Learning Design for: Fibonacci numbers and computers

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CONTEXT

Topic: Learning maths through computer science

Total learning time: 180 minutes

Number of students: 20

Description:

The lesson wants to link unplugged computer science with a game program tool. Students will learn the Fibonacci numbers, to convert them to binary numbers used to computer science. Then students learn to use Fibonacci numbers to everyday life and to nature and make scratch stories using codes with Fibonacci numbers.

AIMS

Students of 12 years old should: 1) Learn the Fibonacci sequence and how we meet it to everyday life and 2) introduce children to computing using a programming tool.

OUTCOMES

Knowledge: pupils should have a deeper knowledge of Fibonacci numbers and how computers work. Comprehension: children should understand information about the numbers and try to use it in everyday life. Analysis: Students should learn to decompose a problem into smaller elements and highlight the relations. Synthesis: students should learn to use new elements to create own materials and to deduce rules on one's own. Evaluation: students should learn to give incisive opinions on your own work and on other's work.

TEACHING-LEARNING ACTIVITIES

Read Watch Listen *5 minutes* *1 students* *Tutor is available*

Read the problem carefully and try to understand it. The problem is: Suppose a newly-born pair of rabbits, one male, one female, are put in a field. Rabbits are able to mate at the age of one month so that at the end of its second month a female can produce another pair of rabbits. Suppose that our rabbits never die and that the female always produces one new pair (one male, one female) every month from the second month on. How many pairs will there be in one year?

Explore:

Collaborate *10 minutes* *4 students* *Tutor is available*

Collaborate with your group members in order to find a solution to the above problem. Try to hypothesize and solve it.

Reflect:

Discuss 10 *minutes* *20 students* *Tutor is available*

With your classmates and your teacher discuss about the sequence of the numbers we have just discovered.

Collaborate *15 minutes* *4 students* *Tutor is available*

With your group members try to convert three consecutive numbers of Fibonacci sequence into binary numbers. The teacher can demonstrate an example of a conversion.

Discuss *5 minutes* *20 students* *Tutor is available*

Discuss the importance of Fibonacci numbers to computer science.

Practice *15 minutes* *1 student* *Tutor is available*

At home get the hang of the Fibonacci numbers converting at least 5 consecutive numbers to binary numbers. At home go to this address: http://www.coolmath-games.com/0-2048-fibonacci and try to learn the sequence of numbers by playing.

Read *15 minutes* *1 student* *Tutor is available*

Read the attached resource or got to: http://www.maths.surrey.ac.uk/hosted-sites/R.Knott/Fibonacci/fibnat.html#petals. See how Fibonacci numbers appeal to nature and everyday life.

Collaborate *10 minutes* *4 student* *Tutor is available*

Try to make a code with the Fibonacci sequence in order to make a flower.

Map:

Produce *10minutes* *4 student* *Tutor is available*

Each group exchange its work and try to decode the code in order to draw the flower.

Practice *20 minutes* *2 students* *Tutor is available*

Listen to your teacher's instruction and make a flower on scratch program using a code based on Fibonacci sequence.

Practice *15 minutes* *1 student* *Tutor is available*

At home: Take a look at a cauliflower: First look at it: Count the number of florets in the spirals on your cauliflower. The number in one direction and in the other will be Fibonacci numbers, as we've seen here. Do you get the same numbers as in the picture? Take a closer look at a single floret (break one off near the base of your cauliflower). It is a mini cauliflower with its own little florets all arranged in spirals around a center. If you can, count the spirals in both directions. How many are there? Then, when cutting off the florets, try this: start at the bottom and take off the largest

floret, cutting it off parallel to the main "stem". Find the next on up the stem. It'll be about 0·618 of a turn round (in one direction). Cut it off in the same way. Repeat, as far as you like. Now look at the stem. Where the florets are rather like a pine cone or pineapple. The florets were arranged in spirals up the stem. Counting them again shows the Fibonacci numbers.

Make:

Produce *10 minutes* *4 students* *Tutor is available*

Try to produce a problem or a story using Fibonacci numbers based on real life situations. An example is this: You are offered a job, which lasts for 7 weeks. You get to choose your salary. Either, you get $100 for the first day, $200 for the second day, $300 for the third day. Each day you are paid $100 more than the day before. Or, you get 1 cent for the first day, 2 cents for the second day, 4 cents for the third day. Each day you are paid double what you were paid the day before.

Show:

Discuss *10 minutes* *20 students* *Tutor is available*

Discuss with your teacher how easy or difficult it was to create a story or a problem with Fibonacci numbers. Listen to your teacher how to solve the problem by splitting it into smaller problems-pieces.

Investigate *10 minutes* *2 students* *Tutor is available*

Explore again the scratch program with your teacher's help and try to find a way to make your story on stage.

Collaborate *20 minutes* *2 students* *Tutor is available*

Use scratch program to type your instructions to make your story on stage. If it works, try to implement your program giving much scrips.

Read *15 minutes* *20 students* *Tutor is available*

When you will have finished your work, you can show it to your classmates.

Discuss *15 minutes* *20 students* *Tutor is available*

You can discuss about the difficulties to create each story in scratch.

Practice *20 minutes* *1 student* *Tutor is available*

At home, you can practice by making a story using Fibonacci numbers in scratch.

View this lesson plan online.

This lesson plan was created as part of the online course 'How to Teach Computing: An Introduction to Concepts, Tools and Resources for Secondary Teachers', funding for which was provided by the Grand Coalition for Digital Jobs.

Grand Coalition
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