Learning Goals and Cycle

Learning Goals (a.k.a. objectives): a statement describing what students will learn

Why use learning goals?

- Makes activities intentional
- Focuses your activity on something specific
- Provides structure to an activity
- Tells youth what they will learn from the activity
- Creates a lasting impact on youth
- Shows activity leaders if they were successful

How to write and use a learning goal:

1. Brainstorm terms, concepts and/or skill you'd like youth to learn from the activity. Refer to the activity write up and content standards for ideas.
2. Pick one to three of the most important.
3. Think about how you will know if youth have learning these things. Will they be able to tell you something? Discuss something? Demonstrate or show you something? Make something?
4. Write a one or two sentence statement for each goal. You can use this format. " Youth will [observable verb] [learning content]."

   E.g. Youth will build a vibrobot. Youth will describe the electrical circuit that makes the vibrobot vibrate.

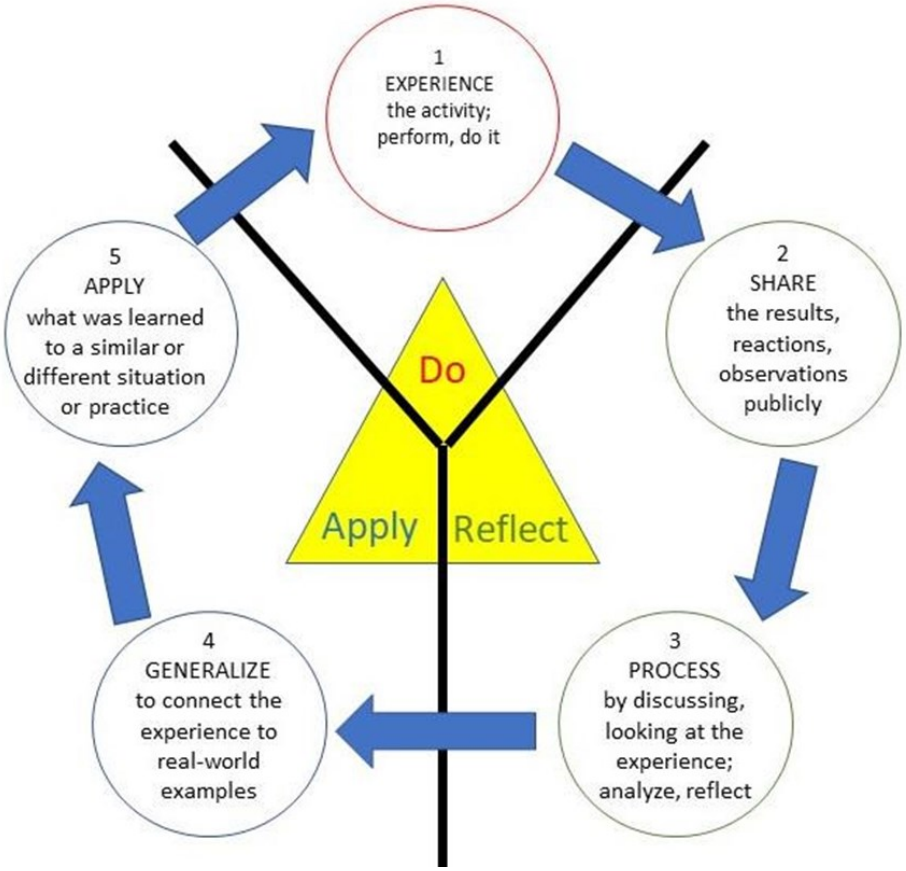
5. Use the learning goal to plan the steps of your activity. Every step of the activity should support the learning goal. Plan discussion questions that help guide students toward the learning goal.

Do, Reflect Apply:

4-H's learning cycle based on the experiential learning cycle

Follow these steps to create a memorable and impactful learning experience with youth. Doing the activity and defining terms and concepts occurs in step 1. Steps 2-5, reflecting on and applying the experience (what the youth did) help cement the learning and make it relevant to youth's lives.

Discuss as a group, in small groups, or have youth pair up to share their ideas with each other.



Keith G. Diem's three step "Do, Reflect, Apply" model for working with youth. Source: Diem, K.G. (2001). Learn by doing the 4-H way. New Jersey 4-H Leader Training Series. Rutgers Cooperative Extension.

Based on: Kolb, David A.. *Experiential Learning: Experience as the Source of Learning and Development.* United Kingdom, Prentice-Hall, 1984.

Science and Engineering Practices

Asking Questions and Defining Problems

A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world works and which can be empirically tested.

Developing and Using Models

A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations.

Planning and Carrying Out Investigations

Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters.

Analyzing and Interpreting Data

Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis.

Using Mathematics and Computational Thinking

In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; statistically analyzing data; and recognizing, expressing, and applying quantitative relationships.

Constructing Explanations and Designing Solutions

The products of science are explanations and the products of engineering are solutions.

Engaging in Argument from Evidence

Argumentation is the process by which explanations and solutions are reached.

Obtaining, Evaluating, and Communicating Information

Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity.

Crosscutting Concepts

1. Patterns
Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

2.Cause and Effect
Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

3. Scale, Proportion, and Quantity
In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

4. Systems and System Models
A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

5. Energy and Matter
Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior.

6. Structure and Function
The way an object is shaped or structured determines many of its properties and functions.

7. Stability and Change
For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

https://ngss.nsta.org/crosscuttingconceptsfull.aspx

Disciplinary Core Ideas: https://ngss.nsta.org/disciplinarycoreideastop.aspx

Idaho Content Standards in Science: https://www.sde.idaho.gov/academic/shared/science/ICS-Science-Legislative.pdf

Learning Progressions (Idaho Content Standards in Science): https://www.sde.idaho.gov/academic/shared/science/Content-Skills-Cross-Cutting-Concepts-Progressions.pdf

Andrea Baerwald, Science/ISAS Coordinator, abaerwald@sde.idaho.gov

Idaho Science Coaches

Marci Barrett (North Idaho): barrett.idahosciencecoach@gmail.com
Sara Tolman (Region III & IV Coach): tolman.idahosciencecoach@gmail.com
McKenzie Sonderegger (Magic Valley): sonderegger.idahosciencecoach@gmail.com
Wendy Snyder (SW Idaho): snyder.idahosciencecoach@gmail.com
Erika Meadows (SE Idaho and Magic Valley): meadows.idahosciencecoach@gmail.com
Eddie Walsh (Eastern and Central Idaho: walsh.idahosciencecoach@gmail.com
Lee Slichter (North-Central Idaho): lee.idahosciencecoach@gmail.com

STEM Activity Quality Checklist

Rate the activity according to the following criteria:

1. Needs major adaptations before teaching
2. Needs some adaptations
3. Suitable
4. Exemplary for this criterion

Rating	To what extent does the activity:
	Move youth towards a learning goal focused around a STEM idea? Describe:
	Utilize materials that are comfortable and safe for youth to utilize? Describe:
	Utilize materials that will hold youth's attention? Describe:
	Utilize materials that will help youth reach the STEM goal? Describe:
	Allow ALL youth to actively participate in the lesson? Describe:
	Provide youth with the opportunity to manipulate materials and interact with the lesson? Describe:
	Relate STEM content to their personal lives and/or STEM careers? Describe:
	Provide opportunity for reflection and sharing? Describe:
	Engages youth in the Scientific and Engineering practices? *Ask Questions/Define Problems; Develop and Use Models; Plan and Carry Out Investigations; Analyze and Interpret Data; Use Mathematical and Computational Thinking; Engage in Arguments from Evidence; Construct Explanations/Design Solutions; Obtain, Evaluate, and Communicate Information.* Describe:

Instructing Youth:
A Self-Assessment Tool

As you are preparing for delivery of 4-H youth programs, are you ensuring quality youth learning? Use this tool to help you key into aspects of a quality 4-H education.

Learning Aspect	Indicators	Reflection	Ready!
Organization	• Materials prepared • Time allocated well • Backup plan (if necessary)	Have I prepared all the materials ahead of time? Am I able to deliver the activity in the scheduled time?	☐
Materials	• Appropriate • Appealing	Do I have a plan to allow for youth voice in an age-appropriate manner? (with boundaries, guidance, clear behavioral expectations)	☐
Space Utilization	• Formal/Informal (type of space) • Appropriate space • No distractions that detract from learning experience	Is there enough adult supervision for this activity? Do I have a plan if there are more adults needed?	☐
Participation	• Access to activity • No prompting • Equality involvement	Can everyone participate in the activity? Does everyone have the same opportunity to engage?	☐
Purposeful Activities	• Activities meaningfully related to learning goals as they are enacted • Time spent towards learning goals, not other unrelated tasks or discussions	Do I know how to read a lesson plan? What are the learning objectives and do we have them?	☐
Engagement	• Hands-on • Minds-on	Am I challenging the participants to understand why we are doing what we are doing?	☐
Content Learning	• Accuracy • Connections among concepts • Evidence of student learning	Is the curriculum from a verified source? Do participants show, through speech and action, that they are learning the content?	☐
Inquiry	• Opportunities to do skills and practices • Doing practices in authentic ways vs. superficial ways	Am I building in ways for participants to test their skills (team building, communication, creativity, problem solving, etc.)? Can they make the connection from this activity to everyday life?	☐
Reflection	• Facilitator creates opportunities for reflection • Depth of student reflection	Am I asking questions that will challenge participant's deeper reflection?	☐
Relationships	• Warm/cold atmosphere • Lack of negative reactions • Student-facilitator, student-student, facilitator-facilitator relationships	Do I have a way to acknowledge positive behaviors? What types of behaviors will I intentionally recognize?	☐
Relevance	• Facilitator connections to students' broader contexts • Student involvement in discussions/demonstrations of relevance	Do I take the time to process the activities with participants? Before, during, and/or after delivery?	☐
Youth Voice	• Student voice • Student ownership • Student decision making	Do I encourage the youth to make choices and think for themselves?	☐

University of Idaho Extension

Adapted from:
Dimensions of Success, https://www.pearinc.org/dimensions-of-success
Essential Elements of 4-H Youth Development: Curriculum and Training Guide, https://shop4-h.org/products/essential-elements-curriculum-training-guide

TMC Activity Learning Plan

Activity:	**Date:**	**Time:**
Location:	**Staff:**	
Planned # of youth:	**Age/grade:**	

Learning goal(s):

Materials needed:

Materials prep:

Site set-up:

DO (Hands-On)

- How will you provide guidance for the activity?
- What concepts/terms will you share to help youth understand their experience?
- How will *all* students participate?

REFLECT (Minds-On Discussion)

- Have youth describe what they just did.
- What worked and what didn't work? Why?
- What did you learn? Pick out important concepts and themes.

APPLY (Hands-On/Minds-On)

- How can students use what they learned elsewhere?
- How does this experience relate to youths' daily lives or future?
- How can youth tinker with their designs to improve/change them? What could youth invent with their designs?

Back-up plan:

Clean-up notes: