

WORD PROBLEMS DESCRIBING MOVEMENT

Helena Binterová^a, Zuzana Strachotová^b

^a*Department of Mathematics, University of South Bohemia
Jeronýmova 10, 371 15 České Budějovice, Czech Republic
e-mail: hbinter@pf.jcu.cz*

^b*Department of Applied Mathematics and Informatics
University of South Bohemia
Studentská 13, 370 05 České Budějovice, Czech Republic
e-mail: strachot@ef.jcu.cz*

Abstract. Several years we have already been oriented to creation of multimedia teaching aids for teaching mathematics in the elementary school. We have successfully solve out variety of grants in this topic. We are developing international relations and cooperation. The results of our work is a program, in which we have tried to create alternative point of view of motivation and work of pupils, who are solving out word problems describing movement. While fore thinking the didactic questions related with creation of software Word problems describing movements we have focused on the matter of motivation and creation of sufficient amount of separated models of visualization and feedback.

The main aim of school education is to provide pupils with a systematic and balanced structure of concepts and their mutual relationships which enable them to sort particular pieces of information and integrate them in a sensible context of knowledge and life experience.

From this point of view, the teaching of mathematics has a unique position. In its essence, mathematics as a science is a mirror of the real world and on the other hand, thanks to its theoretical background, it is at the same time a source of many applications to the real world. For this reason, the learning process should be conducted as a gradual creation of concepts and their integration into already created knowledge structures. However, this should not be performed in the way of transmitting of encyclopaedic pieces of knowledge from teachers to their pupils leading to algorithmisation without thinking. Research in this field (Hejný, Kuřina, 2001) shows that this transmission creates

a certain knowledge apparatus which pupils can reproduce but are not able to use effectively when solving mathematical problems.

In the learning process at school, there is sometimes not enough time devoted to manipulation of objects, numbers, concepts and this can lead to formalisation of learning. The effectively conducted teaching of mathematics with the support of computers can bring involved pupils within a short time many pieces of important information. Various models and the change of objects simulated by a computer enable the pupils to create separated models and make them think about the essence of the presented concepts and also ask questions. This all flows into a better and correct understanding of the given concept.

At the Faculty of Education in České Budějovice, we have been dealing for several years with the question how to make suitable multimedia aids and programs for the teaching of mathematics at primary and lower secondary levels. This fundamental topic has been developed using in various grants, in diploma theses and also in international projects. One diploma thesis is focused on the program Image Logo, enabling its users to create internet multimedia applications, presentations and projects with effective animations. It brings a different view and also motivation to mathematical movement problems.

Word problems seem to be complicated for pupils mainly because of the impossibility of using a single and universal algorithm to solve them. When solving mathematical problems, pupils have difficulties mostly with the understanding of the problem, its analysis, the mathematisation of the problem and finally the process of finding the solution. A significant role is attributed to the subsequent check, and rectification of the solution - feedback which is conducted very often only formally. When thinking about didactical questions connected with the creation of the program called Word Problems about Movement, we focused on the question of motivation, creation of a sufficient amount of separated models of visualisation and feedback (from the point of view of individual needs).

The program can be found at:

<http://www.pf.jcu.cz/stru/katedry/m/diplprace.phtml>

After executing the program, an introductory menu presenting the possibilities of work with the program is displayed. After choosing VSTUPTE / ENTER another site is displayed. According to the text of the given word problem, the user can decide which situation best describes the given problem and the relevant possibility is chosen accordingly. Another site (Figure 1) is very important from the point of view of informal understanding and the cor-

rect creation of a universal model. It is essential to make an estimation of the result taking into consideration the presented data of the given problem. This estimation is displayed in the upper left corner of the screen and it is possible to change during the work with the program. At the end, after the display of the final result, this result is compared with the estimation made beforehand. This serves as feedback and makes the pupils think where they have made a mistake and which consideration and estimation were wrong. We think that this part of the program is the most beneficial considering the didactical point of view, as it enables the pupils to see the problem in several steps of understanding and it enables them to form correct imagery and concepts (Kutzler, 1998).

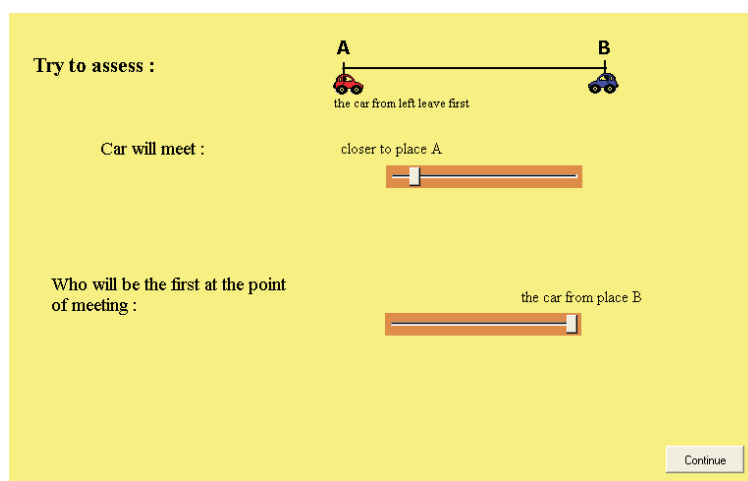


Fig. 1

After the estimation of the result, we enter another site which serves as a motivation part and which can be proceeded with as long as necessary according to the pupils' needs. After entering all the necessary information about the distance and velocity, pressing the button JEDŮ/GO makes two cars go from their original places. The pupils can set the cars at any time to their original places and observe the given situation again and change their estimations. After pressing NEXT SITE / DALŠÍ STRÁNKA, the pupils can create even more profoundly their separated models. Buttons for setting the time of the cars' drive are displayed, offering to see the mutual position of the cars in 5, 15, 30 and x minutes.

At the same time there is a time indicator displayed above the road showing the time of the drive in minutes. Still, it is possible to watch the estimation made which enable the pupils to adjust their estimation and compare it with the reality as a check.

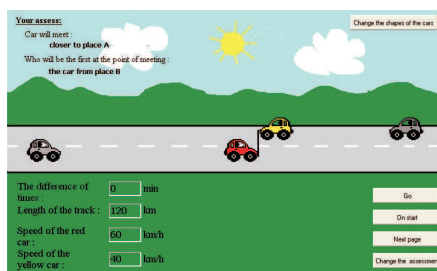


Fig. 2

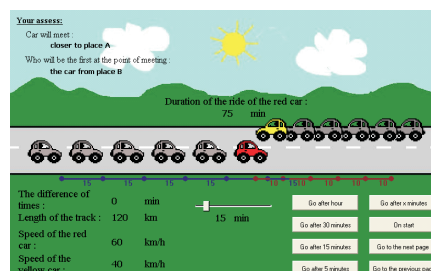


Fig. 3

Another very important fact is the possibility of solving the given problem by estimation of the time interval. By refining and time selection according to the time when the cars meet, the pupils can build and strengthen the presented concept. Another site contains the solution of the given problems and the comparison with the pupils' estimation displayed after pressing the button DISPLAY SOLUTION / ZOBRAZIT VÝSLEDEK.

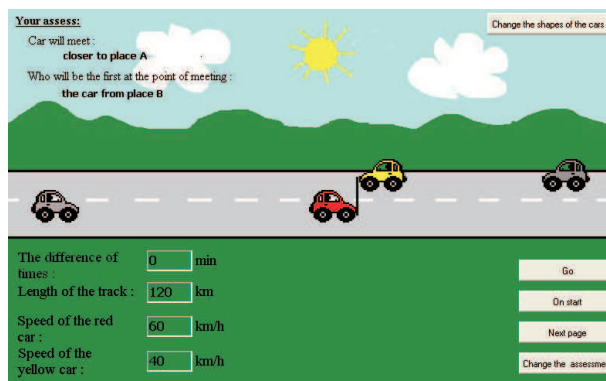


Fig. 4

We have tried the work with this program in several schools and the program has been received with enthusiasm by the pupils as well as by their teachers. The pupils stated that they could understand the setting of the presented word problems and they could analyse them. Other types of problems were not perceived as so much difficult and the work moved ahead more quickly.

One positive aspect of the work with the program was the possibility of trial and error. Scientists and mathematicians attempting to find a solution to a problem also experiment using the method of trial and error.

Why should the pupils abandoned from using these methods? Because of the lack of time? We are against ourselves. Pupils learn only for an effect on

others, for their parents, school and very rarely for themselves and only some of them can use their knowledge effectively in real life as they do not see the mutual coherence.

Use of the program can save a lot of time and open the floor to experimentation and the making of separated models. The change could come with RVP as the teachers will not be binded by a uniform curriculum. However, stereotypes are still prevail in Czech education and for this reason the transformation will need some time.

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