Implementing Citizen Science Project-Based Learning With Y4Y

Oregon 21st CCLC Spring Conference
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YOUR FACILITATORS

Allyson Zalewski
Education Specialist
azalewski@foundationsinc.org

Judy Ha Kim
Lead Training Specialist
jkim@foundationsinc.org

SESSION OBJECTIVES

- Explore why citizen science project-based learning benefits students.
- Develop strategies to implement this approach into your program.
- Identify Y4Y citizen science project-based learning resources that can be customized and used in your program.

HTTP://Y4Y.ED.GOV

DRIVING QUESTION

How can we use Y4Y to **design and facilitate engaging citizen science projects**?

CITIZEN SCIENCE

- Meaningful connections with natural world
- No single “right” answer
- Inquiry-based learning
- Data used by real scientists

Tools/ Learn/Citizen Science Research Brief

POLL

What is your level of experience with Citizen Science?

- I have never done any citizen science activities or projects.
- I have participated in or facilitated at least one citizen science activity or project with students.
- I have some experience participating in or facilitating citizen science activities or projects with students.
- I have a lot of experience participating in or facilitating citizen science activities and projects.

VIDEO EXAMPLE

Learn/ STEM/ Introduction

CHARACTERISTICS OF SUCCESSFUL PROJECTS

- Include student voice and choice
- Focus on high-interest topics and questions
- Emphasize active learning
- Build 21st century skills
  - Critical thinking, teamwork, organization
- Result in a final product or event
- Offer opportunities for reflection

PLANNING FOR IMPLEMENTATION

1. Inspire
2. Prepare
3. Engage
4. Experience

1. INSPIRE

Citizen science:

- Involves everyday people
- Assists in collecting and analyzing data
- Does not require past scientific experience
- Increases public interest in science

RICH RANGE OF PROJECTS

- Matches a wide variety of interests and needs
- Uses a wide range of resources
- Accessible through technology

SAMPLE PROJECTS

YOU FOR YOUTH

- Galaxy Zoo
- Penguin March
- S’COOL

2. PREPARE

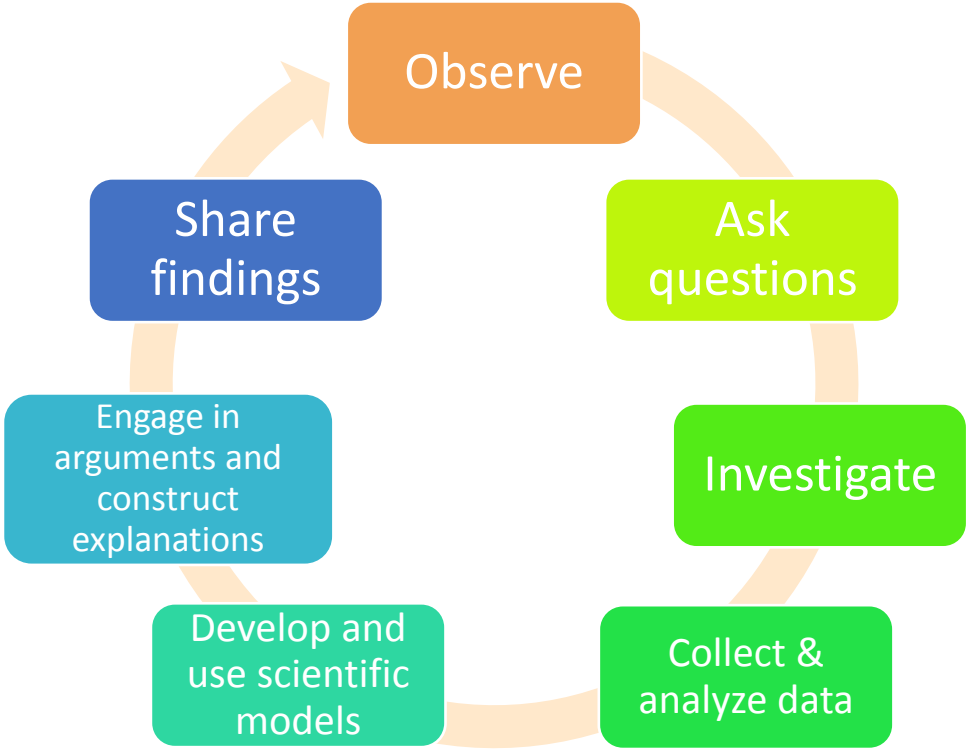
STEM skills

- Science (e.g. scientific process)
- Technology (e.g. presentation development)
- Engineering (e.g. problem solving)
- Math (e.g. graphing)

21st Century skills

- Flexibility & adaptability
- Initiative & self-direction
- Social & cross-cultural skills
- Productivity & accountability
- Leadership & responsibility

SCIENCE PROCESS SKILLS



GUESS MY AGE

www.ageguess.org

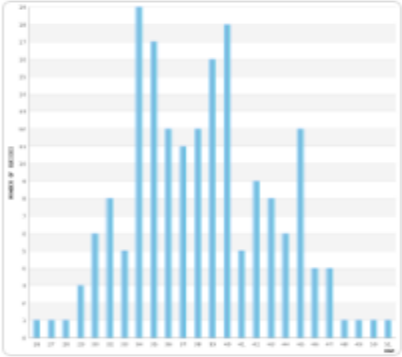
- Online “game” where you guess people’s ages
- Post a photo & record guesses
- Perceived age as biomarker

GUESS MY AGE

Very Close! 5 Points

Real age
34 years
Your Guess
39 years
Difference
5 years

Guesses So Far



Average age guess
38 years
Variance
24 years
Standard deviation
5 years
Number of guesses
182

Click to enlarge

ACTIVITY: PLAN IT OUT

YOU FOR YOUTH

- Select a project and record
  - Name of the project
  - Description of the investigation
  - Ways to incorporate science process skills

DATA GATHERING

YOU FOR YOUTH

Data Gathering

Gathering data may include the following:

- Interviewing people.
- Collecting samples of soil, water, air or living things.
- Making repeated observations of living things or natural processes.
- Viewing samples that have already been collected.
- Running software programs that yield different results.

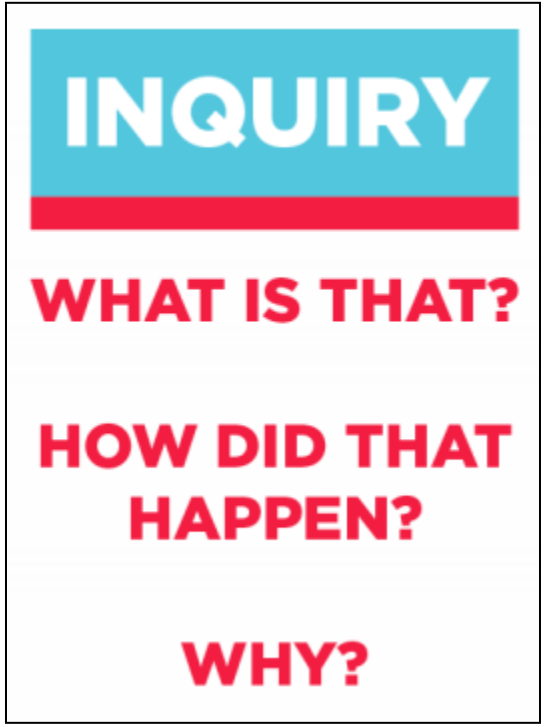
NEXT GENERATION SCIENCE STANDARDS

http://www.nextgenscience.org/

3. ENGAGE

- Emphasize active learning.
- Invite student choice and voice.
- Focus on high interest topics.
- Produce a product.

INQUIRY BASED LEARNING



PROJECT SQUIRREL

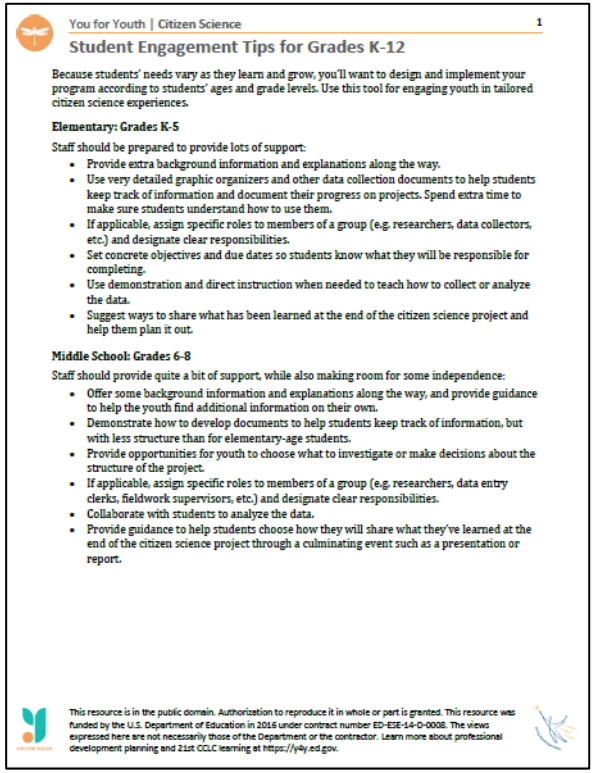
Grey Squirrel
(Large paper clip)

Fox Squirrel
(Small paper clip)

Activity modified from Projectsquirrel.org

TIPS FOR ENGAGING STUDENTS

- Level of structure
- Amount of background information
- Use of demonstration and direct instruction
- Student voice and choice
- Student responsibility and group roles



You for Youth | Citizen Science 1

Student Engagement Tips for Grades K-12

Because students' needs vary as they learn and grow, you'll want to design and implement your program according to students' ages and grade levels. Use this tool for engaging youth in tailored citizen science experiences.

Elementary: Grades K-5

Staff should be prepared to provide lots of support:

- Provide extra background information and explanations along the way.
- Use very detailed graphic organizers and other data collection documents to help students keep track of information and document their progress on projects. Spend extra time to make sure students understand how to use them.
- If applicable, assign specific roles to members of a group (e.g. researchers, data collectors, etc.) and designate clear responsibilities.
- Set concrete objectives and due dates so students know what they will be responsible for completing.
- Use demonstration and direct instruction when needed to teach how to collect or analyze the data.
- Suggest ways to share what has been learned at the end of the citizen science project and help them plan it out.

Middle School: Grades 6-8

Staff should provide quite a bit of support, while also making room for some independence:

- Offer some background information and explanations along the way, and provide guidance to help the youth find additional information on their own.
- Demonstrate how to develop documents to help students keep track of information, but with less structure than for elementary-age students.
- Provide opportunities for youth to choose what to investigate or make decisions about the structure of the project.
- If applicable, assign specific roles to members of a group (e.g. researchers, data entry clerks, fieldwork supervisors, etc.) and designate clear responsibilities.
- Collaborate with students to analyze the data.
- Provide guidance to help students choose how they will share what they've learned at the end of the citizen science project through a culminating event such as a presentation or report.

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4. EXPERIENCE

YOU FOR YOUTH

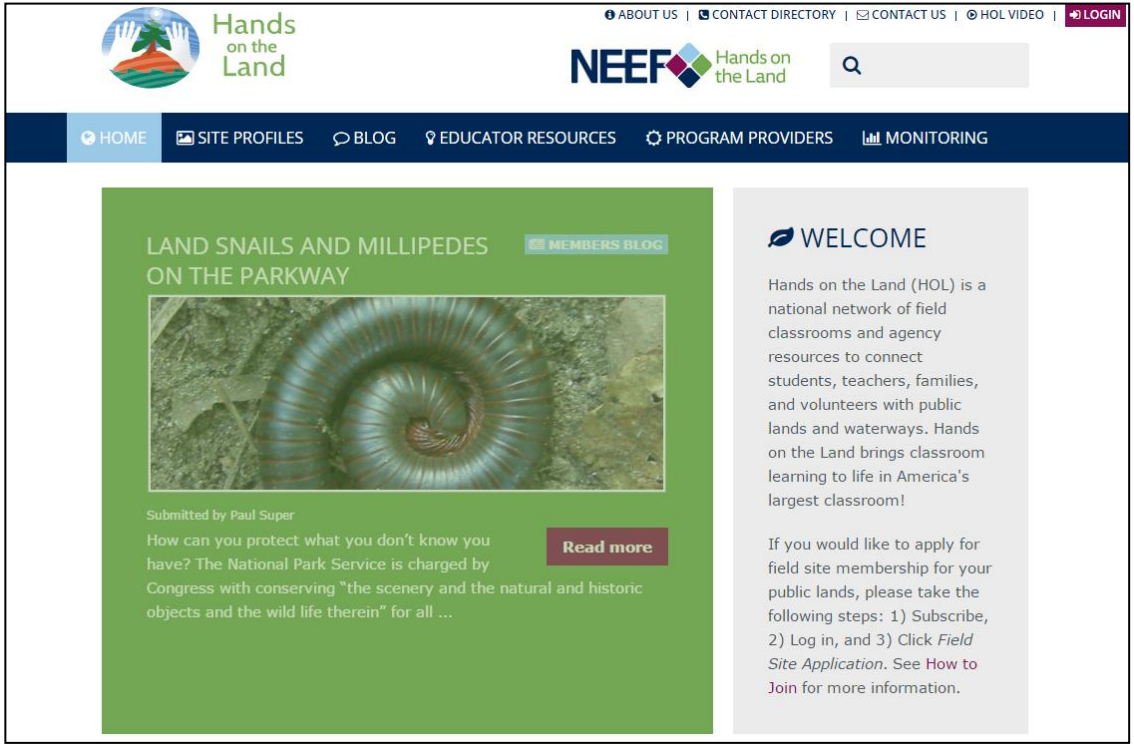
STEM Careers

Citizen science introduces students to potential STEM careers. From the following links you'll get an idea of how many citizen science projects there are and the span of STEM careers they cover.

- **Genetics**
  Nanocrafter
- **Technology**
  Cities at Night
- **Mathematics**
  Panamath
- **Weather and Climate**
  Season Spotter
- **Astronomy**
  Radio Jove
- **Chemistry**
  Measuring Vitamin C in Food
- **Physics**
  Higgs Hunters
- **Health and Medicine**
  Autoimmune Citizen Science
- **Ecology and Conservation**
  OpenTreeMap

Y4Y NASA GLOBE PROJECT

Y4Y NPS STEM LEARNING



LEARN MORE LIBRARY

YOU FOR YOUTH

External Videos ↓

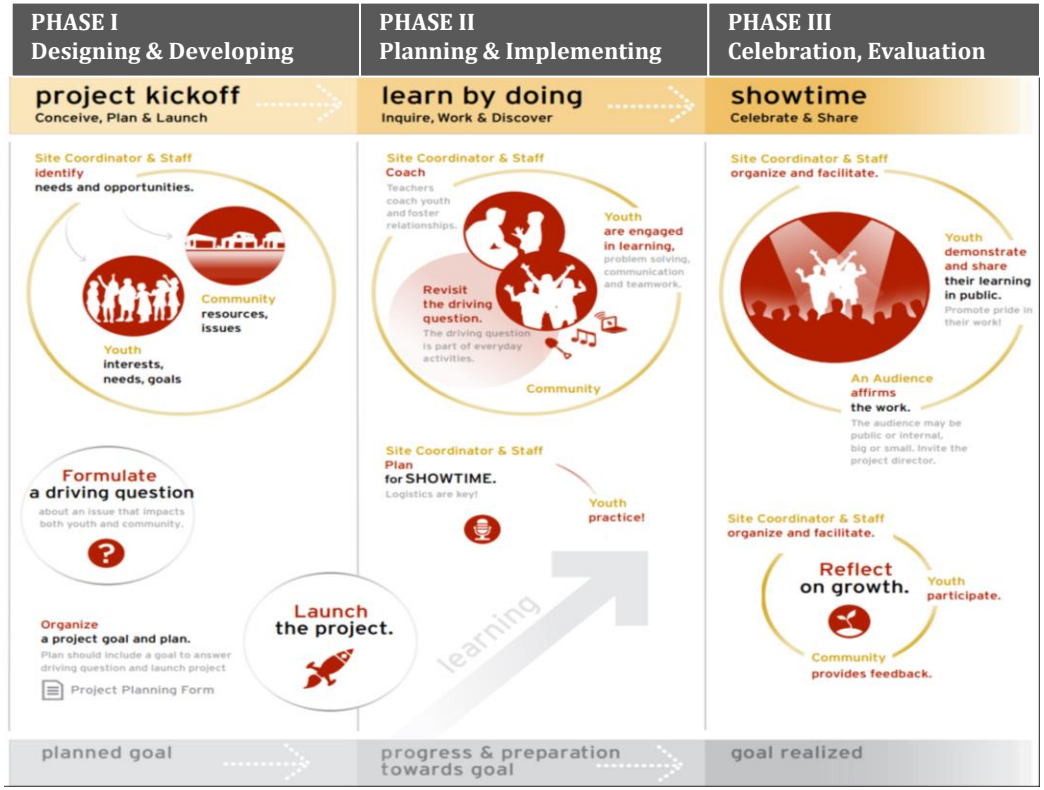
Publications ↓

Web-Based Resources ↓

Lesson Plans and Activities ↓

BREAK

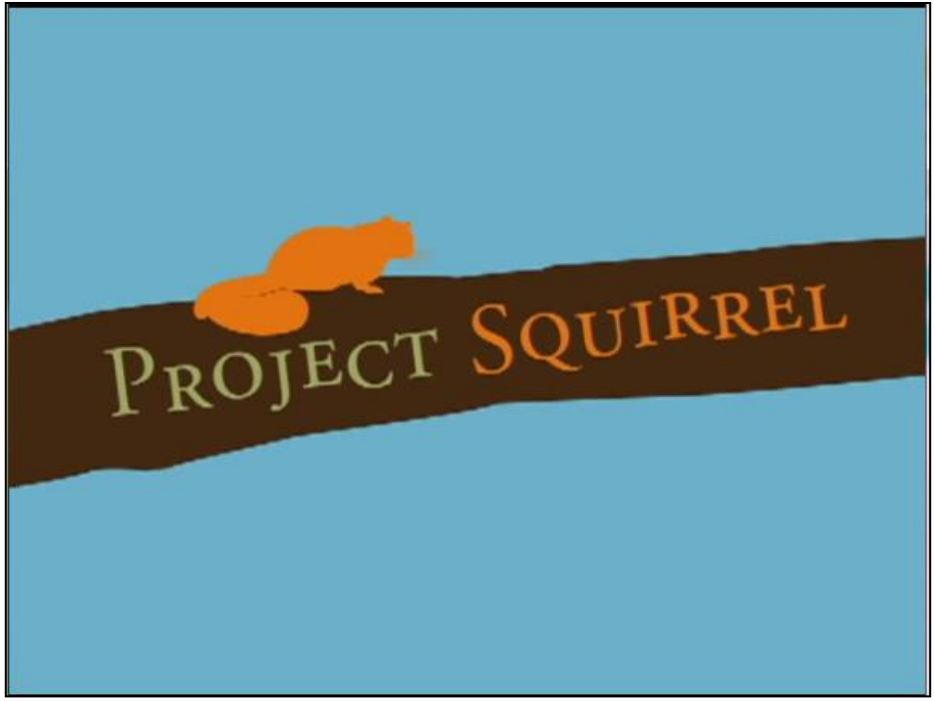
THREE PHASES OF PROJECT-BASED LEARNING



PROJECT-BASED LEARNING
WHAT IS IT?

- In-depth study of real-world topic or problem
- Has a realistic environment
- Directed by students and hands-on
- Focuses on DOING something rather than passively learning ABOUT something
- Project shared with an interested audience
- Aligned with the school day

PROJECT SQUIRREL



Activity modified from Projectsquirrel.org

DRIVING QUESTION

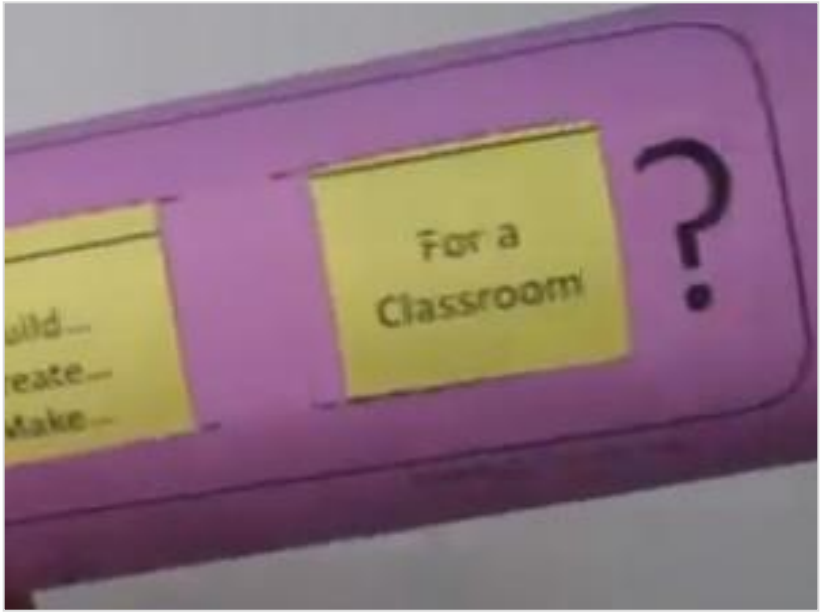
WHO WRITES THE QUESTION?

Student *Voice*

Teacher *Choice*

http://bie.org/object/video/elementary_project_courtyard_redesign

BUCK INSTITUTE“TUBRIC”



Learn More Library/ PBL/ Web Based Resources/Buck Institute

CRAFT A DRIVING QUESTION

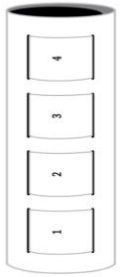
Your question must meet these criteria:

- ✓ Open-ended
- ✓ Relevant to the real world
- ✓ Challenges students to use higher-order thinking skills
- ✓ Connected to youths' lives
- ✓ Potential for actionable solutions

LET'S PRACTICE

QUESTION	WHO	VERB/TO PIC	AUDIENCE
1	2	3	4
[Wild Card]	[Wild Card]	[Wild Card]	[Wild Card]
How can...	I We	Build... Create... Make...	Real-World Problem
How do...	We as, [Roles] [Occupations]	Design... Plan...	For a Public Audience
Should...	[Town] [City] [County]	Solve...	For a School
Could...	[State] [Nation]	Write...	For a Classroom
What...	[Community] [Organization]	Propose... Decide...	For an Online Audience

For more FreeBIEs visit bie.org



Assembly required.
Instructions not included.
Application open-ended

It's Project Based Learning.

TUBRIC™ | bie.org

Topic:

Helping scientists study the indicators of local ecology based on the number of grey and fox squirrels in our community

CELEBRATE YOUR DRIVING QUESTION

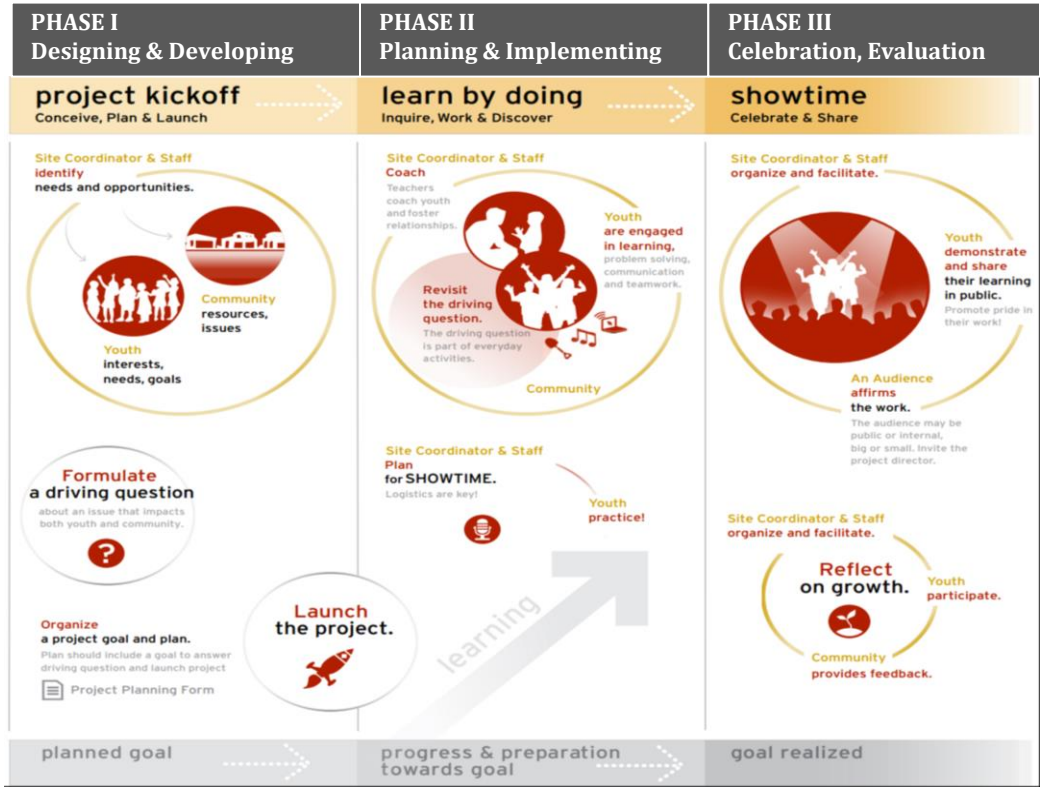
Your driving question is important!

- Put it to music.
- Make banners.
- Make charts.
- Make graphic posters.

If students don't know the question, how will they answer it?

http://learninginhand.com/blog/drivingquestions

THREE PHASES OF PROJECT-BASED LEARNING



PROJECT IDEAS

Projects should provide opportunity for active exploration:

- Extend beyond the classroom.
- Support the practice of core content knowledge and skills in relevant and meaningful ways.
- Connect to field-based investigations, community explorations and work internships.
- Require real investigations using a variety of methods, media and sources.

CHOOSING A PROJECT

- Are your staff and students new or experienced with citizen science?
- Do you want to increase students' proficiency on specific skills?
- Do you want to increase awareness of STEM careers?
- What is that you hope to accomplish when the activity is over?

CITIZEN SCIENCE RESOURCE LINKS

Citizen Science External Resources

Below you will find all of the links, organized alphabetically by chapter, that were mentioned throughout the Citizen Science course.

Chapter 1

Audubon's Christmas Bird Count

Every winter, thousands of volunteers take a bird census and submit their bird counts to the Audubon Society. The information collected guides conservation efforts by assessing bird populations.

Bat Detective

It can take six hours to go through one hour's worth of sound recording to detect and categorize bat calls. The scientists behind Bat Detective have help from citizen scientists from around the world to pore over the amount and range of data that helps them monitor bat populations.

Dognition Citizen Science

You'll play fun, science-based games with your dog. The more you play, the more you'll discover about how your dog's mind works. Your Dognition results will surprise you!

Environmental Preparedness & Resilience Empowering People

Help scientists monitor air quality with an air sampling device. Environmental Preparedness & Resilience Empowering People is a resource based on a low cost passive sampling platform including a common wristband and a stationary sampler. These samplers can be used to evaluate air quality and your personal environmental exposures.

Galaxy Zoo

We want to understand how galaxies are formed! Your job is very simple; all you need to do is classify the galaxies according to their shapes. If you're quick, you may even be the first person to see the galaxies you're asked to classify.

Penguin Watch

This citizen science website is trying to understand the lives of penguins. They want you to help mark images taken from nesting sites around Antarctica. They now monitor over 100 sites and need your help more than ever!

S'Cool

Clouds are an important part of our atmosphere, and scientists are studying how they affect our weather and climate. S'COOL observations provide one more piece of the puzzle. Observe clouds

PROJECT PLANNER

YOU FOR YOUTH

Checklist Project-Based Learning Project Planner

Driving Question

_____
_____
_____

Planning Check
Is the project
- ☐ Based on youth interests?
- ☐ Based on youth input?
- ☐ Appropriate for the amount of time?
- ☐ Engaging, interesting, sustainable?

Project Description

_____
_____
_____

Planning Check
Do the objectives
- ☐ Reinforce, practice, or expand on what youth already know or are able to do?
- ☐ Clearly specify outcomes?
- ☐ Tie to demonstrations and documentation of learning?
- ☐ Connect with skills or knowledge needed for success in school?

Objectives for Learning and Development

_____
_____
_____
_____
_____

Materials Needed

_____
_____
_____
_____

Planning Check
Are materials needed to
- ☐ Guide youth in making a project plan?
- ☐ Carry out the project work?
- ☐ Help youth document learning?
- ☐ Help youth set learning objectives?
- ☐ Establish agreements with or among youth, partners, volunteers?
- ☐ Conduct a culminating event?
- ☐ Reflect, review?

Implementation
Project activities, who is involved

_____ *Start date:* ____ *End:* ____

_____ *Start date:* ____ *End:* ____

_____ *Start date:* ____ *End:* ____

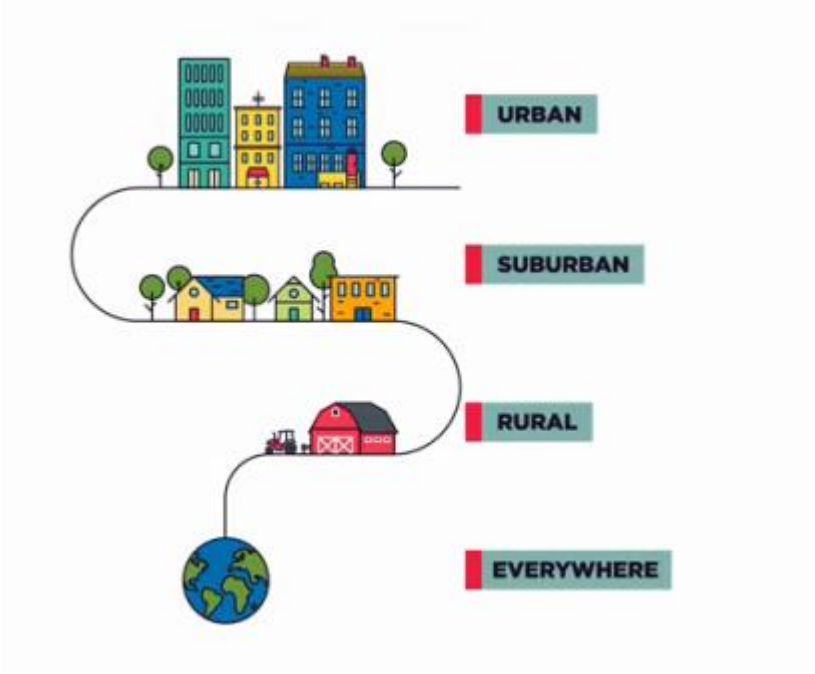
_____ *Start date:* ____ *End:* ____

Tools/ Project Based Learning/ Plan and Implement

IMPLEMENTATION STRATEGIES

- Step 1: Understand Student and Program Needs
- Step 2: Making Time for Citizen Science
- Step 3: Choosing a Citizen Science Project
- Step 4: Mapping Your Resources
- Step 5: Budget
- Step 6: Assess the Learning

CONSIDER YOUR LOCATION



MAPPING YOUR RESOURCES

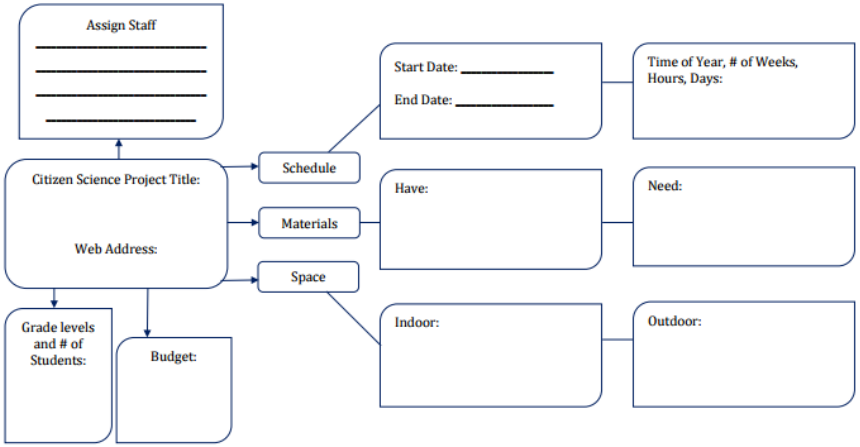
- Space
- Location
- Materials
- Staff
- Partnerships

MAPPING YOUR RESOURCES

Mapping Resources for Citizen Science Implementation

Implementing a citizen science project takes a lot of preparation. To plan a successful project, you will need to have a clear sense of how the project will fit into your program and the possible resources you will need.

Use the graphic organizer below to begin mapping your citizen science project.



PARTNERSHIPS

- Parents
- Family members
- Professional or retired scientists
- Older students
- Business owners
- Civic leaders

CITIZEN SCIENCE IN YOUR STATE

Select a region on the map to find a citizen science project in your state.

INVOLVING COMMUNITY PARTNERS

YOU FOR YOUTH

Involving Community Partners Checklist

Use this checklist to identify potential community partners. Next, brainstorm and check off ways partners might be involved in civic learning and engagement projects (or are involved currently).

Type of Partner	Name of Partner (Group, Organization, or Individual)	Options for Involvement						
		Interview or conduct research	Invite to program	Tour or visit	Meet to present an issue	Collaborate on project activities	Provide a service	Other:
Government:								
Elected Official								
Parks and Recreation Department								
Court House/Judicial Department								
City Council								
Fire Department								
Police Department								
State or Federal Department								
Other								
Community organizations:								
Neighborhood Civic Association								
Service group								
Advocacy group								
Local health organization								
Local environmental organization								
Local education organization								
Other								
Businesses:								
Local small business								
Large company with local office								
Other								
Schools:								
Neighborhood school								
College or University								
Other								

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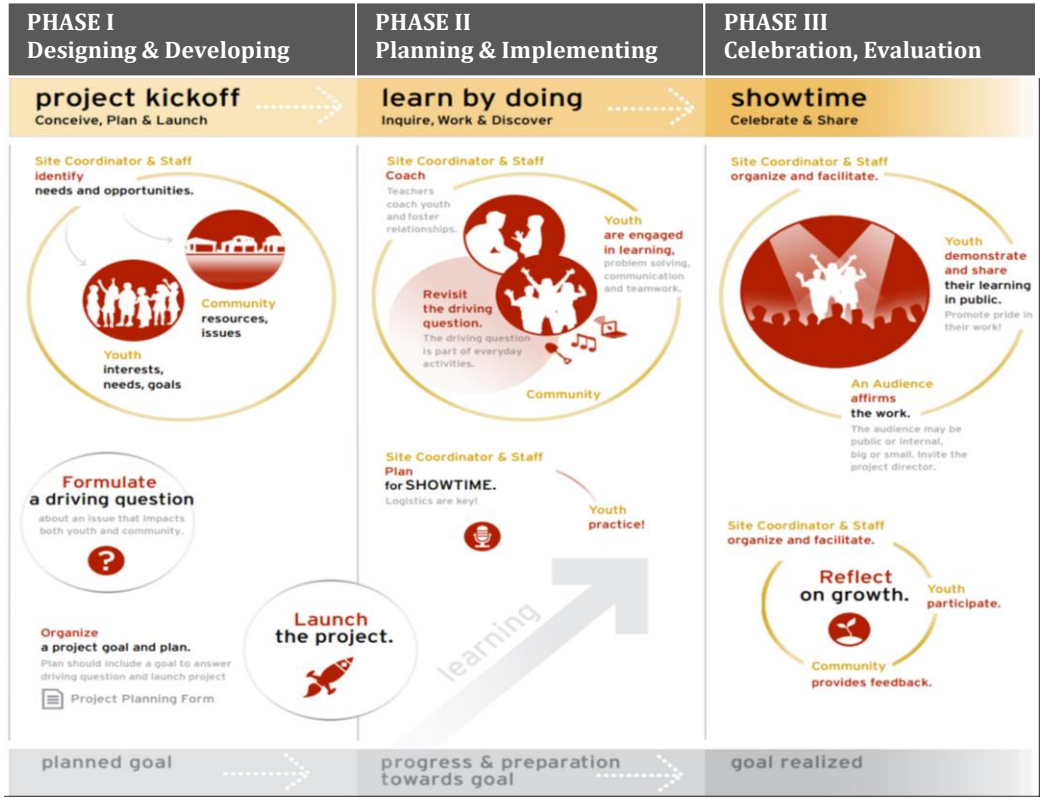
Tools/ Civic Learning and Engagement/ Assess and Reflect

USING STEM EXPERTS

- Experience working with youth and 21st CCLC programs
- Roles and responsibilities of expert and program staff
- How the expert fits into your larger STEM goals
- Possibility of long-term relationship building

THREE PHASES OF PROJECT-BASED LEARNING



ASSESS THE LEARNING

- Helps to determine if instruction worked
- Informs continuous improvement
- Provides clear goals for students

TYPES OF ASSESSMENT

- Formal
  - Pretests and posttests
  - Quizzes
  - Term papers or reports
- Informal
  - Rubrics
  - Checklists
  - Lab notebooks

REFLECTION QUESTIONS

- What worked?
- What didn’t?
- How can we improve the experience?

PROJECT COMPLETION ACTIVITIES

- **Project culminates in a final event or product**
- **Celebrate learning, achievement**
- **Examples:**
  - Presentation to peers, families, community members
  - Published blog
  - Video chat with researchers

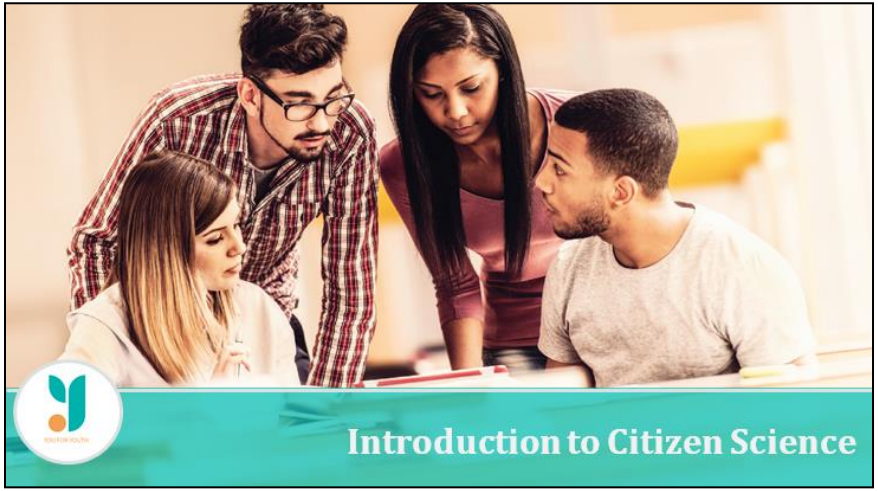
INTEGRATING PBL INTO CITIZEN SCIENCE

Integrating Project-Based Learning Into Citizen Science Activities

Citizen science and project-based learning have a lot in common – for example, they both emphasize hands-on learning, teamwork, real-world applications and more. If you can incorporate project-based learning strategies into your citizen science project, you can enhance your citizen science efforts and strengthen skills in an engaging and academic way. Look at each project-based learning strategy and description, then brainstorm activity ideas for how to implement each strategy in your program.

Project-Based Learning Strategy	Description	How can I implement this strategy in the Citizen Science activities?
Emphasize active learning	Students should learn by doing, through hands-on opportunities to answer the driving question	Sample Activity: Create an opportunity to interview a scientist in the field (face-to-face or virtually) and to collect data outdoors Activity:
Follow a well-established sequence	Projects follow a sequence of planning, active inquiry, and opportunities for students to share and reflect on what they've learned	Sample Activity: Use the 5E's of Learning to help students engage, explore, explain, elaborate and evaluate Activity:
Invite student choice and voice	Invite active student decision making at each stage	Sample Activity: Create a brief survey asking youth to indicate which of four or five citizen science projects they prefer Activity:
Focus on high-interest topics and questions	Your students might choose to explore questions about themselves, their communities and their world	Sample Activity: Facilitate a brainstorming session with students so they can share what is important to them Activity:
Result in a product	Think of a clear and engaging way they can display or share their data for others to see, even if the citizen science project doesn't require it	Sample Activity: Students may choose to design a website, create a museum exhibit or build a mechanical invention Activity:
Include self-reflection	Deliberately incorporate opportunities for students to reflect on how working on a project helps them develop academic and 21st century skills	Sample Activity: Instruct youth to include in their lab notebooks a section for daily or weekly reflection that they can write in among their observation data, then give them writing prompts to help them reflect on their work and learning Activity:

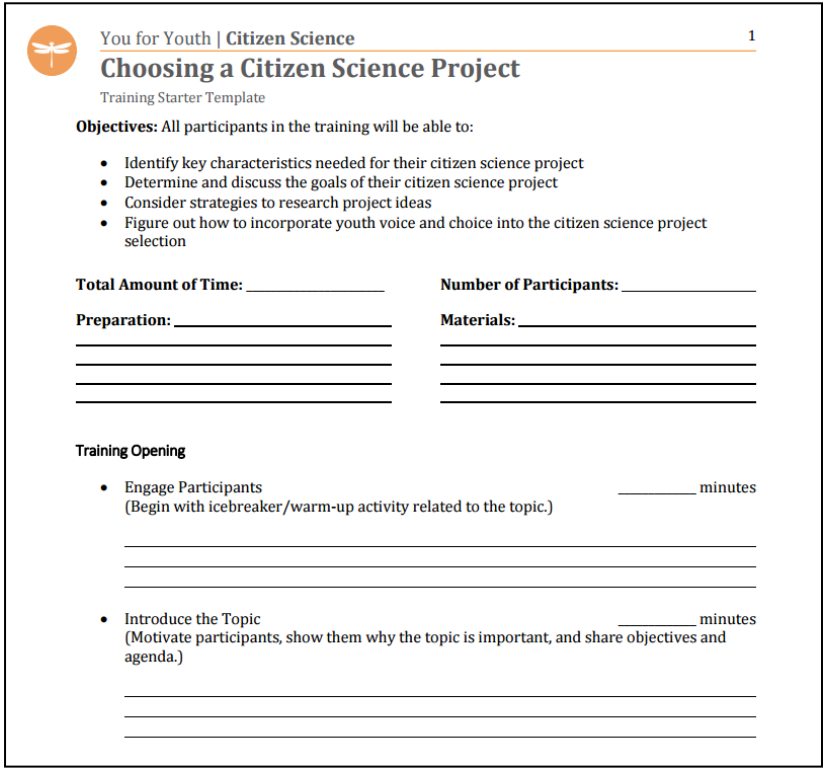
TRAININGS TO GO



- Introducing Citizen Science
- Facilitating Learning to Practice Inquiry and Science Process Skills
- Assessing Citizen Science

TRAINING STARTERS

- Fitting Citizen Science Into Your Program
- Choosing a Citizen Science Project



You for Youth | **Citizen Science** 1

Choosing a Citizen Science Project

Training Starter Template

Objectives: All participants in the training will be able to:

- Identify key characteristics needed for their citizen science project
- Determine and discuss the goals of their citizen science project
- Consider strategies to research project ideas
- Figure out how to incorporate youth voice and choice into the citizen science project selection

Total Amount of Time: _____ **Number of Participants:** _____

Preparation: _____ **Materials:** _____

Training Opening

- Engage Participants _____ minutes
  (Begin with icebreaker/warm-up activity related to the topic.)
- Introduce the Topic _____ minutes
  (Motivate participants, show them why the topic is important, and share objectives and agenda.)

NEXT STEPS

What are your next steps in enhancing citizen science project-based learning in your program?

CONTACT

Judy Ha Kim
jkim@foundationsinc.org

Allyson Zalewski
azalewski@foundationsinc.org

Visit y4y.ed.gov

process diagram

Project-Based Learning

project kickoff
Conceive, Plan & Launch

learn by doing
Inquire, Work & Discover

showtime
Celebrate & Share

Site Coordinator & Staff
identify
needs and opportunities.

Community
resources,
issues

Youth
interests,
needs, goals

Site Coordinator & Staff
Coach

Teachers coach youth and foster relationships.

Youth
are engaged
in learning,
problem solving, communication and teamwork.

Revisit
the driving
question.
The driving question is part of everyday activities.

Community

Site Coordinator & Staff
organize and facilitate.

Youth
demonstrate
and share
their learning
in public.
Promote pride in their work!

An Audience
affirms
the work.
The audience may be public or internal, big or small. Invite the project director.

Formulate
a driving question
about an issue that impacts both youth and community.

Site Coordinator & Staff
Plan
for SHOWTIME.
Logistics are key!

Youth
practice!

Site Coordinator & Staff
organize and facilitate.

Reflect
on growth.

Youth
participate.

Community
provides feedback.

Organize
a project goal and plan.
Plan should include a goal to answer driving question and launch project

Project Planning Form

Launch
the project.

learning

planned goal

progress & preparation towards goal

goal realized

2011

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Learn more about project-based learning at http://y4y.ed.gov.

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Result in a product	Think of a clear and engaging way they can display or share their data for others to see, even if the citizen science project doesn't require it	Sample Activity: Students may choose to design a website, create a museum exhibit or build a mechanical invention Activity:
Include self-reflection	Deliberately incorporate opportunities for students to reflect on how working on a project helps them develop academic and 21st century skills	Sample Activity: Instruct youth to include in their lab notebooks a section for daily or weekly reflection that they can write in among their observation data, then give them writing prompts to help them reflect on their work and learning Activity:

Checklist Project-Based Learning Project Planner

Driving Question

_____
_____
_____

Planning Check
Is the project
- ☐ Based on youth interests?
- ☐ Based on youth input?
- ☐ Appropriate for the amount of time?
- ☐ Engaging, interesting, sustainable?

Project Description

_____
_____
_____

Objectives for Learning and Development

_____
_____
_____
_____
_____

Planning Check
Do the objectives
- ☐ Reinforce, practice, or expand on what youth already know or are able to do?
- ☐ Clearly specify outcomes?
- ☐ Tie to demonstrations and documentation of learning?
- ☐ Connect with skills or knowledge needed for success in school?

Materials Needed

_____
_____
_____
_____

Planning Check
Are materials needed to
- ☐ Guide youth in making a project plan?
- ☐ Carry out the project work?
- ☐ Help youth document learning?
- ☐ Help youth set learning objectives?
- ☐ Establish agreements with or among youth, partners, volunteers?
- ☐ Conduct a culminating event?
- ☐ Reflect, review?

Implementation

Project activities, who is involved

_____ *Start date:* ____ *End:*____

_____ *Start date:* ____ *End:*____

_____ *Start date:* ____ *End:*____

_____ *Start date:* ____ *End:* ____

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Checklist Project-Based Learning Project Planner

Reviews

Date	*Review purpose*	*Reviewers*
_____	_____	_____
_____	_____	_____

Planning Check

Are the reviews

Purposeful, with purpose clear to youth?
Based on documentation, evidence, or product?
Appropriate to project and youth?
Useful in reinforcing skills of self-assessment and reflection?
Inclusive of peers, staff, or others?

Showtime: Culminating Event

Description _____
_____
_____

Date _____

Planning and implementation schedule
_____
_____
_____

Planning Check
Is the culminating event
- ☐ A good demonstration of youth learning?
- ☐ Inclusive of all involved in the project?
- ☐ Clearly tied to objectives?
- ☐ Developed with youth input?
- ☐ Inclusive of families, community, partners, teachers, others?
- ☐ An opportunity for youth to experience pride in accomplishment?

Documentation of Learning

How will learning be documented?

- ☐ Checklists of tasks, products completed.
- ☐ Rating, scoring, or assessment of processes, products or demonstrations against a rubric.
- ☐ Portfolio content, tied to objectives.
- ☐ Reflection logs or journals by youth.
- ☐ Self-assessments completed by youth completing project.
- ☐ Peer assessments of demonstrations and culminating events.
- ☐ Assessments provided by outsiders.
- ☐ Other.

What will be done with the documentation of learning?

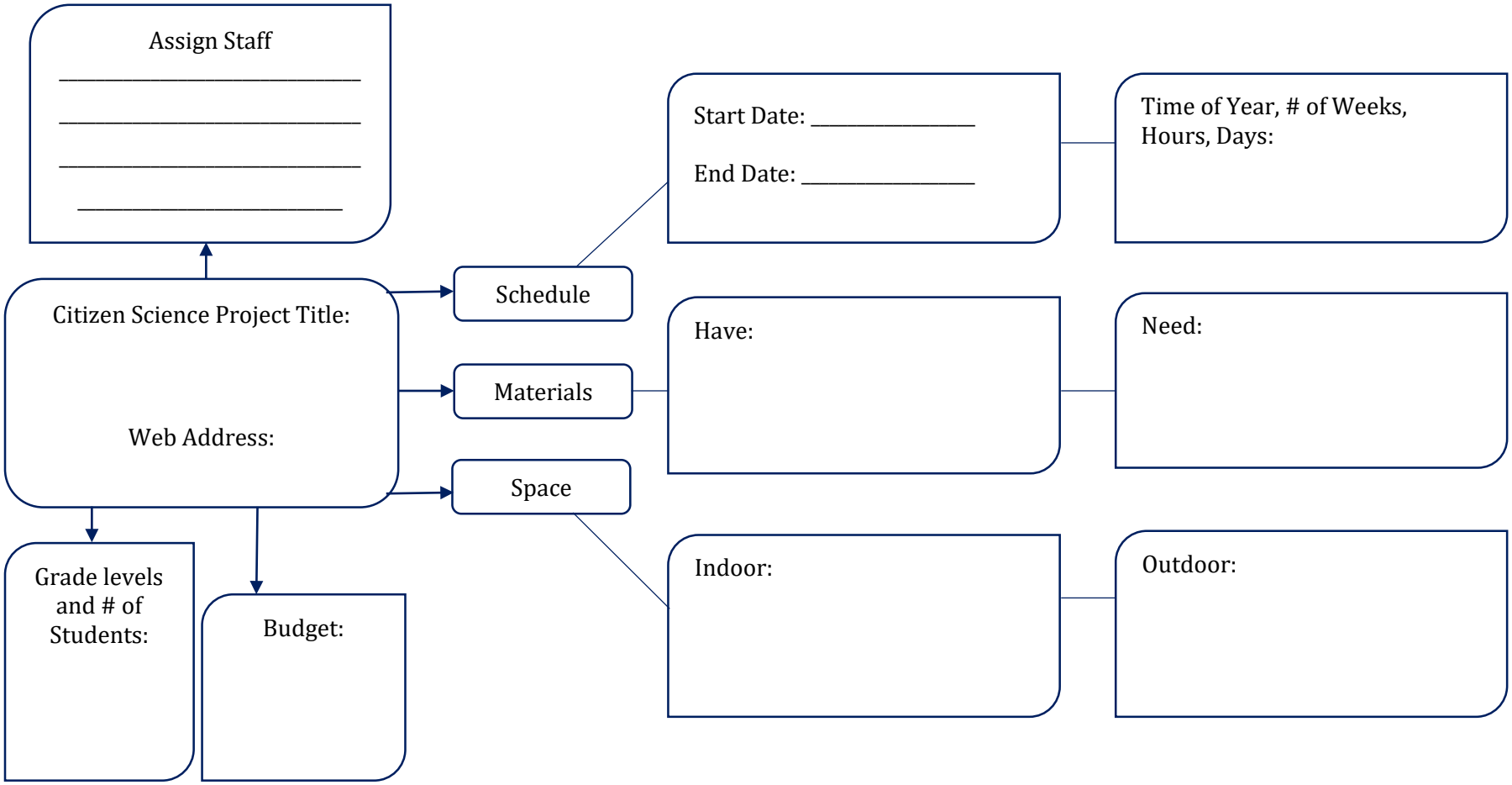
- ☐ Provide to classroom teachers.
- ☐ Provide to youth.
- ☐ Use in discussions with parents.
- ☐ Display.
- ☐ Keep as program record.
- ☐ Use to revise projects or PBL processes.
- ☐ Other.

Planning Check
Is the documentation
- ☐ Appropriate and aligned to the project type and complexity?
- ☐ Aligned with objectives?
- ☐ Readily accomplished?
- ☐ Useful?
- ☐ Applicable to different areas

Mapping Resources for Citizen Science Implementation

Implementing a citizen science project takes a lot of preparation. To plan a successful project, you will need to have a clear sense of how the project will fit into your program and the possible resources you will need.

Use the graphic organizer below to begin mapping your citizen science project.



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Involving Community Partners Checklist

Use this checklist to identify potential community partners. Next, brainstorm and check off ways partners might be involved in civic learning and engagement projects (or are involved currently).

Type of Partner	Name of Partner (Group, Organization, or Individual)	Options for Involvement						
		Interview or conduct research	Invite to program	Tour or visit	Meet to present an issue	Collaborate on project activities	Provide a service	Other:
Government:								
Elected Official								
Parks and Recreation Department								
Court House/Judicial Department								
City Council								
Fire Department								
Police Department								
State or Federal Department								
Other								
Community organizations:								
Neighborhood Civic Association								
Service group								
Advocacy group								
Local health organization								
Local environmental organization								
Local education organization								
Other								
Businesses:								
Local small business								
Large company with local office								
Other								
Schools:								
Neighborhood school								
College or University								
Other								

YOU FOR YOUTH

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Involving Community Partners Checklist

Type of Partner	Name of Partner (Group, Organization, or Individual)	Options for Involvement						
		Interview or conduct research	Invite to program	Tour or visit	Meet to present an issue	Collaborate on project activities	Provide a service	Other:
Other Ideas:								

Student Engagement Tips for Grades K-12

Because students' needs vary as they learn and grow, you'll want to design and implement your program according to students' ages and grade levels. Use this tool for engaging youth in tailored citizen science experiences.

Elementary: Grades K-5

Staff should be prepared to provide lots of support:

- Provide extra background information and explanations along the way.
- Use very detailed graphic organizers and other data collection documents to help students keep track of information and document their progress on projects. Spend extra time to make sure students understand how to use them.
- If applicable, assign specific roles to members of a group (e.g. researchers, data collectors, etc.) and designate clear responsibilities.
- Set concrete objectives and due dates so students know what they will be responsible for completing.
- Use demonstration and direct instruction when needed to teach how to collect or analyze the data.
- Suggest ways to share what has been learned at the end of the citizen science project and help them plan it out.

Middle School: Grades 6-8

Staff should provide quite a bit of support, while also making room for some independence:

- Offer some background information and explanations along the way, and provide guidance to help the youth find additional information on their own.
- Demonstrate how to develop documents to help students keep track of information, but with less structure than for elementary-age students.
- Provide opportunities for youth to choose what to investigate or make decisions about the structure of the project.
- If applicable, assign specific roles to members of a group (e.g. researchers, data entry clerks, fieldwork supervisors, etc.) and designate clear responsibilities.
- Collaborate with students to analyze the data.
- Provide guidance to help students choose how they will share what they've learned at the end of the citizen science project through a culminating event such as a presentation or report.

High School: Grades 9-12

Staff can allow a great deal of independence, while paying attention to when support is needed:

- Provide guidance to point students in the right directions to find background information and explanations on their own.

Student Engagement Tips for Grades K-12

- Demonstrate how to develop or customize documents to help students to collect and analyze date for the project. These can include Excel spreadsheets, databases, graphs, charts, etc.
- Suggest roles for students to assume when working in a group (e.g. researchers, data entry clerks, fieldwork supervisors, etc.) and designate clear responsibilities.
- Guide students as they figure out how to analyze the data by applying the skills they have learned.
- Give students freedom to choose and develop their own ways of sharing what they've learned at the end of the citizen science project.
- Encourage students to engage in discussions about the project with potential partners, the scientists running the initiative or local stakeholders.

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