

OUR EXPERIENCE WITH THE INVOLVEMENT OF STUDENTS IN THE CREATION OF STUDY MATERIALS

DLOUHA Dagmar (CZ), HAMRIKOVA Radka (CZ)

Abstract. In past year we joined a project of the statutory city of Ostrava, which is called The Program focused mainly on supporting education and talent-management in the field of technical and natural science in the statutory city of Ostrava for the year 2017 and 1st trimester of 2018. Within this project we could develop co-operation with our talented students. Currently we have eight students from full-time bachelor, continuing masters and doctoral study.

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Mathematics subject classification: Primary 65D17; Secondary 53A04, 14Q05

1 Introduction

The first activity in which students are participating is the co-operation on the creating of teaching material from maths and descriptive geometry for their subjects of study.

The second activity is recording commented videos of exercises from maths for students of continuing study of Faculty of Mining and Geology.

2 Motivational exercises

The common question of students from bachelor study is - what is math good for? So we engaged students of higher years of bachelor and master study in preparation of exercises, where the themes from bachelors maths and descriptive geometry can be found. Students of three different fields created for their study subject five exercises from professional subjects of theirs study. The parts of descriptive geometry and maths, which are taught within the bachelors or masters study, are included in those exercises. We want to use these exercises on lectures and practices to answer the never-ending question of our students which is "Why do we have to learn this?"

Students had to choose such a exercises, which are being taught in professional subjects and the knowledges of descriptive geometry and high-school maths are necessary for the solution. The information in which year and in which subject is this specific problematic being taught is given in every exercise.

2.1 The example of motivational exercise

Application of rectangular axonometry to the central part of the Rozna mining area.

In the 2nd year of the subject Descriptive Geometry you will deal with plotting in rectangular axonometry. Axonometric rendering of the mine is used for spatial display of underground spaces, eg for emergency plans, mine ventilation maps, etc.

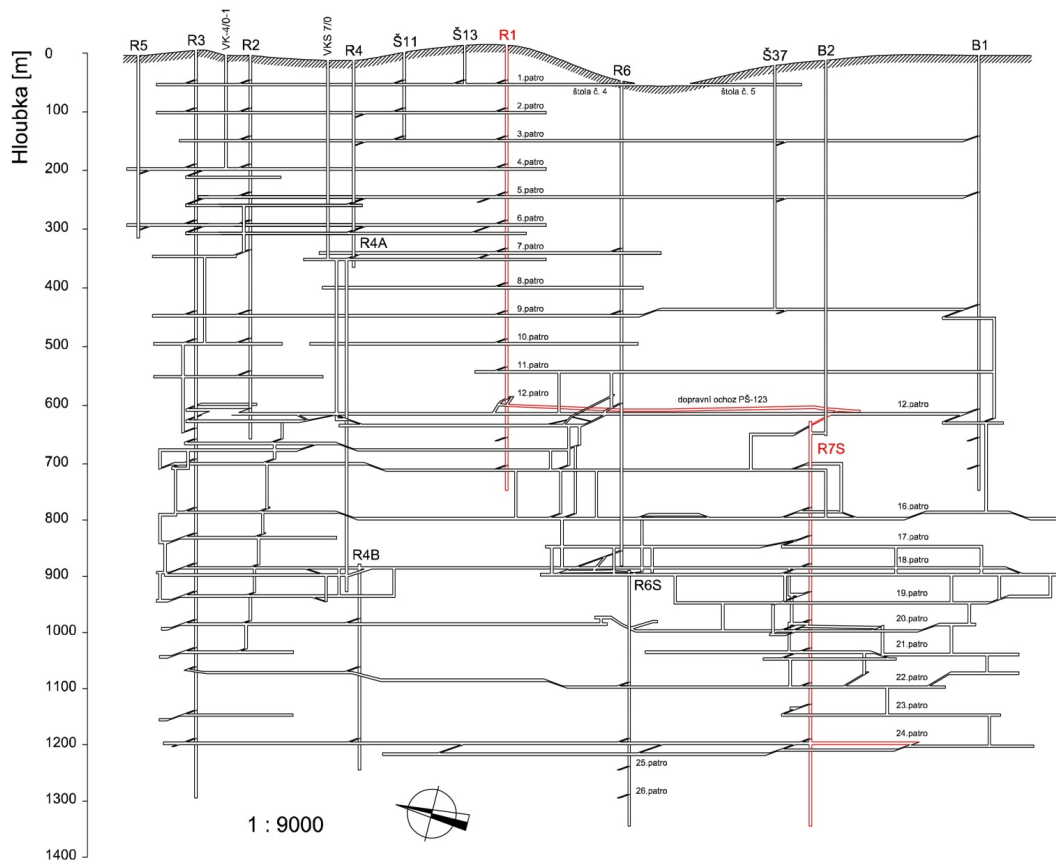


Fig. 1. Scheme of mine

2.2 Use of rectangular axonometry in practice

We can show the use of rectangular axonometry in practice on simplified task of transport in mine: The journey of miner. For the correct plotting you will need to know: scale conversion, rectangular axonometry - isometric staging triangle, display points and lines.

2.2.1 Assignment

The miner works at the Rozna I mine in Dolni Rozinka and needs to get to the mining. [5] The journey takes about half an hour and is as follows:

- on the surface boarding the cage of R1 pit and going to the 12th floor,
- on the 12th floor he is hauled on the rail transport, which takes him to the rim of the hidden pit R7S

- on the 12th floor of the R7S pit, he goes back to the cage and goes to the 24th floor
- on the 24th floor there will be a trekking run

2.2.2 Task

Draw the path of the miner in rectangular axonometry, respectively. in isometric (equilateral isometric triangle) according to the following coordinates (in meters):

Pit R1	$A = [0; 0; 0]$	$B = [0; 0; -648]$
Pit R7S	$C = [2400; 65; -494]$	$D = [2400; 65; -1154]$
Corridor on the 12th floor	$E = [0; 0; -548]$	$F = [2400; 65; -534]$
Corridor on the 24th floor	$G = [2400; 65; -1104]$	$H = [3815; 55; -1040]$

Tab. 1. Coordinates

2.2.3 Task

Draw a isometric diagram of a mining route at a scale of 1 : 20,000. Do not consider the width of mine workings. Scale conversion 1 : 20000. To do so, you divide the given coordinate by the scale and convert it to the extractor unit (in our case, per cm). Example of Pit Counting R1:

$$B_z = \frac{-648 \text{ m}}{20000} = -0,0324 \text{ m} = -3,24 \text{ cm} \quad (1)$$

Pit R1	$A = [0; 0; 0]$	$B = [0; 0; -3.24]$
Pit R7S	$C = [12; 3.25; -2.47]$	$D = [12; 3.25; -5.77]$
Corridor on the 12th floor	$E = [0; 0; -2.74]$	$F = [12; 3.25; -2.67]$
Corridor on the 24th floor	$G = [12; 3.25; -11.04]$	$H = [19.08; 2.75; -5.20]$

Tab. 2. Conversion of individual point coordinates

2.3 Sketch of the feature

Before we go into the resulting feature, we will create a sketch in which we verify that the displayed situation fits to the selected paper size. We will not develop the situation in general axonometry but in isometry. Its advantage is easy to apply co-ordinates and we can go along without an axonometric triangle. We choose the location of the origin of the coordinate system, roughly specifying points. If we do not like the layout, we can adjust it by moving the origin of the coordinate system. Once the situation is well represented, we can go into the resulting feature. See Fig. 2.

2.4 Feature

First, bring the isometric triangle into the upper left corner, see the sketch of the feature. Then convert the recalculated coordinates x and y of all points, according to the respective triangle axes, into the ground plan, ie points with index 1 (B1, C1, ...). Once you get the intersection with the surface, apply the z coordinate to get the depth of the point. You get the lines by linking the relevant points. See Fig. 3.

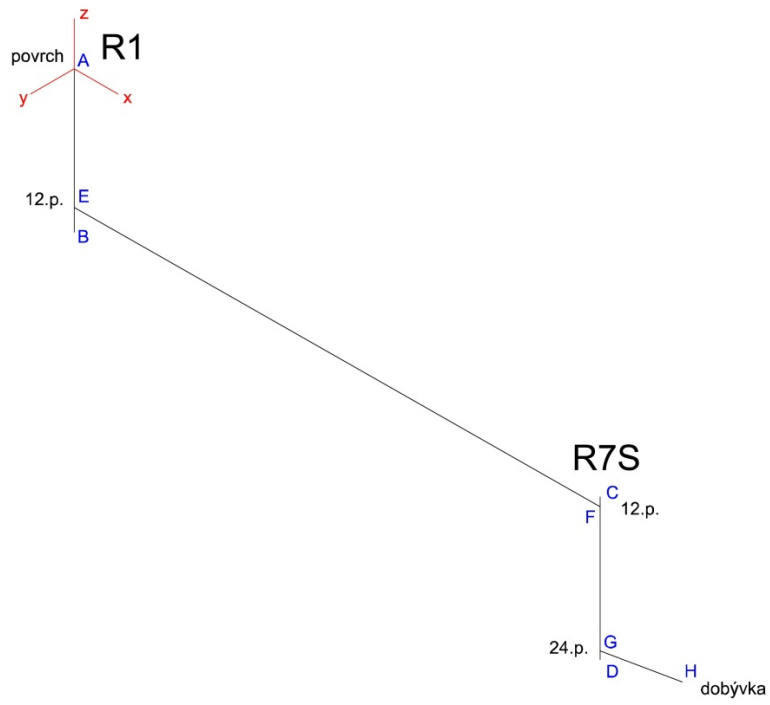


Fig. 2. Sketch

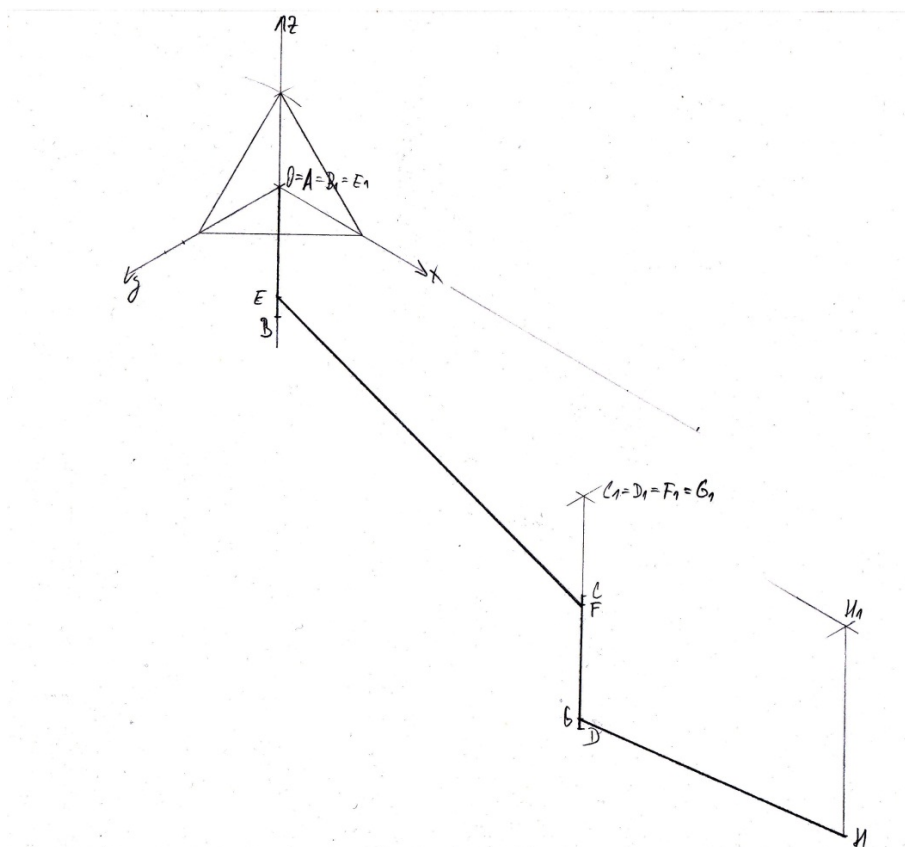


Fig. 3. Feature

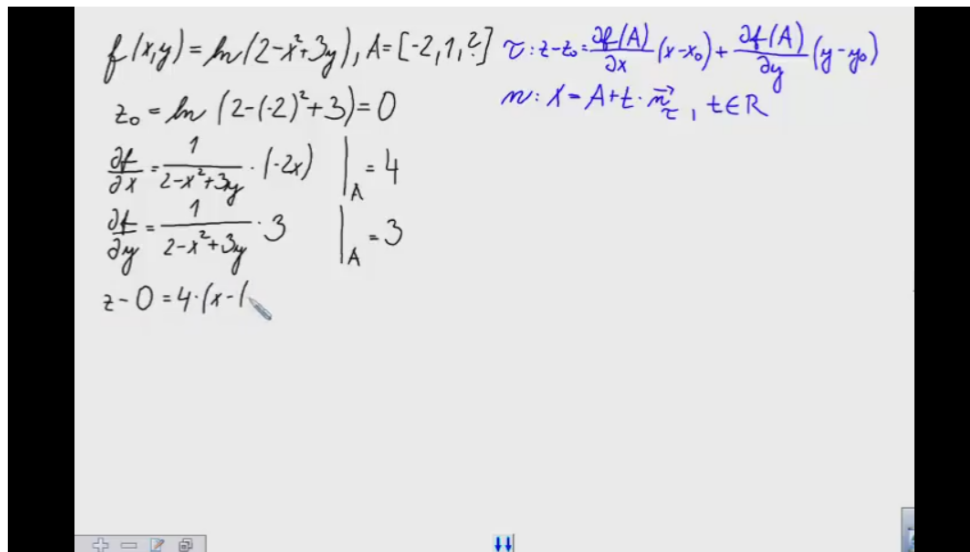
3 Videos for students

Students of master's programs come to the VSB - Technical University from various specializations and the level of their knowledge of mathematics is therefore diametrically different. In this article, we will focus on a variety of students from present and combined following bachelors studies of Faculty of Mining and Geology. We run the Engineering Mathematics and Selected chapters in mathematics for this faculty. The lessons take place in Ostrava and on the detached workplace in Most. Both courses require a good knowledge of a Bachelor's Mathematics I. and II. Not every student has the required knowledge to follow these courses. The combined form of study is divided into 18 hours of classes, which are running in two or three blocks. We have students with different levels of mathematic attending these classes, as they absolved the Bachelor's maths in different schools, where the level was lower than on VSB-TU Ostrava. Students can use the scripts or the web address called "studijni opory" - learning support (www.studopory.vsb.cz). These pages are not only for teaching maths. They were created in 2006 - 2008 in the Learning Support project with preponderant distant elements for subjects of the theoretical basis of the study, also video materials on the web of the department and the collection of unsolved exercises for training. If the student approaches a difficulty, he has the possibility of personal consultation with his tutor. If the personal meeting cannot be arranged, we can consult the student over the phone or Skype.

But because most of our students come from distant places and they have to commute to school or study on our detached workplace in Most, personal consultations are almost impossible for them. In these cases, we can help by leading the consultation via Skype or Phone. And because students understand the explanation from another student better than professional definition from teachers, we approached our excellent students and offered them the possibility to take a part in this activity.

3.1 Commented videos

As a base for video-consultations we used the collection of unsolved exercises for training. From every thematic field, we've chosen one exercise and recorded a video tutorial of solving the problem with the spoken comment. Our students are already used to this form of selfstudy support, as there is already a bank of exercises from the Bachelors Mathematics I, II and Descriptive geometry. For video recording we use interactive board, program for operating the board, which is called the Device manager, then the Camtasia studio for cut and sounding and a graphic calculator GeoGebra for functions and 3D mathematic, which is free to download. This form of study is very popular among our students. We've created a questionnaire and it was answered by half of our students approx. From their answers, it was clear, that our videos are very important part of their preparation for an exam. They appreciate their accessibility on the internet and our willingness to record another videos. From our experiences, we already know, that when solving a certain exercise, students play the commented video of a similar problem in the first place and they try to understand each step of the solution. We record our videos such as the exercise is not only solved correctly but also economically. Too long explaining of each step could discourage the more talented students and would cut down the independent activity of another ones. If any student shall need further and closer explaining of any steps, he can send us a question. For communication with students, we use the school e-mail or comment underneath the videos on YouTube.



Video 5 - tečná rovina a normála

Fig. 4. Students for students - youtube channel

3.2 Youtube channel

At first, we planned to put those materials on school web, where they also were for two semesters and students were using them actively. After we started to do video-consultations we realized that the space on our web is highly insufficient, so after considering another options we decided to move our materials on YouTube. We don't have many views so far, but we believe that students will watch our materials here too, because the rules of videoconsultations are explained in the presentation. All students, who have the certain subject written in their study plan have received an email with a new link to all materials.

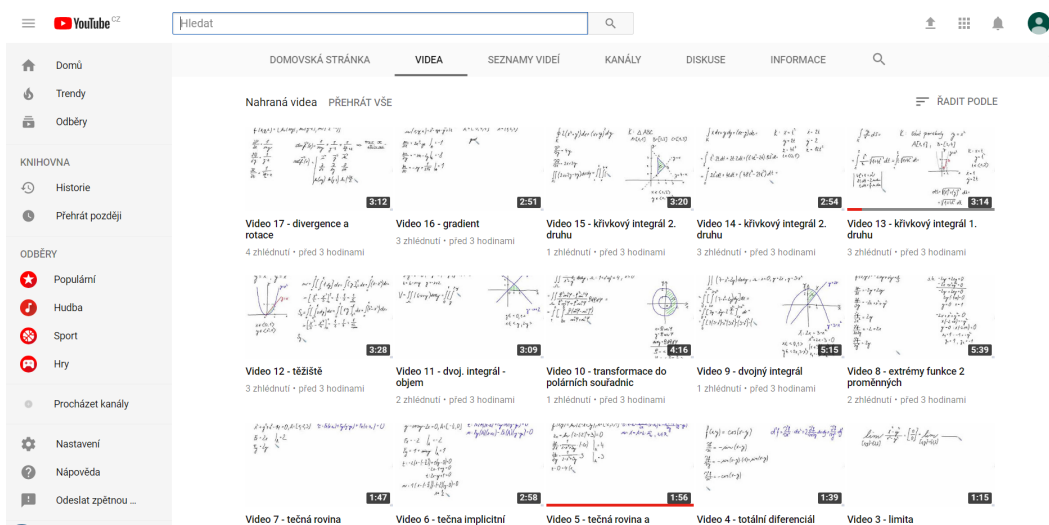


Fig. 5. Students for students - all videos

3.3 Videoconsultations

Now we will be showing how the usual communication between students and tutors looks like. One of the situations is extremes of a function of two variables (local, dependent and global). In the time allocation of 1 hour are students introduced to the theory, they will have the example of exercise calculated and will receive the link to the web address with materials to self-study. Unfortunately, the majority of students is only re-writing the information from the board and are thinking about the meaning back at home, where there is no one to explain what they didn't understand. Many students also cannot attend all classes due to high workloads. Therefore they often find difficulties when solving the exercises from the collection of unsolved exercises as a preparation for the exam, and they are unable to solve them on their own. The collection has 17 themes. We recorded a video of one example of the theme and the students are to solve another exercises by themselves.

4 Conclusion

It is a great contribution to school for the excellent students who work with us to stay at school as postgraduate students, and they can be expected to remain at school as well as scientists even though they are from different regions of the Czech Republic and the Slovak Republic. We want them to be helpful and prepare them for their pedagogical or scientific career by preparing them for the work of the educator, for their publishing activities and ensuring their participation in professional conferences.

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Current address**Dlouha Dagmar, Mgr., Ph.D.**

Institute of Mathematics and Descriptive geometry

VSB - TU Ostrava

17. listopadu 15, Ostrava 70833

E-mail: dagmar.dlouha@vsb.cz

Hamrikova Radka, Mgr., Ph.D.

Institute of Mathematics and Descriptive geometry

VSB - TU Ostrava

17. listopadu 15, Ostrava 70833

E-mail: radka.hamrikova@vsb.cz