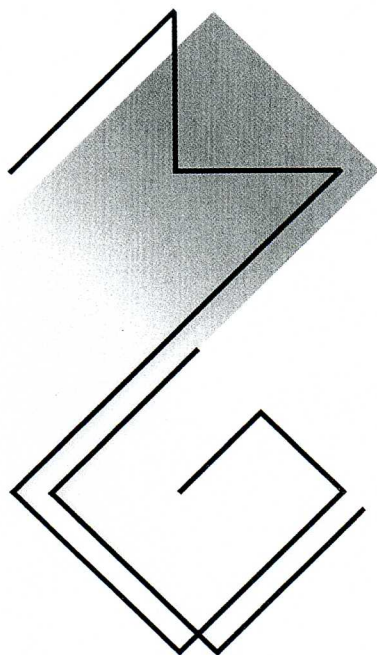


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WHAT KINDS OF TASKS ARE GOOD FOR CONTESTS?

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Abstract

Creating interesting and attractive tasks that are motivating and funny for the students is very challenging. The main attention should be paid while preparing a contest to the development of good tasks that also can be used by the students and teachers in their further learning and teaching activities. The paper deals with some criteria for good tasks in informatics contests for all students (these criteria can be easily applied to mathematics contests, e.g. "Kangaroo". As an example of the international Informatics and Computer Fluency contest "Bebras" (Beaver) the idea of developing some criteria for good tasks is discussed in the paper. Some tasks are presented and analyzed as well.

Key words: *informatics, computer education, learning by contest, explorative learning, tasks, problem solving.*

Introduction

Students like to be involved in a competition, they like to compete. Contests are extracurricular activities that allow students to acquire their knowledge and apply it within a competitive environment. These types of activities provide ways of challenging students in creative and innovative ways.

The international Informatics and Computer Fluency Contest Bebras (Beaver) was held for the first time in Lithuania in 2004, therefore the Lithuanian name Bebras means a vivid dam building animal beaver. It is an Informatics contest for all secondary school students that is held at school, at computers and offers from 18 to 24 problems to be solved by the students within 45–55 minutes. There are different task sets for the age groups Benjamin (grades 5–8), Junior (grades 9–10) and Senior (grades 11–12). In some countries there are two age groups for the youngest: Benjamin and Cadet. The contestants are usually supervised by teachers who may integrate the contest in their teaching activities.

The general goals of the Bebras contest are: (1) to give the students motivating impulses to be interested in informatics; (2) to show the variety of informatics topics and concepts; (3) to show that solving informatics problems is interesting and challenging; (4) to bring learning challenges; (5) to support a positive attitude towards informatics and computer fluency.

The number of the Bebras participants has been growing. In 2009, the Bebras contests took place in 11 countries, with about 150,000 participants in total (Bebras, 2010). Most participants, 82,799, came from Germany (40% of participants were girls!). Estonia had the strongest relative participation. The Bebras mover country, Lithuania, had 10,358 participants in 2009. Seven further countries are going to run the Bebras competitions in November 2010 (Bulgaria, Egypt, Finland, Israel, Romania, Slovenia, and Switzerland).

Workshops for developing the Bebras tasks are organized each spring. The main goals of the workshops are to develop a set of tasks for the coming contest, to discuss them and come to an agreement among the countries with different curricula and traditions of teaching computer science in general education.

Categories of Tasks

Young people are using technology every day. Some of them have a better understanding, other are plain users. However, the users need thinking skills while applying technology. One of the best ways to develop thinking skills is to solve problems. The ability of students to solve problems in real-life settings is of prime concern to educators and policy

makers. Interest and engagement are very important in problem solving (Dagiene, 2005; Dagiene, 2006; Dagiene and Skupiene, 2004).

Problem solving is an individual's capacity to use cognitive processes to confront and resolve real, cross-disciplinary situations where the solution path is not immediately obvious (Casaey, 1997; Reed, 1998). When teaching informatics and computer fluency via problem solving, it is very important to choose interesting and learning motivating tasks (problems). Interest in contest essentially depends on tasks. Attraction, invention, tricks, and surprise should be desirable features of each task presented to participants. The tasks have to be selected carefully, taking into account the different aspects, i.e. what educational power a task contains and whether it stimulates the motivation of learning.

Tasks can be of different types: starting from the most common questions of computers and their applications in the daily life to the main concepts of informatics and specific integrated tasks. It is very important to choose the tasks so that the participants of the contest could have the same chance to solve the tasks, irrespective of the operating system or computer programs used by them.

In informatics, there is also the problem of syllabus. Even if there is an education standard for informatics at school in some countries, there so far is no common agreement what should be included in an integrated syllabus using information technologies. Some guidelines of informatics curricula are presented in the ACM (Anderson, Weert, 2002) and UNESCO recommendations (Tucker, 2003).

At the second international Bebras workshop, a brainstorming session was held to generate ideas for different types of tasks that could be used in the contests. Also the classification of tasks was started to elaborate and some topics groups were suggested (Opmanis, 2006). The classification proceeded further in the next Bebras workshops. In September 2007, the International Bebras Committee has launched the meeting in Potsdam and elaborated the following 6 task categories for the Bebras contests:

- (1) Information comprehension: representation, coding, encryption, etc.;
- (2) Algorithmic thinking;
- (3) Using computer systems: general principles of search engines, spreadsheets, etc.;
- (4) Structures, patterns and arrangements;
- (5) ICT and society: social, ethical, cultural, international, and legal issues;
- (6) Puzzles (Dagiene, Futschek, 2008).

The selection of tasks is very important: they must cover as many sub-areas of informatics as possible, including algorithms and programming methods, and what is most important, the pupils should acquire the skills of using them. The problems have to be selected taking into account the different aspects of each problem. Two large groups of problems were distinguished: 1) interactive problems (for making something with computer and technologies); 2) multiple choice questions. The tasks have to be selected carefully, with regard to different aspects of each task (*i.e.*, what educational power it has) and interpretation of its attractiveness to pupils (whether it stimulates the motivation of learning).

Criteria for Good Tasks

In 2009, the Bebras contest was held in 11 countries with about 150,000 participating students. A qualitative feedback from the participating teachers has showed that some of the teachers wanted a testing system with a better time performance, but all the teachers liked the quality of the posed tasks much or very much. Finding interesting and adequate tasks that can be solved in a few minutes seems to be much more difficult in the field of informatics than in the field of mathematics.

The following list of criteria reflects the experiences of the International Bebras Organizing Committee in developing successful Bebras tasks:

Table 1. Criteria for good Bebras tasks on informatics and computer fluency that are used by the International Bebras Organizing Committee. The criteria that begin with the word “should” may be not fulfilled by all Bebras tasks.

<i>Good tasks ...</i>	<i>Explanation</i>
are related to informatics and support computer fluency	As stated in the aims, the Bebras contest is a competition on informatics and computer fluency.
allow learning experiences	In solving the tasks one should learn something interesting.
can be solved in 3 minutes	3 minutes is the average time to solve a task.
have a difficulty level (3 levels)	Level A (1/3): simple, all pupils of the target group should be able to solve. Level B (1/3): intermediate, challenging tasks that need some thinking to solve. Level C (1/3): hard to solve, for top students.
are adequate to the age of contestants (3 age groups)	The Bebras contest consists of 3 or 4 age groups: Benjamin: age from 11 to 12, Cadet: age from 13 to 14, Junior: age from 15 to 16, Senior: age from 17 to 19. Some tasks may be suitable for more than one age group. They may differ in difficulty of the level.
are independent of the curriculum	The Bebras tasks are oriented to the usual ability of students of the addressed age groups.
have easy understandable task statements	A task statement should be presented clearly: understandable wording and presentation (with pictures, examples, embedded in a proper story, use of a simulation or an interactive solving process), the task statement should never be misleading.
are presentable on a single screen page	A single task should never exceed a single screen page – scrolling is not reasonable in a contest.
are solvable by computer, without other hardware, additional software or paper and pencil	Bebras tasks are independent of specific operating systems or applications: use of additional software should not be necessary (a calculator should not be necessary as well, mental arithmetic should be sufficient for all calculations).
are politically correct	Good tasks do not allow any gender, racial or religious stereotypes.
<i>should</i> be funny	Some sort of excitement or fun should be provoked by a good task or by solving the task.
<i>should</i> have pictures	The pictures should play a role in understanding or solving the task.
<i>should</i> have interactive elements (simulations, solving activities, etc)	Multiple-choice is not adequate in many cases. Sometimes it is appropriate to input the number or a word or have a choice from the list of possibilities. Often the result can be produced by operating a simulation of a machine that should be operated properly.
<i>should</i> give immediate feedback	After solving a task correctly the participant should have the certainty of having solved the task correctly.

Furthermore, a good Bebras task should not be tricky. A tricky task is usually too hard to be solved by thinking, but the knowledge of a very specific detail allows the solution.

Using a computer, the pupils have to solve from 15 to 24 tasks of different levels within 45–55 minutes. Two general types of problems have been used: interactive tasks and multiple-choice tasks. Each task takes 1–4 minutes to be solved.

Conclusions

We discussed the challenges for the group of people who develop tasks for the Bebras Contest. Their key aim is to find interesting (“funny”) tasks in the field of Informatics and Computer Fluency that are challenging and can be solved in a very short time. A list of criteria for good tasks helps them to check the quality of the created tasks.

In some cases, a suitable story may serve as a presentation of a task much easier so that younger participants could solve the problem as well.

We are open for all kinds of proposals and ideas of collaboration and hope to find friends and partners in all countries. Integration of information technologies into the teaching process and understanding technology while using computers should be our target, and we have to try to reach it together.

We are ready to share our experience, technology, and future plans with all who are interested. We expect that it will foster your own competitions similar to the Bebras contest or will encourage you to join us. We are sure that a well-organized competition with interesting, playful, exciting problems, and attractive awards will invite children of all countries to reason about a proper use of computers and to explore and understand realities, capabilities, and failings of technology.

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