

Cornell Lab of Ornithology Evaluation Research

clo-evaluation_research@cornell.edu

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Technical Brief: Self-Efficacy for Learning and Doing Science **(SELDS, Generic)**

Description:

Self-efficacy, or a person's beliefs about his/her capabilities to learn specific content and perform particular behaviors (Bandura 1997), is associated with choice, effort, and persistence in the pursuit of those behaviors (Bandura 1982; 2000; Schunk 1991). Individuals who feel efficacious put more effort into their activities and persist at them longer than those who doubt their abilities. Self-efficacy is sometimes referred to as "perceived competence" (in Self Determination Theory) and "perceived behavioral control" (Ajzen's Theory of Planned Behavior 1991). Berkowitz et al. (2005) treat self-efficacy as an essential component in environmental citizenship (along with motivation and awareness), which is dependent on an individual's belief that they have sufficient skills, knowledge, and opportunity to bring about positive change in their personal lives or communities. Crall et al. (2011) determined that self-efficacy is important in carrying out the principal activities of the project.

Intended Use/Audience: Adults

The SELDS Scale measures an individual's confidence in learning science topics and engaging in scientific activities. It contains 8 items (range 1-5) and can be administered in its entirety or split into its two components: learning science and doing science. The scale can be administered online, by telephone, or via paper. It should take about 10 minutes to complete and can be administered as a pretest and/or posttest. (Please contact us if you would like to administer a retrospective pre-post version of this scale). This scale was developed and tested in the context of informal science learning environments (primarily with participants of citizen science projects).

Evidence Reliability/Structure:

In-person focus groups, online feedback, and expert review were initially conducted with small groups of citizen science participants (8-50) to establish face and content validity. Field tests were conducted with participants from the Great Backyard Bird Count (GBBC), an annual bird count hosted by the Cornell Lab of Ornithology. The Cronbach's alpha coefficient (N=460) was 0.92, indicating high internal consistency. Two-week test-retest reliabilities for the total averaged items were $r = .82$ and $.89$, indicating that the SELDS scale could achieve stable responses from a single sample over time. Item-total correlations measured by Pearson's correlation between each item and the total scale ranged from $.54$ to $.83$, indicating that all items measure consistently with the total scale, and suggesting a positive item discrimination power. The SELDS scale also showed positive correlations with a different scale measuring interest in science and motivation for learning and doing science, suggesting concurrent validity. Finally, an exploratory factor analysis showed a unidimensional scale with all factor loadings above 0.70.

How to Score:

Cleaning your data

Some project participants will not respond to this scale as carefully as you might hope. It is important to clean your data to account for this. Once you have entered the data into a spreadsheet such as Microsoft Excel or a statistical package such as SPSS or R, keep an original version of the master data set, and make a copy from which to work. Do the following simple checks:

- 1) Look across each row or case (i.e., set of responses from individual participants). If more than 25% of responses are missing from any row, exclude that row (participant) from your analysis.
- 2) Look across each row again, checking for rows in which all responses are the same. In general, seeing the same response for all items in a row is an indication that the respondent was not reading the items carefully. In particular, items 3 and 7 are “reverse coded,” which means they are worded in such a way that they should receive opposite answers from other questions if respondents are answering all questions in a consistent manner. We recommend excluding from your analysis cases where all answers are the same unless they are all threes, as many respondents legitimately provide midpoint responses to all questions.

Scoring instructions

Once you have implemented the Self-Efficacy for Learning and Doing Science scale and have cleaned your data, calculate the self-efficacy score as follows:

- 1.) Reverse the responses to questions 3 and 7 such that 1's become 5's, 2's become 4's, 3's stay 3's, 4's become 2's, and 5's become 1's.
- 2.) Average together the scores for all of the items for each participant. Scores below 3 indicate low levels of confidence in learning project-related information and/or participating in project activities. Conversely, you can determine high or low interest of an individual relative to the average of the group score (see below).
- 3.) You can also average together the overall scores from all of your participants for an overall group score.
- 4.) Given that the scale includes separate sets of items for learning (items 1-4) and doing (items 5-8), you might want to average those sets of responses (either for individual or group) separately to investigate whether participants are more or less confident with one or the other concept.

Note: If you are administering the scale before and after program participation and comparing the two sets of scores as part of a pre-post participation evaluation, you might want to consider grouping your participants into those who started out relatively low in self-efficacy and those who started out relatively high. While expecting an increase in self efficacy among participants who started out relatively low is reasonable, you should not expect to see much, if any, increase in those who started out already quite confident in their abilities. You should consider merely maintaining that high level as a positive outcome.

Analytic Options: After your data have been cleaned, the scores can be treated as either ordinal or continuous variables and used in a multitude of analytical options such as t-tests, ANOVA, and regressions.

References:

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On the following page, please find the Self-Efficacy for Learning and Doing Science (SELDS, Generic) scale. There is a form field above the scale so that you may enter your own title for your survey.

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Please indicate how much you **DISAGREE** or **AGREE** with each of the following statements by circling the number in the appropriate column. Please respond as you really feel, rather than how you think “most people” feel.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
These statements are about how you feel about <u>learning and understanding science topics</u>.					
1. I think I'm pretty good at understanding science topics.	1	2	3	4	5
2. Compared to other people my age, I think I can quickly understand new science topics.	1	2	3	4	5
3. It takes me a long time to understand new science topics.	1	2	3	4	5
4. I feel confident in my ability to explain science topics to others.	1	2	3	4	5
These statements are about how you feel about <u>doing scientific activities</u>.					
5. I think I'm pretty good at following instructions for scientific activities.	1	2	3	4	5
6. Compared to other people my age, I think I can do scientific activities pretty well.	1	2	3	4	5
7. It takes me a long time to understand how to do scientific activities.	1	2	3	4	5
8. I feel confident about my ability to explain how to do scientific activities to others.	1	2	3	4	5