4-H Science, Engineering, and Technology Abilities

Learning science is not about memorization. When youth are encouraged to use science processes to discover knowledge themselves, youth become engaged and motivated to learn science content.

Both science **content** and **abilities** (processes) are critical to increase science literacy. The National Science Education Standards call for the learning of unifying abilities as these provide youth with powerful ideas to help them understand the natural world. Emphasis has shifted from being solely on "the content to be learned" to "**how** students learn the content" and "**how** the content is taught."

The 4-H SET program outlines thirty important science processes and refers to them as **4-H SET Abilities**. These thirty 4-H SET Abilities include distinct and measurable behaviors and are critical elements of experiential learning and inquiry. For example – A young person may *state a problem* about water quality (content), *plan an investigation*, *collect data*, *analyze* the data, *graph* results, *summarize, communicate to others*, and then work on *implementing a solution.* Through these steps, content is learned by engaging youth in the process of science, engineering and technology.

Thirty 4-H SET Abilities

1.	**Build/Construct**	Make by putting materials together.
2.	**Categorize/Order/Classify**	Put objects or events in groups or classes.
3.	**Collaborate**	Work together; applies both to the work of individuals as well as larger groups.
4.	**Collect Data**	Record information in an organized fashion about objects and events that illustrate a specific situation.
5.	**Communicate/Demonstrate**	Methods and for involving various media that transfer information from one person to another.
6.	**Compare/Contrast**	Examine and evaluate *similarities* and *differences*. All measurements are forms of comparing.
7.	**Design Solutions**	Written plan or *design brief*, that identifies a problem to be solved, its criteria, and its constraints.
8.	**Develop Solutions**	Systematic strategy used to develop many possible solutions to solve a problem or satisfy

		human needs and wants.
9.	**Draw/Design**	Plan in systematic graphic form; process of originating and developing a plan for a product, structure, system or component.
10.	**Evaluate**	Technique of examining and judging data presented.
11.	**Hypothesize**	State of tentative generalization, which is subject to immediate or eventual testing by one or more experiments; to explain a relatively large number of events.
12.	**Invent/Implement Solutions**	Practical application to fulfill a desired purpose.
13.	**Infer**	Explain an observation in terms of one's previous experience. Leads to predictive explanations.
14.	**Interpret/Analyze/Reason**	Determine the nature and relationship of the parts of the whole. Find a pattern inherent in a collection of data. This process leads to stating a generalization or drawing conclusions. In an experiment, it is the process by which one establishes the relationship between controlled factors and the outcome.
15.	**Measure**	Procedure by which one uses an instrument to estimate a quantitative value associated with some characteristic of an object or event.
16.	**Model/Graph/Use Numbers**	Devise a scheme or structure that will describe specific real objects or events.
17.	**Observe**	Most basic process of science, in which learners use their senses to obtain information about themselves or the world around them.
18.	**Optimize**	Make the best or most of a condition.
19.	**Organize/Order/Classify**	Put into working order; get together and arrange.
20.	**Plan Investigations**	Use a body of techniques, often referred to as the Scientific Method, for considering *phenomena* and acquiring *knowledge*, including the elements of hypothesis development, prediction, and the effects and limits of observation and based on gathering *observable, empirical, measurable evidence*, subject to the principles of *reasoning*.
21.	**Predict**	Projecting future observations on the basis of previously known information.
22.	**Problem Solve**	Part of the *thinking* process considered the most complex of all *intellectual* functions, that includes *problem finding* and *problem shaping*.
23.	**Question**	Raise an uncertainty, doubt, or unsettled issue that may be based on the perception of a discrepancy between what is observed and what is know by the questioner.
24.	**Redesign**	Plan, draw or sketch again.
25.	**Research a Problem**	Active, diligent, and systematic process of inquiry aimed at *discovering, interpreting* and *revising facts*. Is usually associated with the output of *science* and the *scientific method*.
26.	**State a Problem**	First step in the engineering process focused on assessing/creating the need in order to define the problem to be solved.
27.	**Summarize**	Make a brief statement giving the main points of substance of a matter.
28.	**Test**	Verify or falsify an expectation with an observation, often as part of an experiment within the scientific method.
29.	**Troubleshoot**	Systematic search for the source of a problem so that it can be solved.
30.	**Use Tools**	Manipulate objects, instruments and materials as a means of furthering a learner's understanding, appreciation and application of scientific knowledge.