Bebras as a Teaching Resource: Classifying the Tasks Corpus Using Computational Thinking Skills

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ABSTRACT

We present a new classification method for Bebras tasks based on the ISTE/CSTA operational definition of computational thinking. The classification can be appreciated by teachers without a formal education in informatics and it helps in detecting the cognitive skills involved by tasks, and makes their educational potential more explicit.

1. THINKING COMPUTATIONALLY WITH BEBRAS TASKS

The Bebras "International Challenge on Informatics and Computational Thinking" (http://bebras.org/) [4] had about one and a half million participants from more than 50 countries in the last edition. Bebras tasks can be the starting point for further educational activities (a recent proposal is [2]), provided they are categorized to make them easier to retrieve and to use during curricular activities. Indeed, tasks categorization is an issue in the Bebras community since the beginning [3]. A survey we conducted in Italy after the Bebras' last edition (2016) confirms the need by teachers for such a classification: we propose to base it on the operational definition of computational thinking [1] developed by ISTE (International Society for Technology in Education) and CSTA (Computer Science Teachers Association). To decide whether a task belongs to a class ot not, one should answer the question "Would you choose this task to promote or teach this Computational Thinking skill?".

Logically organizing data. Typical tasks in this class deal with: organization of data according to given criteria (*i.e.,* database), use of data structures to make data easier to process, organization of data so that they enjoy relevant properties as in cryptography or compression.

Logically analyzing data. Beside "logical problems" that require logical inference, deductive reasoning, and drawing conclusions about the data presented in the task, in this class we find tasks that require accurate observations (*e.g.,* recognizing patterns), or a systematic approach to establish whether the data of the problem satisfy certain properties.

Representing information. Typical tasks in this class deal with the digital representation of data, or their visual representation with diagrams like histograms or charts. Other tasks refer to data structures to represent relevant properties (*e.g.,* graphs for binary relations).

Algorithmic thinking. Tasks in this class require to go beyond generic intuitive approaches, towards settings that enable automatic processing, for instance by: decomposing a problem into components; combining primitive operations; understanding some formal procedure (*e.g.,* execute it or compute/recognize its output); applying some transition rules to a system in a given configuration; and so on.

Identifying strategies. Problem solving and in particular finding a non-trivial algorithmic strategy to tackle a problem is the theme of this class of tasks.

Analyzing algorithmic solutions. This class contains tasks concerning global characteristics of the considered algorithm, like correctness or complexity. Other typical tasks in this class are those inspired by optimization problems.

Implementing algorithmic solutions. Tasks in this class may be referred to as programming or coding tasks since the focus is on the implementation of algorithms according to a formal syntax defined in the task.

2. REFERENCES

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