CENTER FOR COMMUNITY AND CITIZEN SCIENCE

Connecting to the Standards

Looking at Lesson Development through a Universal Design for Learning (UDL) Lens

One of the unique aspects of engaging students in a YCCS project are the many ways students can engage with both the content and the project. Students have many methods for expressing their understanding and taking action, as well as opportunities that wouldn't always be available if they did not have a direct connection to the scientific community. Students might be looking at data sets from other citizen scientists in their local area to determine which species were most common on school campuses in their town, or writing and reporting on findings or analyzing data from multiple sources with a professional scientist who is applying those data sets. No matter which pathway to action a student chooses to take, engaging with a YCCS project allows students that opportunity for authentic science engagement and learning.

When looking at the YCCS framework developed at the UC Davis Center for Community and Citizen Science, we see core YCCS activities such as contributing data, and key educator practices like positioning youth as people who do science. Through a YCCS project, there are a variety of ways content can be presented, whether it be observation, research or data analysis. When we focus on the key youth practices, we see how students can take action and express learning as they engage with all three dimensions of NGSS. YCCS projects allow for students to be able to engage in a deep understanding of the natural world, but how they engage and how they represent their learning can come in many forms.

By having students conduct research based on their own observations, students not only access English Language Arts content on a more complex level because they see the connections to reading, and have a purpose for writing, but by engaging in a YCCS project in conjunction, they are also able to engage in true 3 dimensional learning. Students engage with the practice of analyzing and interpreting data, the disciplinary core idea as outlined in their grade level, as well as gaining a deep understanding of the cross cutting concepts of systems and system models. WIth this deeper understanding of how the ecosystems around them function, they begin to also understand the Environmental Principles and Concepts, or EP&Cs as they look at the human impact and ways they are able to take action and make change.

The UDL Guidelines are a "tool used in the implementation of Universal Design for Learning, a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn" As educators plan for a YCCS project, it is important to consider how educators can allow for the multiple means of engagement with the project, how they will design lessons with multiple means of representation of the content, and how students will share their understanding and new learning, making room for multiple means of expression.

Multiple Means of Representation

There are many ways to represent content to be shared with students when engaging in a YCCS project, being rich with options for visualizing and sharing data because the content is based on student data. Students' interests drive the method of representation that may be needed. Students might find that reading articles may allow them to gain the information that they need to understand their own findings, or perhaps they may watch a video or listen to podcasts or audio recordings of bird calls. They might look at photographs or maps, but their observations are naturally blended in with conversations with their peers, allowing for a depth of understanding and engagement with the content and skills that may not have been otherwise available to all students. There are many ways to visualize the content. Students might look at data sets, they might look at animations of charts and graphs, they might look at maps, watch an animation or video, or make new observations by watching a webcam. No matter what the means of representations they choose to engage with, they become resourceful in their quest for more knowledge to understand the world around them.

Multiple Means of Engagement

There are many pathways for students to engage with both the content and the standards while collaborating on a YCCS project, and ways to represent new content learning. There are also many ways for students to express that understanding. Students might write in a journal, or collect their data in a chart. They might want to focus on analysis, or might do a deep dive into research, writing a report about their new discoveries. No matter what the pathway for their initial engagement, they are focusing on the best way to communicate their findings both to their peers and with a broader audience. There are multiple ways to communicate that information. They might draw what they observed, develop their scientific sketching skills, write about their findings, they might make signs to engage the broader community, or find a platform for public speaking within their local community, reaching out to other stakeholders, or the scientific community more broadly about the new datasets they have generated. There are then also many ways to use their datasets to develop a plan and take action. It might look like advocating for change on their school campus, engineering or a new design for a school garden, or they might share their research as a way to build upon their learning. Either way, the communication of their learning becomes very strategic and goal directed as they think about their own environmental literacy and agency.

Multiple Means of Action and Expression

One of the unique aspects of engaging students in a YCCS project are the many pathways they have available for expressing their understanding and taking action, and then the opportunities that are then open to them that wouldn't always be available if they did not have a direct connection to the scientific community. They might be connecting with other citizen scientists in their local area, this is an image of a set of observations of biodiversity collected over multiple school sites. The data was then compiled into the platform iNaturalist to determine which species were most common on school campuses in their town. One pathway may look like making connections with other researchers, while another may be writing and reporting on

findings or analyzing data from multiple sources with a professional scientist who is applying those data sets. No matter which pathway to action a student chooses to take, engaging with a YCCS project allows students that opportunity.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	YCCS Framework Core Activities and Key Practices
1. Asking questions (for science) and defining problems (for engineering)	LS1: From Molecules to Organisms: Structures and Processes	1. Patterns	Core Activity: Develop Expertise
2. Developing and using models	LS2: Ecosystems: Interactions, Energy, and Dynamics	2. Cause and Effect	Core Activity: Contribute Data
3. Planning and carrying out investigations	LS3: Heredity: Inheritance and Variation of Traits	3. Scale, Proportion, and Quality	Core Activity: Make Meaning
4. Analyzing and interpreting data	LS4: Biological Evolution: Unity and Diversity	4. Systems and System Models	Core Activity: Share the work and take action
5. Using mathematics and computational thinking	ESS2: Earth's Systems	5. Energy and Matter	Key Youth Practice: Take ownership of Quality Data
6. Constructing explanations (for science) and designing solutions (for engineering)	ESS3: Earth and Human Activity	6. Structure and Function	Key Youth Practice: Engage with complex social ecological systems
7. Engaging in argument from evidence	ETS1: Engineering Design	7. Stability and Change	Key Educator Practice: Position youth as people who do science
8. Obtaining, evaluating, and communicating information	ETS2: Links Among Engineering, Technology, Science, and Society		Key Educator Practice: Frame the work globally and locally