

Popularization of Physics and Motivational Pictorial Task

Marcela Chovancová

Department of Physics

Faculty of Civil Engineering

Slovak University of Technology in Bratislava

Radlinského 11, 813 68, Slovakia

e-mail: marcela.chovancova@stuba.sk

Abstract

This paper aims at very actually problem physics like subject. Physics, unfortunately, doesn't belong to very popular subjects among students in all degrees of education. Solution of some physical problems by students is very formal and lacks their interest. One of the ways may be nonconventional tasks. A part of the task description could be assigned in a pictorial form. There is an option to use funny figures, full colour scheme and situations from real life or humour scenes. The verbal part of the picture has only supplementary function and consists mainly of questions for students to answer.

Keywords: Motivational pictorial task, special metrics, creativity

1 Pictorial Task

Physics belongs to group of no popular and no attractive subjects in education, unfortunately at schools with technical orientation, too. Very actual problem is to contribute to higher attraction of education of physics with emphasis on motivation and creativity development of students. One of ways may be pictorial form of tasks. The picture is the basis of the problem setting. The verbal part of the picture has only supplementary function and consists mainly of questions for students who have to find answers.

Very important is visual perception of the situation. The perception of the situation in the picture is graphical and more intensive than verbal setting of the task (to see once is more than to hear three times).

Pictorial task is time efficiency, too. As for the input data pictorial setting of the task is very efficient and it enables to assign also problems impossible to describe verbally.

Next one using of picture is visualization of the results. The application of the picture is also suitable for the problem solution itself, where it has mainly the function of demonstration.

2 Special metric

Very important is inexplicit input data setting. Majority of necessary data to the solution are hidden in the picture. It depends on the student and his physics knowledge whether he is able to realize what he needs and find it in the picture.

The use of a grid is necessary to the solution of the problem. A special grid is necessary to „read“ input numeric data from the picture.

Pictorial tasks can correspondence with everyday life. Actual metrics are given in a particular problem. In one picture there could be used different metrics for variety of physical quantities (for example 1segment may be 1 meter and force 1 Newton).

Those tasks could be one of ways of informality of the solution problems. The student must consider more carefully what is relevant to the solution of the problem. It is possible to find out or „read“ the input data in two or three dimensions.

3 Motivation

Motivation has an important role in the educational process. There are some of the motivating factors used in the pictorial tasks:

- colourful pictures;
- using entertaining characters;
- selection of physics problems from real life;
- adaptation into a funny form.

4 Pictorial task and Creativity

As a demonstration we are presenting the analysis of the one of the simplest tasks of the Vector Calculus (Figure 1). The assignment is given in the pictorial-verbal form. We have chosen the situation from everyday life, „spicing it up“ with a little bit of humour to make it more student-friendly. That’s the reason why we used funny colourful figures in the picture.

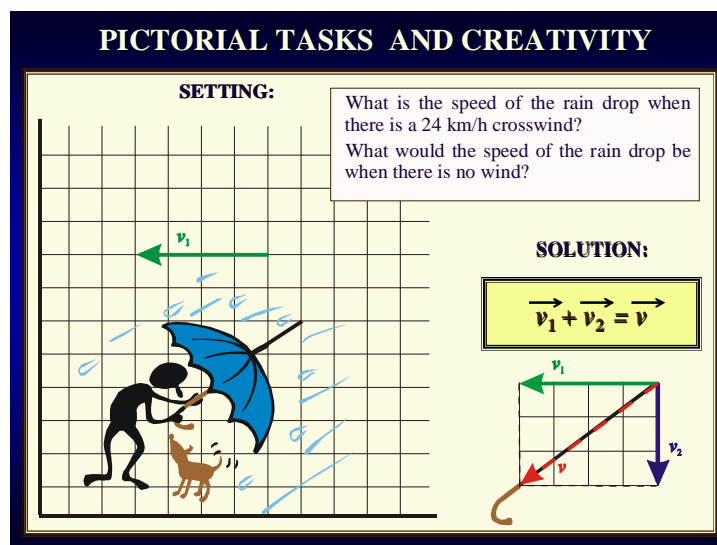


Figure 1

4.1 Pictorial task and Model for the Process of Creativity

In the line with G Wallas theory we recognise four stages of the creative (Zelina 1997):

1. PREPARATION – the phase in which necessary information is collected. The verbal part of the problem gives only one explicit datum – the speed of the side wind (as illustrated in vector parameter in the picture). The student has to deduce metrics of the problem. But he does not know what to do next...

2. INCUBATION – the phase of the inactivity or dealing with other activities. The student is thinking if he is able to solve a task assigned by the picture. Maybe his attention is distracted by the picture (he is making fun of the comic figure...)

3. ILLUMINATION – suddenly, unexpectedly the solution emerges. To find a solution student needs some knowledge from real life how to protect oneself in the rain. He has to realise that the handle of the umbrella should be in the direction of falling drops. It occurs to the student next that it is the simple vector operation-addition.

4. VERIFICATION – when the right idea is here it has to be verified. The following question can be helpful: How do we hold the umbrella when there is no wind? To verify the result it is necessary to estimate the speed of the rain drop. In the process of the solution the student will get to the classification of rain drop motion.

4.2 Pictorial task and Creative tasks

The pictorial task is really creative. This is proved by the existence of the accompanying activities of its solution process (Jurčová 2000).

Investigation, exploration of the unknown mainly in the phase of being introduced into the situation;
Pictorial tasks occur very seldom in the process of education. Mostly they are used as an additional illustration to the verbal task. Students are not used to search for any hidden data of the problem in the picture.

Creation of a new solution strategy, application of new methods, activities or modification of existing procedures, methods and activities;

Contrary to ordinary verbal task the student has to use his knowledge to look for required hidden data in the picture.

Re-structuring and re-building of the knowledge and experience the student had obtained in the previous education process;

Most pieces of the data are not given explicitly so the students should be aware of what data is required to solve the task and how to obtain the missing pieces of information (using metrics of the task).

It is not possible to answer the task by applying simple operations without revision of entries;

The student who has the theoretical knowledge of vector addition might not be able to solve the task. He even might not be aware of the fact that this pictorial task contains this operation.

It is not possible to apply the well known or previously used algorithm;

It is obvious that none of the well known algorithms of task solving or simple „put value into the formula“ could be used. There are no values (only one parameter is given).

Invention, discovering; the solution cannot be deduced simply from the entries;

The student has to realise the way how we protect ourselves from the rain and come to the conclusion that the handle of the umbrella should be held in the direction of the falling drops.

Application of abstract operations connected with creativity and original solution of the tasks (analogy, synthesis etc.).

It is essential to apply theoretical knowledge of a vector addition and a real life experience. The student has to transform his experience into the „physical language“. It is necessary to have a sense of estimation if one wants to compare the obtained value with the experienced real-life one. In the

process of solution the student will get to the classification of rain drop motion. He can find analogy with the motion of the marble freely spilled into the tube with liquid...

5 Examples of Pictorial Tasks

See below some examples of the pictorial tasks from various parts of physics (Figures 2-5). We are presenting full assignment consisting of the pictorial and verbal parts. The picture has an important role as well. As a demonstration we are showing some tasks with their solutions (Figure 2, Figure 3).

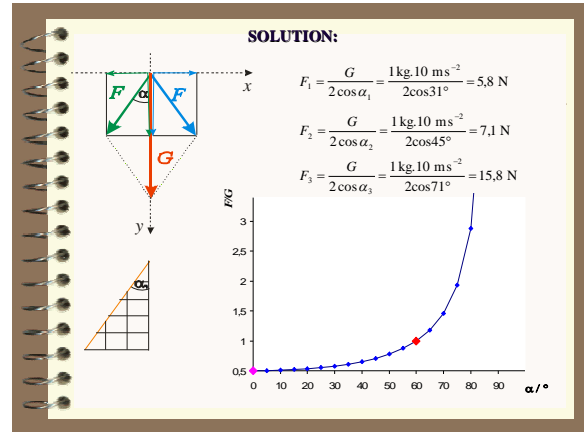
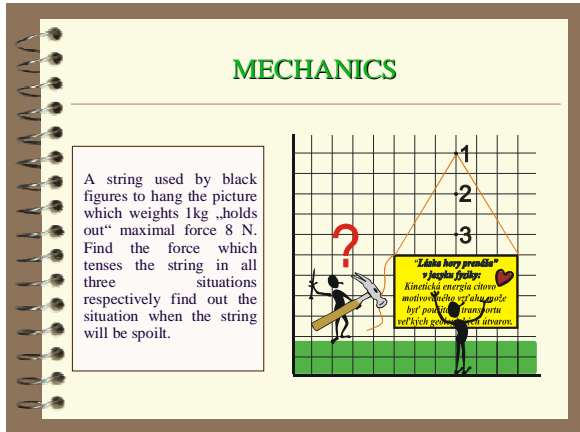


Figure 2

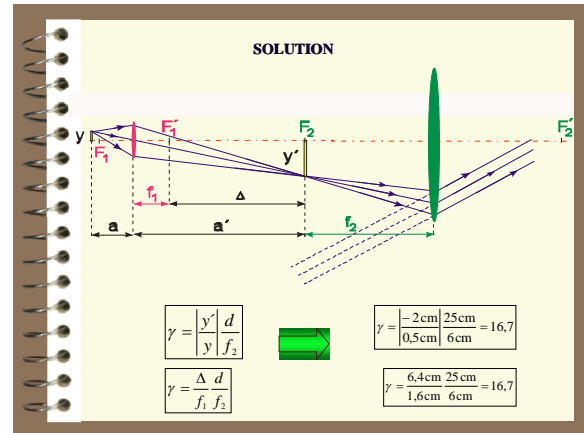
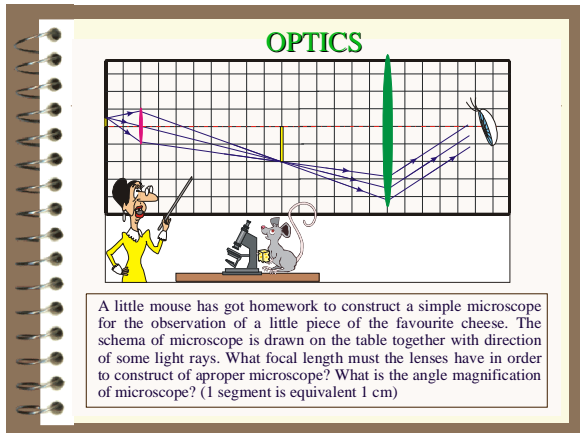


Figure 3

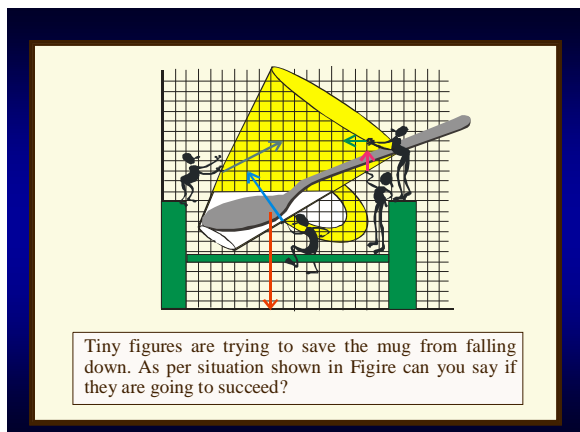


Figure 4

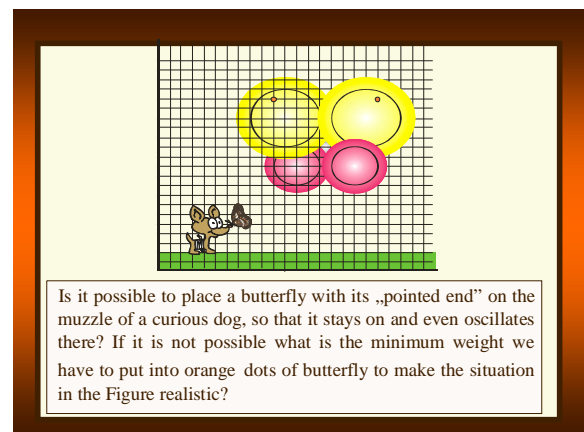


Figure 5

6 Conclusion

Pictorial tasks occur very seldom in the process of education. Mostly they are used as an additional illustration to the verbal task. Students are not used to extracting any hidden information from pictures. Creative tasks should evoke students' deeper interest in physics. Motivational pictorial tasks could serve for enriching physics lessons.

7 Reference list

Chovancová, M. (2007). *Fyzika v obrazových úlohách*. Bratislava : Príroda, 120 p. - ISBN 978-80-07-01573-9.

Nevedelová, M. (2002). Pútavé obrazové úlohy z fyziky. In: *Matematika, fyzika, informatika*. ISSN 1210-1761. - Roč. 12, č. 4, p. 224-226.

Kvasnicová, M. (2000). Pictorial exercises in the Physics, *Zborník 13. konferencia slovenských a českých fyzikov*, Zvolen 23-26. 8. 1999, SFS a TU Zvolen, p. 416 – 418, ISBN 80 - 228 - 0876-8.

Baník, I. - Baník, R.- Chovancová, M.- Lukovičová, J. (2008). *Fyzika netradične 2 : Hydromechanika. Vlnenie. Termofyzika*. - Bratislava : STU v Bratislave, 411 p. - ISBN 978-80-227-2962-8.

Baník, I. – Baník, R. – Zámečník, J. (1990). *Fyzika netradične*. Bratislava, Alfa , ISBN 80-05-00041-3.

Jurčová, M., Dohňanská, J., Pišút, J. (2000). *Didaktika fyziky - rozvíjanie tvorivosti žiakov a študentov*. Bratislava, MFF UK.

Zelina, M. – Jaššová, E. (1984). *Tvorivosť – piata dimenzia*. Bratislava, Smena. ISBN 73 –053 84 02.

Zelina, M. (1995). *Stratégie a metódy rozvoja osobnosti*. Bratislava, Iris.

Zelina, M. (1997). Ako sa stať tvorivým. Šamorín, Fontána.

Lapitková, V.-Brestenská, E. (2003). Fyzika pre 7. ročník špeciálnych základných škôl : Pracovný zošit, Bratislava : EXPOL pedagogika.

Horváth, P. (2006). Fyzikálne úlohy s príbehom. Zborník Inovácie v Inovácie v prírodovednom vyučovaní : Zborník zo seminára, Bratislava : FMFI UK, p. 53-84.

Pišút, J. (1996). O motivácii pri vyučovaní fyziky. Šoltésove dni 96. Bratislava, MC. ISBN 80-7164-207- X, s 22 - 27.

<http://www.directedcreativity.com/pages/WPModels.html>

<http://hockicko.uniza.sk/>

http://web.svf.stuba.sk/kat/FYZ/fyzika_ta_vola/index.html