How Wild Horses Were Captured

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At a Glance

Grades: 8
Content Standard: Social Studies, Life Science, Reading
Essential Understanding: Beliefs, Spirituality, Oral History (EU 3)
CS Concept: Conditional Statements, Debugging
Duration: Three 50 min. class periods

1 Unit Overview

In this social studies, life science, and reading lesson, students learn about how wild horses were captured by an American Indian tribe, Warm Springs. We focus on a story from the Warm Springs Tribe that outlines the techniques used, challenges encountered, and knowledge learned during the process of capturing wild horses. Students explore the American history of wild horses and current policies in place for the management of wild horses. Students are given an Alice world with a bug in it: the conditional statements are not correct. They must update the code in order to corral the horses.

1.1 Anchor Text

"How Wild Horses Were Captured"[1] was written in 1977 by the Warm Springs Reservation Committee to teach American Indian children about methods used to domesticate wild horses. The story provides historical insight into the techniques used by the tribe, and is the central text for this lesson.

Text Summary "How Wild Horses Were Captured" describes how in the springtime men would build corrals with gates to capture wild horses. The horses would be chased to the corral and then directed into it by tribal members hiding nearby. The horses would then be trained and broken for riding by the young members of the tribe.

Tribe(s) in the Text The story was recorded by the Warm Springs Tribe.

Place and Time Plains of the Northwest (Oregon), after the introduction of the horse in the early sixteenth century until the modern day.

1.2 Resources and Materials Needed

The following is a comprehensive list of educational tools to accompany the Wild Horses lesson plan. These include resources on the lesson plan webpage and outside materials to promote student understanding and engagement.

1. Resources available on the Wild Horses lesson plan page[2] include:
   (a) A PDF of this lesson plan.
   (b) Three pre-built worlds (`horses_starter_world.a2w`, `horses_day_2_solution.a2w`, and `horses_day_3_solution.a2w`) that depict the story with a brief animation. These worlds can be saved to a local folder then opened from within Alice 2 by selecting the 'Open a World' tab from the welcome screen.
   (c) A link to the final animation solution.
   (d) A link to the Indian Reading Series story, "How Wild Horses Were Captured."
   (e) A link to the Bureau of Land Management's webpage.
   (f) If desired, the longer readings can be used instead:
      i. "How the Indian Got the Horse"

[1] This story was commissioned through the *Indian Reading Series*, a reading and language arts program for Indian children. Twelve Indian reservations from the Northwest participated in the development of the materials for the Indian Reading Series.
[2] https://montanastorytelling.github.io/alice-lessons/horses/

ii. "American Indian Horse History"

(g) Five Worksheets and their solutions.

2. A projector or monitor to view the video, "Wild Horses: An American Romance."

3. Computers will need to have Alice 2 installed. Alice is a freely available drag-and-drop programming environment provided by Carnegie Mellon University. See the Alice 2 download page[3] for software download and instructions. Be sure to install Alice 2, not Alice 3. Note: Alice 2 does not work on macOS High Sierra (version 10.13) currently.

1.3 Related Lessons

1. "How Wild Horses Were Captured Lesson Plan" by Education Northwest
2. "Wild Horses: An American Romance" by South Dakota Public Broadcasting
3. "Horse Rich, Dirt Poor" by US Bureau of Land Management

2 Learning Objectives & Instructional Outcomes

This module is part of the collection of lesson plans developed by Storytelling, a cross-disciplinary NSF-funded project at Montana State University (MSU) that develops lesson plans at the middle school level that (1) meet Montana content standards, (2) address the IEFA Essential Understandings, and (3) introduce students to topics in computing. We provide learning objectives with assessments for each of these areas:

1. Discuss the history, as well as the present-day benefits and challenges, associated with having wild horses live on public lands managed by the U.S. government (Social studies standards SSCS.1 and SSCS.3).
2. Explain the story about how wild horses were captured by American Indians and the different roles that specific tribal members played in capturing the horses. Emphasize how American Indian oral history is a valid account of events in North America. (Essential Understanding 3).
3. Use conditional statements in Alice to close the corral gate after the horses have entered the corral (Computer Science Content standards CS.AP.5.3, CS.AP.4.3, and CS.AP.6-8.3).

See Appendix A for a complete list of learning objectives in all three areas: content standards, IEFA Essential Understandings, and Montana OPI Computer Science Content standards.

3 Methods and Instructional Strategies

In this unit, students will learn about how wild horses were captured by American Indians, both in the past and in the present day. They will learn about the history of wild horses in the American West, and explore resources from the Bureau of Land Management to learn about modern policies in place for the management of wild horses. Students will work in Alice to complete an animation where horses are being led into a corral; the students must modify the conditional statements in the code to capture the horses.

This lesson plan is comprised of three class periods. The following descriptions provide specific instructions for the execution of each lesson. We provide a complete instructional unit, but you, as the teacher, may choose to use only parts of it or adapt it to your classroom needs.

[3] https://www.alice.org/get-alice/alice-2/

3.1 Preparation

1. Print copies of the following documents, one for each student:
   - The anchor text, "How Wild Horses Were Captured".
   - The supplementary readings.
   - The five Worksheets.
2. Download Alice 2 onto all computers and open the program. Ideally, you should have one computer for every two to three students.
3. Download the starter Alice world (`horses_starter_world.a2w`) and pre-load onto each computer. After opening Alice 2, select the tab 'Open a World' from the Welcome screen, and navigate to where you saved the `horses_starter_world.a2w` file. For assistance, a worksheet describing the process of opening a saved Alice 2 world is available on the Storytelling lessons webpage.
4. Review technical ideas and terms used in the lesson, defined in Appendix C.

3.2 Class Period One

In this class period, students read the story "How Wild Horses Were Captured" and explore the history of wild horses in North America. They also learn about conditional statements and familiarize themselves with the Alice programming environment.

1. (15 *minutes*). **Reading Activity**: Students learn about how American Indians captured wild horses.
   (a) (5 *minutes*). **Read**: Ask the students to read the story "How Wild Horses Were Captured", provided by the Warm Springs tribe, and to complete Worksheet 1 with questions about the reading.
   (b) (10 *minutes*). **Discuss**: Discuss the answers to Worksheet 1 with the class as a whole. Make sure to point out vocabulary terms, specifically, 'short stop' and 'wing line,' that students will need to know to answer questions in Worksheet 1.
2. (20 *minutes*). **Reading Activity**:
   Students learn about how horses were introduced to North America, and the role that they played and continue to play in everyday life.
   (a) (10 *minutes*). **Read**: Ask the students to read one of the two supplementary readings, and answer the questions in Worksheet 2. Note that some questions on Worksheet 2 are specific to the first reading, some are specific to the second reading, and others can be answered using information from both readings.
   (b) (10 *minutes*). **Discuss**: Discuss the answers to Worksheet 2 with the class. Ask students to record the answers on their worksheet for the questions that were not addressed in their assigned reading.
3. (15 *minutes*). **Conditional Statements**: Students learn how conditional statements are structured and their potential uses through a series of examples.
   (a) A conditional statement allows a command to be executed if certain conditions are met. Conditional statements in English can take the form of "`If` *hypothesis*, `then` *conclusion*". For example, "`If` *it is raining outside*, `then` *I will bring an umbrella.*"
   Use the following examples to explore conditional statements and what conclusions may, or may not be drawn.
   Example: `If` *it is raining outside*, `then` *I will bring an umbrella.*
   - **Scenario**: It is raining outside. What will I do?
     ▶**Answer Guidance**: I will bring an umbrella.

- **Scenario**: It is not raining outside. What will happen?
  ▶**Answer Guidance**: We can not draw any conclusions! It might be the case that I bring an umbrella in case it rains later. Or, I could leave the umbrella at home and hope for a sunny day! Not raining does not guarantee that I don't bring an umbrella.

(b) Ask the students for their own examples of conditional statements. Students should be able to point to the hypothesis and the conclusions. Ask them to decide whether a conclusion may be drawn based on the conditional statement and the scenario under which the conditional statement may be evaluated.

(c) Tell the students that they may extend conditional statements with `else` to provide an alternate conclusion. For example, "`If` it is raining outside, `then` I will bring an umbrella, `else` I will wear my sun glasses." Now the students can draw a conclusion in the case that the hypothesis is false. Ask students to come up with their own examples.

Figure 1: A conditional statement in Alice.

(d) Show the students how they may construct a conditional statement in the Alice programming environment based on Figure 1 in `horses_starter_world.a2w`. You may discuss the conditional statement in Figure 1 using the image without opening Alice as well.

(e) Tell the students that they may also form *complex hypotheses* by including `and` as well as `or` statements. For example, "`If` it is raining outside `and` it is windy, `then` I will wear a rain coat." Ask the students to come up with their own examples.

(f) Finally, tell the students they may create *nested conditional statements* where the conclusion is itself a conditional statement.

if *It is raining outside* **then**
  if *It is windy* **then**
    I will wear a rain coat
  else
    I will bring an umbrella
  end
else
  I will wear sunglasses
end

Tell the students that although the complexity of conditional statements can grow quickly, their nested structure allows computers to quickly find the right action for a given set of conditions.

3.3 Class Period Two

In this class period, students learn about the history of horses in North America. They also modify the code in the Alice programming environment to correctly animate the "How Wild Horses Were Captured" story so that the short stop turns the horses towards the corral.

1. (5 *minutes*). **Inspect Starter World**: Students are given a guided overview of the starter world and the coding problems they will be tasked with solving.

   On the computer connected to the projector, open Alice and open `horses_starter_world.a2w`, and give an overview of the Alice programming environment.

   (a) Go over the different parts of the Alice environment that are labeled in Figure 2 in particular, objects (including the horses, the short stop, and the gate keeper), object methods, world preview, programming environment, 'Play' button, and block statements.

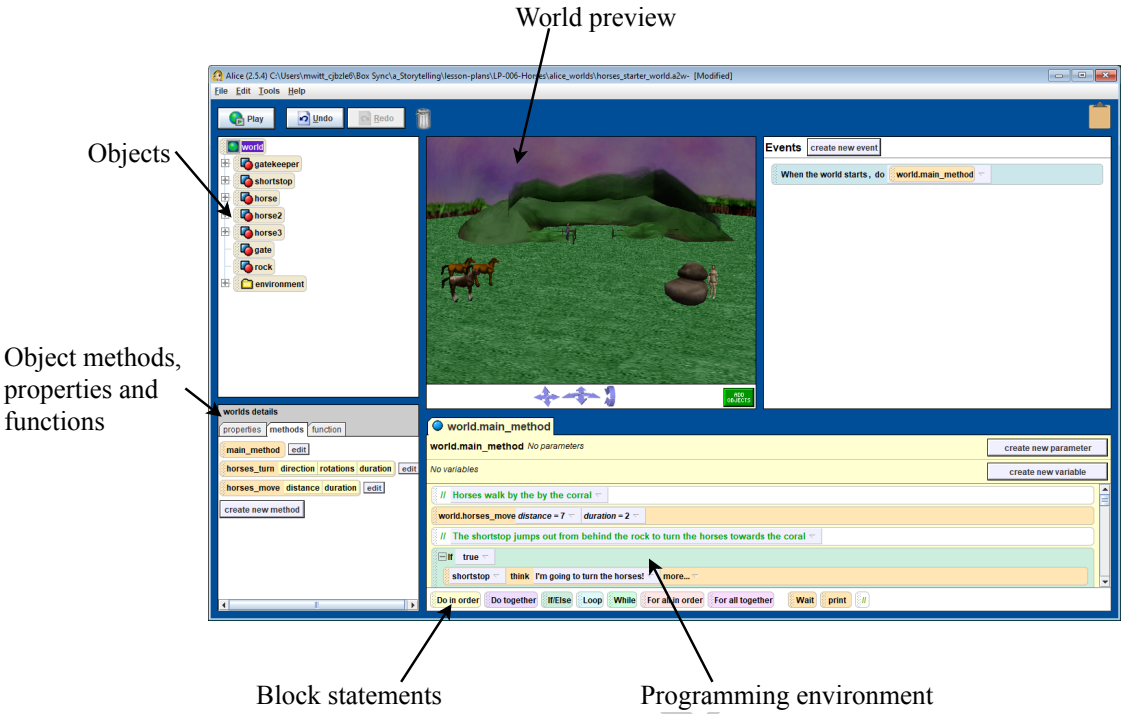

Figure 2: Labeled overview of the Alice software and the first starter world. The *world preview* allows students to manage their objects and the layout of the scene. The *programming environment* is where students make modifications to the code to change the sequence of events in the world. An object's *methods* control how objects interact with the other objects. The objects area contains all active objects in the world. When the green 'Play' button is clicked, the animation starts.

(b) Push 'Play' and watch the short animation. How is what happens different from the story?
►**Answer Guidance**: The horses continue past the corral and do not get captured. Tell the students that their job over the next two days is to write code that modifies the behavior of the short stop and the gatekeeper, so that they successfully capture the horses.

(c) Locate the *programming environment*, and open the code for `world.main_method`. Explain to the class that the computer interprets this code like a sequential set of instructions for the animation they just watched. The goal of this activity is for the students to understand the flow of the program, including the conditional statements that animate the story.
►**Answer Guidance**: You should rely on the comments included in the code (green lines preceeded by '//') to explain the meaning of each code block.

2. (15 *minutes*). **Discuss the programming problems and the solution**: Students are given a further explanation of the programming problems they will be asked to solve and further guidance on how to solve them.

(a) Show the students the problems with the starter world, namely that the horses run by the short stop and that the gatekeeper does not close the gate on time. Show the students the animation of the correct solution, which they will be building up to over this and the following day, to motivate their work in creating an animated story of how horses were captured.

(b) Look at the first `if` block in `world.horses_turn_away_from_shortstop` (Figure 3). To navigate to `world.horses_turn_away_from_shortstop`, select world in the "Objects" panel in the top left section of the window and then choose the "Methods" tab in the menu below. Locate `world.horses_turn_away_from_shortstop` in the methods list and click on the edit box. Ask the students to identify the hypothesis and the conclusion of this block. Ask the students what conclusion the program will draw. Ask students what the goal should be for the shortstop to do based on trying to make the story realistic to what they read.

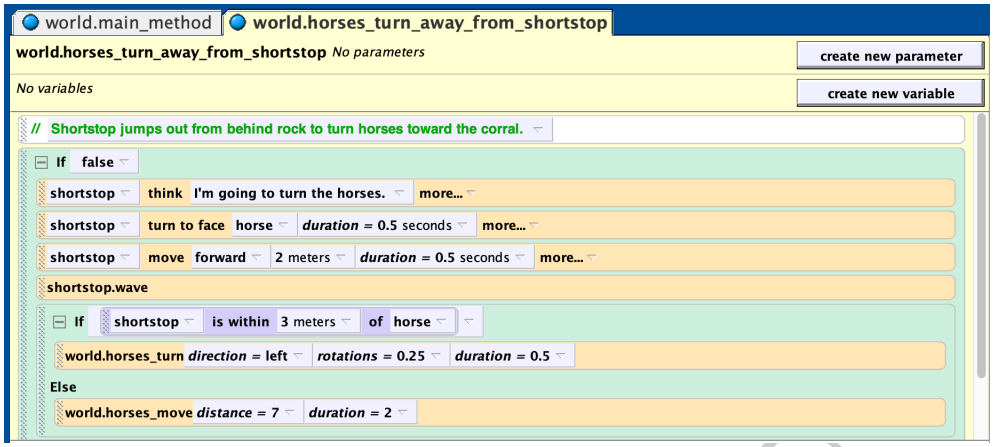

Figure 3: Code block controlling the actions of the short stop.

►**Answer Guidance**: The short stop does not jump out from behind the rock to turn the horses towards the corral.

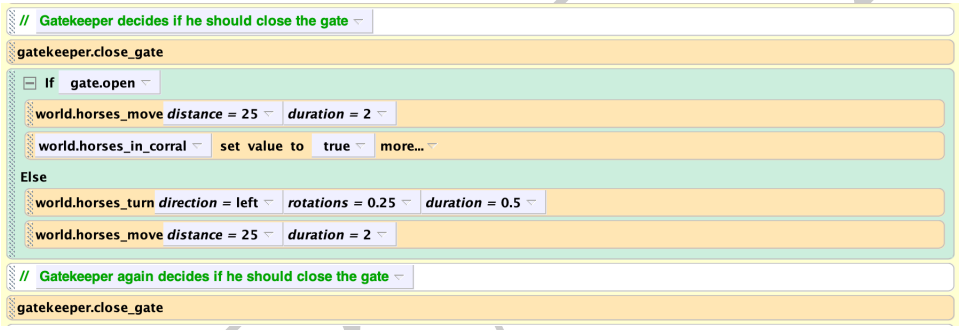

Figure 4: Invocations of `gatekeeper.close_gate`.

(c) Show the students where the `gatekeeper.close_gate` method is called in the code. The function is invoked twice in `world.main_method` as shown in Figure 4. Inspect the method by opening it clicking on the `gatekeeper` object and then on the 'edit' button next to the method. Figure 5 shows the code in the `gatekeeper.close_gate` method. Ask the students what type of conditional statement is in the method.
►**Answer Guidance**: A nested conditional statement.
Ask the students whether the gate will close when the method is called.
►**Answer Guidance**: No, because the hypothesis in the outer conditional statement is false.

(d) Show students the animation of the final solution world. Observe that horses turn away from the short stop and the gate closes behind the horses once they enter the corral.This is the solution the students work to put together by modifying `horses_starter_world.a2w` over the next two days.

3. (30 *minutes*). **Edit Alice Code to Enhance Animation**: Students work with a conditional statement to trigger the short stop jumping out from behind the rock to turn the horses towards the corral.

(a) Remind the students of what they learned about conditional statements and the relationship between the hypothesis and the conclusion. Direct students to the conditional statement in `world.horses_turn_away_from_shortstop`. Ask the students to change the condition to 'true' and to run the program again. Ask them describe what happens. Ask students how this differs from the events in the story they read.

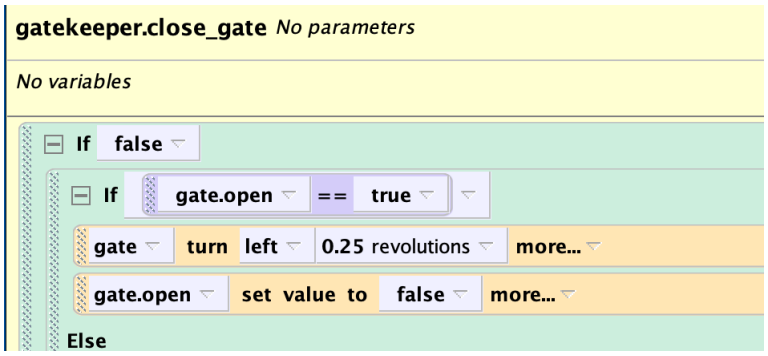

Figure 5: Nested conditional statement in `gatekeeper.close_gate`.

►**Answer Guidance**: The short stop jumps out from behind the rock too early and the horses run past the shortstop. The horses also escape the corral, but we deal with that problem on day 3.

(b) Tell students that adding a hypothesis based on how far away the horses are, which can be referred to as proximity based hypothesis, will send the horses into the coral. It would be more realistic for the short stop to jump out when the horses are close to the rock. Ask the students to implement a proximity based hypothesis in the conditional statement instead of 'true'.
►**Answer Guidance**: Click on the `horse` object in the "Objects" panel. Click on the `functions` tab in the "Object methods, properties and functions" panel. Drag the `is within` method into the hypothesis so that that the short stop jumps out when the horses are within 5 meters of the rock. This is demonstrated in Figure 6. `world.main_method`.

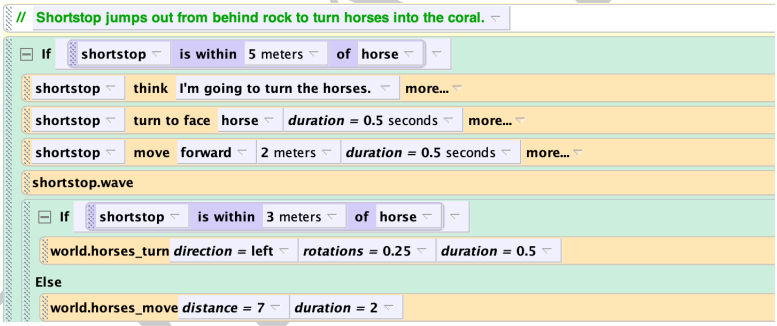

Figure 6: Example of correct proximity based hypothesis in `world.horses_turn_away_from_shortstop`.

(c) Ask students to implement the short stop waving his arm to scare the horses into the corral. They can do so by moving the short stop's arm up and down using the `shortstop.Torso.RightUpperArm.roll` method.
►**Answer Guidance**: Expand the `shortstop` object in the "Objects" panel. Expand the `Torso` object. Click on the `RightUpperArm` object, then click on the `methods` tab in the "Object methods, properties and methods" panel. Finally, drag the `roll` method into `shortstop.wave` method. A call to `shortstop.wave` is included at the end of short stop animation conditional statement block.

3.4 Class Period Three

In this class period, students learn about the contemporary management of horse populations.They also use compound conditional statements and Boolean variables to animate the closing of the gate once the horses are in the corral.

1. (25 *minutes*). **Internet Research**: Students are given time to research the history of wild horses and answer a series of questions related to their research.

(a) (15 *minutes*). **Research**: Ask students to investigate the Wild Horse and Burro Program using web-links on the Bureau of Land Management's webpage to answer the questions in Worksheet 3.

(b) (10 *minutes*). **Discuss**: Discuss the answers to the questions in Worksheet 3 with the class.

2. (20 *minutes*). **Fixing Alice Code**: Students solve the problem of how to close the gate on time to capture the horses in the animation of the story.

   (a) Assign students around available computers, and hand out Worksheet 4.

   (b) Ask the students to look at the compound conditional statement in the `gatekeeper.close_gate` method. Remind them that with the hypothesis being 'false' the gatekeeper will not close the gate. Ask the students to confirm this by running the code.

   (c) Ask the students to change the hypothesis in `gatekeeper.close_gate` to 'true' and to run the code again. Ask them what happens.
   ▶**Answer Guidance**: The gatekeeper closes the gate too soon!

   (d) Ask the students when the gatekeeper should decide to close the gate.
   ▶**Answer Guidance**: The gatekeeper should close the gate when the horses are in the corral.

   (e) Ask the students how the program knows when the horses are in the corral.
   ▶**Answer Guidance**: When `world.horses_in_corral` is set to 'true.'

   (f) Ask the students to modify the hypothesis of the conditional statement in `gatekeeper.close_gate` to close the gate only if the horses are in the corral.

   (g) Currently the horses run through the gate even if it closes. Ask the students to add a conditional statement so that the horses stay behind the gate.
   ▶**Answer Guidance**: Students can use the `gate.open` method to determine if the gate is open. If it is, the horses should run out of the corral, otherwise the horses should not move to stay within the corral.

3. (5 *minutes*). **Celebratory Animation**: Students add their own animation to celebrate horses being captured. Use this activity if students finish the previous activity early.

   (a) Ask the students to add a celebration animation if the horses were captured successfully.
   ▶**Answer Guidance**: The students may inspect the `gatekeeper`, `shortstop`, and `horse` objects and their `methods` to add animations to their Alice program.

4 About Storytelling

The Storytelling project develops middle school curriculum materials that incorporate computer science and computational thinking into lesson plans, in addition to the Montana content standards and IEFA Essential Understandings. The team uses Alice 2, a drag-and-drop programming environment, to create interactive activities for the students. Using Alice, students can animate their own stories in the lesson plans being developed. This process ties into the American Indian tradition of using storytelling to share their heritage. This research is conducted by a group of researchers at Montana State Universtiy, under grant NSF DRL 1657553 For more information, please email us at `storytelling@montana.edu` or visit our website `www.montana.edu/storytelling`. We welcome any suggestions for improvements and/or suggestions for future lesson plans to develop. This particular lesson plan was developed by Sam Micka, Allison Theobold, Barbara do Amaral, and Mike Wittie.

Disclaimer: Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

This lesson plan is currently a work in progress, and we would appreciate any comments and feedback that you may have. Please email `storytelling@montana.edu` with feedback.

A Standards in Three Areas

A.1 Content Standards

We follow the content standards provided by the Montana Office of Public Instruction (OPI) K-12 Content Standards and Revisions.[4]

- Primary: **MCS Social Studies Standards**:

  SSCS.1 **Students access, synthesize, and evaluate information to communicate and apply social studies knowledge to real world situations.** (End of Grade 8)

  SSCS.1.1 Apply the steps of an inquiry process (i.e., identify question or problem, locate and evaluate potential resources, gather and synthesize information, create a new product, and evaluate product and process).

  SSCS.1.2 Assess the quality of information (e.g., primary or secondary sources, point of view and embedded values of the author).

  SSCS.1.3 Interpret and apply information to support conclusions and use group decision making strategies to solve problems in real world situations (e.g., school elections, community projects, conflict resolution, role playing scenarios).

  SSCS.3 **Students apply geographic knowledge and skills (e.g., location, place, human/ environment interactions, movement, and regions).** (End of Grade 8)

  SSCS.3.3 Analyze diverse land use and explain the historical and contemporary effects of this use on the environment, with an emphasis on Montana.

  SSCS.3.4 Explain how movement patterns throughout the world (e.g., people, ideas, diseases, products, food) lead to interdependence and/or conflict.

  SSCS.3.5 Use appropriate geographic resources to interpret and generate information explaining the interaction of physical and human systems. (e.g., estimate distance, calculate scale, identify dominant patterns of climate and land use, compute population density).

- Primary: **MCS Life Science Standards**:

  LS2.A **Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem and analyze scientific concepts used by American Indians to maintain healthy relationships with environmental sources.** (Grades 6-8)

- Secondary: **MCS Social Studies Standards**

  SSCS.4 **Students demonstrate an understanding of the effects of time, continuity, and change on historical and future perspectives and relationships.** (End of Grade 8)

  SSCS.5 **Students make informed decisions based on an understanding of the economic principles of production, distribution, exchange, and consumption.** (End of Grade 8)

- Secondary: **MCS Reading Standards for Literacy in History/Social Studies**:

  RH.6-8.4 **Anchor Standard #$RH.6-8.4$ for Craft and Structure: Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/ social studies.** (Grades 6-8): MCS reading standards for literacy in history/ social studies.

[4] https://opi.mt.gov/Educators/Teaching-Learning/K-12-Content-Standards-Revision

A.2 Essential Understandings

We follow the Montana Office of Public Instruction (OPI) Essential Understandings Regarding Montana Indians.[5]

- **Essential Understanding Beliefs, Spirituality, Oral History (EU 3):** The ideologies of Native traditional beliefs and spirituality persist into modern day life as Tribal cultures, traditions and languages are still practiced by many American Indian people and are incorporated into how Tribes govern and manage their affairs. Additionally, each tribe has its own oral histories, which are as valid as written histories. These histories pre-date the "discovery" of North America.

A.3 Computational Concepts

We follow the Montana Office of Public Instruction (OPI) Computer Science Content standards[6].

- Primary:

  CS.AP.5.3 *Create programs that include sequences, events, loops, and conditionals.*

- Secondary:

  CS.AP.4.3 *Test and debug a program or algorithm to ensure it runs as intended.*

  CS.AP.6-8.3 *Develop programs that combine control structures, including nested loops and compound conditionals.*

[5] http://montanateach.org/resources/essential-understandings-regarding-montana-indians/
[6] https://montanastorytelling.github.io/alice-lessons/overview/resource-opi-cs-standards

B Understanding by Design Framework

Essential questions, key concepts, key knowledge, and key skills have been created to adhere to the recommendations from *Understanding by Design* (Wiggins & McTighe, 2005). These essential questions involve questions that recur throughout our lives, questions that help students to inquire and make sense of important but complicated ideas and knowledge, and questions that engage a diverse set of learners.

B.1 Essential Questions

1. How can storytelling be used to understand society and culture?
2. How can historical details be used as a tool to understand culture?
3. How does culture shape society as it progresses?

B.2 Key Concepts

By the end of this lesson, a student should understand:

1. The importance of horses in the history of American Indian peoples.
2. The importance of tradition in contemporary American Indian societies.
3. How technology changes traditional processes.
4. The importance of logic in computer programs.
5. The difference between the decision-making processes of a person and a computer.

B.3 Key Knowledge

By the end of this lesson, a student will know:

1. The process of capturing horses used by American Indian peoples.
2. How traditional processes of capturing horses have evolved over time.
3. How different American Indian tribes used horses in the past.
4. What makes a horse wild and how "wild" can be misunderstood and misconstrued.
5. How the Wild Horse and Burro Program manages and protects wild horses and burros.
6. How a computer interprets a conditional statement.

B.4 Key Skills

By the end of this lesson, a student is able to:

1. Engage in productive, multifaceted debates about how to manage public lands.
2. Navigate the Internet in order to gather valuable information about public policy.
3. Engage in algorithmic problem solving: design, implement, test, evaluate.
4. Engage in collaborative discussions, building on others' ideas and clearly expressing their own.
5. Integrate new features and capabilities into an previously developed algorithm to solve more advanced problems.

C Glossary

This glossary provides descriptions, and definitions for terms used in this lesson. We hope the descriptions included in this glossary will help clarify the concepts used in the coding activity portion of the lesson plan.

Boolean A *boolean (true/false)* is a type of variable that can take one of two values: `true` or `false`. Booleans can be used as the condition in a conditional (if/then) statement or as a condition (sometimes called the loop guard) in a `while` loop. In Alice, functions can return a boolean variable. For example, the world has a function "both a and b" that takes as input two booleans, `a` and `b`, and returns `true` if both are true, and `false` if otherwise.

Comment A *comment* is a region of text in code that is not meant to be executed, but instead provides information about the executable code around it.

Conditional Statement A *conditional (if/then) statement* controls whether or not certain lines of code are executed. A boolean (true/false) value or expression is given as input, and *if* that value is true, *then* the code is executed. For this reason, conditional statements are sometimes referred to as if/then statements. In Alice, if/else blocks can be found at the bottom of the programming environment, all `if` blocks have an `else` block that follows. Code in the `else` block is executed if the input value is false. We see conditional statements in everyday language as well! For example: `if` *the day is Monday,* `then` *we go to school.*

Property A *property* is a variable that describes an object. In Alice, all objects (e.g., `horse`) have properties, including `skin texture` and `isShowing`. You can see the list of properties for an object by clicking on the object in your scene, then select in the `properties` tab under `objects details` in the bottom left hand corner.

Variable A *variable* is a value that stores information to describe an object or method. The value can be a number (e.g., height), a string (e.g., name), or even a color. In Alice, for example, a variable is used when the user wants to specify the number of jumps an object should take.