FRAMEWORK FOR PURPOSEFUL TECHNOLOGY INTEGRATION IN ENVIRONMENTAL EDUCATION USING INQUIRY BASED LEARNING

by

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Framework for Purposeful Technology Integration in Environmental Education
Using Inquiry Based Learning

This project has been a journey to answer the research question, how do you incorporate technology to facilitate raw exploration of the natural world that reinforces inquiry-based learning in Environmental Education? By reviewing various frameworks and templates, a framing guide with templates and steps was developed to assist educators in developing a program that incorporates lessons that help address the research question.

Some of the development of the project was started back in a previous class I was taking where we were challenged with creating STEAM type programing for young children. Through this process, I learned to create framing and templates to develop lessons for early elementary students. Through the process I learned that the technology aspect of the environmental experience was not truly developed as it could be in my work place, thus showing the need for this guide.

Technology has been recognized by several audiences as an important part of education that prepares students for the work force. Today’s jobs incorporate so many different technology concepts that there is almost no end to the potential applications and tools that are currently used or yet to come. Incorporating appropriate technology in early stages of life, at developmentally appropriate amounts, to encourage learning and growth, will help build skill sets to be applied for more complex technologies in future years.

The guide utilizes systems including Backward Design (Wiggins, 1998), as well as buzz word concepts like STEAM and inquiry-based learning, which includes essential questions derived from Cox (Cox, 2015, para. 4). These components were combined with some of the framework I had created previously to help develop lessons that were focused on reaching K-12th grade students. National curriculum standards and State standards were also applied to help focus the content of the work. This is important to adhere to the principle of developmental appropriate practices.
The framing guide consists of a series of templates that have step-by-step descriptions, detailing the mind set and material that should be created for each part of the template. These templates include a Technology Tool Evaluation Survey, Environmental STEAM Program Development Assessment, Program Design Framework, Program Effectiveness Evaluation Tool, and a Journaling Tool. Each of these sections causes the educator to critically think about the development of the lesson, while focusing the content appropriately. In addition to development of the lesson, an outline is created to share with other educators who may want to use the developed program. The Technology Tool Evaluation Survey is also a dual purpose component that can catalog the searched technologies for future use in other program development projects.

The guide is reinforced with examples of classes at three different grade grouping levels to demonstrate the application of the different sections.

The guide was developed with the intention of helping educators, from a wide variety of backgrounds, begin the development process of a technology they have discovered that could be used for a program. But like many programs, tools, or templates there will always be room to grow. This guide includes blank templates for educators to use and modify as they develop new ideas encounter new challenges not yet for seen by the project. Growing, changing and adapting is the essence of learning that we strive to see in our students. And so it is fitting that our programs and teaching styles exemplify those qualities as well.
Framing Guide for
Environmental Education & Technology
Through STEAM Lesson Planning

Jonathan Massung
Hamline University
2018
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Introduction to the Guide:

Environmental Education & Technology

Through STEAM Lesson Planning

This guide is to assist educators in developing a program concept when you identify a potential technology that could be used for an environmental educational experience. The steps in the framework will help you through the process of developing a program, focusing in STEAM Disciplines (Science Technology, Engineering, Art & Math), with the primary discipline being technology. Secondary disciplines are identified to reinforce the learning objectives and establish cross curricular learning. Each section walks you through the steps to develop a program that can use a technology concept. The sections are presented first broken down through a step-by-step process to understand how to use each of the different parts of the chart or form. These are then followed by examples of application of the templates and tools in three different class module examples at three different grade group levels; elementary, middle and high school. The blank templates are then included at the end for you to create your own program.

- The first template is the Technology Tool Evaluation Survey (TTES) that lets you reflect on the tool to be used. Here you will not only be surveying the tool you have chosen, but will also be creating an index report of that tool that you can store and use at a later time for development of future classes.

- The second is the Environmental STEAM Program Development Assessment that is used to layout the different components and concepts of the program that you hope to create using the identified tool from TTES. Each section walks you through a step by step process that helps to critically
think about each part of the program by helping you to create essential questions, organize curriculum focus to compare to key learning concepts, and identify assessment methods that can be incorporated into a program outline for each lesson section.

- The third step frames the program concept using the **Program Design Framework (PDF)**. This makes a clean cut version for a teacher to review your program and assure alignment with their learning goals or needs.

- The final step is to evaluate the program concept using the **Journaling Evaluation Tool (JET)** and the **Program Effectiveness Evaluation Tool (PEET)** as a summary during and post program phases to monitor and reflect on the program. **JET** is used at the end of individual phases of the program to quickly take fresh notes after a learning session. Whereas the **PEET** is used to accumulate the notes into a working document to reflect on as you make adjustments and improvements.
Technology Tool Evaluation Survey (TTES)

The purpose of this tool is to help evaluate how a technology can be integrated into a program by causing the educator to critically review different aspects of effectiveness and appropriateness to the facilities parameters. Some technology can be really cool to use, but impractical for a student group that may be too young. Or the tool could become too costly to purchase or maintain by the facility. These surveys can be created as a tech tool is identified, and then cataloged for use as reference in developing several classes rather than a single class use. This cataloging concept helps expand on a tool’s possible applications and encourage student Inquiry-Based Learning.
Technology Tool Evaluation Survey Overview

<table>
<thead>
<tr>
<th>Tech Tool:</th>
<th>Brand Name:</th>
</tr>
</thead>
</table>

This section helps to identify the tool that is being used. The **Tech Tool** section should be a very general title of the object, like drone, rather than too detailed with a specific brand or type. The **Brand Name** section is to identify the tool to a specific company and model number to be referenced to for later use and comparison of other units or specification information.

**What are the foreseeable uses?**

This section will grow over time. Using a digital copy of the form allows the developer and staff to add to the list as students and staff develop new applications for the referenced tool. This allows others to review past work that has been done for inspiration and forethought when developing new modules.

**How is the tool relatable to common use in a career field?**

This is an important section that helps establish purpose for a chosen tool. Helping students be career ready is a key component to education. Showing ties to tools used currently in the work field helps students find purpose and connections between their projects and real world application. The truth is that some of their work can be real world application by collecting citizen science data for research monitoring by scientists.

**What is the appropriate age group/grade level for the technology tool?**

Having a clear idea of the audience best suited for the tool can help developers write modules in the development stages for establishing topics, vocabulary, and certain skill sets that match developmentally appropriate practices.
Like most of this form, having a digital and ongoing list of **Cons** for this tool helps establish foreseeable issues that could arise. Having a **Pros** section helps to balance out and evaluate the potential for a tools application to a project or module.

**Possible sources to acquire the tool?**

Creating a list of sources for a tech tool helps establish a paper trail that can allow for future purchases, price comparisons, parts ordering, troubleshooting and warranty information.
Environmental STEAM

Program Development Assessment

This section highlights the different elements of the program by causing you to critically think about each element of the lesson, and the overall program focus. The first steps are essential background knowledge when developing any program. You need to identify who your audience is by looking at age or grades, locations they are from, and other demographics that may determine culturally relevant ideas or terms that are applicable to the audience. This in turn will help to create a meaningful program that your audience can relate too.

Your next steps include identifying key concepts to focus your learning on. Too many ideas can overwhelm an audience. Think quality over quantity as you develop a program and keep it basic, it will become more focused later in curriculum phases. To help with this process, work through the essential questions section to help get the thinking about how you can guide your group discussion without making it more like a lecture of ideas. This causes your group to start thinking critically with you.

Your next steps are to look at the curriculum and identify correlations. There is no need to match several different points. Remember to think quality over quantity so as not to overwhelm your audience. Your final phases are to outline the program and lessons in as many steps as needed and identify how you plan to assess the audience learning in different formats as outline in the Program Development Assessment.
Environmental STEAM
Program Development Assessment Overview

Unit: STEAM

Program Title:

The Unit will usually be a STEAM based design, but this could change over time with changes in programs. The Title will change as new programs are designed.

Part 1: Learning Objectives

1. Target Audience: (Age/grade, location, urban vs. rural, group size)

Knowing your audience helps to establish proper Developmentally Practices for teaching the modules. Vocabulary and skill sets are all tied back to not only age or grade, but also several other demographic differences that determine exposure to different technologies and related knowledge or skills.

2. Key Learning Objectives?

1. __________________________________________
2. __________________________________________
3. __________________________________________

These Objectives are very basic and to the point ideas that summarize the essential learning concept and essential questions. (ex. Potential Energy for a physics class) These basic objectives help direct the main concepts. Having only a few objectives tends to be the best approach to not over load the students.

3. The essential learning concept of the program: The long term take away.

(one sentence response)

This sentence can be an umbrella idea concept that helps tie the objectives together into an inspiring and memorable concept that students can not only retain for a long time, but will remember the lesson as it ties back to their personal lives.
4. Essential Questions: What question(s) will you ask students in order to...

1. Assess Initial Knowledge?
   What kinds of questions will indirectly draw out vocabulary for answers?

2. Focus on the Essential Learning Concept?
   Remember not wander off topic. Keep questions to the main basic topics.

3. Engage them in inquiry, meaning making, and/or transfer?
   Craft question in a manner that questions the discussed objectives.

4. Encourage them to explore multiple possible answers?
   Incorporating Small-Group times encourages multiple thoughts and solutions.

5. Give them a reason to care about learning targets (standards, knowledge, skills, and practices)? The material needs to tie back to personal lives for it to become applicable to them and part of their world of thought and importance.

5. Learning Targets & STEAM Disciplines:
   What prioritized standards will you explicitly teach and assess? (NGSS*, Common Core and/or Content-Area Standards)

   a. Primary Discipline:
      • Standards:

   b. Secondary Disciplines:
      • Discipline:
         • Standards:
      • Discipline:
         • Standards:

This section helps a developer to breakdown the key discipline ties and relate them back with direct connections to the standards like NGSS and Common Core. This also serves as a good reference to teachers and administrators to their learning goals for the group.
6. Acquisition/Building Blocks:

1. What do students need to know? (Vocabulary, facts, formulas, background knowledge, geography)

   *This section helps establish an expectations list that will help guide assessment development, as well as help teachers prepare their students for a program with the necessary knowledge.*

2. What do students need to be skilled at?

   *Sometimes necessary skills are need to perform projects. Helping Identify these helps teachers prepare their students for the skills need to carry out a project so as not to detract form the learning experience.*

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**Part 2: ASSESSMENT GUIDE**

1. What are some assessment methods to be used?

   a. Formal

   *Designing formal quizzes or survey questions on paper to do before and after a program helps to monitor individual progress and provide documentation of student growth. Here you can list appendixes or similar to address this need.*

   b. Informal

   *This kind of assessment really has no structure other than a discussion or similar assessment to establish front door knowledge or skills. Again here you can mention the concepts or appendixes as applicable.*

   c. Post Project Ideas: (Students Teaching Attained Knowledge)

   *This section provides a list of possible follow-up activities that a teacher could refer to when developing a applicable program for their particular group of students.*
2. What evidence shall be collected for assessment?

In this section, be very specific as to what information will be collected or product will be collected for assessment. This should indicate anticipated assessment results which is needed for the PEET.

3. How will you determine individual growth separate from group responses?

Specifically identify what assessment method will capture group vs. individual growth.

Part 3: LEARNING EXPERIENCES AND INSTRUCTION

- Background thoughts: Students should be able to answer these questions if someone were to ask them.
  - What are you doing?
  - Why are you doing it?

LEARNING PLAN: (Lesson Plan Building Blocks)

1. Pre-trip Program Outline: (Naturalist visits school, teacher led programing, formal assessments, project planning, etc.)

This section provides space with a brief bulleted outline of the different activities and steps which serves as a basis for a specific schedule with times to be created according to the school. Note that the specific times is not necessary here, but rather a timeframe notation of how long a step should take. (ex. nature walk to tower – 60min.)

2. On-site Trip Program Outline: (Identify: Formal or Informal Assessments, detailed timeline of activities and learning steps, supplies needed, staff needed, etc.)

Similar to the Pre-Trip Program Outline, except for use at the facility for the program.

3. Suggested Follow-Up Activities at School: (Naturalist visits school, teacher led programing, formal assessments, project summary, Program response presentation or project, etc.)

Here you will list activity titles or ideas with a timeframe and possibly Appendix to the activity outline.
**Program Design Framework**

This section helps to identify different aspects of the project from the Program Development Assessment and arrange them into a framework that can be easily read by not only yourself, but also a nice clean document for an educator to review. This will help present your program to a potential teacher that wants to visit your site, or for an administrator or grant board to review for approval of the program. Most of the elements are included form the assessment, but in a more formal layout to be reviewed. This also gives you a chance to help express the connections to site mission statements or other programs your site is engaged.

Finally, you will include a more detailed outline of time frames and programing that the teacher can review to anticipate timing with bus times to site, lunch, and other needs that may arise.
# Program Design Framework Overview

## Learning Objective:
(Simple one sentence goal)

A detailed sentence that identifies the whole concept or purpose of the class.

<table>
<thead>
<tr>
<th>Age/Grade:</th>
<th>Timeframe:</th>
<th>Season: (Is it season specific?)</th>
</tr>
</thead>
</table>

The age/grade indicated with indication of timeframe, like a week to 3 months, to complete and any seasonal restrictions.

## Primary STEAM Discipline:

<table>
<thead>
<tr>
<th>Standards:</th>
</tr>
</thead>
</table>

Here you indicate the main discipline, which for this program is Technology, and the standards associated to it. Note: do not try to link too many standards. Keep it simple.

## Secondary STEAM Disciplines:

<table>
<thead>
<tr>
<th>Standards:</th>
</tr>
</thead>
</table>

Here you will indicate any other disciplines in descending order of importance with associated standards. Again keep things simple as too much can detract from the learning experience an overwhelm a class in to much information that cannot be retained.
Curriculum Alignment: (NGSS & Common Core)

This section will relist the curriculum standard with specific details.

Mission Statement Points
(What are points or connections to sites mission statement? ex. invasive species, etc.)

Most facilities have a mission or learning goals. It is important to reflect here on how the program aligns to your facilities’ mission.

Learning Outcomes:
(Brief 2-4 bullets of one sentence expected outcomes.)

These Learning Outcomes should parallel the Key Objectives and the Assessments that are being conducted.

Previous/Front Door Knowledge:
- (Bullet point of different concepts students should understand to grasp this lesson)

A brief overview of vocabulary and skills need to be successful to complete this program.
**Assessment Methods:**

*Here you will bullet out each assessment type and appendix of documents for the assessment if applicable.*

---

**Material Needed:**

*(Very detailed list of all necessary supplies)*

*As indicated, a very detailed list of supplies needs to be listed here so that almost any educator could look through this list and prepare for class easily.*

---

**Pre-Trip Program:**

*(Detailed list of steps and sub steps, Timeframe of major steps, and reference appendixes as needed.)*

*An outline of each activity and section with indicating timeframes that serve as a model to create a schedule for a school visiting. ex. (ex. nature walk to tower – 60min.)*

---

**Onsite Program:**

*(Detailed list of steps and sub steps, Timeframe of major steps, and reference appendixes as needed.)*

*An outline of each activity and section with indicating timeframes that serve as a model to create a schedule for a school visiting. ex. (ex. nature walk to tower – 60min.)*
Optional Methods:
(Basic description or title with reference page or appendix if needed.)

This section is important to list out different ways of carrying out a project or class experience. Although the class concept may be the same, our learning styles and different weather patterns can change what we are able to do for a class experience.

Suggested Follow-Up Activities at School:
(Bullet point of different activity titles with referenced page number or appendix number.)

As indicated, this section serves as a reference or menu of ideas for a teacher to select from that will best suit the class’s needs.
Journaling Evaluation Tool

This tool is used to take quick notes about each section of the program; either after each lesson or activity. Our best notes tend to be right after a program when the thoughts are still fresh. But having a form that makes you critically think about a program’s elements is important as well to capture essential parts that you may not think about at first. Different parts could be hard to recall later after the whole program and it just helps to jot down those thoughts now or have the spot open even if it comes to you later on as you go. These can also be helpful to compare to an observer’s notes, like a supervisor, to see if you both had the same impression from the program.
Journaling Evaluation Tool Overview

<table>
<thead>
<tr>
<th>Program Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Name:</td>
</tr>
</tbody>
</table>

| Location of Program: | Program Date: | Program Phase: (Pre, Main, Post) |

Similar to what was done with PEET, these basic details help to track programs for comparison. Different demographics could play a role in how successful a program may be, as well as seasonal effects that may not have been indicated as being an issue previously. This can also track a school's patterns for year to year for performance.

Assessment Summary Notes:
(Answers given or modeled)

This section is used as a brief reflection after a class or activity to reflect on the assessment or assessments for that class. This would include all forms of assessment and should be indicated as well. ex. formal, informal, project

Student Engagement Observations:
Effective Observations notes:
Ineffective Observations notes:

This section is a good reflection piece on the learning styles of the group and the effectiveness or ineffectiveness of the activity or program with student engagement. This would also be a good place to include observer notes of the class by supervisor or other educator.
Challenges: (Timing of sections, Materials, etc.)

This section serves as space to expand into detail different aspects of the program just didn’t work as planned: from timeframe issues, to supply needs or concepts not being retained or understood by the class.

Suggestions for Improvement:

Once the different challenges have been identified, this section serves as a brainstorming area to try and address the issues with solutions that can be utilized to improve the learning experience. It also serves as a reflection of thought for others to look back to see what has already been tried and explanation of why some things are done certain ways.
**Program Effectiveness Evaluation Tool**

This tool allows you to organize notes from your journal entries into one document to do an overall review of the program. This is beneficial in many ways as it can serve as a personal reference tool to make adjustments and improvements. But it can also be helpful for reporting to superiors on the progress and effectiveness of a program. I would suggest that you ask supervisors to sit in and review your program after a couple rounds to also make observations and note areas of improvement. Those logs could also be included in a program to help see it from another’s point of view. Sometimes we can miss things when we become too focused on organizing a lesson or activity.
Program Effectiveness Evaluation Tool Overview

These basic details help to track programs for comparison. Different demographics could play a role in how successful a program may be, as well as seasonal effects that may not have been indicated as being an issue previously. This can also track a school's patterns for year to year for performance.

<table>
<thead>
<tr>
<th>Program Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Name:</td>
</tr>
<tr>
<td>Group Age/Grade:</td>
</tr>
<tr>
<td>Location of Program:</td>
</tr>
<tr>
<td>Program Date:</td>
</tr>
</tbody>
</table>

Pre-Trip Program | Notes:

Assessment Results: | Anticipated Results:

This section is reserved to take notes by either the educator or an observer. This is not used necessarily for assessing any one part of the program, but rather a cumulative collection of notes from a journal entry from the JET tool in the next section. This also serves as a log sheet to capture data from the program regarding assessment effectiveness and student performance.

The Actual score data is collected in the Assessment Results section. And the Anticipated Results section indicates a minimum score goal for growth.
This section is like the one from **Pre-Trip Program** and is reserved to take notes by either the educator or an observer. This is not used necessarily for assessing any one part of the program, but rather a cumulative collection of notes from a journal entry from the **JET** tool in the next section. This also serves as a log sheet to capture data from the program regarding assessment effectiveness and student performance. The Actual score data is collected in the **Assessment Results** section. And the **Anticipated Results** section indicates a minimum score goal for growth.

### Onsite Program

<table>
<thead>
<tr>
<th>Notes:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Assessment Results:</th>
<th>Anticipated Results:</th>
</tr>
</thead>
</table>

### Post-Trip Activities

<table>
<thead>
<tr>
<th>Where Any Selected?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Results:</th>
</tr>
</thead>
</table>

This section makes note of any continuing education that might have occurred Post-Program. Activities may include anything you did or any other ideas that the teacher may have conducted on their own. Also best to capture any indications or evidence of effectiveness those programs had to the overall learning experience.
## Lower Elementary Example Module

### Technology Tool Evaluation Survey (TTES)

<table>
<thead>
<tr>
<th>Tech Tool:</th>
<th>Brand Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borescope</td>
<td>Pancellet Inc., Endoscope for Android, 5.5mm</td>
</tr>
</tbody>
</table>

**What are the foreseeable uses?** (Photography, Journaling, Video, Etc.)

- Photography, Video Capture
  - Investigate small holes in ground, Bird boxes, Inside logs, Underwater

**How is the tool relatable to common use in a career field?** (List some examples)

This tool is used by work crews to examine appliances, motors, home inspection and various outdoor spaces

**What is the appropriate age group/grade level for the technology tool?**

This tool is simple enough for ages 7 and up. The skill set is similar to a camera, but will require some skill with a portable device like a tablet or similar.

**Pros: (Cost, accessibility, etc.)**

- Fairly inexpensive with several vendors.
- Simple operation with hundreds of uses

**Cons: (Cost, weather concerns, etc.)**

- Requires a portable device
- Some operating systems are not compatible.

**Possible sources to acquire the tool?**

**Amazon:** https://www.amazon.com/Endoscope-Pancellent-Waterproof-Borescope-Inspection/dp/B01MR8EONS
Environmental STEAM
Program Development Assessment

Unit: STEAM

Program Title: Borescope Investigation

Part 1: Learning Objectives

1. Target Audience: (Age/grade, location, urban vs. rural, group size)

   *This program is intended for K-5th grade groups. Size of group depends on equipment available to use. No more than 4 students per small group.*

2. Key Learning Objectives?

   1. _Basic use of tablets_________________________________________
   2. _Beginning to understand Subterranean Ecosystem_____________________
   3. _Application of a video device___________________________________

3. The essential learning concept of the program: The long term take away.
   (one sentence response)

   *The concept of the class is to cause students to critically think about and investigate using a common use tool known as a borescope in an environmental application.*

4. Essential Questions: What question(s) will you ask students in order to...

   a. Assess Initial Knowledge?
      
      *What do you think makes the holes in trails?*

   b. Focus on the Essential Learning Concept?
      
      *How could we investigate what lives in the holes? What tools could we use?*

   c. Engage them in inquiry, meaning making, and/or transfer?
      
      *How could this information we gather be important?*

   d. Encourage them to explore multiple possible answers?
      
      *What variables could change what we saw on the trip?*
e. Give them a reason to care about learning targets (standards, knowledge, skills, and practices)?

How can this project apply to a job in the world? What are somethings you might investigate with this tool?

5. Learning Targets & STEAM Disciplines:
What prioritized standards will you explicitly teach and assess? (NGSS and Michigan Educational Technology Standards)

a. Primary Discipline: Technology
   - Standards:
     o 3-5.CI.3. Participate in discussions about technologies (past, present, and future) to understand these technologies are the result of human creativity.
     o 3-5.CT.2. Use information and communication technology tools (e.g., calculators, probes, videos, DVDs, educational software) to collect, organize, and evaluate information to assist with solving problems.
     o 3-5.TC.1. Use basic input and output devices (e.g., printers, scanners, digital cameras, video recorders, projectors).

b. Secondary Disciplines: Science
   - Discipline: Science
     - Standards:
       o K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
       o 3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
       o 4-ESS2-2. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
6. Acquisition/Building Blocks:
   a. What do students need to know? (Vocabulary, facts, formulas, background knowledge, geography)
      
      *Vocabulary Terms: Variables, Producer, Consumer, Decomposer, Habitat*

   b. What do students need to be skilled at?
      
      *Skills: Basic tablet usage*

Part 2: ASSESSMENT GUIDE

1. What are some assessment methods to be used?
   a. Formal
      
      *Pre-trip and Post-trip assessment surveys, Vocabulary Description workbook page, ABC Learning Page, Journaling Page (Will vary based on grade levels)*

   b. Informal
      
      *Large and Small Group discussions*

   c. Post Project Ideas: (Students Teaching Attained Knowledge)
      - Creating poster project or display for hallway at school to share about the experience.
      - Develop a similar project conducted at school.

2. What evidence shall be collected for assessment?
   
   - Pre-trip and post-trip assessment survey of
   - Workbook Pages
   - Journals entries
   - Post-trip projects

3. How will you determine individual growth separate from group responses?
   
   *By comparing the work for the evidence, there should show a individuals growth aside from small and large group discussions*
Part 3: LEARNING EXPERIENCES AND INSTRUCTION

- Background thoughts: Students should be able to answer these questions if someone were to ask them.
  - What are you doing?
  - Why are you doing it?

LEARNING PLAN: (Lesson Plan Building Blocks)

1. **Pre-trip Program Outline:** (Naturalist visits school, teacher led programing, formal assessments, project planning, etc.)

15min. **Introduction:**
- *Pre-trip assessment survey*

  *Discuss in a large group: Essential Questions*

  - *Introduce Project Concept*

15min. **Discuss terms:**
- *Producer, consumer, decomposer and variables*
- *Vocabulary Description workbook page*

  *Discuss in a large group: habitat components and animal adaption.*

30 min. **Tech Lab Training:** Assist students with learning how to use a tablet and borescope.

30 min. **Discuss in small groups: steps to do an investigation with borescope**
- *How to write notes*
- *What we might find*
- *What things could affect what we see*

  *Create journals to use for project*
2. **On-site Trip Program Outline:** (Identify: Formal or Informal Assessments, detailed timeline of activities and learning steps, supplies needed, staff needed, etc.)

15min. **Introduction:**

- *Discuss in a large group: Essential Questions*
- *Reintroduce Project Concept*

15min. **Discuss terms in a large group:**

- *Producer, consumer, decomposer and variables*
  
  *Discuss in a large group:*
  
  - *Expectations of journals*

45 min. **Field Lab:** Students begin hiking and investigating using their borescopes around visitor center and trails. Students also record images and take notes about observations.

20 min. **Discuss in small groups: What they found and finish journal entries**

  *Discuss in large group: Results from the investigation*

15min. **Complete Post-trip assessment survey**

3. **Suggested Follow-Up Activities at School:** (Naturalist visits school, teacher led programing, formal assessments, project summary, Program response presentation or project, etc.)

  i) *Create a model of a food web that illustrates the connection of producer, consumer and decomposer.*

  ii) *Students create an investigation around the school similar to the project from the trip and share on a poster project, or similar project, in the school.*
# Program Design Framework

**Title:** Borescope Investigation

**Learning Objective:**
Introduce students to general use of a borescope for basic environmental observation study.

<table>
<thead>
<tr>
<th><strong>Age/Grade:</strong></th>
<th><strong>Timeframe:</strong></th>
<th><strong>Season:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd-5th</td>
<td>90 min. Pre-lesson 140min. Main lesson</td>
<td>Any Season</td>
</tr>
</tbody>
</table>

**Primary STEAM Discipline:**
- Technology

**Application:**
- Borescope
- Tablet

**Secondary STEAM Disciplines:**
1. Science

**Application:**
1. Environmental Biology

**Curriculum Alignment:**
- **3-5.CI.3.** Participate in discussions about technologies (past, present, and future) to understand these technologies are the result of human creativity.
- **3-5.CT.2.** Use information and communication technology tools (e.g., calculators, probes, videos, DVDs, educational software) to collect, organize, and evaluate information to assist with solving problems
- **3-5.TC.1.** Use basic input and output devices (e.g., printers, scanners, digital cameras, video recorders, projectors)
- **K-ESS2-2.** Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
- **3-LS4-4.** Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- **4-ESS2-2.** Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation
<table>
<thead>
<tr>
<th>Mission Statement Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>(What are points or connections to sites mission statement? ex. invasive species, etc.)</td>
</tr>
<tr>
<td>No Child Left Inside</td>
</tr>
<tr>
<td>Project Wild</td>
</tr>
<tr>
<td>Project Learning Tree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcomes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students can demonstrate appropriate handling of tablet computer &amp; borescope equipment.</td>
</tr>
<tr>
<td>Students will develop basic skills for proper use of a borescope.</td>
</tr>
<tr>
<td>Students can explain the importance of utilizing technology as a tool to help them learn.</td>
</tr>
<tr>
<td>Students will begin to recognize habitat connections and impacts between plants, insects and other animals (including humans); including the 4 basic parts of a habitat.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Previous/Front Door Knowledge:</th>
</tr>
</thead>
<tbody>
<tr>
<td>No pre-required natural science knowledge needed beyond that of Pre-K natural science comprehension appropriate to the grade level of the given group</td>
</tr>
<tr>
<td>Vocabulary examples: Variables, Producer, Consumer, Decomposer, Habitat</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment Method:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief discussion about:</td>
</tr>
<tr>
<td>• Pre-trip assessment survey</td>
</tr>
<tr>
<td>• Basic Tablet usage and handling and what experiences the students have had using them.</td>
</tr>
<tr>
<td>• Plants and animals and the 4 basic parts that make up a habitat.</td>
</tr>
</tbody>
</table>
### Material Needed:

1. Tablet or similar device to take pictures.
2. Digital microscope.
3. Journal books made by students

### Pre-trip Program:

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 15 min.    | Introduction:  
- Pre-trip assessment survey  
Discuss in a large group: Essential Questions  
- Introduce Project Concept |
| 15 min.    | Discuss terms:  
- Producer, Consumer, Decomposer and Variables  
- Vocabulary Description workbook page  
Discuss in a large group: habitat Components and animal adaption. |
| 30 min.    | Tech Lab Training: Assist students with learning how to use a tablet and borescope. |
| 30 min.    | Discuss in small groups: steps to do an investigation with borescope  
- How to write notes  
- What we might find  
- What things could affect what we see  
Create journals to use for project |
<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 15min.     | Introduction:  
|            | • Discuss in a large group: Essential Questions  
|            | • Reintroduce Project Concept |
| 15min.     | Discuss terms in a large group:  
|            | • Producer, Consumer, Decomposer and Variables  
|            | Discuss in a large group:  
|            | • Expectations of journals |
| 45 min.    | Field Lab: Students begin hiking and investigating using their borescopes around visitor center and trails. Students also record images and take notes about observations. |
| 20 min.    | Discuss in small groups: What they found and finish journal entries  
|            | Discuss in large group: Results from the investigation |
| 15min.     | Complete Post-trip assessment survey |

**Optional Methods:**

1. **Students investigate around a building**
2. **Students investigate bird houses**

**Suggested Follow-Up Activities at School:**

- Create a model of a food web that illustrates the connection of producer and consumer through a digital photo album.
- Conduct project at school
- Create a poster project for school hallway
# Program Effectiveness Evaluation Tool

<table>
<thead>
<tr>
<th>Program Title:</th>
<th>Borescope Investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Name:</td>
<td>Bangor Lincoln</td>
</tr>
<tr>
<td>Group Age/Grade:</td>
<td>3rd</td>
</tr>
<tr>
<td>Location of Program:</td>
<td>Bangor</td>
</tr>
<tr>
<td></td>
<td>Lincoln Elem. &amp; Bay City State Park</td>
</tr>
<tr>
<td>Program Date:</td>
<td>March 4th &amp; April 10th</td>
</tr>
</tbody>
</table>

## Pre-Trip Program

Notes: Group did not talk very much at first. Survey seemed to be about right level to comprehend.

Most students knew how to use tablet and finished section early.

Assessment Results: 40%  
Anticipated Results: 25%

## Onsite Program

Notes: Students seem to remember some part from pre-trip, but not as much as anticipated. Students investigated more than holes in trials. Most students utilized journals.

Assessment Results: 90%  
Anticipated Results: 80%

## Post-Trip Activities

Where Any Selected? Poster Project for school display.

Results: To be posted on Facebook page.
# Journaling Evaluation Tool

<table>
<thead>
<tr>
<th>Program Title:</th>
<th>Borescope Investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Name:</td>
<td>Bangor Lincoln</td>
</tr>
<tr>
<td>Location of Program:</td>
<td>Bangor Lincoln Elem.</td>
</tr>
<tr>
<td>Assessment Summary Notes:</td>
<td>(Answers given or modeled)</td>
</tr>
</tbody>
</table>

Students took a bit to get motivated to take assessment. May need new concept idea for assessment.

**Student Engagement Observations:**

**Effective Observations notes:**

Survey seemed to be about right level to comprehend.

Most students new how to use tablet and finished section early.

**Ineffective Observations notes:**

Group did not talk very much at first.
## Middle School Example Module

### Technology Tool Evaluation Survey (TTES)

<table>
<thead>
<tr>
<th>Tech Tool:</th>
<th>Brand Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echo Meter Tool</td>
<td>Echo Meter Touch 2</td>
</tr>
</tbody>
</table>

**What are the foreseeable uses?** (Photography, Journaling, Video, Etc.)

Collection of raw data that demonstrates live graphing. This allows for students to practice reading graphs while actively interpreting its meaning.

**How is the tool relatable to common use in a career field?** (List some examples)

These basic tools are similar to what is being used to study bats all over the world. Some job applications relate to population monitoring and wind turbine effects.

**What is the appropriate age group/grade level for the technology tool?**

This tool is appropriate for using with 6th grade and up.

**Pros:** (Cost, accessibility, etc.)

- Active participation in a project that is real.
- Night time experience
- Grants to cover cost
- Graphing Application
- Capacity to be an ongoing project from year to year.

**Cons:** (Cost, weather concerns, etc.)

- The item cost about $175 each although grants are available.
- Requires portable device.
- Seasonal applications: not suitable in northern climates during winter cold.

**Possible sources to acquire the tool?**

Wildlife Acoustics: [https://www.wildlifeacoustics.com/](https://www.wildlifeacoustics.com/)
Environmental STEAM
Program Development Assessment

Unit: STEAM

Program Title: Bat Survey Investigation

Part 1: Learning Objectives

1. Target Audience: (Age/grade, location, urban vs. rural, group size)

   *Grades 6th-8th, small groups should be no more than 4-5 students*

2. Key Learning Objectives?

   1. _Graphing Basics__________________________
   2. _Bat Biology_____________________________
   3. _Data Interpretation and Recording_________

3. The essential learning concept of the program: The long term take away.
   (one sentence response)

   *The concept of the program is to cause students to investigate an animal group using digital graphing equipment that is recorded and analyzed for species identification that helps develop dialog for interpretation of results, management, and human effects of that species.*

4. Essential Questions: What question(s) will you ask students in order to...

   a. Assess Initial Knowledge?

      *How would you describe echo location and where is it observed in our world or Michigan?*

   b. Focus on the Essential Learning Concept?

      *How do researchers study animals that utilize echo location today?*
c. Engage them in inquiry, meaning making, and/or transfer?

   *Where do we see echo location research being done? Why?*

d. Encourage them to explore multiple possible answers?

   *How might we collect and interpret the data in our area?*

e. Give them a reason to care about learning targets (standards, knowledge, skills, and practices)?

   *How could our collected data be utilized/applied? Any current research projects? Wind Turbines?*

5. **Learning Targets & STEAM Disciplines:**
   What prioritized standards will you explicitly teach and assess? (NGSS and Michigan Educational Technology Standards)

   a. Primary Discipline: *Technology*

   - Standards:
     - 6-8.RI.5. Employ data-collection technologies (e.g., probes, handheld devices, GPS units, geographic mapping systems) to gather, view, and analyze the results for a content-related problem
     - 6-8.CT.1. Use databases or spreadsheets to make predictions, develop strategies, and evaluate decisions to assist with solving a problem
     - 6-8.CT.2. Evaluate available digital resources and select the most appropriate application to accomplish a specific task (e.g., word processor, table, outline, spreadsheet, presentation program)
     - 6-8.CT.3. Gather data, examine patterns, and apply information for decision making using available digital resources

   b. Secondary Disciplines: *Science, Math, Science*

   - Discipline: *Science*

   - Standards:
     - MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
Discipline: **Math**

Standards:
- MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave

**6. Acquisition/Building Blocks:**

a. What do students need to know? (Vocabulary, facts, formulas, background knowledge, geography)
   
   **Vocabulary:** Habitat, species, sound waves, echo location, graphing

b. What do students need to be skilled at?

   **Graph interpretation, data recording, Spreadsheets, Map reading**

**Part 2: ASSESSMENT GUIDE**

1. What are some assessment methods to be used?
   
   a. Formal
      
      **Pre-trip and Post-trip assessment surveys**

   b. Informal
      
      **Large and small group discussion**
      
      **Journaling**

   c. **Post Project Ideas:** (Students Teaching Attained Knowledge)
      
      - **Connection and collaboration to local researchers**
      - **School presentation or project display**
      - **Website design**
2. What evidence shall be collected for assessment?
   - Pre-trip and Post-trip assessment surveys
   - Post-project journals of data

3. How will you determine individual growth separate from group responses?
   Pre-trip and Post-trip assessment surveys along with journal entries will help to identify individual growth and literacy.

Part 3: LEARNING EXPERIENCES AND INSTRUCTION

- Background thoughts: Students should be able to answer these questions if someone were to ask them.
  - What are you doing?
  - Why are you doing it?

LEARNING PLAN: (Lesson Plan Building Blocks)

1. Pre-trip Program Outline: (Naturalist visits school, teacher led programing, formal assessments, project planning, etc.)

15min. Introduction:
- Pre-trip assessment survey
  Discuss in a large group: Essential Questions
- Introduce Project Concept

15min. Discuss terms:
- Habitat, species, sound waves, echo location, graphing
- Map interpretation exercise
  Discuss in a large group: habitat components, animal adaption, and human impacts on local wildlife.

30 min. Tech Lab Training: Assist students with learning how to use a tablet and Echo Meter Touch2 tool.

30 min. Discuss in small group:
- How data will be recorded
- What results we might get
- What things could affect what we see in the data

Create journals to use for project
2. **On-site Trip Program Outline:** (Identify: Formal or Informal Assessments, detailed timeline of activities and learning steps, supplies needed, staff needed, etc.)

15min. **Introduction:**
- Discuss in a large group: **Essential Questions**
- Reintroduce Project Concept

15min. **Discuss terms in a large group:**
- Habitat, species, sound waves, echo location, graphing

Discuss in a large group:
- Expectations of journals

45 min. **Field Lab:** Students begin hiking and investigating using their **Echo Meter Touch2 tool** around visitor center and trails. Students also record wave recordings and take notes about observations.

20 min. **Discuss in small groups:** What they found and finish journal entries

Discuss in large group: **Results from the investigation**

15min. **Complete Post-trip assessment survey**

3. **Suggested Follow-Up Activities at School:** (Naturalist visits school, teacher led programing, formal assessments, project summary, Program response presentation or project, etc.)

- Graph out results to compare between small groups
- Produce a presentation for the school or other group
- Create bat boxes or other habitat improvement project
# Program Design Framework

**Title:** Bat Survey Investigation

**Learning Objective:**
Introduction to app and tablet or smart phone technology and environmental application and education.

<table>
<thead>
<tr>
<th>Age/Grade:</th>
<th>Timeframe:</th>
<th>Season:</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th-8th</td>
<td>90 min. Pre-lesson 140min. Main lesson</td>
<td>Spring-Fall</td>
</tr>
</tbody>
</table>

**Primary STEAM Discipline:**
- Technology

**Application:**
- Bat Echo Meter App

**Secondary STEAM Disciplines:**
1. Science
2. Math

**Application:**
1. Bat Ecology
2. Graphing

**Curriculum Alignment:**
- 6-8.RI.5. Employ data-collection technologies (e.g., probes, handheld devices, GPS units, geographic mapping systems) to gather, view, and analyze the results for a content-related problem
- 6-8.CT.1. Use databases or spreadsheets to make predictions, develop strategies, and evaluate decisions to assist with solving a problem
- 6-8.CT.2. Evaluate available digital resources and select the most appropriate application to accomplish a specific task (e.g., word processor, table, outline, spreadsheet, presentation program)
- 6-8.CT.3. Gather data, examine patterns, and apply information for decision making using available digital resources
- MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave
- **Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**

<table>
<thead>
<tr>
<th><strong>Mission Statement Points</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>(What are points or connections to sites mission statement? ex. invasive species, etc.)</td>
</tr>
<tr>
<td>No Child Left Inside</td>
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<tr>
<td>Project Wild</td>
</tr>
<tr>
<td>Project Learning Tree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Learning Outcomes:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Students discover different apps applicable to environmental study</td>
</tr>
<tr>
<td>Students will be able to appropriately handle and care for smart phones or tablets in outdoor setting.</td>
</tr>
<tr>
<td>Students begin to develop an understanding on bat ecology and echo location.</td>
</tr>
<tr>
<td>Students begin to develop project step planning.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Previous/Front Door Knowledge:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocabulary: Habitat, species, sound waves, echo location, graphing</td>
</tr>
<tr>
<td>Some basic graphing skills and map reading</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Assessment Method:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-trip and Post-trip assessment survey</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Materials Needed:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Echo Meter Touch2 tool</td>
</tr>
<tr>
<td>2. tablet</td>
</tr>
<tr>
<td>3. journals</td>
</tr>
<tr>
<td>4. flashlights with red covering</td>
</tr>
</tbody>
</table>
### Pre-trip Program:

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 15min.     | Introduction:  
• Pre-trip assessment survey  
Discuss in a large group: Essential Questions  
• Introduce Project Concept |

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 15min.   | Discuss terms:  
• Producer, Consumer, Decomposer and Variables  
• Map interpretation exercise  
Discuss in a large group: habitat components, animal adaption, and human impacts on local wildlife. |

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>30 min.</td>
<td>Tech Lab Training: Assist students with learning how to use a tablet and Echo Meter Touch2 tool.</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 30 min.  | Discuss in small groups: steps to do an investigation with borescope  
• How to write notes  
• What results we might get  
• What things could affect what we see in the data  
Create journals to use for project |

### On Site Program:

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 15min.     | Introduction:  
• Discuss in a large group: Essential Questions  
• Reintroduce Project Concept |

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 15min.   | Discuss terms in a large group:  
• Producer, Consumer, Decomposer and Variables  
Discuss in a large group:  
• Expectations of journals |
| 45 min. | Field Lab: Students begin hiking and investigating using their Echo Meter Touch2 tool around visitor center and trails. Students also record graphs and take notes about observations. |
| 20 min. | Discuss in small groups: What they found and finish journal entries  
Discuss in large group : Results from the investigation |
| 15min. | Complete Post-trip assessment survey |

**Optional Methods:**

1. **Students could survey other local sites besides the park.**
2. **Have students interpret data from other sites in relation to human impacts to the surrounding area.**

**Suggested Follow-Up Activities at School:**

- Create a mural habitat poster to display insects and remind students of the day's lesson.
- Create a model of a food web that illustrates the connection of producer and consumer.
- Make a collage of insect body parts and match them to tools we see around us.
- Create a collage of food humans eat that tied to pollinators.
- Insect Treasure Hunt visit to explain insects through hands-on-project.
Program Effectiveness Evaluation Tool

<table>
<thead>
<tr>
<th>Program Title: Bat Survey Investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Name: John Glen</td>
</tr>
<tr>
<td>Group Age/Grade: 6th</td>
</tr>
<tr>
<td>Location of Program: John Glen &amp; Vets Park</td>
</tr>
<tr>
<td>Program Date: April 23rd</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Pre-Trip Program: Notes:
Students had difficulty grasping the concept of graphs. Many students were familiar with the bat and wind turbine issue. Habitat knowledge was solid. Small group discussion time was most productive.

| Assessment Results: 35% | Anticipated Results: 25% |

Onsite Program: Notes: Students had a little difficulty getting around as they were not really familiar with area. Each group worked best with a chaperone to guide process. Some of the students were not very engaged; possibly from fear of bats.

| Assessment Results: 85% | Anticipated Results: 75% |

Post-Trip Activities: Where Any Selected? Group project presentation to be shared through school program.
Results: To be posted on You Tube and Facebook
# Journaling Evaluation Tool

<table>
<thead>
<tr>
<th>Program Title: Bat Survey Investigation</th>
<th>Program Date: May 28th</th>
<th>Program Phase: (Pre, Main, Post)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Program: Vets Park</td>
<td></td>
<td>Main trip</td>
</tr>
</tbody>
</table>

**Group Name:** John Glen

**Assessment Summary Notes:** (Answers given or modeled)

- Some of the students had a hard time finding their way around the park.
- Most were able to use the graphing tool with guidance from chaperone.
- Group discussion seemed to carry on longer than anticipated.

**Student Engagement Observations:**

- **Effective Observations notes:**

  - Students quickly learned how to use the Echo Meter Touch2 tool.
  - Students had a very lengthy discussion about data, bats, and human impact.

- **Ineffective Observations notes:**

  - Battery life started to get effected.
  - Time of day effected the ability to focus for some.
# High School Example Module

## Technology Tool Evaluation Survey (TTES)

<table>
<thead>
<tr>
<th>Tech Tool: Drone</th>
<th>Brand Name: DJI - Mavic Air</th>
</tr>
</thead>
</table>

**What are the foreseeable uses?** (Photography, Journaling, Video, Etc.)
- Live video capture and quick field observation.
- Canopy investigation in forest.

**How is the tool relatable to common use in a career field?** (List some examples)
The drone is currently used by architects, environmental engineers, media, search & rescue, surveying and many more job applications.

**What is the appropriate age group/grade level for the technology tool?**
- Middle school to high school application

**Pros:** (Cost, accessibility, etc.)
- Real world career readiness tool
- Visual accessibility into unreachable areas.
- Wide variety of application
- Several drones styles to choose from for budget

**Cons:** (Cost, weather concerns, etc.)
- Pricey if students are not experienced. May want separate trainer drone.
- Weather conditions can effect drone flight and stability
- Batteries and travel distance

**Possible sources to acquire the tool?**
https://www.dji.com/mavic-air?site=brandsite&from=nav
Environmental STEAM
Program Development Assessment

Unit: STEAM

Program Title: Drone Project

Part 1: Learning Objectives

1. **Target Audience:** (Age/grade, location, urban vs. rural, group size)
   
   *Highschool 9th-12th*

2. **Key Learning Objectives?**
   
   1. __Map reading & charting____________________
   2. __Human & Natural interactions______________
   3. __Drone application_______________________

3. **The essential learning concept of the program: The long term take away.**
   
   (one sentence response)

   *The concept of the class to familiarize students to drone application to environmental studies and to discuss human environmental impact issues.*

4. **Essential Questions: What question(s) will you ask students in order to...**
   
   a. **Assess Initial Knowledge?**
      
      *What kinds of applications are drones being used today?*

   b. **Focus on the Essential Learning Concept?**
      
      *What kinds of human impacts do we see in our local area on the environment?*

   c. **Engage them in inquiry, meaning making, and/or transfer?**
      
      *What kind of study could we do locally suing a drone?*
d. Encourage them to explore multiple possible answers?

*Are there other tools needed to do the project?*

e. Give them a reason to care about learning targets (standards, knowledge, skills, and practices)?

*How will this project connect to local studies or projects?*

**5. Learning Targets & STEAM Disciplines:**
What prioritized standards will you explicitly teach and assess? (NGSS, Common Core and/or Content-Area Standards)

a. Primary Discipline: *Technology*

- Standards:
  - 9-12.TC.3. Explore career opportunities, especially those related to science, technology, engineering, and mathematics and identify their related technology skill requirements
  - 9-12.TC.9. Participate in experiences associated with technology-related careers


- Discipline: *Science*

- Standards:
  - HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

**6. Acquisition/Building Blocks:**

a. What do students need to know? (Vocabulary, facts, formulas, background knowledge, geography)

*Vocabulary: Habitat, ecosystems, global positioning system, biodiversity and carrying capacity*

b. What do students need to be skilled at?

*Drone flying, map reading and recording skills*
Part 2: ASSESSMENT GUIDE

1. What are some assessment methods to be used?
   a. Formal
      Pre-trip and Post-trip assessment survey

   b. Informal
      Large and small group discussion
      Journaling

   c. Post Project Ideas: (Students Teaching Attained Knowledge)
      - Connection and collaboration to local researchers
      - School presentation or project display
      - Website design

2. What evidence shall be collected for assessment?
   - Pre-trip and Post-trip assessment surveys
   - Post-project journals of data

3. How will you determine individual growth separate from group responses?
   Pre-trip and Post-trip assessment surveys along with journal entries will help to identify individual growth and literacy.
Part 3: LEARNING EXPERIENCES AND INSTRUCTION

- Background thoughts: Students should be able to answer these questions if someone were to ask them.
  - What are you doing?
  - Why are you doing it?

LEARNING PLAN: (Lesson Plan Building Blocks)

1. **Pre-trip Program Outline:** (Naturalist visits school, teacher led programing, formal assessments, project planning, etc.)

15min. **Introduction:**

- Pre-trip assessment survey

  *Discuss in a large group: Essential Questions*

- Introduce Project Concept

15min. **Discuss terms:**

- Habitat, ecosystems, global positioning system, biodiversity and carrying capacity

- Map interpretation exercise

  *Discuss in a large group: habitat components, animal adaption, and human impacts on local wildlife.*

30 min. **Tech Lab Training:** Assist students with learning how to use a drone.

30 min. **Discuss in small group:**

- How data will be recorded
- What results we might get
- What things could affect what we see in the data
Create journals to use for project

2. On-site Trip Program Outline: (Identify: Formal or Informal Assessments, detailed timeline of activities and learning steps, supplies needed, staff needed, etc.)

15min. Introduction:
• Discuss in a large group: Essential Questions
• Reintroduce Project Concept

15min. Discuss terms in a large group:
• Habitat, species, sound waves, echo location, graphing

Discuss in a large group:
• Expectations of journals

45 min. Field Lab: Students begin hiking and investigating using their drone around visitor center and trails. Students also record video recordings and take notes about observations.

20 min. Discuss in small groups: What they found and finish journal entries

Discuss in large group: Results from the investigation

15min. Complete Post-trip assessment survey

3. Suggested Follow-Up Activities at School: (Naturalist visits school, teacher led programing, formal assessments, project summary, Program response presentation or project, etc.)

• Group presentation project to the school
• Create a website or You Tube posting on research
• Connect with a local research project
# Program Design Framework

**Title:** Drone Project

**Learning Objective:**
Introduction to drone technology and real world application.

<table>
<thead>
<tr>
<th>Age/Grade</th>
<th>Timeframe</th>
<th>Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-12</td>
<td>90 min. Pre-lesson 140min. Main lesson</td>
<td>Any Season</td>
</tr>
</tbody>
</table>

**Primary STEAM Discipline:**
- Technology

**Application:**
- Drone

**Secondary STEAM Disciplines:**
1. Science

**Application:**
1. Michigan Ecology

**Curriculum Alignment:**
- 9-12.TC.3. Explore career opportunities, especially those related to science, technology, engineering, and mathematics and identify their related technology skill requirements
- 9-12.TC.9. Participate in experiences associated with technology-related careers
- HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

**Mission Statement Points**
(What are points or connections to sites mission statement? ex. invasive species, etc.)

- No Child Left Inside
- Project Wild
- Project Learning Tree
Learning Outcomes:
Students can describe different drone applications to environmental studies. Students can plan out steps to conduct a study utilizing drone technology. Students will develop basic map reading skills.

Previous/Front Door Knowledge:
- Vocabulary: Habitat, ecosystems, global positioning system, biodiversity and carrying capacity
- Drone flying, map reading and recording skills

Assessment Method:
- Brief large and small group discussion before and after project to assess vocabulary and literacy levels on the subject matter.
- Journaling

Material Needed:
1. Drone and comparable loaner model for practice. (There are many different types, choose the best for your situation and budget. Drone should include camera for video and photo data collection for project and ample battery for flight time or spare batteries.)
2. Student Journals
3. Pencils for notes.
4. Map of location to be studied

Pre-trip Program:

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>15min.</td>
<td>Introduction:</td>
</tr>
<tr>
<td></td>
<td>- Pre-trip assessment survey</td>
</tr>
<tr>
<td></td>
<td>Discuss in a large group: Essential Questions</td>
</tr>
<tr>
<td></td>
<td>- Introduce Project Concept</td>
</tr>
<tr>
<td>Time Frame</td>
<td>Activity</td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
</tr>
</tbody>
</table>
| 15min.     | Discuss terms:  
- Habitat, ecosystems, global positioning system, biodiversity and carrying capacity  
- Map interpretation exercise  
Discuss in a large group: habitat components, animal adaptation, and human impacts on local wildlife. |
| 30 min.    | Tech Lab Training: Assist students with learning how to use a drone |
| 30 min.    | Discuss in small groups: steps to do an investigation with drone.  
- How to write notes  
- What results we might get  
- What things could affect what we see in the data  
Create journals to use for project |

**On Site Program:**

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 15min.     | Introduction:  
- Discuss in a large group: Essential Questions  
- Reintroduce Project Concept |
| 15min.     | Discuss terms in a large group:  
- Habitat, ecosystems, global positioning system, biodiversity and carrying capacity  
Discuss in a large group:  
- Expectations of journals |
| 45 min.    | Field Lab: Students begin hiking and investigating using their drone around visitor center and trails. Students also record video and take notes about observations. |
| 20 min.    | Discuss in small groups: What they found and finish journal entries  
Discuss in large group: Results from the investigation |
| 15min.     | Complete Post-trip assessment survey |
Optional Methods:

1. Conduct multiple studies over a period of time.
2. Have students study different parts of an area for a whole site project.
3. Have an on-going study of an area to compare over time.

Suggested Follow-Up Activities at School:

- Poster project of results for school or another site
- School or class presentation
- Facebook or other community publication of project
# Program Effectiveness Evaluation Tool

**Program Title:** Drone Project

<table>
<thead>
<tr>
<th>Group Name: Western High School</th>
<th>Group Age/Grade: 10th-11th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Program: Western High School &amp; Bay City State Park</td>
<td>Program Date: March 14th April 28th</td>
</tr>
</tbody>
</table>

### Pre-Trip Program

**Notes:** Students had a little difficulty at first flying practice drone. Should have a few sessions to practice. Discussions were in-depth and took longer than expected.

**Assessment Results:** 35%  
**Anticipated Results:** 30%

### Onsite Program

**Notes:** Program went smooth when students had chaperon to keep them on task. Students had some familiarity with local environmental issues. Retention of pre-trip knowledge was ok, but needed refreshing.

**Assessment Results:** 60%  
**Anticipated Results:** 75%

### Post-Trip Activities

**Where Any Selected?** The post program selected was a You Tube video of the groups findings for school website.

**Results:**
### Journaling Evaluation Tool

<table>
<thead>
<tr>
<th>Program Title: Drone Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Name: Western High School</td>
</tr>
<tr>
<td>Location of Program: Bay City State Park</td>
</tr>
</tbody>
</table>

**Assessment Summary Notes:** (Answers given or modeled)

Students seem to have difficulty remembering things from pre-trip. Some of the terms became mixed up.

**Student Engagement Observations:**

**Effective Observations notes:**

Students seemed to do well delegating duties among themselves in small groups. Many seem to enjoy the outdoor experience.

**Ineffective Observations notes:**

Some became frustrated when the drone wasn’t capturing just the right image and ran out of time to complete survey of area.
Framing Guide Summary

This guide is not a final product of what its potential could be. Rather it is meant to be a beginning with a long life of future revisions and adjustments, just as education and research are ever changing and growing fields. Many of the concepts from the three example modules can be adapted for a certain work site. These examples are meant to be simple representations of a bigger design that could be utilized in future programming for a site. Some specifics were written with the background of my current work site to help illustrate utilization of the framework in the guide. Feel free to change and adapt as needed for your worksite or class needs. Good luck on your journey; and continue to explore and grow!
# Technology Tool Evaluation Survey (TTES)

<table>
<thead>
<tr>
<th>Tech Tool:</th>
<th>Brand Name:</th>
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<tbody>
<tr>
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</table>

**What are the foreseeable uses?** (Photography, Journaling, Video, Etc.)

<table>
<thead>
<tr>
<th>How is the tool relatable to common use in a career field?</th>
<th>(List some examples)</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**What is the appropriate age group/grade level for the technology tool?**

<table>
<thead>
<tr>
<th>Pros: (Cost, accessibility, etc.)</th>
<th>Cons: (Cost, weather concerns, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

**Possible sources to acquire the tool?**
Environmental STEAM
Program Development Assessment

Unit: STEAM

Program Title:

Part 1: Learning Objectives

1. **Target Audience:** (Age/grade, location, urban vs. rural, group size)

2. **Key Learning Objectives?**
   
   1. _________________________________
   
   2. _________________________________
   
   3. _________________________________

2. **The essential learning concept of the program: The long term take away.**
   (one sentence response)

3. **Essential Questions: What question(s) will you ask students in order to...**
   
   a. Assess Initial Knowledge?

   b. Focus on the Essential Learning Concept?

   c. Engage them in inquiry, meaning making, and/or transfer?

   d. Encourage them to explore multiple possible answers?

   e. Give them a reason to care about learning targets (standards, knowledge, skills, and practices)?
4. **Learning Targets & STEAM Disciplines:**
   What prioritized standards will you explicitly teach and assess? (NGSS, Common Core and/or Content-Area Standards)
   
   a. Primary Discipline:
      - Standards:
      
   b. Secondary Disciplines:
      - Discipline:
        - Standards:
        - Discipline:
          - Standards:

5. **Acquisition/Building Blocks:**
   a. What do students need to know? (Vocabulary, facts, formulas, background knowledge, geography)
   
   b. What do students need to be skilled at?
Part 2: ASSESSMENT GUIDE

2. What are some assessment methods to be used?
   a. Formal
   b. Informal
   c. Post Project Ideas: (Students Teaching Attained Knowledge)

3. What evidence shall be collected for assessment?

4. How will you determine individual growth separate from group responses?
Part 3: LEARNING EXPERIENCES AND INSTRUCTION

- Background thoughts: Students should be able to answer these questions if someone were to ask them.
  o What are you doing?
  o Why are you doing it?

LEARNING PLAN: (Lesson Plan Building Blocks)

1. **Pre-trip Program Outline:** (Naturalist visits school, teacher led programing, formal assessments, project planning, etc.)

2. **On-site Trip Program Outline:** (Identify: Formal or Informal Assessments, detailed timeline of activities and learning steps, supplies needed, staff needed, etc.)

3. **Suggested Follow-Up Activities at School:** (Naturalist visits school, teacher led programing, formal assessments, project summary, Program response presentation or project, etc.)
# Program Design Framework

**Title:** Program Template

<table>
<thead>
<tr>
<th>Learning Objective:</th>
<th>(Simple one sentence goal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age/Grade:</td>
<td>Timeframe:</td>
</tr>
<tr>
<td>Primary STEAM Discipline:</td>
<td>Standards:</td>
</tr>
<tr>
<td>Secondary STEAM Disciplines:</td>
<td>Standards:</td>
</tr>
</tbody>
</table>

**Curriculum Alignment:** (NGSS & Common Core)

**Mission Statement Points**
(What are points or connections to sites mission statement? ie: invasive species, etc.)

**Learning Outcomes:**
(Brief 2-4 bullets of one sentence expected outcomes.)

**Previous/Front Door Knowledge:**
- (Bullet point of different concepts students should understand to grasp this lesson)
### Assessment Methods:
- (Bullet out each assessment type, point lesson plan timeline and appendix of documents for the assessment if applicable.)

### Material Needed:
4. (Very detailed list of all necessary supplies)

### Pre-Trip Program:
- (Detailed list of steps and sub steps, Timeframe of major steps, and reference appendixes as needed.)

### Onsite Program:
- (Detailed list of steps and sub steps, Timeframe of major steps, and reference appendixes as needed.)
Optional Methods:

- (Basic description or title with reference page or appendix if needed.)

Suggested Follow-Up Activities at School:

- (Bullet point of different activity titles with referenced page number or appendix number.)
# Program Effectiveness Evaluation Tool

<table>
<thead>
<tr>
<th align="left">Program Title:</th>
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</table>

<table>
<thead>
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<th>Group Age/Grade:</th>
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<table>
<thead>
<tr>
<th>Location of Program:</th>
<th>Program Date:</th>
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<table>
<thead>
<tr>
<th>Pre-Trip Program</th>
<th>Notes:</th>
</tr>
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<table>
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<tr>
<th>Assessment Results:</th>
<th>Anticipated Results:</th>
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<thead>
<tr>
<th>Onsite Program</th>
<th>Notes:</th>
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<tr>
<th>Assessment Results:</th>
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## Post-Trip Activities

<table>
<thead>
<tr>
<th>Where Any Selected?</th>
<th>Results:</th>
</tr>
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</table>


# Journaling Evaluation Tool

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<tr>
<th>Program Title:</th>
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<table>
<thead>
<tr>
<th>Group Name:</th>
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</table>

<table>
<thead>
<tr>
<th>Location of Program:</th>
<th>Program Date:</th>
<th>Program Phase: (Pre, Main, Post)</th>
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<tr>
<th>Student Engagement Observations:</th>
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<tbody>
<tr>
<td>Effective Observations notes:</td>
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</table>

<table>
<thead>
<tr>
<th>Ineffective Observations notes:</th>
</tr>
</thead>
</table>
**Challenges:** (Timing of sections, Materials, etc.)

**Suggestions for Improvement:**
References


What is STEAM? (2014, -02-21T16:54:15+00:00). Retrieved from https://educationcloset.com/steam/what-is-steam/