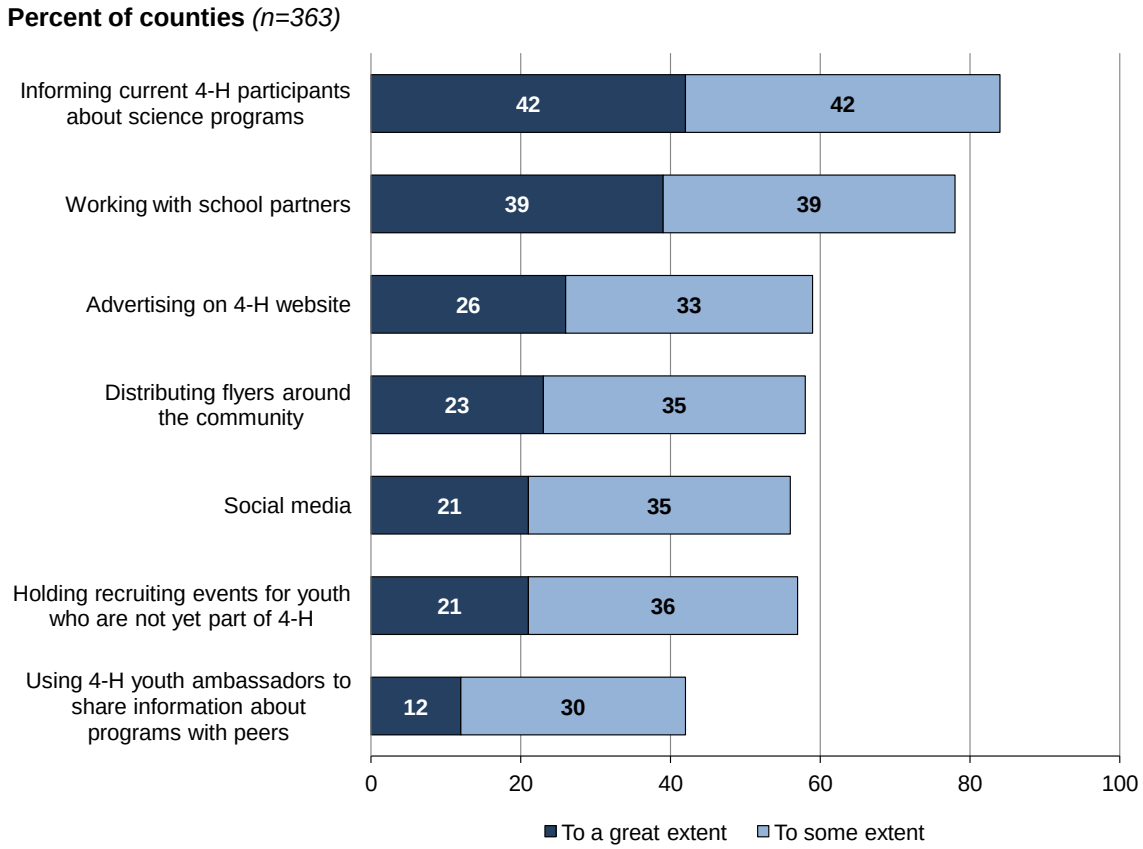

Exhibit reads: When asked to what extent they recruit youth by informing current 4-H participants about science programming, 42 percent of counties said they do this to a great extent, and an additional 42 percent said they do this to some extent.

Judging from the responses above, county staff may be under-utilizing social media as well as youth-to-youth recruiting strategies. From past national-level surveys of youth in 4-H science programs, this evaluation has found that for the majority of youth, being able to spend time with friends was one of their favorite aspects of their science program (Mielke et al., 2011). County staff could encourage current 4-H participants to recruit their friends into 4-H science programs, and encourage participants to share information about their program in ways that their peers can easily access.

Underrepresented youth. One of the desired outcomes of the 4-H Science Initiative is to increase diversity in the science fields. 4-H science programs have the opportunity to spark an interest in science in girls and in youth from racial and ethnic groups that are underrepresented in science fields. By igniting students' interest in science, programs like 4-H can increase the number of youth pursuing post-secondary education in science and pursuing science-related careers, and can also foster diversity within this STEM pipeline (Afterschool Alliance, 2010).

Few county agents reported placing great emphasis on strategies for recruiting and supporting youth from groups historically underrepresented in science fields. With respect to

recruitment, 17 percent of county agents reported that they were strengthening outreach efforts to recruit girls or youth from underrepresented groups to a great extent; 37 percent of counties reported doing so to some extent (Exhibit 8). A similar percentage of counties reported implementing programming specifically designed to increase the engagement of girls and/or youth from underrepresented groups in science: 15 percent of counties did so to a great extent; 38 percent did so to some extent.

Exhibit 8
Recruitment and support of underrepresented youth

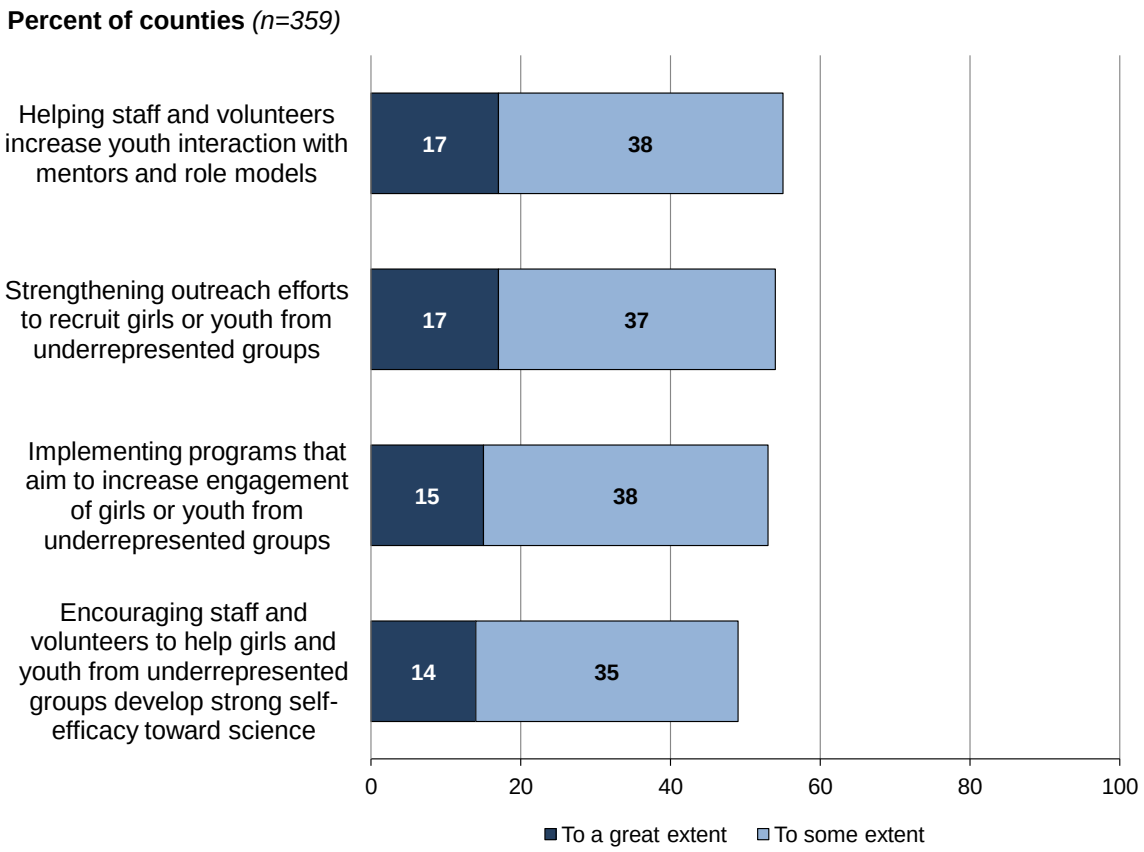

Exhibit reads: When asked to what extent they help staff and volunteers to increase youth interaction with mentors and role models, 17 percent of counties responded that they did this "to a great extent". Thirty-eight percent of counties said they do this "to some extent".

While there may be other strategies that counties were using to increase enrollment and support of youth from underrepresented groups, the above support strategies were not heavily stressed in most counties.

Professional Development

County staff and volunteers need training and support in order to effectively design and lead science programs. If 4-H knows what training staff and volunteers currently participate in – and what training and professional development needs are not currently being met – it can work to offer professional development that addresses counties' preferences and needs.

According to the county agents surveyed, there is substantial professional development related to youth development available to them and to their staff and volunteers. Most county staff felt that the training needs of their staff and volunteers with respect to youth development were being met, but that their staff and volunteers still needed training in topics such as science pedagogy, as described below.

Training. Training in science content, and in how to teach science concepts to youth, was less prevalent in counties than training in youth development. This was true for both the trainings that county staff participated in themselves and for the training that was provided to other staff and volunteers in the county (Exhibit 9). For example, 73 percent of county staff reported participating in training related to youth development in the past year, while 39 percent reported participating in training in how to teach science concepts to youth. The prevalence of youth development training makes sense in light of the fact that youth development concepts are relevant to all 4-H programming – including, for example, programs that focus on healthy living or citizenship – in addition to science programs.

Exhibit 9
Types of staff training

Training in the past year	Percent of counties: For the county agent *(n=367)*	Percent of counties: For other staff or volunteers *(n=360)*
Youth development	73	56
Science content	49	34
How to design activities that include experiential learning elements	41	38
How to teach science concepts to youth	39	32
How to design activities that focus on youth inquiry, creativity, and curiosity	37	32
How to support staff and volunteers in science programming	25	n/a
How to design or adapt curricula	23	17
None of the above	10	23

Exhibit reads: Seventy-three percent of county staff reported participated in youth development training in the past year. Fifty-six percent of county staff reported that they or someone else in their county had provided youth development training for 4-H science staff and volunteers in the past year.

In addition to training, about half of counties (46 percent) reported having shared resources for staff and volunteers to use, such as curriculum guides, a Wiki, or a website.

Communication with state leader. Almost all county staff, 86 percent, reported that their state has a state-level leader who heads professional development or science programming efforts in their state. Among county agents who have a state-level leader, 70 percent said that they interact with that person to access resources they could use in their county. A similar percentage of county agents (67 percent) said that they work with the state leader to learn more about 4-H Science (Exhibit 10).

The survey findings point to the potential influence of the state leader. This is evident not only because most county agents viewed their state leader as a conduit for information about 4-H science, but also because county agents who looked to their state leader as an information source were more likely to report specific practices that are encouraged for 4-H Science.

Exhibit 10
Contact with state leaders

Reasons for working with state science or professional development leader	Percent yes *(n=313)*
To access resources I could use in my county	70
To learn more about 4-H Science	67
To learn more about teaching experiential and inquiry-based science to participants	47
To find professional development for staff in my county	26

Exhibit reads: Among county staff who reported that their state has a science or professional development leader, 70 percent reported working with him or her to access resources they could use in their county.

For example, county agents who worked with their state leader to learn more about teaching experiential and inquiry-based science to participants were more likely to provide professional development on youth inquiry for their staff and volunteers. Several differences also existed between the 26 percent of county agents with a state science leader who worked with that person to find professional development for staff in their county, and the agents who did not. County agents who contacted their state leader to find professional development were more likely to support high-quality programming in their counties by encouraging staff to: develop activity goals, incorporate college and career exploration, and align program content with national and state science education standards. These county agents were also more likely to provide training on teaching science concepts to youth, and on designing inquiry-based activities.

State leaders have the opportunity to promote practices such as incorporating experiential and inquiry-based learning to the county agents they work with, even if the county agent did not originally look for help in those areas. Such promotion could help make counties aware of available resources to improve the quality of their science programs.

Professional development needs. County agents reported that volunteers and staff leading 4-H science programs in their county most needed professional development in science content, in how to teach science concepts to youth, and in how to implement activities that focus on youth inquiry, creativity, and curiosity (Exhibit 11). As discussed above, training was less prevalent on these subjects than on the subject of youth development. Only 20 percent of counties said that science volunteers and staff needed training in youth development "to a great extent."

Exhibit 11
County professional development needs

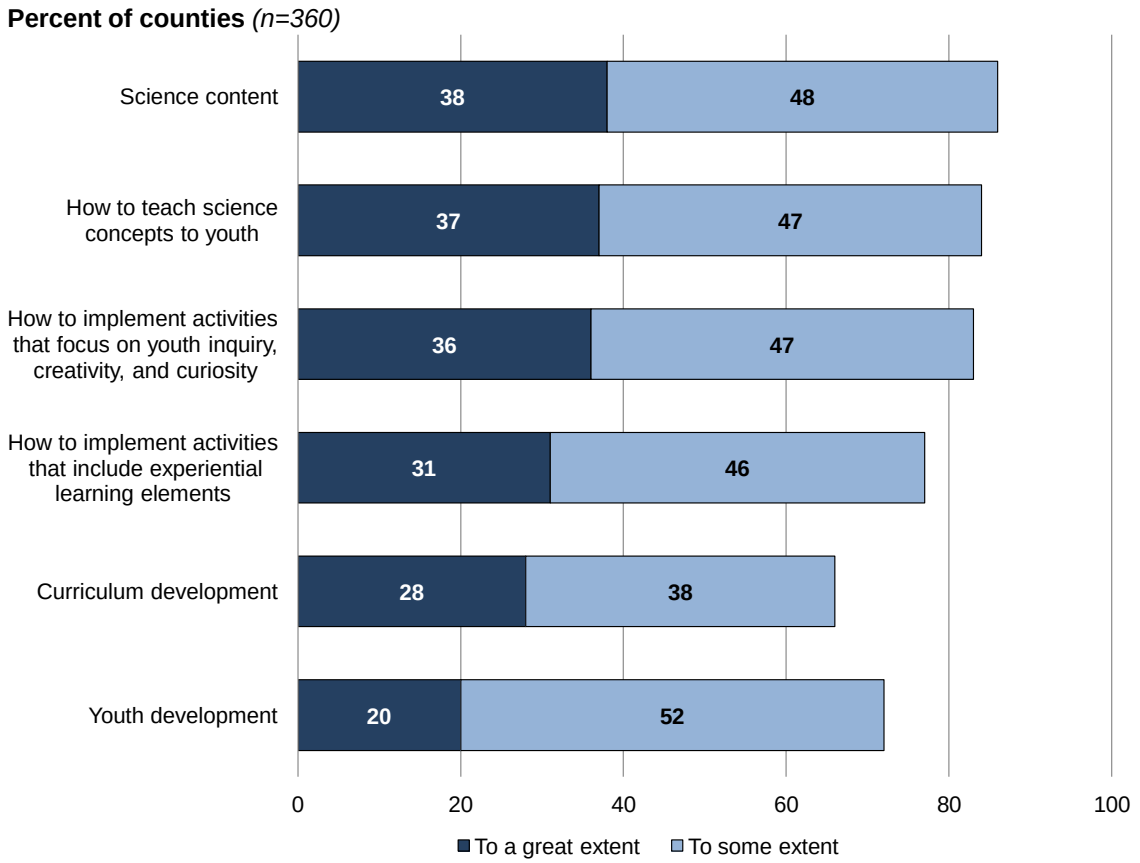

Exhibit reads: Thirty-eight percent of county youth development agents reported that 4-H science staff and volunteers in their county needed professional development or training in science content to a great extent; 48 percent said such training was needed to some extent.

Previous evaluation reports have found that LGUs frequently pointed to a lack of funds and a lack of staff time as impediments to moving forward with science programming (Mielke et al., 2009; LaFleur et al., 2010). Similarly, finding time for staff and volunteers to attend training and finding funds to pay for that training were reported to pose major challenges for the majority of counties (Exhibit 12). Finding the time for volunteer leaders to attend trainings when they may have jobs aside from 4-H likely contributes to this challenge. A lack of staff and/or volunteer interest in attending training also presented a major challenge to 49 percent of counties. On the other hand, fewer counties reported challenges related to the location of training events or finding training events that were relevant.

Exhibit 12
Challenges to meeting professional development needs

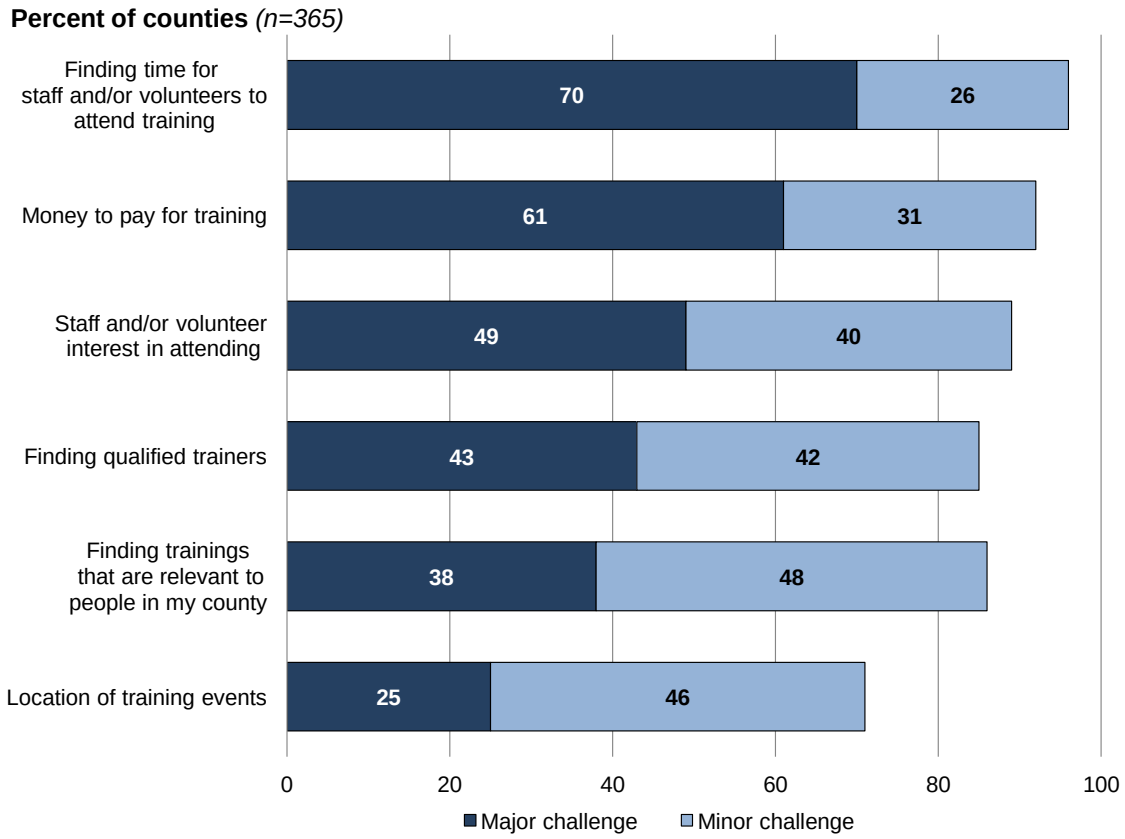

Exhibit reads: Seventy percent of county youth development agents reported that finding time for staff and/or volunteers to attend training poses a major challenge to meeting the county's professional development needs; 26 percent said that finding time poses a minor challenge.

Partnerships and Resource Support

4-H offices and programs create partnerships with various local, state, and national organizations in order to support programming. Partners might be businesses, school districts, universities, foundations, and faith-based organizations. These partners support 4-H science programming by providing funding, in-kind donations, and volunteers, among other resources.

The evaluation's first-year report on the implementation of the 4-H Science Initiative found that LGUs had developed partnerships within their university and with outside organizations to develop science programming (Mielke et al., 2009). In the evaluation's second year, we found that LGUs' academic departments as well as outside organizations could and did provide resources to support science programming (LaFleur et al., 2010).

Most counties reported establishing partnerships with school districts, small businesses, and local government agencies. Their partners contributed volunteers or mentors, and donated facilities, space, materials, or supplies. Counties most often cited the lack of administrative staff

at the county office to recruit and sustain partnerships and to secure resources as major partnership challenges.

Types of partnerships. Counties most often formed partnerships with local organizations; school districts, small businesses, and local government agencies were the most commonly cited partners (Exhibit 13). Several types of local partners were less common, such as local university departments or faith-based organizations. Given that only one-third of counties recruited staff from local universities, and about one-third partnered with local universities, there appears to be a significant opportunity for counties to work more closely with college and university departments in their area to access staff, volunteers, facilities, mentoring, and other resources.

Exhibit 13
Types of partners

	Percent of counties *(n=361)*
School districts	86
Small businesses	75
Local government agencies	60
State 4-H foundation	52
Large businesses	43
Local colleges or university departments (other than your state's land grant university)	35
Faith-based organizations	35
4-H Friends and Alumni Association	33
Federal government agencies other than USDA (e.g., NASA)	19
Other	13
None of the above	2

Exhibit reads: Eighty-six percent of county agents reported that 4-H science programs in their county have partnerships with school districts.

4-H programs often rely on community volunteers to lead clubs and other programs. County agents reported that their partners are a significant source of these volunteers (Exhibit 14). Most counties noted that their partners have also contributed facilities, space, materials, and supplies to their science programs.

Less often, partners supplied counties with curricula or staff training. As discussed in the Curriculum section above, county staff tended to use their network of 4-H colleagues and 4-H online resources to look for science curricula or programming ideas. Since partners such as school districts and other youth development organizations could potentially be rich sources of curricula and professional development resources, investigating such sources could be beneficial for science programming.

Exhibit 14
Partner contributions to science programs

	Percent of counties *(n=359)*
Volunteers or mentors	76
Donations of facilities or space	68
Donations of materials or supplies	66
Funding	54
Help with participant recruitment	37
Curriculum	21
Transportation services for participants	16
Training for 4-H staff and/or volunteers	15
None of the above	7

Exhibit reads: Seventy-six percent of counties reported that their partners have contributed volunteers or mentors to 4-H science programming.

State- and national-level 4-H resources. County 4-H offices received resources and support from their state 4-H offices (located in LGUs) as well as from 4-H at the national level (such as National 4-H Council). Overall, counties relied on their state office for a broad array of resources and supports, and on national 4-H mainly for curricula and marketing materials. Curricula were the resources most commonly received from both the state and national levels to support science programming. National 4-H was more often a source of curricula than were state offices (79 percent of counties vs. 65 percent) (Exhibit 15). Many counties also used marketing or promotional materials from National 4-H (41 percent of counties), and about the same number (43 percent) reported using marketing materials from their state office.

More than half of counties (56 percent) reported consulting with staff at their state office in order to support science programming in their county; only a few (six percent) consulted with national-level staff.

Exhibit 15
State- and national-level supports for science programming

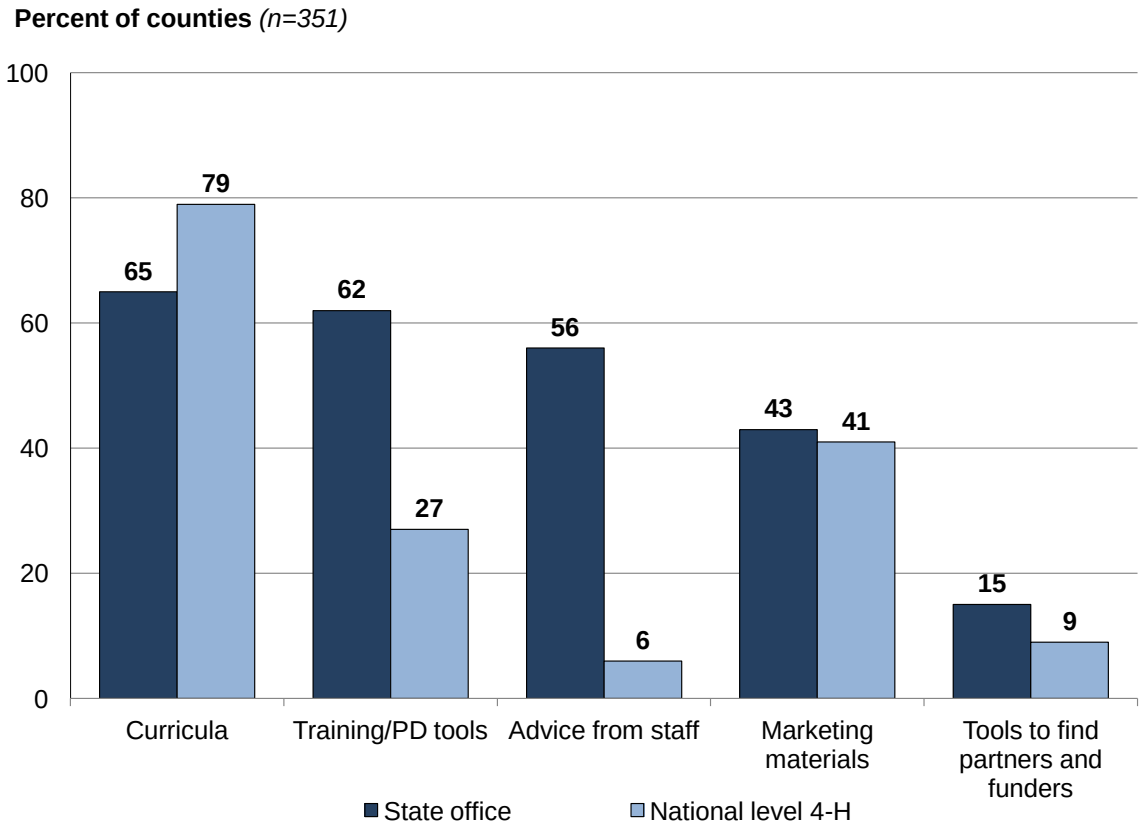

Exhibit reads: Sixty-five percent of counties reported using curricula developed by their state office or LGU.

Few counties reported using tools from either their state office or from 4-H at the national level designed to help them find partners and funders, although survey results indicate that such tools could be helpful to them. As discussed below, finding partners and funders posed a major challenge for 20 percent of counties, and a minor challenge for 54 percent. It could be that available tools at the state and national level for finding partners and funders are not advertised sufficiently to counties, or that these tools do not meet their needs.

Ten percent of counties reported using none of the listed state-level resources, and 14 percent of counties reported using none of the national-level resources.

In addition to the items in Exhibit 15, 24 percent of counties reported using organizational guidelines from 4-H at the national level; for example, guidelines on how to start a 4-H club.

In focus groups conducted in December 2010 as part of this evaluation, state-level science staff expressed an interest in having more centralized support from 4-H, including: more 4-H Science Initiative marketing materials, a clearinghouse of information about available resources (curricula, professional development models), and a central way for states to

communicate the science-related work they were doing so that states could share best practices (Policy Studies Associates, 2011).

Since the state office appears to be the main source of support for counties and the place that county staff first turn for help on many issues, 4-H at the national level could do more to ensure that state-level offices know about the professional development tools that are offered nationally. State offices that are well-informed about national-level resources could act effectively as conduits for this information.

Challenges to building partnerships and securing resources. Overall, county staff seemed to know where to find resources and partnerships, but to lack the staff to secure such resources or partnerships. Counties were familiar with resources at their state offices for building partnerships and securing resources (Exhibit 16). However, the central challenge for counties in building partnerships and securing resources for 4-H science programming was a lack of staff to recruit partners, sustain partnerships, or secure resources.

Exhibit 16
Challenges to building partnerships and securing resources

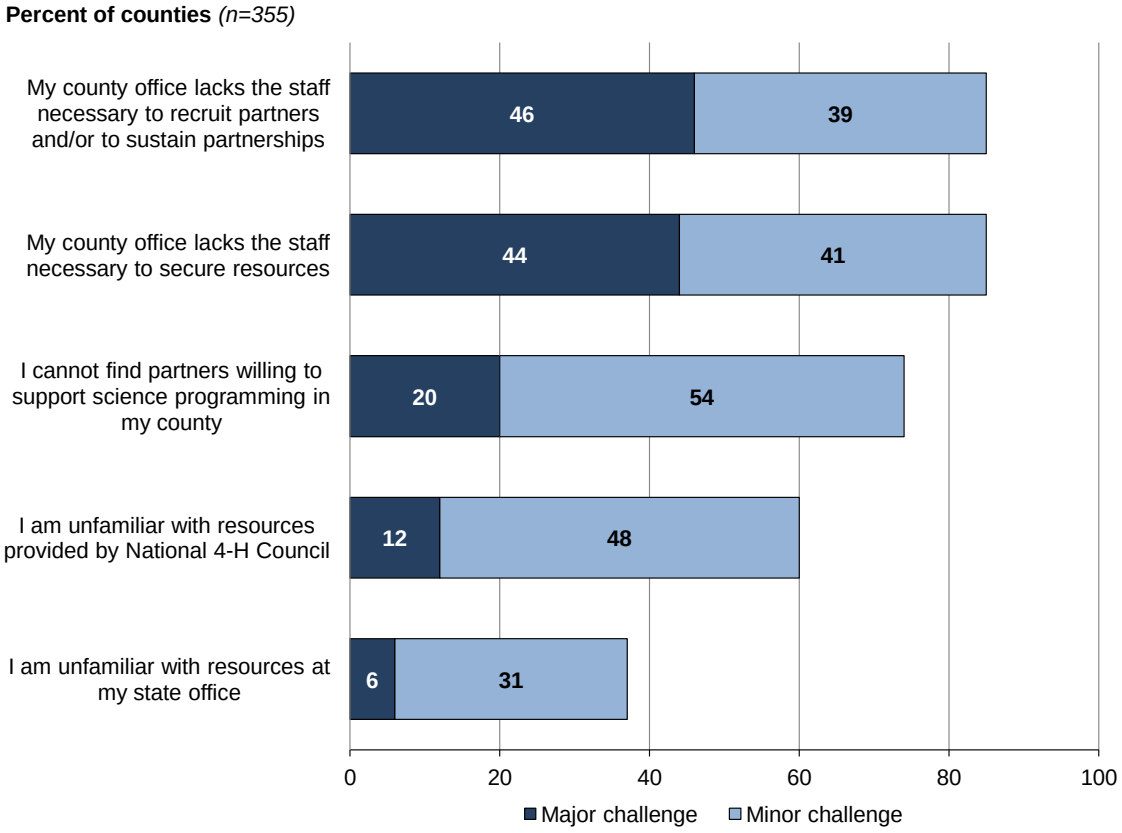

Exhibit reads: Forty-six percent of counties reported that their office's lack of staff to recruit partners and/or to sustain partnerships is a major challenge to building partnerships and securing resources for science programming; 39 percent of counties said it was a minor challenge.

County staffing challenges and partnership challenges may be related to one another. Among counties for whom finding partners to support science programming was a major challenge, 74 percent said that finding qualified science content experts was also a major challenge; 74 percent said that finding qualified youth development experts was a major challenge (Exhibit 17). Partnership challenges and staffing challenges were also related in counties that said their office lacks the staff to secure resources. These analyses do not indicate that one challenge causes another, but rather that many kinds of challenges appear to go hand-in-hand, perhaps indicating a more general issue of capacity in the county office.

Exhibit 17
Successful partnerships in counties with staffing challenges

		Finding qualified science content experts		Finding qualified youth development experts	
		Major challenge	Not a major challenge	Major challenge	Not a major challenge
Item is a "major challenge"	I cannot find partners willing to support science programming in my county *(n=70)*	74*	27	74*	26
	My county office lacks the staff necessary to secure resources *(n=157)*	65*	35	61*	39
	My county office lacks the staff necessary to recruit partners and/or to sustain partnerships *(n=166)*	68*	32	66*	34
	I am unfamiliar with resources at my state office *(n=21)*	57	43	61	38
	I am unfamiliar with resources provided by National 4-H Council *(n=40)*	63	38	68	33

Exhibit reads: In counties that said that finding partners willing to support science programming in their county was a major challenge, 74 percent also said that finding qualified science content experts was a major challenge.

Evaluation

By evaluating science programming in their counties, 4-H staff can monitor program implementation, develop appropriate training for staff and volunteers, improve program quality, and document youth outcomes.

Previous evaluation reports found that LGUs were using or planning to use some form of evaluation for the science programs they run (Mielke et al., 2009). This year, almost two-thirds

of counties surveyed (63 percent) reported that they conduct evaluations of at least some of the science programs in their counties: 54 percent of counties reported collecting and analyzing data for some of the science programs in their county, and nine percent of counties report collecting and analyzing data from all science programs in their county.

Purposes of evaluation. Counties most often conducted evaluations for two very different reasons: because they wanted data to help improve science programs, or because they were required to. More than three-quarters of counties said that they used evaluation data to guide programming decisions (83 percent) or to fulfill reporting requirements not related to grants (76 percent) (Exhibit 18).

Exhibit 18
Use of evaluation data

	Percent of counties *(n=230)*
To guide programming decisions	83
To fulfill other reporting requirements *(other than for grants)*	76
To help replicate promising approaches to programming	47
To fulfill grant requirements	44
To make decisions about professional development/training for volunteers	43

Exhibit reads: Eighty-three percent of counties who conduct evaluations of science programs said that they use evaluation data to guide programming decisions.

Evaluation approaches. Counties that evaluated at least some of their science programs most often developed their own evaluation tools that can assess programming: 23 percent of counties that conducted evaluations did so to a great extent, and 39 percent of counties did so to some extent. Some counties turned to their state extension office to conduct evaluations (19 percent did so to a great extent, 37 percent to some extent). Using external evaluators and working with 4-H National Headquarters to conduct evaluations were uncommon among counties.

Almost all counties that evaluated programs used youth surveys (Exhibit 19). Judging from the number of counties that used state-created youth surveys, counties – and perhaps individual programs – are developing their own youth surveys to use in evaluations. When asked what tools in particular they used to collect data on youth in science programs, 50 percent of counties that evaluated science programs reported using a state-created youth survey to collect data on youth. The national-level Youth Engagement, Attitudes, and Knowledge Survey (YEAK) and the CYFERNET Common Measures were used infrequently – by nine and five percent, respectively, of counties that conducted evaluations.

Exhibit 19
Evaluation methods used

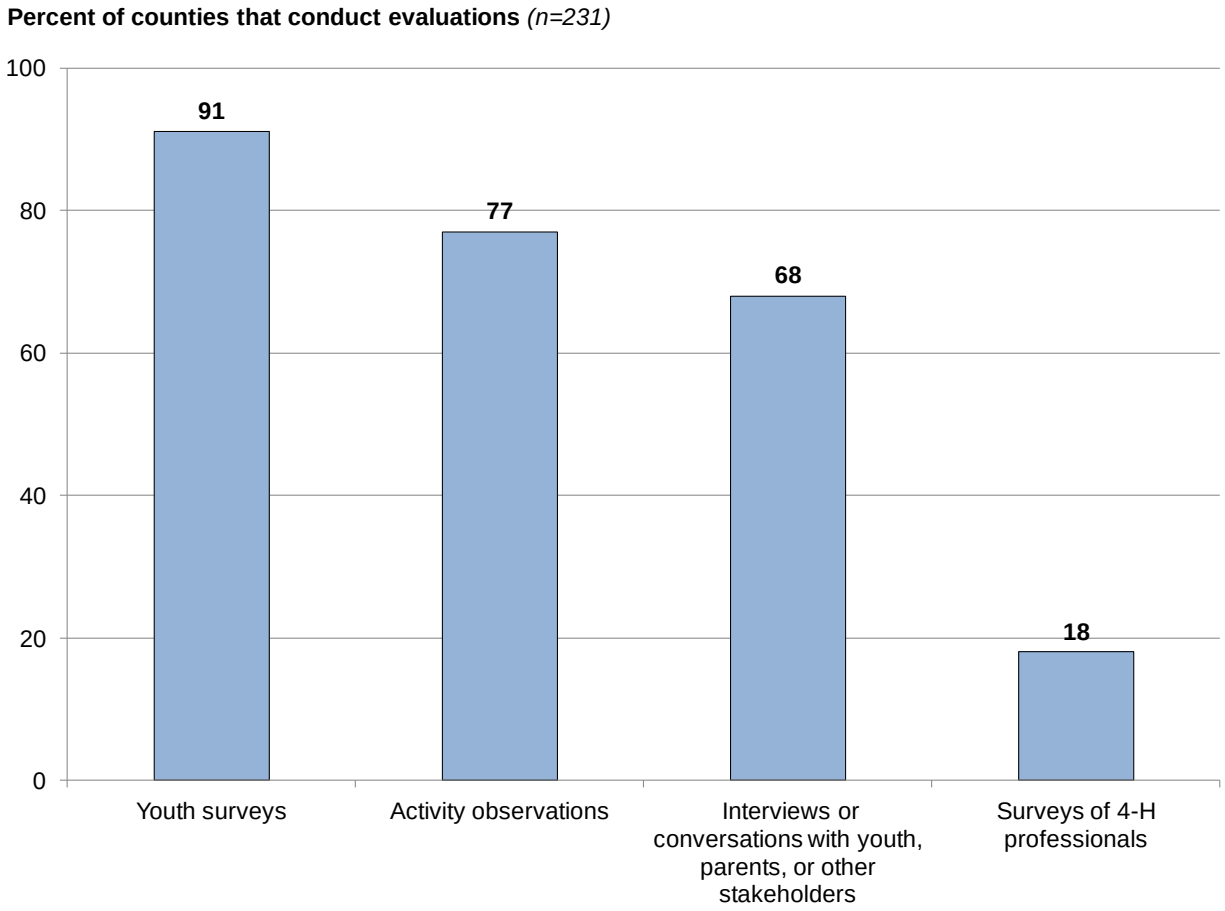

Exhibit reads: Of counties that conduct evaluations of at least some of their science programs, 91 percent reported using youth surveys to do so.

Challenges. All counties, regardless of whether they conducted evaluations of science programming, were asked what challenges they faced. There were differences in almost all areas between the counties that did conduct evaluations of science programs, and those that did not: counties that did not conduct evaluations were significantly more likely to say that the barriers listed posed major challenges to evaluation.

Among counties that did not evaluate science programming, collecting consistent data from programs and a lack of staff time most frequently posed major challenges (Exhibit 20).

Exhibit 20
Major evaluation challenges for counties who do not evaluate science programs

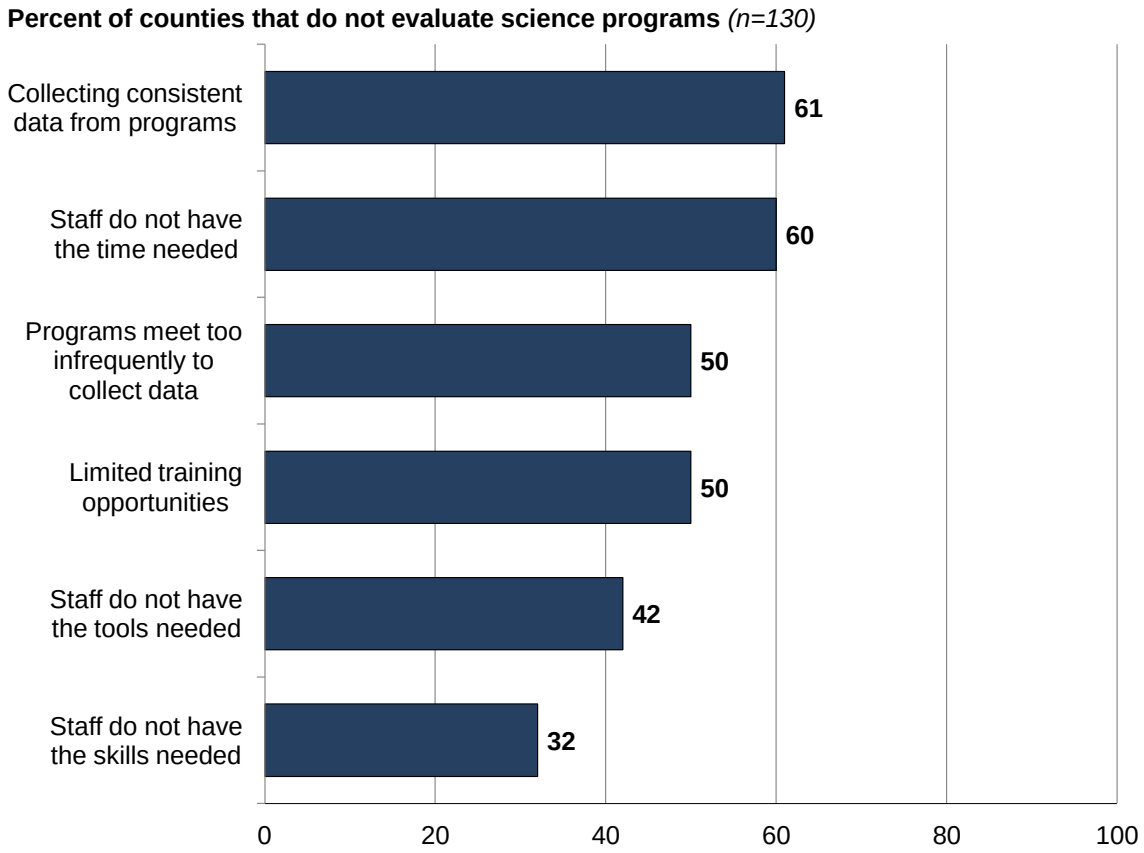

Exhibit reads: Sixty-one percent of counties that do not evaluate science programs said that a major challenge to evaluating programs was collecting consistent data from programs.

Overall, counties that did not conduct evaluations reported more challenges to evaluating science programming than counties that did evaluate: on average, non-evaluating counties reported experiencing 2.9 of the listed major challenges, compared to 1.5 challenges for counties that did conduct evaluations.

Whether or not they conducted evaluations, the majority of counties said that they needed additional supports such as funding, staff training, and additional staff members in order to evaluate 4-H science programs in their counties (Exhibit 21). There were no differences in the additional supports that counties said would help them evaluate 4-H science programs based on whether or not they actually did conduct evaluations.

Exhibit 21
Additional supports needed to conduct evaluations

	Percent of counties *(n=338)*
Additional resources to fund evaluations or purchase evaluation tools	63
Training for local/county staff	63
Additional staff members to conduct evaluations	52
Support from an evaluation specialist	47
Other	8

Exhibit reads: When asked what additional support was needed to evaluate 4-H science programs in their county, sixty-three percent of respondents said that they needed additional resources to fund evaluations or purchase evaluation tools.

Overall Challenges to Implementation

When county agents looked across all of the areas affected by their efforts to implement science programming, the three biggest challenges they faced in implementing science programming all related to staffing. Roughly half of counties reporting that finding science content expert staff, finding youth development staff, and maintaining enough support staff in the county office were major challenges (Exhibit 22).

More than half of counties felt that each of the elements listed in Exhibit 22 posed at least a minor challenge.

Exhibit 22
Challenges to implementation

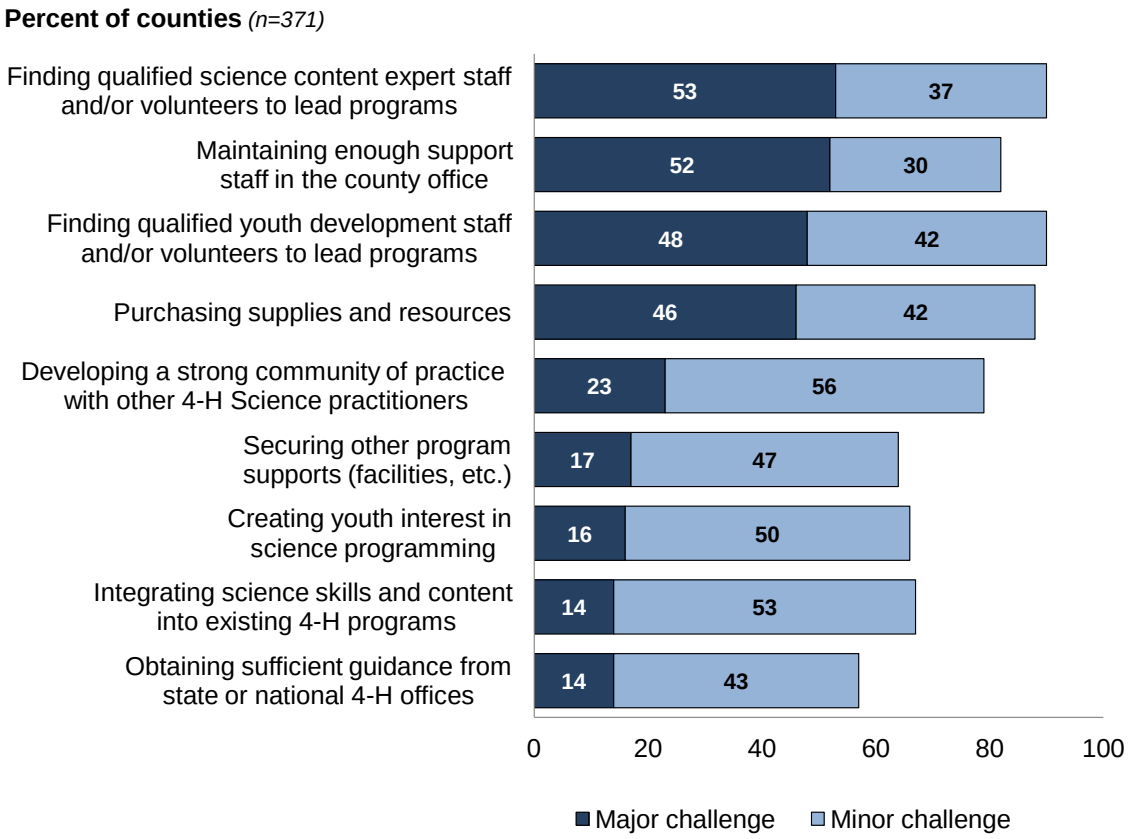

Exhibit reads: Fifty-three percent of county youth development agents said that finding qualified science content expert staff and/or volunteers is a "major challenge"; 37 percent of agents said this is a "minor challenge".

Counties reported fewer major challenges with other aspects of implementing programming, including creating youth interest in science programming, integrating science content into traditional 4-H programs, and acquiring program supports.

Few counties reported facing major challenges in obtaining sufficient guidance from state or national 4-H offices: 14 percent of counties reported that obtaining sufficient guidance was a major challenge to implementing science programming, while 43 percent said it was a minor challenge. Although few counties felt that a lack of guidance posed a major challenge, this is an area that state and national 4-H leaders can directly address.

4-H Science as a State and County Priority

As one of the three mission mandates, 4-H Science is a very high priority for 4-H at the national level. Starting in 2007, with guidance from National 4-H Council, LGUs began to develop strategic plans to implement the 4-H Science Initiative in their states. Each plan outlined the LGU's goals and priorities for science program development, curricula, funding, marketing, professional development, and evaluation. Prior to the start of the 2008 study on science implementation, 56 LGUs submitted a strategic plan (known as a Plan of Action) to National 4-H Council. By 2011, all 50 of the 1862 LGUs and 13 of the 17 LGUs established in 1890 had Plans of Action for implementing science in their areas.

One goal of the survey was to determine the extent to which the science emphasis at the national and state levels has made its way to counties nationwide. The implementation survey asked county-level staff to identify the extent to which their county and their state prioritized science programming. About one-third (37 percent) said that science programming was a high priority in their county, while almost twice as many (66 percent) reported that science was a high priority in their state (Exhibit 23).

Exhibit 23
Science as a priority at state and county levels

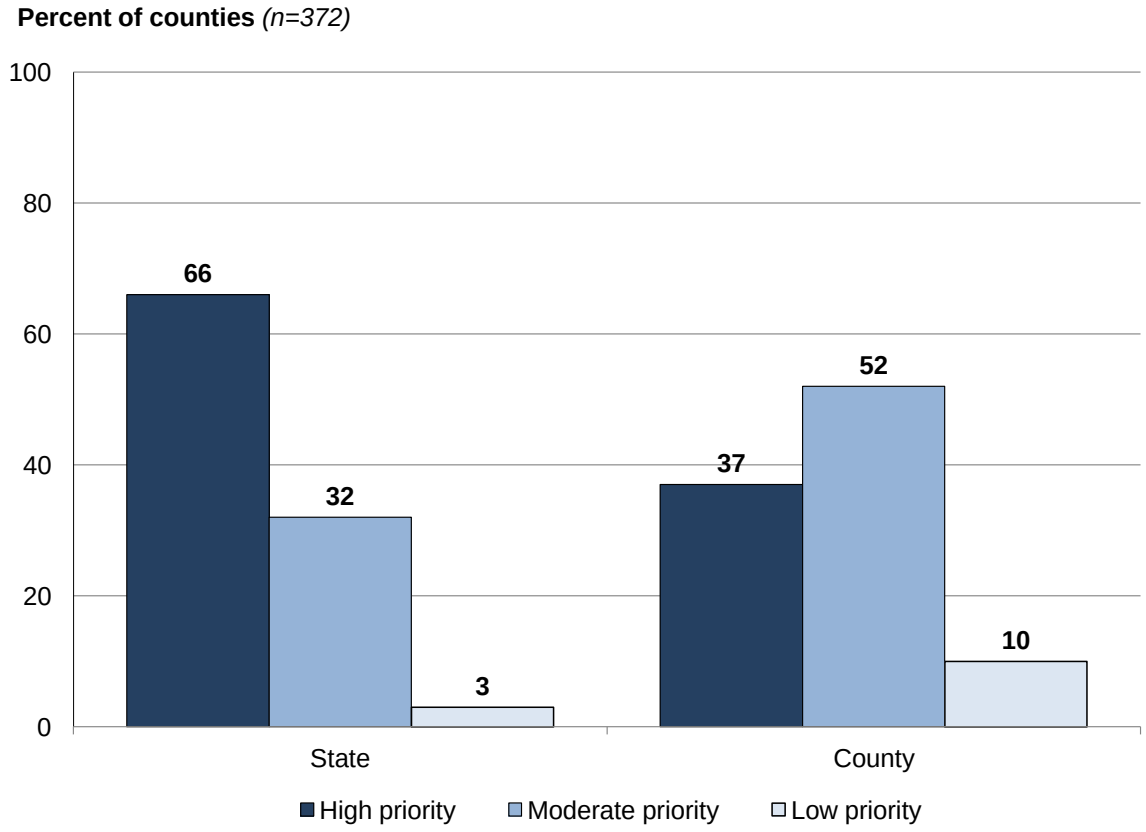

Exhibit reads: Sixty-six percent of respondents reported that science is a high priority in their state. Thirty-seven percent of respondents indicated that science is a high priority in their county.

Among these county youth development agents, 35 percent said that science was a higher priority in their state than in their county: this included those who said it was a high priority for the state and a moderate priority for their county (31 percent of all respondents) and another four percent who said it was a high priority for the state but not a priority for their county (Exhibit 24).

Exhibit 24
Science as a priority at state and county levels (in percents)

	County priority *(n=370)*		
State priority	**High**	**Moderate**	**Low/Not a priority**
High	31	31	4
Moderate	7	19	6
Low/Not a priority	0	2	1

Exhibit reads: Thirty-one percent of county respondents said that in both their county and their state, science is a high priority.

Communication between LGUs and counties regarding 4-H Science is widespread but still has room for improvement, according to the survey. Two-thirds of county agents were aware of their state's strategic plan for science, but one-third was not: 66 percent of respondents said that their LGU had a strategic plan for science; six percent said that their LGU did not have a strategic plan, and 29 percent were unsure. Just over half of the county respondents, 67 percent, said they had worked with a state-level staff person to learn more about 4-H Science.

Growth in science priority since 2006. The county-level focus on science is generally increasing. Among the staff members who had been working in their position as a youth development agent in their county since before 2006, 73 percent said that their county now places more emphasis on establishing and maintaining science programming than it did before 2006. An additional 25 percent said that their county currently places the same emphasis on science programming as it did before 2006. (Almost three-quarters (73 percent) of county staff reported that they had been in their position as their county's youth development agent since at least 2006, the initiative's launch year.)

Program Implementation in Relation to the Priority Placed on Science

Counties more often followed recommendations of the 4-H Science Initiative when the county placed a high priority on science. It is possible that a county made a decision to prioritize science and then implemented the recommended practices, or that implementing these practices sparked a greater commitment to science as a core component of 4-H programming. Although our survey does not reveal *how* priorities and practices developed, it does show that in 37 percent of counties—those that reported placing a high priority on science—program design and support activities showed significant differences from those found in other counties. The counties that

reported placing a high priority on science were more likely than other counties to take many of the actions 4-H considers necessary for high-quality science programs, such as ensuring that programming helps youth build science skills, training staff and volunteers in science content, and evaluating science programs; they also reached out more widely in recruiting youth and staff. At the same time, in the 63 percent of counties that reported a moderate or low priority on science, the practices encouraged in the 4-H Science Initiative were less common, and some of these practices were quite rare.

With respect to program design, 4-H believes that high-quality programming for youth has features such as experiential and inquiry-based learning, alignment with state and national education standards, and activities facilitated by well-trained adults. Analysis of the survey data showed significant differences (both in statistical significance and in effect size) between the two groups of counties in the reported frequency of each of the following practices:

- Incorporating experiential learning into curriculum (reported in 88 percent of counties that placed a high priority on science vs. 65 percent of other counties)
- Incorporating inquiry-based science learning (74 percent vs. 42 percent)
- Connecting curricula to issues directly affecting their county or region (73 percent vs. 49 percent)
- Asking staff to incorporate college and career exploration activities in their programs (50 percent vs. 23 percent)

For every survey item asking about the agents' efforts to ensure high-quality programs, a higher proportion of agents in counties where science was a high priority said that they "always" or "almost always" engaged in that particular type of effort (Exhibit 25), compared with agents in other counties. Notably, 84 percent of these agents reported ensuring that science programming would help youth build science skills, while this was reported by 58 percent of the agents in counties that gave science a lesser priority.

Exhibit 25
Supports for high-quality programming

Supports for high-quality programs	Prioritization of science		All counties *(n=362)*
	High priority *(n=135)*	Not a high priority *(n=225)*	
I encourage activities that include experiential learning elements	93*	78	83
I encourage activities that focus on youth inquiry, creativity, and curiosity	87*	73	78
I ensure that programs are facilitated by adults who are well-trained	77*	64	69
I ensure that science programming helps youth build science skills	84*	58	68
I design, or help design, programming that addresses the Essential Elements of Positive Youth Development	67*	55	59
I work to align science programming with state science education standards	48*	32	38
I work to align science programming with national science education standards	28*	16	21
I strive to make science programs in my county Science Ready as described by the 4-H Science Checklist	29*	16	21
I require volunteers and staff to submit lesson plans or activity guides for the science activities they lead	18*	9	12

Exhibit reads: Among counties who consider science a high priority, 93 percent said they “always” or “almost always” encourage activities that include experiential learning, compared to 78 percent of counties who do not consider science a high priority.

*Differences were statistically significant.

In counties that considered science a high priority, county agents were more likely to recruit youth by informing current 4-H participants about science programming or by advertising on the 4-H website, compared with those in other counties. They were also significantly more likely to engage in recruitment strategies that targeted underrepresented groups. About two-thirds of the counties that prioritized science reported each of four types of outreach to underrepresented groups, but this was the case for half or fewer of the other counties (Exhibit 26).

Exhibit 26
Recruiting and supporting underrepresented groups, by county science priority

Recruitment and support strategies	Percent of counties who do this "to a great extent" or "to some extent"		
	High priority *(n=135)*	**Not a high priority** *(n=223)*	**All counties** *(n=358)*
Helping staff/volunteers increase youth interaction with mentors/role models	68*	46	55
Strengthening outreach efforts to recruit girls and/or youth from underrepresented groups	68*	46	54
Implementing programs that aim to increase engagement of girls and/or youth from underrepresented groups	67*	44	53
Encouraging staff/volunteers to help girls and/or youth from underrepresented groups develop strong self-efficacy toward science	65*	39	49

Exhibit reads: Among counties who consider science a high priority, 68 percent said they help staff and volunteers increase youth interaction with mentors and role models, compared with 46 percent of counties who do not consider science a high priority.

*Differences were statistically significant.

Staff recruitment and training. Counties that considered science a high priority were significantly more likely than their peers to go outside of their 4-H networks to recruit science content experts. While both groups recruited science content experts from parents of 4-H participants and from former 4-H participants, counties that placed a higher emphasis on science reported more recruitment of science experts from:

- Local science-related businesses (68 percent in counties that placed a high priority on science vs. 36 percent in other counties)
- High school and/or college students (58 percent vs. 37 percent)
- University departments (56 percent vs. 22 percent)
- Other community members (67 vs. 45 percent)

There were differences in the science training for county agents and other staff, based on whether science programming was a high priority for their county:

- Training in science content for agents (65 percent in counties that placed a high priority on science vs. 39 percent in other counties) or for staff and volunteers (49 percent vs. 25 percent)

- Training in how to teach science concepts to youth for agents (54 percent vs. 29 percent) or for staff and volunteers (48 percent vs. 22 percent)

- Training in how to design activities that focus on youth inquiry, creativity, and curiosity for staff and volunteers (46 percent vs. 23 percent)

- Shared resources for staff and volunteers to use, such as curriculum guides, a Wiki, or a website (59 percent vs. 37 percent)

Generating staff and/or volunteer interest in attending training was easier in counties where science was a high priority: just 36 percent of those counties called it a major challenge, compared with 56 percent of respondents in counties where science was a moderate or low priority.

Partnerships. Building partnerships and securing resources often posed challenges, regardless of the priority the county placed on science, but the nature of partnerships differed in some respects across counties. Counties in which science was a high priority were more likely to report the following:

- Partnerships with local colleges or university departments other than their state's land grant university (52 percent vs. 25 percent in other counties).

- Partners that contributed volunteers or mentors to support science programming (88 percent vs. 68 percent).

Evaluation. Finally, evaluation practices also varied with the priority placed on science. In counties where science programming was a high priority, respondents were more likely to say that they evaluate at least some science programs in their counties (82 percent of counties, vs. 53 percent of counties where science was a lower priority). Moreover, among counties that evaluated their science programs, 27 percent of counties where science was a high priority had gathered data through surveys of 4-H professionals, compared with nine percent of counties where science was not a high priority but where some evaluation was carried out.

Conclusions and Recommendations

County youth development agents, in their survey responses, described an overall picture of science programming that had several of the strengths that the 4-H Science Initiative has sought to cultivate. The results also suggest ways in which 4-H can continue to work at the national, state, and local levels to expand and improve youth experiences in science.

Widespread Program Strengths

High proportions of counties reported each of the following important strengths in programs and program supports:

- Counties reported offering a broad range of science content to youth. Almost all counties (93 percent) had programs that address newer, non-traditional content as well as programs that address traditional content.

- Experiential learning, an approach recommended in the literature on science learning, was widely valued: 83 percent of county agents reported that they encouraged activities that include experiential learning.

- Willing partners were not hard to find: only 20 percent of county agents said that an inability to find partners to support science programming was a significant challenge. Most counties reported having partnerships with school districts, small businesses, and local government agencies. Partners most often contributed volunteers or mentors, or donated facilities, space, materials, or supplies.

- Most counties had used curricula developed by 4-H at the national level (79 percent) or by their LGU (65 percent) in their science programs.

- Almost two-thirds of counties reported evaluating at least some of their science programs.

- Science was a growing priority: among county youth development agents who have been in their positions since before 2006, most (73 percent) said that their county was placing more emphasis on establishing and maintaining science programming than it did before 2006.

Pacesetting Counties

The 37 percent of counties where science was said to be a high priority were setting the pace for 4-H Science implementation. The following practices were reported in at least two-thirds of counties that placed a high priority on science, and were reported at a rate significantly higher than in other counties:

- Programs incorporated experiential learning in curriculum (88 percent)

- Programs incorporated inquiry-based science learning (74 percent)
- Curricula were connected to issues directly affecting the county or region (73 percent)
- County youth development agents worked to ensure each of the following additional program features:
  - Science programming that would help youth build science skills (84 percent)
  - Programs facilitated by well-trained adults (77 percent)
  - Programming that addressed the Essential Elements of Positive Youth Development (67 percent)
- Youth recruitment and support were designed to target underrepresented groups in each of the following ways:
  - Increasing youth interaction with mentors or role models (68 percent)
  - Strengthening outreach efforts to recruit girls and/or youth from underrepresented groups (68 percent)
  - Implementing programs that aimed to increase engagement and/or youth from underrepresented groups (67 percent)
- Partners contributed volunteers or mentors to support science programming (88 percent)
- Experts in science content were recruited from local science-related businesses to serve as staff or volunteers (68 percent)
- At least some science programs were evaluated (82 percent)

Areas for Improvement

More work remains to be done in implementing the 4-H Science Initiative. Some areas that appeared to be stumbling blocks for many counties were:

Program content and pedagogy. More could be done to infuse standards-based science content into programming. Although almost all counties provided programs in traditional content areas, only 55 percent of counties reported that they integrated intentional science learning into traditional 4-H content areas. Fewer than half of county agents reported that they always or almost always worked to align science programming with state science standards (38

percent), and just 21 percent reported striving to make science programs Science Ready as described by the 4-H Science Checklist.

While experiential learning was reportedly widespread (incorporated into programs in 73 percent of counties), inquiry-based learning was less so (54 percent of counties). Inquiry-based learning may be more difficult for county staff and volunteers to understand and to implement in programming. Indeed, 82 percent of county agents said that their staff and volunteers needed professional development in inquiry, at least to some extent.

Youth recruitment. Counties most often reported that they recruited youth into science programs by informing current 4-H participants about science opportunities (a strategy used at least to some extent by 84 percent of counties) and connecting with schools (78 percent). Fewer used social media (56 percent), despite its ubiquity among youth. Even fewer used youth ambassadors to recruit other youth into science programs (42 percent).

Staff and volunteers. Counties most often looked to 4-H networks, such as parents of 4-H participants and former 4-H participants, as sources of staff and volunteers. At the same time, most counties indicated that finding experts in science to facilitate science programming posed challenges, with 53 percent calling this a major challenge. More outreach to college or university departments or to local businesses with a science focus could help address this challenge.

Although county agents overwhelmingly reported that staff and volunteers who led science programs needed at least some professional development in science content (86 percent) and in how to teach science concepts to youth (84 percent), fewer counties were delivering such training. Only one-third reported that they or someone else in their county had provided professional development in these areas for staff or volunteers during the past year.

Program evaluation. Almost two-thirds of counties reported evaluating at least some of their science programs, most often gathering data through youth surveys. Counties also reported that lack of staff time for evaluation posed a challenge. For greater efficiency, it would be possible for more counties to use existing youth surveys rather than developing their own. Counties might also focus their evaluation efforts on just a few science programs, helping staff and volunteers use the findings for program improvement.

Opportunities for Expanding and Improving 4-H Science in Counties

Across the board, counties reported the challenge of lack of staff time. Still, some counties were doing more than others in science despite this barrier. This suggests that 4-H can build on what has already been accomplished, showing the way to strengthen science programming efficiently. Examples of leading-edge practices can both inspire and support improvement efforts, especially with detailed "how-to" materials. Useful examples could be found in the work that many counties are doing in each of several areas: intentional science learning incorporated into traditional programming, inquiry-based science, outreach that uses social media or youth ambassadors or that targets underrepresented youth, staff training, recruitment of partners from science-rich settings, and practical program evaluation.

Sources of support within 4-H were known and used by counties. In their efforts to implement science programming, the majority of counties relied on their state offices for curricula, training, and advice. Counties accessed curricula as well as marketing materials from 4-H at the national level. Support for the county implementation of the 4-H Science Initiative can continue to come from both the state and the national levels, taking into account the types of help that counties are most accustomed to receiving from each level: widely usable materials from the national level; and both materials and tailored advice from the state.

But not every county will respond in the same way to actions taken at the state or national level. The responses of county agents to our questions about the priority placed on science suggest that counties fell into three groups, almost equal in size, that may bring different predispositions to their work in science. We speculate that these may represent "early adopters," "later adopters," and "laggards" with respect to the innovative ideas in the 4-H Science Initiative (Rogers, 2003).

Just over one-third of county agents (37 percent) reported that science was a high priority in the county. As we have discussed, these counties were doing more than others in many ways. They seem to include the early adopters, and thus many of them are likely to continue to welcome and use new ideas.

Another group of agents (28 percent) said that science was a moderate or low priority in their county *and* also perceived that it was a moderate or low priority in their state. Many members of this group might be characterized as late adopters, and better communication about national and state priorities could be one strategy for sparking their attention to science programming. Recalling that one-third of counties did not know that their state had a plan for science, we conclude that not all LGUs are communicating a sense of urgency about this priority. More direct encouragement and exhortation may help mobilize counties in this group to adopt new practices to strengthen their science programs.

A final group of agents (in 35 percent of counties) said that science was a moderate or low priority in the county while acknowledging that it was a high priority in their state. Some agents in this group may be resistant to the 4-H Science Initiative; others may feel that implementing more or better science programming is simply beyond the capabilities of county staff and volunteers. This group may be slower to embrace the initiative until and unless its features become more and more routine parts of 4-H practice.

Regardless of the attitudes that counties may hold, however, the program approaches and supports that they reported in the survey provide evidence that can be useful in further developing the 4-H Science Initiative. We have reported here on the types of progress being made in implementing the initiative, the areas where further work may be most needed, and the types of support that counties have received from 4-H and their local partners. As 4-H builds on the strengths and continues to offer support, 4-H Science can continue to grow.

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Appendix A: Survey Frequencies

Exhibit A1
When did you begin work as the youth development agent for 4-H in your county?

Year	Percent of counties *(n=372)*
2006 or earlier	73
2007 or later	27

Exhibit A2
Compared to 2006 and earlier, how much emphasis does your county currently place on establishing and maintaining science programming?

Level of emphasis	Percent of counties *(n=269)*
More emphasis than 2006	73
The same emphasis as 2006	25
Less emphasis than before 2006	2

Exhibit A3
Overall, science programming in your county is:

Priority level	Percent of counties *(n=370)*
A high priority	37
A moderate priority	52
A low priority	10
Not a priority	1

Exhibit A4
Does your state have a strategic plan for science?

	Percent of counties *(n=369)*
Yes	66
Don't know	29
No	6

Exhibit A5
Overall, science programming in your state is:

Priority level	Percent of counties *(n=372)*
A high priority	66
A moderate priority	32
A low priority	3
Not a priority	0

Exhibit A6
How much of a challenge is each of the following to implementing 4-H Science programming in your county?

Implementation challenges	Percent of counties *(n=368)*		
	Major challenge	Minor challenge	Not a challenge
Finding qualified science content expert staff and/or volunteers to lead programs	53	37	10
Maintaining enough support staff in the county office	52	30	18
Finding qualified youth development staff and/or volunteers to lead programs	48	42	10
Purchasing supplies and resources	46	42	12
Securing other program supports (facilities, etc.)	17	47	36
Creating youth interest in science programming	16	50	34
Integrating science skills and content into existing 4-H programs	14	53	33
Obtaining sufficient guidance from state or national 4-H offices	14	43	43
Developing a strong community of practice with other 4-H Science practitioners in my county, state, or nationwide	23	56	21

Exhibit A7
Which of the following content areas are addressed in your county's 4-H Science programming?

	Percent of counties *(n=367)*
Large animal science	81
Gardening	75
Small animal science	74
Food science	67
Environmental Science	63
Horticulture	61
Consumer and Family Sciences	58
Veterinary science	56
Robotics	53
Aerospace/Rocketry	53
Plant Science	51
Technology	45
Environmental Stewardship	43
Engineering	34
Geospatial Technology (GPS/GIS)	31
Earth Science	30
Computer Technology	29
Physical Sciences	28
Weather and Climate	27
Other	7

Exhibit A8
Are you responsible for selecting science curricula for use in your county?

Curriculum selection method	Percent of counties *(n=371)*
Yes	64
No, selection is done at the state level	28
No, someone else in my county is responsible for curriculum selection	5
No, we do not use particular science curricula	2

Exhibit A9
What do you look for when selecting curricula?

Criteria for curriculum selection	Percent of counties *(n=238)*
Incorporation of experiential science learning	81
Related to local or regional needs or issues	75
Readily available	72
Educator and volunteer input	66
Incorporation of inquiry-based science learning	66
Low cost	57
Does not require the purchase of new supplies or tools	47

Exhibit A10
Do you use any of the following methods to adapt established curricula or design your own curricula or programming?

Methods for designing or adapting curricula	Percent of counties *(n=369)*
I incorporate experiential science learning	73
I collaborate with educators and volunteers in my county	72
I look for outside materials to supplement curricula	69
I try to connect curricula to issues directly affecting my county or region	58
I integrate intentional science learning into traditional 4-H content areas	55
I incorporate inquiry-based science learning	54

Exhibit A11
Where do you look for science curricula or programming ideas?

Source of program content	Percent of counties *(n=370)*
Other 4-H professionals	66
National 4-H Council website, www.4-h.org	64
Another state's 4-H website	61
My state's 4-H website	60
Science organizations (e.g. museums, science centers)	50
Local teachers	35
Another website not operated by 4-H	10
Other	10
A collaborative website of youth development educators (not necessarily belonging to 4-H)	6
I don't look for science curricula or programming ideas	4

Exhibit A12
How do you support the implementation of high-quality science programming in your county?

Supports for high-quality programming	Percent of counties *(n=362)*		
	Always/Almost Always	Sometimes	Never
I encourage activities that include experiential learning elements	83	16	1
I encourage activities that focus on youth inquiry, creativity, and curiosity	78	21	1
I ensure that programs are facilitated by adults who are well-trained	69	30	1
I ensure that science programming helps youth build science skills	68	29	3
I design, or help design, programming that addresses the Essential Elements of Positive Youth Development	59	33	8
I work to align science programming with state science education standards	38	51	12
I work to align science programming with national science education standards	21	58	21
I strive to make science programs in my county Science Ready as described by the 4-H Science Checklist	21	51	28
I require volunteers and staff to submit lesson plans or activity guides for the science activities they lead	12	43	45

Exhibit A13
What elements do you encourage volunteers and staff to consider when planning science programming?

Program elements	Percent of counties *(n=363)*
Age appropriateness	94
Materials and supplies needed	85
How the activity gives participants opportunities for experiential learning	75
How the activity illustrates the "real world" applications of science content	73
Activity goals	68
How the activity engages participants in scientific inquiry	59
Activity sequencing (e.g., how an activity will build on a previous activity)	52
How the activity includes college and/or career exploration	34
How the activity addresses state or national science learning standards	29
Benchmarks for skill mastery	28
None of the above	2

Exhibit A14
What additional resources do you need to help plan science programming in your county?

Resource	Percent of counties *(n=341)*
Help identifying curricula	61
Training on how to support staff in their efforts to deliver science programming	56
Guidance on inquiry-based learning	44
Help designing or adapting curricula	44
Guidance on experiential learning	34

Exhibit A15
Where do you recruit staff and volunteers?

Sources of staff and volunteers	Percent of counties *(n=369)*	
	Experts in science content	Experts in youth development
Parents of 4-H participants	79	79
Former 4-H participants	65	71
Other community members	53	65
Local businesses with a science focus (e.g., a veterinarian, a biologist)	48	25
High school or college students	44	40
Local college or university departments	34	32
Online or newspaper advertisements	12	20
I have not recruited such staff or volunteers	14	10
Local businesses without a science focus	11	20

Exhibit A16
To what extent have you used the following strategies to encourage youth to join science programs?

	Percent of counties *(n=363)*			
	To a great extent	To some extent	To a limited extent	Not at all
Informing current 4-H participants about science programs	42	42	13	3
Working with school partners	39	39	17	5
Advertising on 4-H website	26	33	21	20
Distributing flyers around the community	23	35	27	15
Holding recruiting events for youth who are not yet part of 4-H	21	36	26	16
Social media	21	35	23	21
Other	13	24	19	45
Using 4-H youth ambassadors to share information about programs with peers	12	30	29	29

Exhibit A17
To what extent is your county using any of the following strategies to encourage girls and/or youth from other groups historically underrepresented in science fields to join science programs?

Strategies for recruitment of underrepresented youth	Percent of counties *(n=356)*			
	To a great extent	To some extent	To a limited extent	Not at all
Encouraging staff/volunteers to place program content in a "real world" context	26	39	23	13
Strengthening outreach efforts to recruit girls and/or youth from underrepresented groups	17	37	28	17
Helping staff/volunteers increase youth interaction with mentors/role models	17	38	26	19
Implementing programs that aim to increase engagement of girls and/or youth from underrepresented groups	15	38	31	17
Encouraging staff/volunteers to help girls and/or youth from underrepresented groups develop strong self-efficacy toward science	14	35	29	22

Exhibit A18
Is there a person in your state's 4-H office that leads professional development, or that leads Science/STEM programming efforts?

	Percent of counties *(n=368)*
Yes	86
No	8
Don't know	7

Exhibit A19
Have you worked with this person in any of the following ways?

	Percent of counties *(n=313)*
Yes, to access resources that I could use in my county	70
Yes, to learn more about 4-H Science	67
Yes, to learn more about teaching experiential and inquiry-based science to youth participants	47
Yes, to find professional development for staff in my county	26
Yes, for another reason	14
No	13

Exhibit A20
What types of professional development have you participated in during the past year?

Professional development participation	Percent of counties *(n=367)*
Training on youth development	73
Training in science content	49
Training on how to design activities that include experiential learning elements	41
Training on how to teach science concepts to youth	39
Training on how to design activities that focus on youth inquiry, creativity, and curiosity	37
Training on how to support staff and volunteers in science programming	25
Training on how to design or adapt curricula	23
None of the above	10
Other	5

Exhibit A21
What types of professional development or resources have you or someone *in your county* provided for 4-H Science staff and volunteers during the past year?

Professional development offered	Percent of counties *(n=360)*
Training on youth development	56
We have shared resources for staff/volunteers to use (e.g., curriculum guides, a website, Wiki, etc.)	46
Training on how to design activities that include experiential learning elements	38
Training in science content	34
Training on how to teach science concepts to youth	32
Training on how to design activities that focus on youth inquiry, creativity, and curiosity	32
None of the above	23
Training on how to design or adapt curricula	17
Other	2

Exhibit A22
To what extent do you believe 4-H Science staff and volunteers in your county need professional development and/or training in the following areas?

Professional development needs	Percent of counties *(n=359)*			
	To a great extent	To some extent	To a limited extent	Not at all
Science content	38	48	11	3
How to teach science concepts to youth	37	47	15	2
How to implement activities that focus on youth inquiry, creativity, and curiosity	36	47	14	4
How to implement activities that include experiential learning elements	31	46	19	5
Curriculum development	28	38	24	10
Youth development	20	52	24	5
Other	15	31	16	39

Exhibit A23
How much of a challenge is each of the following to meeting your county's professional development needs?

Training Challenges	Percent of counties *(n=364)*		
	Major challenge	Minor challenge	Not a challenge
Finding time for staff and/or volunteers to attend training	70	26	4
Money to pay for training	61	31	9
Staff and/or volunteer interest in attending	49	40	12
Finding qualified trainers	43	42	15
Finding trainings that are relevant to people in my county	38	48	14
Location of training events	25	46	29

Exhibit A24
To what extent does your county evaluate 4-H science programs (i.e., collect data from programs and/or youth)?

	Percent of counties *(n=367)*
We collect and analyze data from some 4-H science programs in our county	54
We do not collect and analyze data from 4-H science programs in our county	37
We collect and analyze data from all 4-H science programs in our county	9

Exhibit A25
To what extent has your county used the following approaches to evaluating science programs?

Evaluation approaches	Percent of counties *(n=223)*			
	To a great extent	To some extent	To a limited extent	Not at all
Developing evaluation tools that can assess programming	23	39	25	14
Working with a state extension office to conduct evaluations	19	37	24	19
Training county/local staff members to conduct evaluations	11	33	32	24
Working with an external organization to conduct evaluations	5	8	21	67
Working with 4-H National Headquarters, USDA or National 4-H Council to conduct evaluations	2	10	20	68

Exhibit A26
Which of the following do you use to evaluate science programs?

Evaluation methods	Percent of counties *(n=231)*
Youth surveys	91
Activity observations	77
Interviews or conversations with youth, parents, or other stakeholders	68
Surveys of 4-H professionals	18
None of the above	<1

Exhibit A27
Do you use any of the following tools to collect data on youth in science programs?

Evaluation tools	Percent of counties *(n=221)*
State-created youth survey	50
None of the above	34
State-created observation tool	27
Other	14
Youth, Engagement, Attitudes, and Knowledge Survey (YEAK)	9
CYFERNET Common Measures	5

Exhibit A28
How does your county use evaluation data?

	Percent of counties *(n=230)*
To guide programming decisions	83
To fulfill other reporting requirements	76
To help replicate promising approaches to programming	47
To fulfill grant requirements	44
To make decisions about professional development/training for volunteers	43
None of the above	1

Exhibit A29
How much of a challenge is each of the following to evaluating science programs in your county?

Challenges to evaluation	Major challenge	Minor challenge	Not a challenge
County/local staff do not have the time needed to conduct evaluations	45	40	15
Collecting consistent data from programs	43	47	10
There are limited training opportunities to prepare staff to conduct evaluations	35	47	19
Programs meet too infrequently to collect data	31	43	26
County/local staff do not have the tools needed to conduct evaluations	30	43	27
County/local staff do not have the skills needed to conduct evaluations	20	46	34

Exhibit A30
What additional support is needed to evaluate 4-H science programs in your county?

	Percent of counties *(n=338)*
Training for county/local staff	63
Additional resources to fund evaluations or purchase evaluation tools	63
Additional staff members to conduct evaluations	52
Support from an evaluation specialist	47
Other	8

Exhibit A31
Please indicate the types of organizations with which your county's 4-H programs have partnerships. Partners may provide funding, supplies, materials, facilities, or other supports that help keep programs operational.

	Percent of counties *(n=361)*
School districts	86
Small businesses	75
Local government agencies	60
State 4-H foundation	52
Large businesses	43
Local college or university departments (other than your state's land grant university)	35
Faith-based organizations	35
4-H Friends and Alumni Association	33
Federal government agencies other than USDA (e.g., NASA)	19
Other	13
None of the above	2

Exhibit A32
Please indicate the contributions that partners have made to science programming in your county.

	Percent of counties *(n=359)*
Volunteers or mentors	76
Donation of facilities or space	68
Donation of materials or supplies	66
Funding	54
Help with participant recruitment	37
Curriculum	21
Transportation services for participants	16
Training for 4-H staff and/or volunteers	15
None of the above	7
Other	1

Exhibit A33
Which of the following resources from your state office have you used to support science programming in your county?

	Percent of counties *(n=351)*
Curricula developed by my state office or Land Grant University	65
A state-operated website to access training and/or professional development tools	62
I have consulted with staff at the state office	56
Marketing or promotional materials	43
Tools to find partners and funders	15
None of the above	10
Other	3

Exhibit A34
Which of the following resources provided by 4-H at the national level have you used to support science programming in your county? *(Select all that apply)*

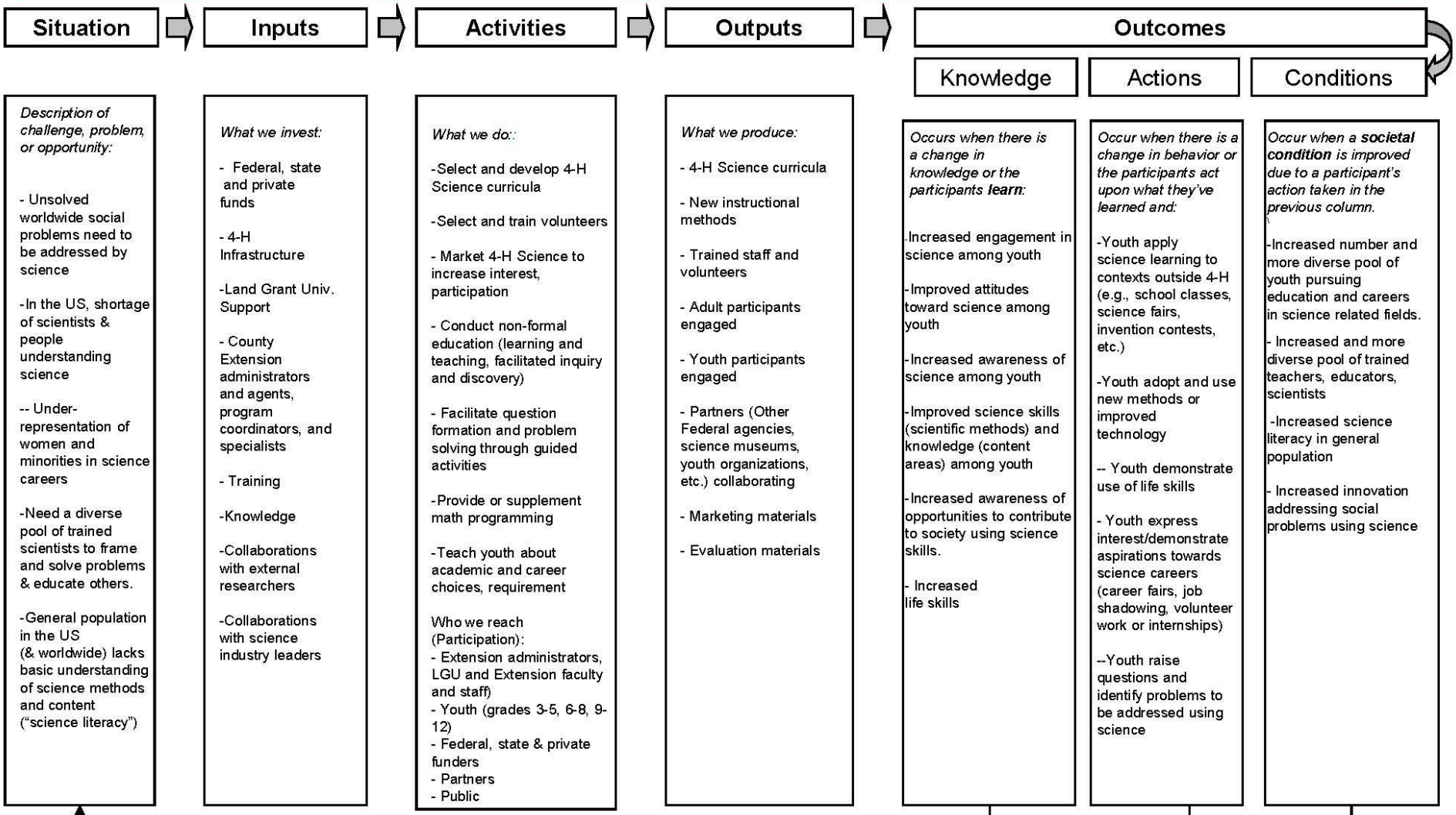
	Percent of counties *(n=351)*
Curricula developed or supported by 4-H at the national level	79
Marketing or promotional materials	41
Training and/or professional development tools (e.g., scripted training guides, self-guided training, etc.)	27
Organizational guidelines (e.g., how to start a club)	24
None of the above	14
Tools to find partners and funders	9
I have consulted with national-level staff	6
Other	2

Exhibit A35
How much of a challenge to building partnerships and securing resources for 4-H Science programming in your county are each of the following?

Partnership challenges	Percent of counties *(n=355)*		
	Major challenge	Minor challenge	Not a challenge
My county office lacks the staff necessary to recruit partners and/or to sustain partnerships	46	39	15
My county office lacks the staff necessary to secure resources	44	41	15
I cannot find partners willing to support science programming in my county	20	54	27
I am unfamiliar with resources provided by National 4-H Council	12	48	41
I am unfamiliar with resources at my state office	6	31	63

Appendix B: 4-H Science Logic Model and Checklist

4-H Science Logic Model



ASSUMPTIONS – 4-H non-formal experientially based programming addresses science abilities, concepts and content under guidance of trained (scientifically able) 4-H learning facilitator; 4-H develops appropriate science abilities to emphasize in non-formal education; 4-H essential elements create optimal youth development context for learning; 4-H reaches diverse population; and increased awareness of science skills, content, and career possibilities increases engagement of youth in science careers.

EXTERNAL FACTORS – Youth experience in schools including [with] science & mathematics, No Child Left Behind (course content, testing, tutoring provided in school), changing landscape of schools, community and family influence (e.g., religious teaching on Creationism), population changes, immigration, global economy and competition in science education and science pursuits.

Note: 4-H Science encompasses science, engineering, technology and applied math.

Updated November 1, 2010

4-H Science Checklist

A "Science Ready" 4-H experience is a program that is framed in Science concepts, based on Science standards and intentionally targets the development of science abilities and the outcome articulated by the 4-H Science Logic Model. Additionally, it integrates the Essential Elements and engages participants in experiential and inquiry based learning. In addition to the following criteria below, it's also recommended that science programs offer a sustained learning experience which offers youth the opportunity to be engaged in programs with relevant frequency and duration. Utilize the following checklist to self assess the program you deliver.

To meet the needs of children, youth and the nation with high-quality science, engineering and technology programs…

☑	**Are you providing science, engineering and technology programs based on National Science Education Standards -** Science education standards are criteria to judge quality: the quality of what young people know and are able to do; the quality of the science programs that provide the opportunity for children and youth to learn science; the quality of science teaching; the quality of the system that supports science leaders and programs; and the quality of assessment practices and policies. **http://www.nap.edu/readingroom/books/nses/**
☑	**Are you providing children and youth opportunities to improve their Science Abilities?** Predict, Hypothesize, Evaluate, State a Problem, Research Problem, Test, Problem Solve Design Solutions, Measure, Collect Data, Draw/Design, Build/Construct, Use Tools, Observe, Communicate, Organize, Infer, Question, Plan Investigation, Summarize/Relate, Invent/Implement Solutions, Interpret/Analyze/Reason, Categorize/Order/Classify, Model/Graph/Use Numbers, Troubleshoot, Redesign, Optimize, Collaborate, Compare
☑	**Are you providing opportunities for youth to experience and improve in the Essential Elements of Positive Youth Development?** Do youth get a chance at **mastery** – addressing and overcoming life challenges in your programs? Do youth cultivate **independence** and have an opportunity to see oneself as an active participant in the future? Do youth develop a sense of **belonging** within a positive group? Do youth learn to share a spirit of **generosity** toward others?

☑	Are learning experiences led by trained, caring adult staff and volunteers acting as mentors, coaches, facilitators and co-learners who operate from a perspective that youth are partners and resources in their own development?
☑	Are activities led with an experiential approach to learning?
☑	Are activities using inquiry to foster the natural creativity and curiosity of youth?
☑	Does your program target one or more of the outcomes on the 4-H Science Logic Model and have you considered the frequency and duration necessary for youth to accomplish those outcomes?