LEARNING MODULES

GK-12 DISSECT at New Mexico State University

Title: Weather Tool Algorithm

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Discipline or Area: Weather

Teacher: Kathleen Guitar

School: Vista Middle School

Subject of class: Science

Grade: 6th

COVERAGE OF COMPUTATIONAL TOPICS

The concept of algorithms as a sequence of steps used to solve a problem was reiterated. Clarity, correctness, and efficiency in algorithm writing was taught and practiced.

OBJECTIVES

Students will learn how to write correct, clear, and efficient algorithms to make weather tools.

EQUIPMENT AND MATERIALS

Picture Handouts
Brown Paper Bags
Balloons
Pencils (wooden)
Pins
Tape
Notecards
Scissors
Baby Food Jars
Straws
Shape Handouts
Crossword Handout

BACKGROUND AND REFERENCES

The purpose of this module is to get students comfortable with clarity, correctness, and efficiency of algorithms. They will learn what these terms mean and how to score algorithms in each. Next, they will practice writing clear, correct, and efficient algorithms multiple times, which will culminate in the weather tool algorithm.

PROCEDURE

Provide detailed instructions on how this module is taught.

The first class was used to introduce the new terms, clarity, correctness, and efficiency to the students. We began by giving them the crossword and let them work on it for 15 minutes. Next, we went over the correct answers and talked about examples of the new words. We demonstrated the importance of correctness, clarity, and efficiency by writing an algorithm with the entire class on how to draw a chosen shape, or shapes. I went in the hallway, while the class wrote the algorithm, and I came back in when they were finished and followed their algorithm. The drawings were usually way off, so they saw how important these CT concepts were to algorithm development. Next we had the kids pair up and they each chose a shape from an envelope and made their own algorithms to draw it. They switched notebooks with their partners and they followed each other's algorithms. They each rated on a scale of 1 to 3 (3 being the best) the algorithms for each clarity, correctness, and efficiency.

On the second day, as a warm up activity, we reviewed the importance of correctness, clarity, and efficiency by writing an algorithm to draw a chosen shape. After 5 minutes, they switched with a partner and drew each other's algorithms. Some kids' algorithms did not produce the correct drawings, while other kids' algorithms produced correct drawings. There was a definite increase in correct algorithms from last week, which shows they are learning how important these CT concepts are to algorithm development. They each rated on a scale of 1 to 3 (3 being the best) the algorithms on clarity, correctness, and efficiency. Next we split the kids into groups of two or three, and had them designate a writer and a supplier. There were usually ten groups per class, so five groups went in the hallway and five groups stayed in the classroom. The supplier from each group got a brown paper bag with the materials needed for the project. The groups in the classroom got supplies to build a weather vane, and the groups in the hallway got supplies to make a barometer. Each group was given a picture of the final product, but no instructions. They had to build the tool based on the picture, and then write an algorithm for how to build it. Next week we will have the groups switch and they will build the opposite tool based on only their classmates' algorithms.

On the third day, as a warm up activity, we reviewed their understanding of correctness, clarity, and efficiency by asking them individually for either the word or the definition. Next we split the kids into their groups of two or three. They switched either to the hallway, or to the classroom from the last activity. The supplier from each group got a brown paper bag with the materials needed for the project. The groups in the classroom got supplies to build a weather vane, and the

groups in the hallway got supplies to make a barometer. Each group was given an algorithm to make the product, which was written by a different group from the last class. They had to build the tool based on the algorithm. Once they were finished, we showed them the final products, and they rated the algorithms on correctness, efficiency, and clarity on a 1 to 3 scale, with 3 being the best score.

What were the "learning goals?"
The learning goals are to learn how to write correct, clear, and efficient algorithms on how to make a weather tool.

How did you introduce CT?
The new terms, such as clarity, correctness, and efficiency were introduced in the form of a crossword with a word bank. After learning the terms, they were put into extensive practice by having them write algorithms for drawing shapes and for making their weather tools.

How could you assess the understanding of CT in this module?
The CT understanding assessment can be done by looking at the weather tools they made from each other's algorithms and looking at their scores for correctness, clarity, and efficiency. We also had another Fellow come in and evaluate the class as a whole.

NOTES AND OBSERVATIONS

What were challenges you encountered in the overall development of the module?
It was very challenging getting the kids not to show each other their shapes. We had one partner go outside and the other stay in the classroom, but they still shared their shapes with the other students, which made it much easier for some of them to guess what their partner's algorithm was describing, rather than following the algorithm. When rating each other's algorithms, the kids often got confused between correctness and clarity; many gave a low correctness score because it was hard to understand. Also, they gave low efficiency scores because it took them a longer time to understand what they were supposed to do, which made the algorithm take longer, instead of evaluating the number of steps. There were no algorithms that were 100% correct, though some were close. Some were completely off, which was a little discouraging.

What was successful?
The students that did not "cheat" were mostly very confused by their partner's algorithms, which was the point of the module. The kids are working on inventions for a multiple week project. In this project they have to write instructions on how to use and make their inventions. This module demonstrates how in depth they have to go with their algorithms to make them clear, correct, and efficient. They really liked actually building something, and I noticed that the kids who usually aren't engaged when we do writing exercises were very involved in the building process. I thought this

gave opportunities to the students who like to write as well as the students who like to be more hands on. We will find out next week if their correctness, clarity, and efficiency scores go up. I expected their scores to be higher because we have practiced this so much, but they still need to work on their correctness and clarity.

How was the students' reception to the content of the module?

The students really enjoyed this module because they were able to do more hands-on work and also had to work on their teamwork skills. They really liked seeing how off their algorithms were and many kids liked writing them. It was definitely challenging for them, but they enjoyed it.

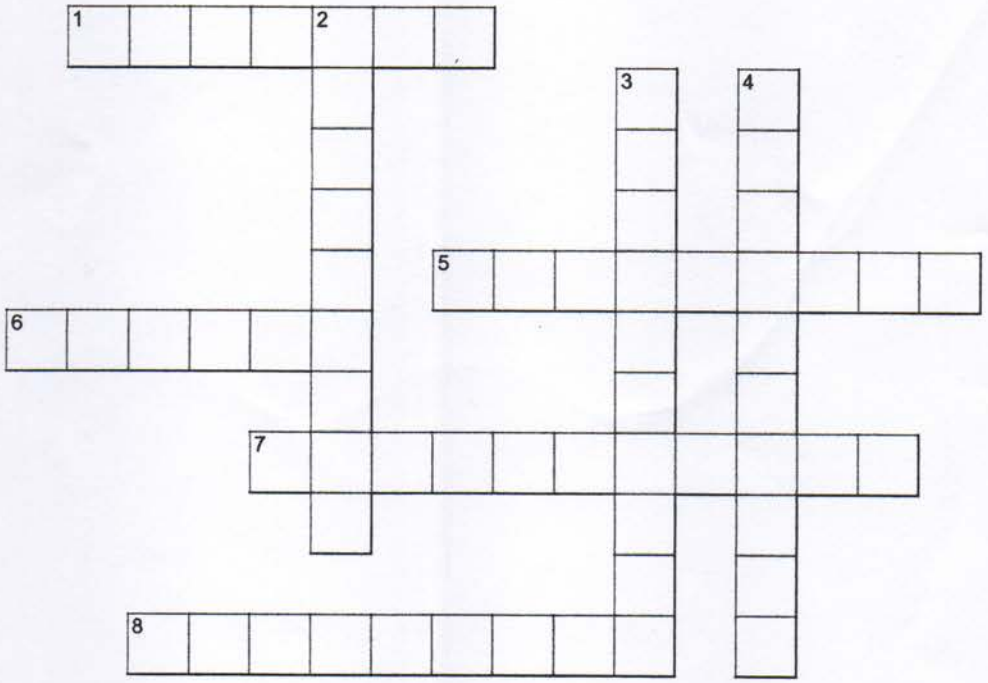
efficiency invention iteration

algorithm patent innovation clarity

correctness

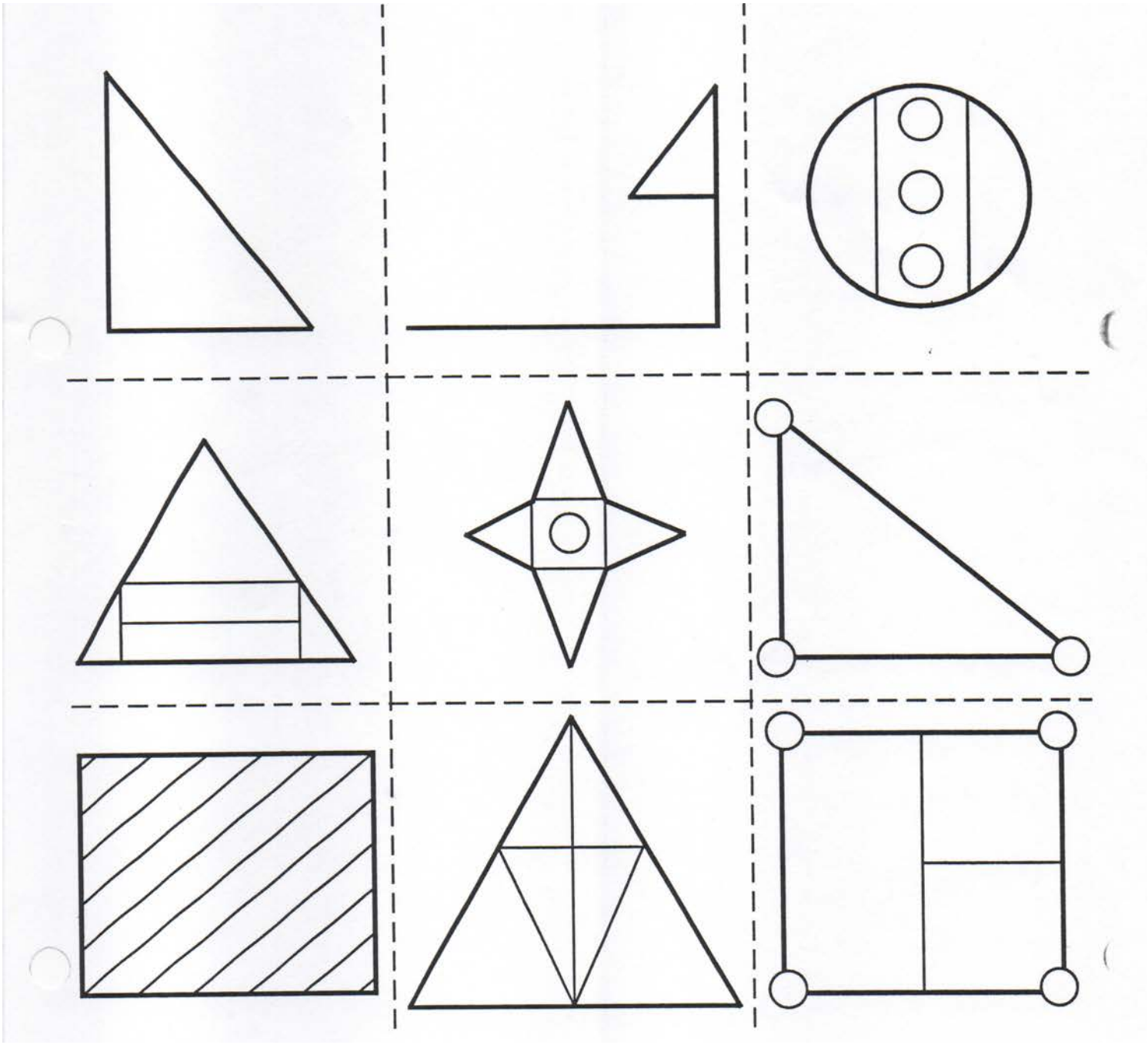
Computational Thinking Vocabulary

Algorithm Review

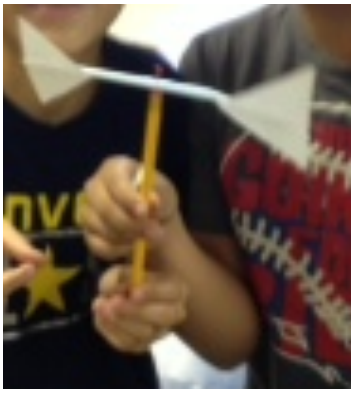


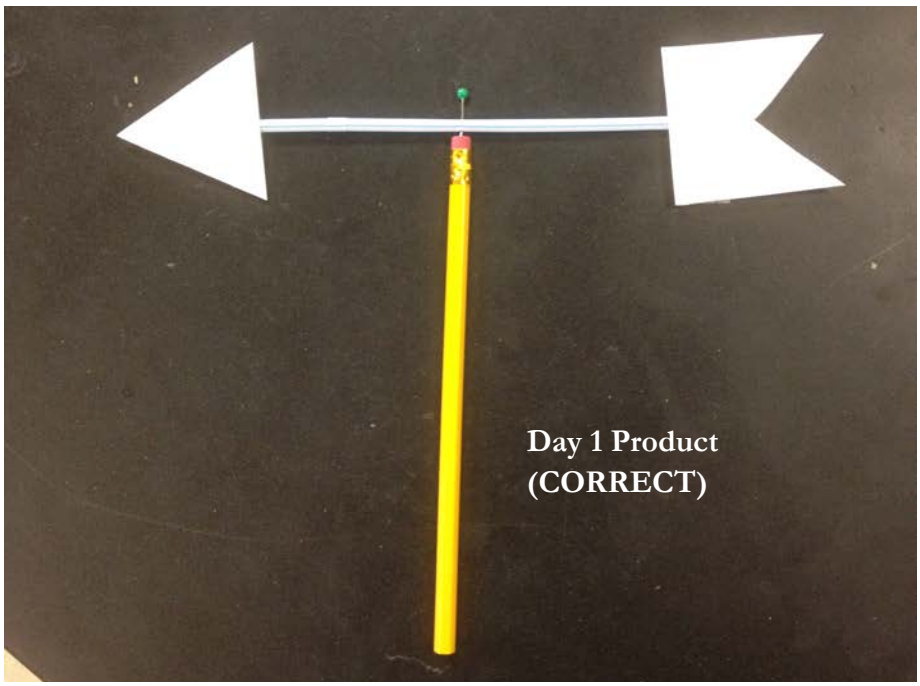
ACROSS
1 the readability of an algorithm
5 A sequence of steps
6 a way to protect your invention idea
7 ensuring that the algorithm gives the correct answer
8 a tool used to solve a problem

DOWN
2 repetition of a sequence of steps
3 an improvement to an invention
4 the speed of the algorithm



Day 1 Product
(CORRECT)




Day 1 Product
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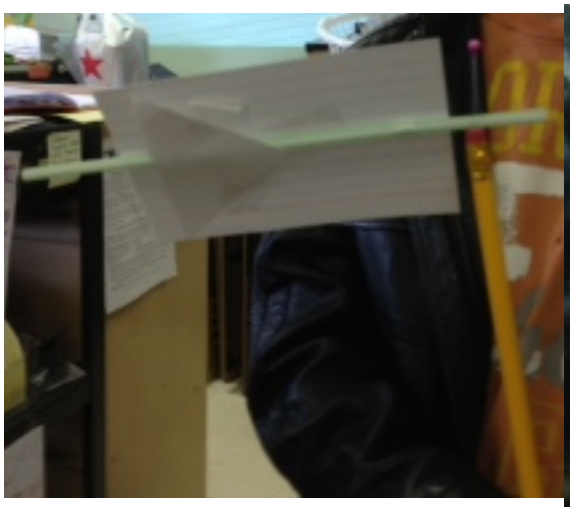

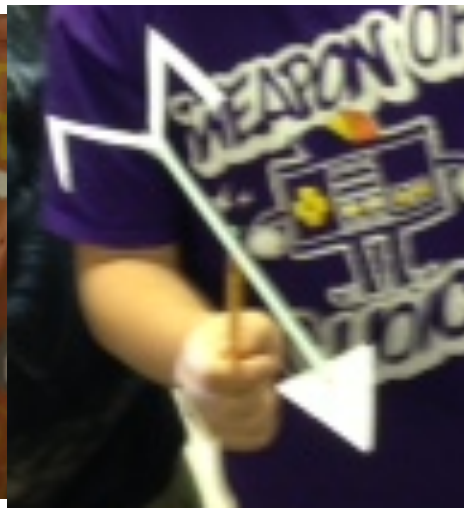

Weather Tool #1

Weather Tool #2