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STEM Exploration Club

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NEBRASKA HONORS PROGRAM
CLC EXPANDED LEARNING OPPORTUNITY CLUBS
INFORMATION SHEET

Name of Club: STEM Exploration

Age/Grade Level: Middle School: 6th-8th

Number of Attendees: 4

Goal of the Club:

Explore various aspects of STEM, develop problem-solving skills, have fun

Resources: (Information for club provided by)

Paper roller coaster : <https://www.sciencebuddies.org/stem-activities/paper-roller-coaster>

Ice cream : <https://www.sciencebuddies.org/stem-activities/ice-cream-bag>

DNA : <https://www.youtube.com/watch?v=67KXatgoNKs>

Building Bridges : <https://www.youtube.com/watch?v=y6FmrOS72EA>

Content Areas: (check all that apply)

- Arts (Visual, Music, Theater & Performance)
- Literacy
- STEM (Science, Technology, Engineering & Math)
- Social Studies
- Wellness (Physical Education, Health, Nutrition & Character Education)

Outputs or final products:

There is no formal final project. Students will be able to take some experiments (bracelets from binary bash) with them.

Introducing your Club/Activities:

STEM Exploration consists of individual and partner activities that will building teamwork and problem-solving skills. The actives are also designed to let the students' curiosity grow.

General Directions:

Introduce the topic to the class. Review basic definitions and background knowledge about the topics. Give introduction to activity. This introduction includes instructions and relevance to the topic. Then, the students completed the activity. After we completed the activity, we discussed the results, any findings, and ways to dive deeper into the topic.

Tips/Tricks:

We allowed the students to complete the tasks at their own pace and checked in with them periodically instead of doing a class experiment.

LESSON PLAN WORKSHEET

Lesson Activity Name: Introduction

Length of Activity: 1 hour

Supplies: Recycling paper

Directions:

Introduce the club and express any goals and expectations. Get to know the students by talking with them. Complete Icebreakers to build relationships. Use the paper to complete the following tasks if time allows - constructing a paper tower and/or constructing a paper table.

Constructing a paper tower: Group activity; The students have 5 minutes to build the tallest tower with a limited number of supplies. Each group has 10 sheets of paper and 2 feet of tape.

Constructing a paper table: Group activity; The students have 5 minutes to build a table made of paper. The goal is to build the table that can support the most weight. Each group only gets 6 inches of tape and 5 sheets of paper.

Conclusion of the activity:

Students will learn what the club will be about, build teamwork skills, and build problem solving skills.

Parts of activity that worked:

Students were very competitive completing the activities and thought outside the box.

Parts of activity that did not work:

The activities and ice breakers take varying lengths of time depending on the group.

LESSON PLAN WORKSHEET

Lesson Activity Name: Exploring Our World Through the Senses

Length of Activity: 1 hour

Supplies: Touch sensory test : Cardboard box with opening on one end; plates/bowls; orange peel; mini donuts; hot chocolate mix; frosting; shaving cream; applesauce; oatmeal
Taste test : plates/paper towels; starbursts/gummy bears; blindfolds?;
Reflexes test : Activity 1 - 1 inch wide strip of paper; Activity 2 - Ball or something big to grab at

Directions:

Begin lesson reviewing our different senses and questioning how the senses tie into each other.

Complete the Touch Senses test : Each student will have the opportunity to stick their hand into the box to feel the unknown object, while their hands are in the box, the student will whisper to the instructor 3 characteristics of the object they are touching (ex. Soft, squishy, hard, slimy, etc.) (note: tell them to be as descriptive as possible), students will then whisper their guess as to what the object they are touching is, after each student has completed the activity, we will discuss as a class how everyone described the same object and compare their guesses, reveal to the class what the object was, repeat whole procedure with each object (7)

Complete the taste test : Each student will be asked to wash their hands and use hand sanitizer, ask each student to pair with a partner, one person will first be the “taster”, this person will sit either blindfolded or with their eyes closed in their chair, the other person will be the “navigator”; this person will be in charge of recording the students guesses and passing the candy to the tester to eat, the “navigator” will come up to the front of the class and take 1 candy of each color back to their table, the “taster” will sit at their chair blindfolded while the “navigator” will place the unwrapped candy in each the tasters hand, the taster will eat the candy and guess the flavor and the type of candy (gummy bear or starburst), after the taster has guess each candy, they can take off their blindfold and hear how accurate they were, then, the 2 will switch positions and repeat the whole process, once both students have been the taster, we will discuss as a class how challenging it was, next we will repeat the whole experiment, except the taster must also plug their nose, when both students have been the taster with their nose plugged, we will discuss as a class how much more difficult this task was.

Reflexes test (activity 1) : Each student will need to be paired with a partner, one partner will be the “dropper” while the other is the “catcher”, the dropper will hold the piece of paper at the by the tip, the catcher will place their fingers approximately 1 inch away on either side of the paper at the first tick, once the dropper drops the paper, the catcher will attempt to catch the paper between their fingers relying on their sense of sight, if catcher is successful at catching it, they may move onto tick 2 and so on, after a few minutes, the partners will switch positions

Reflexes Test (activity 2) : Students will be paired with a partner, each partner will stand facing each other equidistant from the ball on the ground in front of them, each person will perform the movements directed by the instructor (Ex. “touch your nose”, “touch your toes”, “spin in a circle”, “Jump in the air”, etc), when the student hear the word “Ball” they must grab the ball as fast as they can, after a few rounds of this game, we will switch partners and continue to complete the game, when done, we will discuss the reaction time between hearing and taking action

Conclusion of the activity:

Students will learn how different people can have different perceptions of the world through senses and how all the senses tie together to paint picture of world.

Parts of activity that worked:

Students were very interactive during the activities.

Parts of activity that did not work:

Didn't have much time for discussion at the end of our club.

LESSON PLAN WORKSHEET

Lesson Activity Name: Engineering with Bridges

Length of Activity: 1 hour

Supplies: 2 textbooks, 200 toothpicks, 1 bag of mini marshmallows, 10 sheets of paper, Cup, light weights (pennies, grams, etc)

Directions:

Introduction : Talk about the field of Engineering and types of bridges

Activity : **Planning/Designing:** Students will take this time to sketch out a design and show what they learned in the introduction, Give the students paper, Ask students about their design and offer suggestions. **Building:** Students will use this time to implement their design and try to build a successful bridge, Give each student 50 toothpicks and 50 mini marshmallows, Communicate with students about their plan and implementation. **Testing:** Students will test their projects by placing a cup on their bridge and adding weight to the cup. Give each student a cup and weights

Conclusion : As a group, discuss how everyone decided to solve the problem and design/build their bridges. Discuss what could have been done different. Reiterate the importance of problem-solving and planning in engineering

Conclusion of the activity:

Students will learn what it means to be an Engineer, the planning/design processes, and build problem-solving skills.

Parts of activity that worked:

Students enjoyed building bridges.

Parts of activity that did not work:

Students did not follow their plans when constructing a bridge.

LESSON PLAN WORKSHEET

Lesson Activity Name: Building a Paper Roller Coaster

Length of Activity: 1 hour

Supplies: Marbles, paper (construction paper works best but other will do), tape, rulers, scissors

Directions:

Discuss definitions and how they relate to our world. Give students instructions of activity. Show students how to create simple 'shapes' for track out of paper (ex. Supports, loop, hill, curve). Allow students to create successful roller coaster. Allow students to test same roller coaster with a ball of different mass. Does the ball make it through? Reconvene to discuss findings.

Conclusion of the activity:

Students will learn the science behind roller coasters and build problem solving skills.

Parts of activity that worked:

Students had creative ways in building a roller coaster.

Parts of activity that did not work:

Students weren't able to make the shapes appropriately.

LESSON PLAN WORKSHEET

Lesson Activity Name:

Binary Bash

Length of Activity:

1 hour

Supplies:

Colorful Beads, String, Pencil, Paper

Directions:

Introduction: Talk about the computer scientists. (What does a computer scientist do? What qualities does a computer scientist possess? Different areas/fields of computing (career-wise)). Talk about binary code (Go over the definitions above, Discuss areas where the binary system is used, Teach how to convert from binary to alphabetic (and vice-versa)). Talk about algorithms (What is an algorithm? When are they used? Why are they important?)

Group Challenge: Students will be asked to use what they learned in the introduction in order to figure out what "secret" binary messages I have given them. I will write the binary code on the board and they will translate it.

Partner Challenge: Students will write secret messages in binary code, and their partners will have to decode it.

Planning: Students will take this time to figure out what their name would be in binary "language". Give the students a binary cheat sheet. Have them write their name in binary

Creating: Students will use this time to make a bracelet with their binary name. Give each student beads. Have the students use 2 different colors (representing 1s and 0s) to create their bracelet

Algorithm activity: Talk about algorithms. Have the students develop an "algorithm" to create a design on paper by arranging pieces of candy. The students will write out their algorithm (steps to create the design) on a piece of paper. Their partner will then try to replicate the design while using their algorithm

Conclusion: As a group, discuss how everyone felt about the lesson. Discuss what could have been done different. Reiterate the importance of problem-solving and algorithms in computer science

Conclusion of the activity:

Students will learn what it means to be a computer scientist, how to read binary code, problem-solving skills, and how to develop an algorithm.

Parts of activity that worked:

Students enjoyed making bracelets using coding.

Parts of activity that did not work:

Doing the bracelet activity took up the majority of the time, and the students didn't have time to completely finish their bracelets. So, I would recommend only doing that activity.

LESSON PLAN WORKSHEET

Lesson Activity Name: DNA

Length of Activity: 30 minutes

Supplies: Strawberries, rubbing alcohol, dish soap, table salt, Ziploc bags, strainer or coffee filters, plastic cups, plastic forks, and spoons

Directions:

Before the club starts, I will make the soapy salt solution to be used in the activity that the whole group will use. I will also place the rubbing alcohol in the freezer so that it can be chilled by the time we start. To make the soapy salt solution, I will place about a $\frac{1}{3}$ cup of water in a glass. I will add a pinch of salt and about a tablespoon of dish soap. Next, I will gently stir the solution so that it dissolves, trying not to make too many bubbles

Discuss definitions and learn about the anatomy of a cell

Complete the activity: Each student will work on their own. The project will be completed as a class. The instructor will do the process with the students and not move on until everyone is ready. Each student will take 2-3 strawberries, cut off the stems, and place them into a Ziploc bag. Then, the students will seal the bag tightly, removing as much air as possible. Smash the strawberries inside the bag so that they are paste like. Once complete, the students will come to the front of class and add 3 spoonfuls of the soapy salt solution to their Ziploc bag of strawberries. Seal the bag again and mix the solution with the strawberries until it is a consistent texture. Drain the Ziploc bag into a plastic cup using either the strainer or coffee filter. (Coffee filter works better but takes longer). The instructor will gently pour the chilled rubbing alcohol into each student's cup with the strawberries. Be careful not to let the alcohol mix with the strawberries. It should form a layer on top of the strawberries. Stop when there are equal parts. After waiting a few minutes, there should be some white stringy/cloudy substances forming in the rubbing alcohol. This is the DNA. Using the plastic utensils, extract the DNA from the cup

Clean up: The solutions can be poured down the drain. Throw away any cups and utensils used

End with class discussion about careers in this field and other uses for this experiment. (DNA analyzer, lab work, crime scene technician, archaeologist, horticulture, endangered species zoologist, forensic analyst, epidemiologist) Fields: Archeology, Genetics, Biology, Anthropology, Forensics, Chemistry, Agriculture, Legal, and medical research

Conclusion of the activity:

Students will learn about DNA, possible careers that involve working with DNA, and how to follow directions.

Parts of activity that worked:

Students were able to pick out the DNA with a fork.

Parts of activity that did not work:

Have activities planned for after the activity.

LESSON PLAN WORKSHEET

Lesson Activity Name: Ice cream

Length of Activity: 20 minutes

Supplies: Measuring spoons, Measuring cup, Sugar, Milk, Vanilla extract, Salt (rock or table), ice cubes, Ziploc bags (small and large)

Directions:

In each small sealable bag, place one tablespoon of sugar, $\frac{1}{2}$ cup of half-and-half (or milk or heavy whipping cream), and $\frac{1}{4}$ teaspoon of vanilla extract. Seal both bags well.

Add four cups of ice cubes to one of the large, gallon-sized bags. Then add $\frac{1}{2}$ cup of salt to the bag.

Put one of the small bags you prepared into the large bag with the ice cubes. Be sure both bags are sealed shut.

Put on oven mitts or wrap the bag in a small towel and then shake the bag for five minutes. Feel the smaller bag every couple of minutes while you shake it, and take a peek at it.

Conclusion of the activity:

Students will learn about how the experiment works and test their patience.

Parts of activity that worked:

Students enjoyed making and eating the tasty treat.

Parts of activity that did not work:

Have activities planned for after the activity.
