Logic, Loops, & Conditionals

If you have any corrections or suggestions to make this write up better, please let us know HERE. We want to hear from you!

For more information on digital literacy, or for additional resources, please refer to the session presentation HERE.

Science	Practical & Applied Arts
Grade 1 Science – SE1.1 Grade 5 Science – HB5.5	ROBA26 ROBA28A ROBA65 ROBA66A

Arts Education	Mathematics	Physical Education
Grade 1 Art - CP1.1 Grade 2 Art - CR2.2 Grade 3 Art - CP3.1	Grade 1 Math - P1.1 Grade 2 Math - P2.1 Grade 3 Math - P3.1 Grade 4 Math - P4.2	Grade 1 - PE1.4 PE1.9 Grade 2 - PE2.10 Grade 3 - PE3.8 Grade 4 - PE4.12

Activity in this Package!

Activity 4: Taxonomic Logic

Additional Resources

Inspiring learning through play! https://www.thinkfun.com/teachers/downloadable-games-brainteasers/

Unplugged Coding Websites:

- https://www.csunplugged.org/en/
- https://hourofcode.com/
- https://www.madewithcode.com/projects/

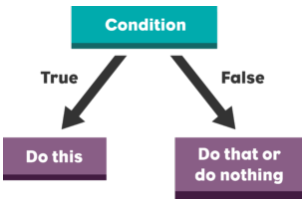
Looking for more ways to use the Let's Go Code! Activity Box? Take a look here for more cool ideas!
Youtube videos:

- If you are needing a little help understanding how to use the Let's Go Code! Activity Box click here

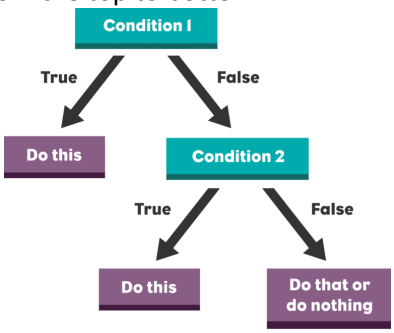
Big Ideas

Conditional Statements

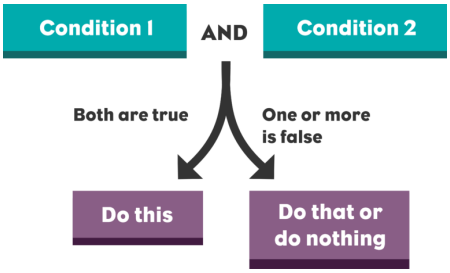
- **If/Else**- the "if" statement tells the computer what to do if the condition is true. The "else" statement tells the computer what to do if the condition is false
    - ex. *If* the number is divisible by 2 it is even, *else* it is odd.



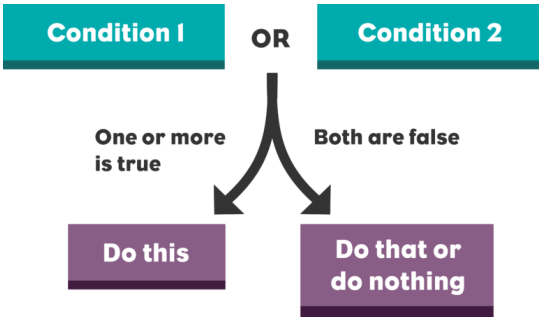
    - Multiple conditions can be added by inputting an additional else if statement between the initial conditions
    - ex. *If* you are free tonight we can meet then, *else if* we can meet tomorrow *else* we can meet on Saturday.
    - conditions are tested from the top to bottom



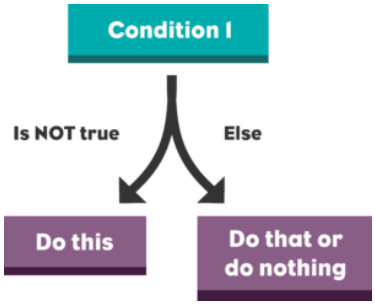
- **Logical Operators:** combine many boolean statements together (Checkpoint: **Boolean statements** are statements that are either true or false)
    - three main operators: and, or, & not.
    - **And:** for an "and" statement to be true, all of its' conditions must be true
        - True and True = True
        - False and True = False
        - True and False = False
        - False and False = False



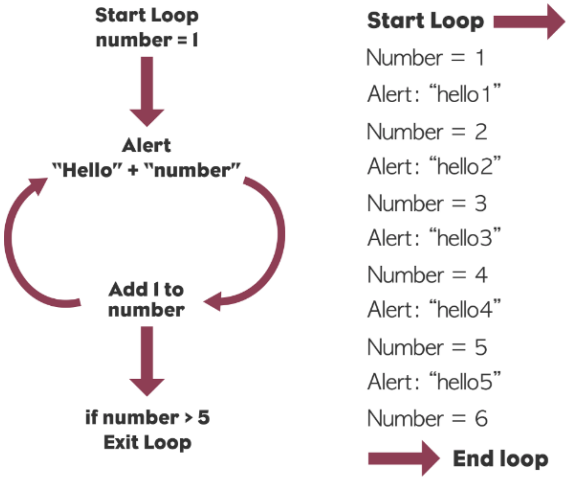
- **Or:** for an "or" statement to be true, at least one of its' conditions must be true
  - true or true = true
  - true or false = true
  - false or true = true
  - false or false = false



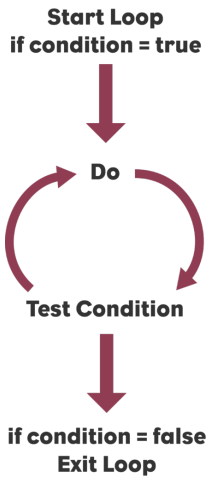
- **Not:** switches the value of the boolean to be the opposite of what it is
  - Not true = false
  - Not false = true



- **For Loops-**repeat a block of code a specified number of times. You determine how long your loops will go *for*
  - often use a variable, defined as counter, inside your loop to count how many times your loop has been run



- **While Loops:** loops that will continue to go until the condition(s) are no longer true
    - ex. **while** (amount of people at a party) > 0, **do** play music.
    - As demonstrated above there are two parts to a while statement: while and do



Quick Reference Terminology

Review of key words:

- Booleans - datatype that can be true or false
- Conditions - something an app evaluates to be true or false
- Conditional Statement - tells the app what to do after evaluating conditions
- AND Operator - evaluates as true if all of the inputs are true

- OR Operator - evaluates as true if one of the inputs is true
- NOT Operator - evaluates as the opposite of the input
- Loop - a repeating block of code
- For Loop - repeats a block of code a certain number of items
- For Each Loop - repeats a block of code for the number of items in a list
- While Loop - repeats a block of code while a condition is true

Real-world Applications: The other meaning of 'Logic'

...afterall, why is teaching logic important??

What is logic?

Understanding the world around us on a deeper level is something we want all of our students to achieve. Whether they are just starting their academic careers, in grade one, or reaching the bring of teenage-dom, all students should be taught the importance of logic.

Logic is the part of science that informs our students about validity and falsity in varying situations. It is the role of logic that helps students to decide what is true or false based on principle facts and inference.

Logic is separate from reasoning because logic forces concrete examples to support or deny the claims presented by specific situations. Our students will experience a myriad of different experiences in their adolescent years. We need to be teaching them how to differentiate between valid and invalid arguments through a solid understanding of logic.

Real-world applications:

As our world grows increasingly dependent on technology, our students are more susceptible than ever to fall prey to fake news, deep fakes, and whatever else the internet comes up with next. **Having the skills and abilities to tell the difference between fake news reports and real ones is crucial for our students now more than ever.**

Peer pressure and the need to fit in is pressing on our students through the increased use of technology. Not only are their friends putting pressure on our students, but so do the phones in their pockets. Thinking logically often helps students to see past the liminal experiences of the present and think critically about the consequences of their actions. Exposed to literally thousands of advertisements, videos, and unrealistic expectations, students must be trained to think logically in order to stay true to themselves and stay away from unhealthy habits promoted through social media.

What are the implications for academic success?

As educators, we all hope for our students to reach their utmost academic potential. One way that we, as educators, can boost our students likelihood of achieving academic success is teaching them

how to think logically. **Simply igniting that critical thinking aspect allows our students to overcome the adversaries that stand in the way of academic progress.**

Reading is more than just words

A student's probability of completing high school can be determined based on their grade three reading abilities. When measuring students' reading sufficiency there is more taken into account than just being able to sound out the words on a page. Comprehension as well as response are equally as important when it comes to reading. If you cannot understand the sentence you have read and respond accordingly there is not much point in having the ability to read the words. What do reading abilities have to do with logic you might ask? **Comprehension and response are learned through logical thinking.** Being able to think deeply about the text at hand will drastically increase a students reading sufficiency.

Library Resources

What is in the RPL "Let's Go Code" class-set box?

Activity 4:

Taxonomic Logic

Project Description

In this activity, students will use coding logic in combination with biological concepts to classify organisms and the things around them.

Big Ideas

Bioinformatics is a discipline that combines computer science and biology. Bioinformatics uses the algorithms and technology of computer science, mathematics, and statistics to solve problems for biology.

"Classification or Taxonomy, does form the foundation for biology, but it is by no means unique to biology. In fact, you used your first classification scheme within hours of your own birth: "mother vs. not-mother". Just as we attempt to explain the world around us, we also attempt to categorize and organize the things around us, whether they are cars, music, beverages, or other living things… In

biology, **taxonomy** is a process of using a series of names to identify an organism as unique." (Biol 100 Lab Manual, University of Regina - Nola Erhardt).

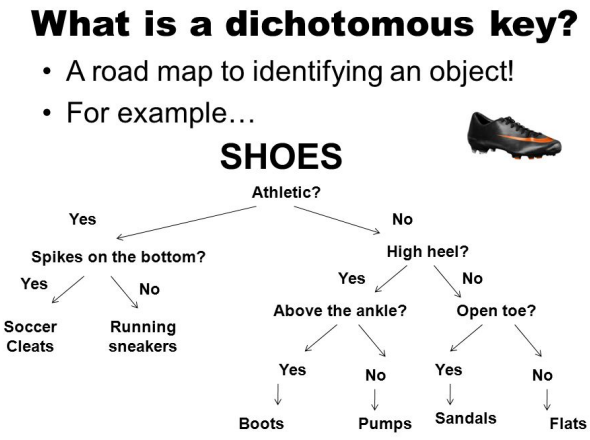
A **Dichotomous Key** is a set of paired and numbered statements that defines opposing traits in efforts to classify that thing being examined. Think of a Dichotomous key as a flowchart that is used to identify something.

Materials

Paper and Pencil for each student

Procedure

1. Ensure that students are familiar with the logical operators, conditionals, and loops describing at the top of this document (specifically if/else statements).
2. Familiarize your students with the concepts of a dichotomous key. Use the following as an example:



This illustration is equivalent to the following statements (in the form of a Dichotomous key)

1a. Shoes are athletic ……2
1b. Shoes are not athletic ……3

2a. Shoes have spikes ……..Soccer Cleats
2b. Shoes does not have spikes ……..Running Sneakers

3a. Shoes have a high heel ……..……4
3b. Shoes does not have a high heel ……..……5

4a. Shoes are above the ankle ……..Boots
4b. Shoes are not above the ankle ……..Pumps

5a. Shoes have an open toe ……..Sandals
5b. Shoes do not have an open toe ……..Flats

3. Explain and demonstrate how we are going to convert a dichotomous key into a series of logical statements to get the same identification. This may require us to embed logic within our code. Note: there are many answers for the same code. For example (again using the above shoe example):

If the shoes are athletic AND have spikes, then they are soccer cleats.
If the shoes are athletic AND do not have spikes, then they are running sneakers.
If the shoes are not athletic AND have a high heel AND are above the ankle, they are boots.
If the shoes are not athletic AND have a high heel AND are not above the ankle, they are pumps.
If the shoes are not athletic AND do not have a high heel AND have an open toe, then they are sandals.
If the shoes are not athletic AND do not have a high heel AND do not have an open toe, then they are flats.

4. Have students create a dichotomous key and the logical statements to go with it to classify the students (or a group of students in the class). Note: the more students to be classified, the more complex the activity. For example you could use some of the following ideas to classify people:
    a. Gender
    b. Hair Colour
    c. Hair texture (curly, straight)
    d. Eye colour

Note: it is important that the characteristics being used are concrete. For example, the person is pretty is not a good characteristic (especially because everybody is pretty). You also should not use things that are subject to change (i.e. a person's shirt colour). Using concrete and distinct characteristics is key to a correct classification.

5. Test students by using the dichotomous key they created and see if you (or their classmates) can identify everybody.

Resources

University of Regina Biology 100 Lab Manual - Nola Erhardt