Generating symbols by coloring single cells

1. Name of the project:

Generating symbols by coloring single cells

2. Subjects covered from STEAM areas:

Arts
Mathematics
Technology
Engineering

3. Target group (age range and size of the group):

End of grade 4 / grade 5,
children aged 10-12 years,
15-20 children

4. Duration of the activity:

60 minutes

5. Key words:

Pixels,
upscaling and ratios,
coloring/rendering cells,
color gradations,
digital tools,
coding numbers.

6. Key sentence describing context of the activity, followed by short description (200 words):

Within the unit, the children will describe the function of "cells", so-called pixels on a screen, through various analog and digital activities. During the unit, they will create (new) symbols themselves by coloring cells or pixels and then try out the implementation on digital tools.
The unit starts with a survey of the children's pre-concepts and an activation of their prior knowledge in order to be able to explicitly address the children's prior knowledge and experiences within the unit and to establish a connection to their lifeworld. Subsequently, the function of "cells", is discussed and developed in relation to a digital display. In the following lesson, the children are asked to explain the principle of "upscaling" and "ratios" in televisions and computers, so that the necessity of a pixel becomes clear again. Next, the creation of analog symbols (black vs. white) on box paper with numerical codes (binary codes) will be explored. Then, these symbols will also be displayed on digital tools (such as Excel) and the children will work with different digital tools. The following lessons can include more in-depth exploration of other coding numbers/combinations for representing different colors (gray levels) or for letters. In this way, the children will know

about the function of number combinations for representing a color and will try their hand at using them, both in analog and digital form.

a. Acquisition of pre-concepts + activation of prior knowledge
b. Function of a single pixel - thematization of this in digital display
c. Principle of upscaling + ratios (in televisions / computers)
d. Creation of analog symbols (black - white) on box paper with binary codes (represent an image with numbers)
e. Subsequent testing of the representation in digital tools
f. Testing of further coding numbers for representation of different colors (gray levels) - number combinations for representation of one color

7. Description of the activity environment, including the list of materials and tools needed:

- Analog + digital symbols to get started
- Worksheet
- Squared paper + pens
- Tip cards for coding representation

8. Step by step, detailed description of the activity, including teaching and learning strategies:

Representing a picture with numbers
Start in plenary (10 minutes)
- Greeting the children
- Symbols (analog vs. digitally drawn) with colored cells (boxes) and corresponding coding representations by numbers (0, 1) are shown to the children.
    - Children are asked to describe what they see
    - Children are asked to speculate how the symbols could have been created + what meaning the coding representation could have

Work phase in individual/partner work (30 minutes)
- Children should work individually to draw shown / newly selected symbols by hand on box paper + represent the pixels / boxes of the pictures in coding form with 0 and 1 (represent a picture with numbers)
- Children present their different symbols to each other in partner work + describe the connection between the coding representation + the drawn representation on box paper

Reflection in plenary (20 minutes)
- What worked well? What was easy/difficult?
- Presentation of selected drawings of the children
    - Description of how they created the symbols (analog) + explanation as well as review of why the coding representation fits.
- Outlook for next lesson
    - How can we represent the symbols digitally now?
    - Decide on a symbol that they would like to try to represent digitally on the tablet/computer in partner work.
- Next lesson
    - With the help of the program, children try to represent their symbol

digitally in partner work (e.g. with Excel).
- Further symbols can be tried out (differentiation via scope of work).

9. Learning objectives/competencies:

- Children will be able to draw symbols in analog form with pencils on box paper by coloring boxes appropriately (black + white) and using the appropriate coding representation of binary numbers (0, 1).
- Children can describe their approach to symbol creation by explaining, contrasting, and reviewing the box representation and the coding representation.
- The children can get involved with a partner during the work phase and work together with this partner by presenting their results to each other and then agreeing on a symbol that they would like to represent digitally in the next lesson.

10. Evaluation/assessment guidelines:

++	Independent thinking up of new symbols for the representation forms. First testing of symbols with different colors + Attempt of an independent explanation for the coding representation
+	Presentation of the symbols and different representations with explanations of the procedure in front of the whole class.
o	Representation of the presented symbols on box paper + corresponding matching coding representation. Description of the procedure and review of the two types of representation. Agreeing with a partner on a symbol for the next lesson.
-	Display the presented symbols on box paper and appropriately display the coding for selected symbols. Can engage in partner work
--	Carefully record / draw the symbols on box paper, record without overpainting. Match coding representations to the presented + recorded symbols Work with the support of a teacher in partner work

11. Lessons learned:

By dealing with the "templates" and the "STEAM" aspects, I learned that arts can also play a role within computer science and programming and extend the model. In addition, programming can be used in all subject areas as well as tested, so that helpful supports in everyday life or everyday questions can be mastered with it. It became clear to me once again that computer science or programming does not have to be limited to mathematical or technical problems. Also by independently creating a template I was able to come up with a teaching unit for an (older) elementary school class. The content can be didactically reduced so that programming and computer science can also be addressed with younger children. In this way, it became clear to me that even younger children can deal with this content. Since computer science is now used as a standard subject in grades 5 and 6, there is more focus on

embedding different types of programming and aspects of computer science already in elementary school.

12. additional information/links: -

13. contact person:

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