

Research on preparing control engineers and advanced Matlab users

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Abstract: This paper is about the Matlab teaching at the Faculty of Electrical Engineering and Information Technology in Bratislava. In this course we are focusing on the individual work of students. Students work on assignments every week and they are evaluated for finishing tasks on the exercises. We studied their results and impact of evaluating the tasks on the exercises. We also compared this type of evaluating and others used before.

Key-Words: Teaching strategies, Learning, Matlab, Week tasks, Forum, Web materials

1 Introduction

Learning is one of the most important and one of the longest activities in our lives. There is variety of learning and teaching strategies. There are many materials (online or printed) that describe how to use these strategies in teaching or learning process at the top of that [1, 2, 3]. The hardest part is choosing ones that are appropriate and effective for current situation (course). In this paper we don't deal about strategies of learning. We want to focus on the facts that the evaluation of their results through the year (or semester) has impact on their willingness to learn. There are certainly again different types of evaluation of their work at the course. Most common are a few tests or checkpoints through year, but everything depends on the type of course. In our course we teach Matlab. It is advanced environment for technical computing and control engineering. We decided that we should evaluating students every week through the course and see what the impact is on their capability of learn and see if their results are better.

The paper is divided into few parts. In the second section we described Matlab course in detail. In the third section we write about task evaluating strategies and comparing the result of different types of strategies onto students. In the fourth section we show you the student's opinion on our course and evaluation. Final section is the conclusion.

2 Matlab course

The Matlab high-performance language for technical computing integrates computation, visualization in programming in an easy-to-use environment where problems and solutions are expressed in familiar

mathematical notation. It allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction the time it would take to write a program in scalar non-interactive language such as C or Fortran. In university environments, it is a standard instructional tool for introductory and advanced courses in mathematics, engineering and science. In industry, Matlab is a tool of choice for high-productivity research, development, and analysis [4].

MATLAB features a family of add-on application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes allow you to learn and apply specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. You can add on toolboxes for signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many other areas [4].

2.1 Lectures and exercises

At the Faculty of Electrical Engineering and Information Technology Bratislava is Matlab used in many mathematical and technical courses. Students use Matlab for their computations and solutions in bachelor, diploma or dissertation thesis. It is a part of their all student live. Matlab course is introductory course to Matlab and Matlab toolboxes. The faculty has a two terms per year. Each term has twelve weeks. Course can be taken in second year of study in the second term at the faculty. It consists of one lecture (100 minutes) and

practice (100 minutes) per week. The lectures aren't compulsory, but practice are.

The aim of the Matlab course is to introduce students to the Matlab, to learn them basic principles and solutions of some common problems. We focus on the most common problems which students may use in their future study or on the others courses. We cover these topics:

- Matlab basics and programming
- Graphics and GUI
- Simulink
- Continuous and discrete systems
- Identification
- Fuzzy logic
- Virtual reality
- Stateflow
- Neural networks
- Real-time

As you can see there are many topics for just one course. But with time that is given to us we just cover simple introduction to this topics. That is not a big problem because they will have detailed courses for most of the mentioned topics in the future. Main idea is to show them basic principles and solutions that Matlab provide. Then they can extend their knowledge of Matlab course on the other courses.

The practices relate to the lectures. There are two lessons at which student solving some problems related to the theme on actual lecture. Problem is at the first solved verbally and at the board. Students then try to find out solutions in Matlab environment. Practices are set up in the way that students haven't much time to learn the topic on exercise so they have to always come poised.

2.2 Further materials

The main study materials are lectures. Matlab course has own web-page where students can find all lectures and exercises in electronic form. A few topics has own video tutorials and students could view it at home and be better prepared on the practices. Some of the video tutorials are mentioned in references [5, 6].

The lectures aren't one source of materials. Students can use many different materials at the practices. The main material for Matlab study could be the Matlab reference manual which covers all topics and functions that students can use. The practices room has computers connected to the internet of course. Students can find their problems solutions on the web.

We also founded Matlab forum [7] where students can ask a questions about Matlab. It isn't forum just for this course. The questions can be related to various

problems at which students came through on their study in every course and are about Matlab. There were more than six hundred themes and more than twenty seven thousand replays at the time we wrote this paper. The usage of the forum grows beyond our faculty. Now day's students from different faculties around Slovak Republic and Czech Republic come to our forum and ask questions about Matlab. Foreign students are also welcomed and they can ask us in English. We also want to help these students not only on the forum but with other study materials. So we decided to write small articles about Matlab in Slovak language (also understandable in Czech because these two are very similar). The articles come out one or two times per month.

We established new facebook group for students of Matlab course last year. This group has 58 active members who are mainly students of our course. We use this group for quick and short informations about course. Every member can comment tasks from practices and lecture. It is very useful feedback from students to teachers. Lot of students use this group for publicity their works. They want to show results of their work to other students and share the algorithm. It can be a platform for new projects in the future. It can be used as a sort of learning management and e-learning system.

3 Evaluating tasks

Student's results are evaluated through pointing of courses at the Faculty of Electrical Engineering and Information Technology Bratislava. Students can achieve 100 points at most. Most times points are divided into two parts. The first amount of points can student gets on practices or tests through term. The second part they can get on the exam. In most cases it is 30/70 (practice/exam) or 40/60. Weight is on the exam as we can see.

There are two main evaluation (or pointing) systems. In the first students have two or three check points through term. So in the end all comes to these tests. Point results depends on how successful are students to answer the test tasks. It is a little bit problem when students doing great at the practices, but they vacillate on the tests at the end of course. Also they don't have to learn until test is in sight. This problem had mathematician's long time ago. Students came from high schools and weren't used to learn so much more or they had different knowledge of mathematics. Many of them fail some basics mathematic courses. Mathematicians try another pointing system that "forces" students to learn more often than just before tests.

Student was evaluated on every exercise. On the next exercise they had small test on previous topic. The results of the student grow significantly. We also stick to

this schema. We had two reasons for that. One reason was that we had many topics covered in our course. It would be not wise to test student on topics they forget long time. Another was that we want to “force” student to do something more. We choose to give more points during the term, so we give 40 points maximum for exercises. There were 10 practices for 4 points, the first and the last weren’t evaluated. Student gained about 30 – 40 points. On the exam they were doing also good and they hadn’t problems to pass it.

4 Students opinions

In automatic control system there is the most valuable information one that come form the feedback. Certainly we stick to this concept in our course. We are giving some questions to the students at the end of the term. Their answers are anonymous. Some of the questions are:

- How do you rate the course difficulty?
- How much do you thing you have learned?
- How would you rate lectures?
- How would you rate practices?
- Were the topics explained clearly?
- Do you like the system of work evaluation on every exercise?

The answers depend on individual students, but most of them agreed at some points. The lectures and practices were rated positive too. Explanation was clear, but they want more practical examples. The most interesting part of the questions was the first two questions mentioned. In course difficulty the answers were following:

- very easy
- easy
- normal
- hard
- very hard

Most of the students answered normal or easy. So in the comparison with other courses was Matlab course difficult same or easier. The result of the answer to the first question is depicted in the Fig. 1.

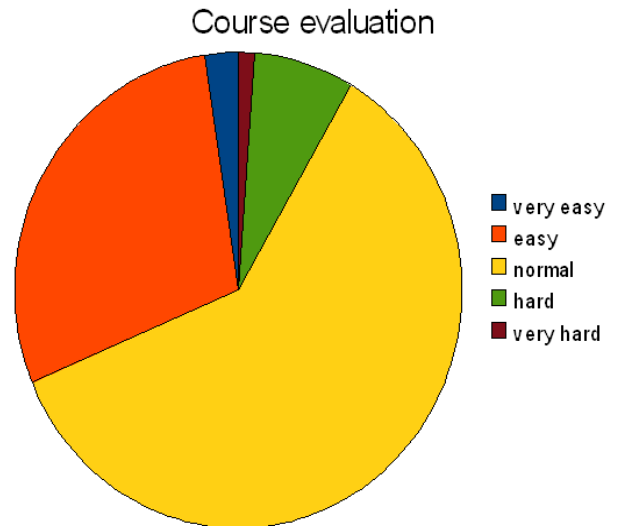


Fig.1 How do you rate the course difficulty?

Equivalently we ask students what they thing about how much they have learned or handled. The possibilities were follows:

- very little
- little
- normal
- much
- very much

Students had to learn for every exercise, so they subjective evaluation was that they has learned mostly much. But that wasn’t only the subjective opinion. Their pointing results show that they were doing well.

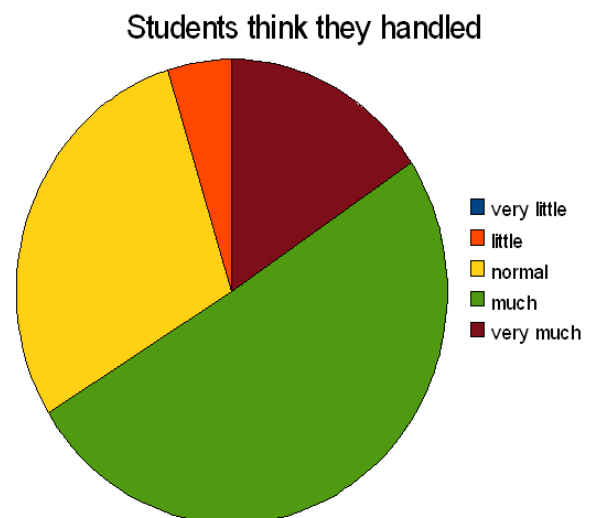


Fig.2 Students has learned

The last question was about evaluation system. Almost everyone (except one student) thought that this system

was suitable. This quiz was taken before exam, so the results weren't affected by exam results.

5 Conclusion

In this paper we wrote about Matlab course at the Faculty of Electrical Engineering and Information Technology Bratislava. Because we cover many topics in single course, it is important that students are prepared for every practice. They can use a lot of materials, mainly lectures. But there are several others materials that can they use like original Matlab documentation, web-pages or forums.

Great motivation is to evaluate their results weekly. On practice they have to solve some problems within the given time range. So students must come to the practice prepared very well, if they want to get a good point result. We can say, that we are "forcing" them to learn continuously. As the result of the anonymous questions at the end of course shows that they prefer this system. We know that this system fits from students because there are saying (it is within anonymous questions):

"The best course so far! I have learned many handy things in Matlab and Simulink. Lectures were explained clearly and practices adequately."

"I liked challenge that I must doing everything on the practice (what I never done before), mainly at the end of the course it was very interesting."

Of course within many positive reactions we found some reactions that can lead us to make even more suitable course for students. The most are about using more practical approach than theoretical:

"It would be suitable to show something from praxis not only virtual. For example motor or else."

In the last group of reactions students wanted to take the course sooner than in the second year and second term. Teachers from the other courses have this requirement too. For this reason the Matlab course is shifted to the first study year in second term. Hopefully we keep up the most students satisfied and educated.

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