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An Instrument to Evaluate 4-H Cloverbud STEM Programming

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Abstract. Evaluation data is needed to demonstrate the impact of 4-H science, technology, engineering, and mathematics (STEM) programming on children and youth. However, collecting evaluation data from cloverbuds (ages 5–7) is particularly challenging given their developmental age. We adapted an observational Cloverbud evaluation tool to measure basic life skills, essential elements of positive youth development experiences, and, unique to this tool, STEM specific experiences. We developed the STEM items using educational science standards allowing Extension to document STEM in addition to youth development outcomes. Doing so, may increase the adoption of 4-H STEM programming by teachers in the school setting.

INTRODUCTION

Science, technology, engineering, and mathematics (STEM) programs in 4-H, such as LEGO robotics, animal science, and shooting sports, use hands-on activities to inspire youth to explore STEM concepts. STEM-related learning opportunities can teach young people life skills, such as how to problem-solve and think critically (Simoncini & Lasen, 2018; Tippett & Milford, 2017). Because youth interest in STEM decreases over time (Brotman & Moore, 2008), introducing young children to STEM topics is crucial for fostering future interest in STEM-related activities (Maltese & Tai, 2011; Wai et al., 2010). This interest can lead to long-term outcomes identified in the National 4-H Science Logic Model (National 4-H Council, 2010), including increased and more diverse youth pursuing science-related education and careers. As a result, Mississippi State University Extension developed the 4-H LEGO Engineering Club for Cloverbuds (ages 5–7) to address the need for early exposure to STEM education. Given the importance of STEM and Donaldson et al.'s (2020) recent call for Extension professionals to conduct rigorous evaluation of 4-H STEM programs, we developed a tool to collect STEM information from the youngest 4-Hers.

DESCRIPTION OF PAST CLOVERBUD EVALUATION TOOLS

Evaluation of programming with young children (such as Cloverbuds ages 5–7) is challenging, as it is inappropriate to survey the children directly, given that they do not yet have the capacity for concrete operational thought (Piaget, 1952). Therefore, observational assessments completed at the end of the program (i.e., retrospective) are an effective way to collect evaluation data on young children. For example, Extension nutrition programs for young children have used observational instruments completed by adults to estimate the number of children they perceived to have achieved benchmarks (Arnold & Screiber, 2012; Bellows et al., 2021; Edwards & Herman, 2011) and retrospective surveys completed by parents (Norman et al., 2018) to assess program outcomes for young children.

Scheer (n.d.; Scheer et al., 2011) developed the Ohio 4-H Cloverbud Evaluation instrument, an observational tool to collect data on the youngest 4-Hers (see Table 1). The instrument includes 13 items to assess outcomes. The first five items represent basic life skills, such as self-esteem, physical skills, subject-matter knowledge, the ability to get along with others, and decision-making skills. The remaining eight items reflect the eight essential elements of effective 4-H youth development programs and experiences developed in 1999 by a team of evaluators from

Table 1. Items Assessing Outcomes on the Ohio 4-H Cloverbud Evaluation Instrument

Because of participation in 4-H Cloverbuds LEGO Engineering program, I observed that the 4-H Cloverbud children:	***Circle One*** *None of the Children*				*All of the Children*
Gained self-confidence - self-esteem (children displayed confidence and positive self-esteem as observed in their ability to participate in the 4-H Cloverbud activities, ask/answer questions, and interaction with others)	0	1	2	3	4
Improved their physical skills (children exhibited fine [writing, cutting, drawing, etc.] and gross [jumping, arm and leg movement, body coordination, etc.] motor skills)	0	1	2	3	4
Gained subject matter knowledge (children expressed verbal and nonverbal knowledge related to the subject matter content of their 4-H Cloverbud activity involvement)	0	1	2	3	4
Improved in getting along with others (children were able to share, communicate, and make friends with other peers in the 4-H Cloverbud group)	0	1	2	3	4
Increased decision-making skills (children were able to make decisions in regard to activity input and interaction with peers and adult leaders)	0	1	2	3	4
Experienced positive relationships with caring adults (children were learning and developing in an adult-leader-directed environment: a positive learning environment that is caring, supportive, and fun)	0	1	2	3	4
Experienced inclusive environments (using cooperative-learning techniques as the children worked on activities together; engaging the children in curriculum that were noncompetitive without setting up categories or classes; valuing and respecting the diversity of all participants)	0	1	2	3	4
Experienced opportunities for mastery/competence (allowing the children to be creative across eight different subject areas; utilizing the experiential learning cycle through the activities as children experienced, shared, processed, and generalized; having curriculum and activities that met the needs of these children)	0	1	2	3	4
Experienced opportunities to value and practice service to others (the appreciation of community service through 4-H Cloverbud activities; cleaning up after activities and children helping each other; sharing materials and respecting fellow 4-H Cloverbud members)	0	1	2	3	4
Because of participation in 4-H Cloverbuds LEGO Engineering program, I observed that the 4-H Cloverbud children:	***Circle One***				
Experienced an emotionally and physically safe environment (meeting the needs of children where they were emotionally, physically, socially, and cognitively; taking special considerations to ensure the safety of 4-H Cloverbud children with low-risk and safe activities; having a low ratio of children to adults, at about 6 to 1)	0	1	2	3	4
Experienced opportunities for self-determination (success-oriented activities to help children gain confidence; using noncompetitive activities to foster intrinsic motivation; focusing on the process of doing activities rather than the product)	0	1	2	3	4
Experienced opportunities for engagement of learning (fun, positive experiences for children; providing numerous subject areas that interested the participants; being a nurturing role model, enthusiastic, and sensitive)	0	1	2	3	4
Experienced opportunities to see oneself as an active participant in the future (giving the children choices in upcoming activities; exploring a variety of future career options; discussing and role-playing the reality that what one does today often determines what happens tomorrow)	0	1	2	3	4
Experienced opportunities for leadership and independence (gained skills and confidence for leadership and self-discipline; learned responsibility for decisions made and action taken; led simple tasks)	0	1	2	3	4

Note. Reprinted from Scheer, S. D. (n.d.). Ohio 4-H Cloverbud Evaluation. Ohio State University Extension. https://ohio4h.org/sites/ohio4h/files/d6/files/4-H%20Cloverbud%20Program%20Evaluation(1).pdf.

the National 4-H Impact Design Implementation Team (Essential Elements National 4-H Learning Priority Team, 2009). The items were structured by using an observational scale to represent what proportion of the participating children exhibited the listed behavior or experienced the listed setting as a result of their involvement in the 4-H program. The scale ranged from 0 (*none of the children*) to 4 (*all of the children*). Therefore, the tool allows for a group-level assessment. Five additional items document program delivery information. The instrument is completed at the conclusion of the program by adult volunteer leaders who have worked directly with the participating children.

CLOVERBUD STEM EVALUATION TOOL

To develop an evaluation tool to measure the 4-H LEGO Engineering Club for Cloverbuds curriculum, Mississippi State University Extension added a new section to Scheer's Cloverbud tool to assess STEM outcomes (i.e., interest/engagement, favorable attitudes, skills/abilities). Like the existing Cloverbud tool, the STEM section uses an observational and retrospective approach. In developing this section, we aligned individual items to state and national educational standards (Mississippi College- and Career-Readiness Standards for Science [Mississippi Department of Education, 2018] and the Next Generation Science Standards [NGSS Lead States, 2013]). Two items assess STEM interest and attitudes, and the remaining items measure STEM skills and abilities (see Table 2). In addition to adding the STEM items, we changed the response options on the original Cloverbud tool from a numeric scale to statements reflecting what proportion of the participating children exhibited each listed outcome (i.e., *none of the children*, *some of the children*, *half of the children*, *most of the children*, *all of the children*); those response options were carried through on the STEM items.

Table 2. STEM Add-On Evaluation Items

Because of participation in 4-H Cloverbuds LEGO Engineering program, I observed that the 4-H Cloverbud children:	**None of the children**	**Some of the children**	**Half of the children**	**Most of the children**	**All of the children**
Increased interest and engagement in STEM (Science, Technology, Engineering and Math) (children expressed interest in science and were engaged by the science-based lessons and activities)					
Improved attitudes toward STEM (children expressed positive attitudes and aspirations toward science)					
Developed STEM skills and abilities (such as listening, observing, searching, asking questions, gathering information, etc.)					
Asked questions about a problem					
Defined a problem					
Developed a simple model					
Used a simple model					
Constructed explanations					
Designed solutions					
Evaluated information					
Communicated information					
Answered questions about a problem					
Spoke audibly					
Expressed thoughts, feelings, and ideas clearly					
Used a combination of drawing, dictating, and writing to communicate about a topic					
Added drawings or other visual displays to descriptions to provide additional detail					
Participated in collaborative conversations with peers and adults					

Scheer's original items assessing program delivery were adapted to collect additional participant demographics and program delivery information (see Table 3). For instance, we developed an item to capture which curriculum lesson(s) were delivered on the date the evaluation was completed. We also added items to document the number of boys and girls who participated and the setting in which the curriculum was delivered. Because Mississippi State University Extension STEM curricula are also implemented in multiple settings, we added an item to account for adults in other roles who might be completing the evaluation.

USING THE EVALUATION TOOL

In Mississippi, the tool has been used to evaluate multiple 4-H Cloverbud STEM curricula. There is flexibility in administering this tool post-assessment, as it could be used after a multi-lesson curriculum has been fully implemented or following each lesson. Although it was originally designed to be completed on paper, it can also be administered online via Qualtrics.

The evaluation tool is used to provide a snapshot of the proportion of children who displayed life skills, encountered the elements of positive youth development programs, and achieved STEM outcomes (i.e., interest/engagement, favorable attitudes, skills/abilities) as a result of program participation. Because the tool allows for a group-level assessment, there is no need to compile individual surveys, and comparisons across demographic groups cannot be made. Therefore, little to no analysis is required to interpret and use the evaluation results.

The evaluation findings have immediate and direct utility for teachers, Extension agents, 4-H volunteers, or others implementing a 4-H Cloverbud STEM program. Data collected with this tool can be used by facilitators to determine whether certain STEM skills warrant further development. For instance, if none or only some of the children exhibited a particular skill, the facilitator may need to spend additional time on that skill, whereas if most of or all the children are exhibiting a skill, that may indicate mastery of that skill. Collecting this information may be particularly useful to teachers to demonstrate what proportion of students have achieved educational STEM standards.

These data are valuable for Extension professionals to document that 4-H Extension programming contributes to STEM outcomes among our youngest 4-Hers. Data collected across a state can be aggregated to demonstrate the proportion of children who have encountered STEM as a result of 4-H Cloverbud programming. These data may be particularly valuable for Extension to leverage with local and state legislators to justify increased funding for 4-H educational efforts.

Table 3. Demographic and Program Delivery Items

Number of children represented in this evaluation ________________
Number of girls __________ and boys ___________
How was this program delivered? ☐ 4-H Club ☐ 4-H Camp ☐ After-School Program ☐ In-School Program ☐ Other: ____________________________
Person completing this evaluation ____
Which county does this evaluation represent? ____________________________
What is your role? ☐ 4-H Cloverbud Volunteer Leader ☐ Teacher ☐ 4-H Cloverbud Parent ☐ Extension Agent ☐ Youth Worker ☐ Other: ____________________________
How long (e.g., months, years) have you served as a 4-H Cloverbud Volunteer Leader? _____________

CONCLUSION

A recent scoping review of 4-H youth development programs revealed a need to conduct rigorous program evaluation and research on said programs to document their effect on youth and improve youth development programming (Agans et al., 2020). Collecting data on 4-H Cloverbud programming is an important step toward documenting outcomes and strengthening programming for the youngest 4-Hers. This evaluation tool provides an opportunity for Extension systems implementing Extension programming with young children to collect evaluation data on this population. It captures basic life skills, essential elements of positive youth development experiences, and, unique to this tool, STEM-specific experiences. The inclusion of state and broader science standards in the evaluation tool enhances the adoptability of the curriculum in schools, as teachers can demonstrate that their students will meet state and national science standards as a result of the program.

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