

GPS Mathematics in nature

Štefan Havrlent, Miroslava Sovičová

1 Introduction

In this article, we deal with the research preparation of mathematics teaching, particularly geometrical assignment, in a real environment, in nature, with the help of ICT. By this pre-research, we want to state research objectives, define suitable tasks and determine the appropriate target group of pupils of primary school or students of secondary school, as well as to find a proper environment for the research realization.

Considering the methodology of the research, we decided to use an observation. As for the ICT tools, we work with the GPS navigation systems, the Excel spreadsheet and the dynamic mathematical software GeoGebra.

Our pre-research was conducted with the sample of students from the third grade of secondary-grammar school. During the hiking, we observed their perceptiveness, behaviour and the interest in mathematics teaching in nature. Moreover, we focused on their capability and abilities to use GPS navigation system.

Due to the accurate and efficient objective statement of our research, we established some preliminary partial objectives:

- To find a proper environment in nature which complies with the safety principles stated by the school and law.
- To find the environment in nature for pupils or students, so that it was possible to implement all the tasks which we have developed.
- To determine the target group of pupils or students and to define the part of curriculum for the research (grade and school)
- To develop the tasks for pupils or students supporting an innovative, inductive approach to the teaching of mathematics.

The tasks for students are situated in two different situations within one environment. The tasks are focused on the representation of regular geometrical figures and on the transformation of the obtained data into the graphs.

On the basis of this pre-research, we want to determine the final task assignments, our final research objectives and also to create suitable research questions.

2 Tasks for students

2.1 Task 1

With this task, we would like to orientate ourselves on the representation of the data obtained by the students in the graphs. When creating the hiking plan, the student as a tourist can find the height profile graph of his hiking route on the internet, which is pictured on Fig. 1.

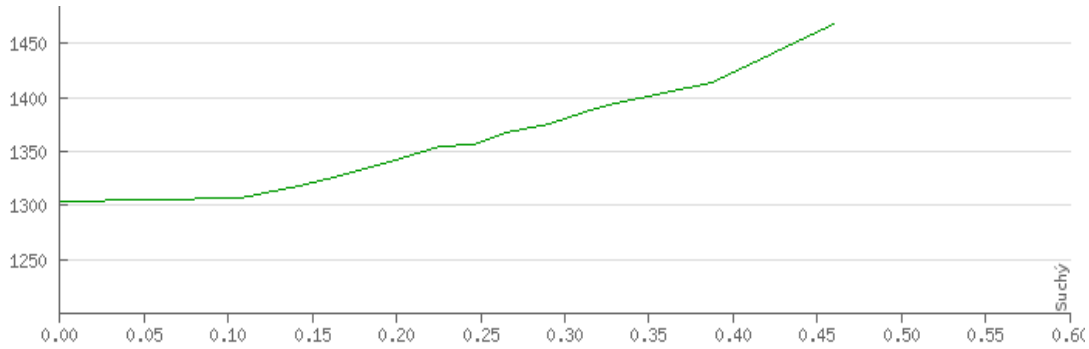


Fig.1 The graph of the height profile of hiking route Sedlo pod Suchým – Suchý.

The aim of this task is for students to obtain the data needed for creating their own height profile graph of the hiking route. We use GPS navigation system for obtaining these data and a MS Excel spreadsheet for displaying the obtained, measured data.

2.1.1 A suitable environment in nature

For the place of achieving these tasks, we set mountain Suchý vrch in the natural area malá Fatra (Fig. 2). We consider also other suitable places for the research task accomplishment, namely mountain Zobor in a mountain chain Tribeč, or mountain Chopok in Low Tatras.

We consider these locations as an appropriate environment in nature for the task realization by pupils.

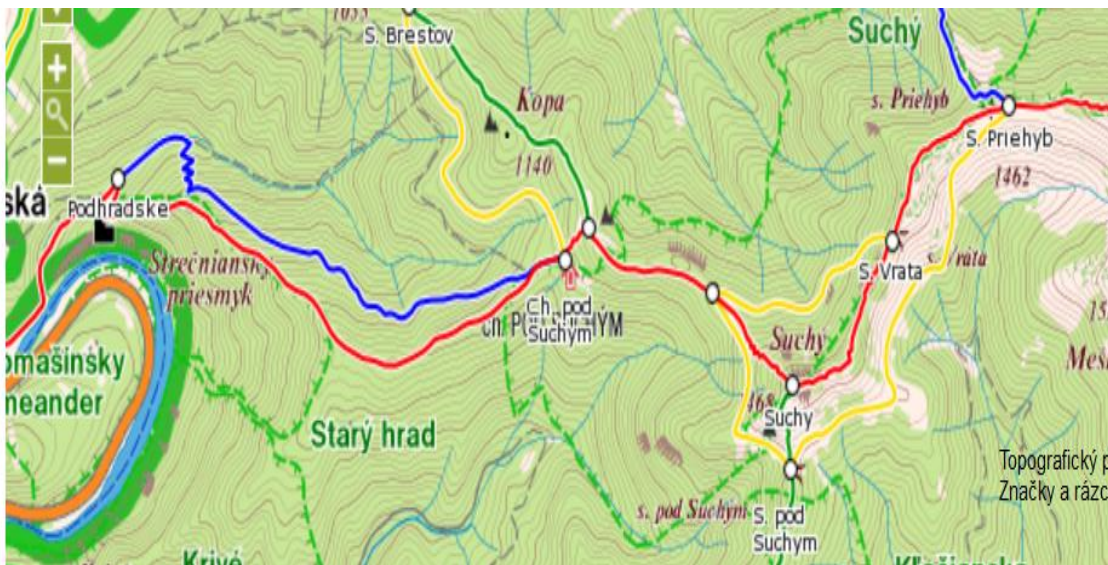


Fig.2 Touristic map of natural area Malá Fatra.

2.1.2 The development of the task

The assignment of the task, supporting an innovative, inductive approach to the teaching of mathematics, can be formulated like this:

Find the data needed for the construction of height profile of hiking route Sedlo pod Suchým – Suchý. For the representation of the obtained data use the Excel spreadsheet.

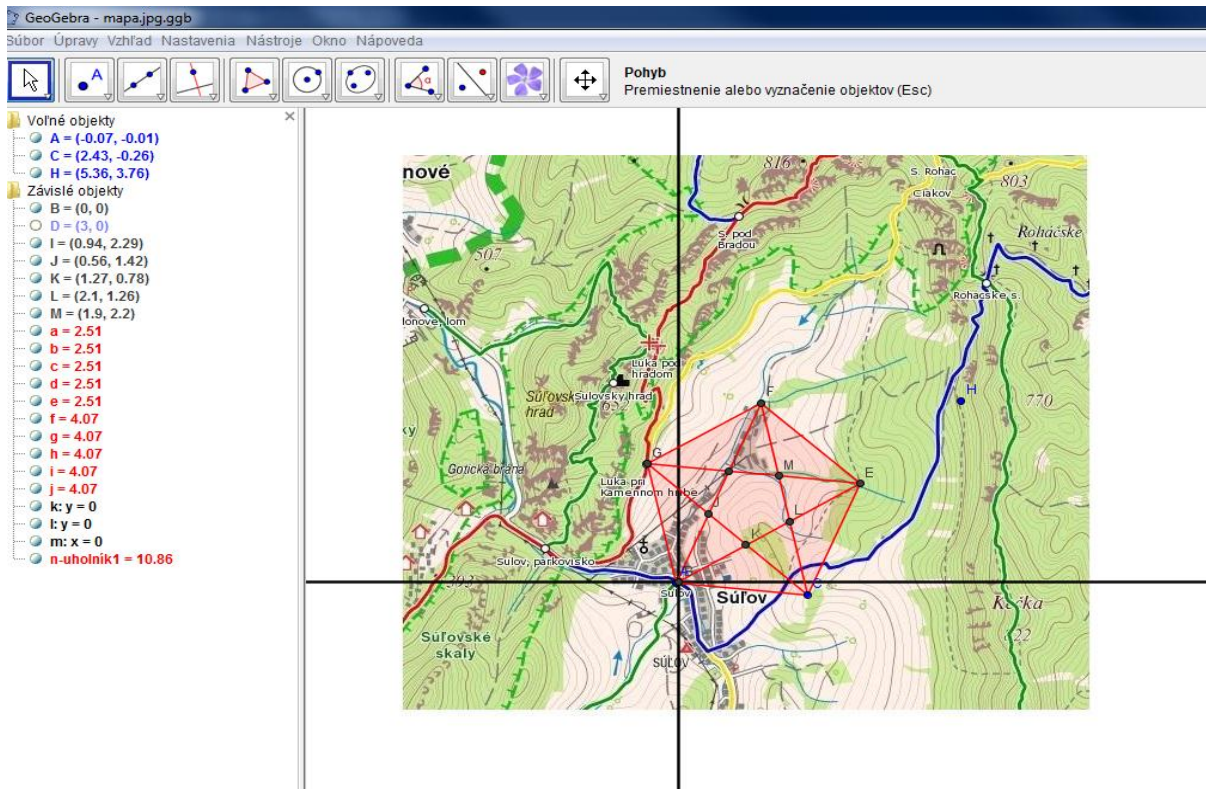


Fig.4 The polygon in Geogebra environment.

3 Conclusion

Observation of students

We observed the students of the third grade of secondary-grammar school. Their behaviour was natural and safe, it corresponded well with their abilities. On the basis of this observation, we conclude that the choice of the location was appropriate and the difficulty of the terrain is suitable also for younger students, or even for the pupils of the primary school.

The observation of students showed that their experience with the manipulation with GPS navigation system is not sufficient, for the majority of pupils it was a new experience. Therefore, we want to recommend a short practice with the navigation system manipulation before solving the tasks in the terrain.

Environment

The environment chosen for solving Task 1 was suitable, technically manageable. It means that there are no natural obstacles while moving to given points determining the vertices of the polygon. The GPS signal for the device was not interrupted and we did not come across the places without the signal when using it.

In the environment chosen for solving Task 2, there were no technical difficulties. While determining of the altitude with the help of GPS, we had small inaccuracies which can be solved before the realization of the research.

Tasks

The concrete assignments of the tasks are still in the process of preparations. They will be adjusted according to the further observations in nature, more specific determination of point coordinates and a better familiarity with the terrain.

References

- [1] Burjan, V., Hrdina, E., Maxian, M. *Prehľad matematiky pre žiakov stredných škôl*, Exam, Bratislava, 2002, ISBN 80-968298-7-4
- [2] Čermák, P., Červinková, P. *Zmaturuj z matematiky*, Didaktis, Bratislava, 2004, ISBN 80-89160-01-8
- [3] Kuzma, J., Reiterová, M. *Matematika základnej školy v kocke: Príprava na prijímacie skúšky na stredné školy*, Príroda, Bratislava, 2011, ISBN 978-80-07-01899-0
- [4] http://www.statpedu.sk/files/documents/svp/2stzs/isced2/vzdelavacie_oblasti/matematika_isced2.pdf (July 11, 2011)
- [5] http://www.statpedu.sk/files/documents/svp/gymnazia/vzdelavacie_oblasti/matematika_i_sced3a.pdf (July 11, 2011)