

# Preferred information sources and the quality of online sources for programming courses

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*Abstract:* Programming courses are part of many technical study programs. Programming courses are not just the domain of universities, but because of many Internet sites about programming, students can learn it without actually taking any courses. For the students that take programming courses, the Internet can be a suitable addition to other resources like lectures or books. In this paper we studied the preferred information sources of students for learning programming. We created a small survey and asked them what are the preferred information sources for their practices and final exams. The credibility and quality of the information sources was considered. Students also pointed out if quality of lectures affects searching for recourses on the Internet.

*Key-Words:* - Programming, Survey, Online sources, Education, Functionality, Efficiency

## 1 Introduction

Many of the technical study programs contain courses that are aimed at programming various systems in various programming languages. Because we also teach a few programming courses, our priority is to constantly improve their quality.

A good example of the development of a programming course is the approach of the authors of [1], where they have built a teaching platform for lessons of embedded systems programming. According to [2], the grades of students do not reflect the actual software engineering or programming skills that the students have acquired. Quite often students get good grades but they are still facing great challenges at workforce, or have difficulties to take on real programming jobs. Therefore the modernization and the improvement of the learning courses at the universities should be every year's task [3]. However, if a learning course is to be improved, there has to be a reliable feedback from the students that can be used for this purpose. There are several possible criteria you can choose for your feedback, but you can not change the whole course because it would be not transparent for the students.

One type of the feedback is the survey about the information sources the students use for their study. Each type of resources is available for improving knowledge of software programming and programming languages or for solving specific problems by using those languages [4].

Only the very minimum of the students use only the information from the lectures and practices for their study. The bigger part of them use also resources like books, papers or the Internet. Not all of the resources are always relevant or of a high quality, so the students have to consider the credibility and the quality of the information resources. If the students search the relevant information over the Internet, the exact way how they search for the information or the databases they use is also an important finding [5].

The way of how the survey is filled out is also important because the students are not always willing to participate if the method is not comfortable for them. In our findings, the surveys filled via the Internet are the most suitable, because they do not take very much time, and their fulfillment is easy and comfortable.

We decided to make a survey about the information resources the students use for their further study of programming courses to have an insight over their habits in order to adapt and improve the courses we teach. The survey was uploaded on the Internet and it consisted of six questions. All of the obtained information were very useful for us for further study and we present the findings in the next chapters. Our findings are concluded in the end of the paper.

We would like to mention that the e-learning and web learning portals are also very useful study

resources for the students [6][7]. They are sometimes based on open-source technologies [8].

## 2 Background of the students

The first question from our survey was about programming background of the students. We wanted to know which programming courses at our faculty they have taken. The target group of students for our survey were the students that finished two or more programming courses at our faculty. The most of the students finished courses about C/C++, Matlab and Web technologies (HTML, PHP, JavaScript, ...).

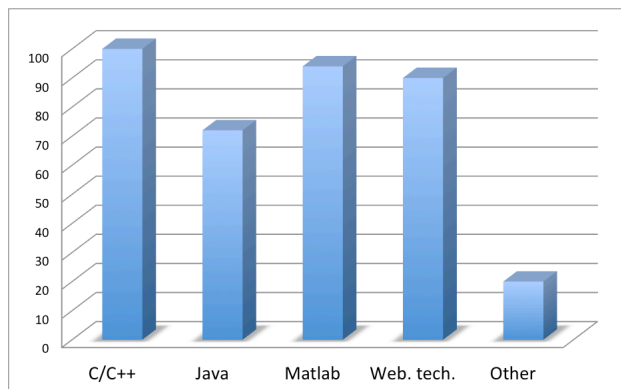


Fig.1 Course experience

In other answers students also mentioned courses about other programming languages. Most of the answers were Microsoft technologies (.NET, C#) or Unix/Linux scripting (bash).

## 3 Information sources

Students gained a significant new source of information with the arrival of the Internet. Traditional resources like lecture materials or books are used less frequently today. On the contrary, online materials are used more and more. Students could find information on the Internet in online help, product help or forums. Another source of information are their course mates (collaborative learning).

### 3.1 Practices

First we focused on practices of the programming courses. Students can use any kinds of materials on our practices at our faculty. Results of our survey show, that students use mostly online resources. Specific answers for any problem can be easily found on forums or pages designed specifically for that purpose. These sources are often used in C/C++ or Java courses. Courses for specialized products

like Matlab have rich product help, therefore students are using this resources too. Lectures are used if they contain procedures for solving problems and online resources are not necessary in this case. We do not mind if the students ask their colleagues for help, because the collaboration between students strengthens their teaching and explaining skills.

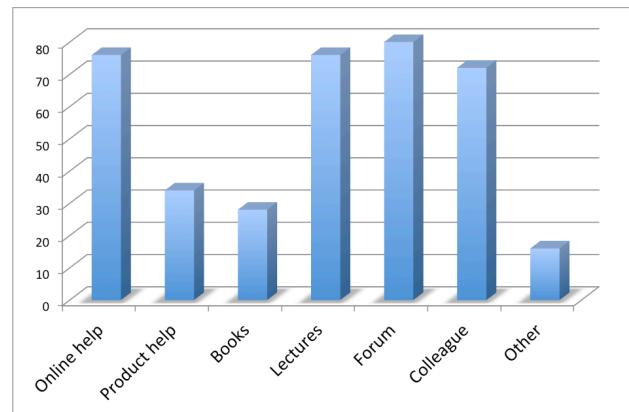


Fig. 2 Information sources for practices

Additional source of information for practices can be the problem solutions from previous years of study for certain course. This can be also counter-productive because students could abuse the results of previous students to their advantage. Interesting answer was, that the student can use the help of the teacher responsible for specific practice. Some students are shy and afraid that they would ask a “stupid” question. On the contrary, the knowledge or the experience of the teacher often help them to find the solution or the bugs much faster.

### 3.2 Final exam

Our survey shows that students use different resources in the preparation for the final exams. The most used information sources are lecture materials. The probability that the answer is explained in the lecture material is high. In programming course lectures contain theoretical background, therefore the online resources that contain problem solutions are not that useful. Collaboration between students is strong when comes to learning for the final exam. Groups of students can cooperate and explain to each other what they do not understand. Explanation of specific topics is sometimes much clearer from the students point of view rather than teachers. Books are more preferred for learning on final exams rather than on practices. They often contain theoretical background for some problem and the explanation is maybe broader than on lectures, especially for students that do not attend them. Books are also recommended from teachers and

students do not have to look for specific resources. Online materials are used also, but less. The benefit of these materials is that answers can be found in a few second.

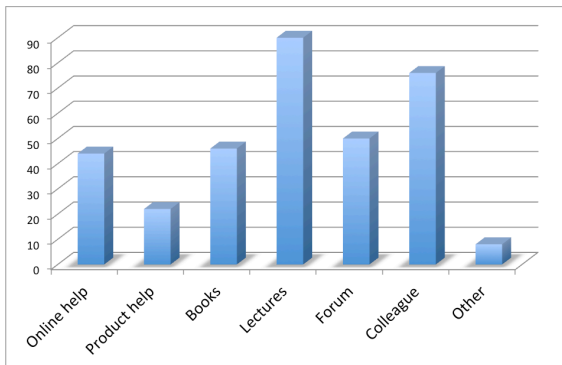


Fig. 3 Information sources for final exam

Additional materials for final exams could be the example programs from lectures. The example programs could help students better understand some problems and principles. It is interesting that this fact did not mention anyone in the survey about practices because they are much more suitable for them in our opinion.

## 4 Credibility and quality of the information sources

Most of the papers dealing with information sources for programming courses does not consider the credibility or quality of the information sources. In our survey, we asked students if they think of these properties.

### 4.1 Credibility of the sources

First we asked them about the credibility of the information sources. The credibility of the information sources is important because the answer is more likely correct and efficient. Wrong source could lead students towards less efficient solution and the finding of error in functionality could extend significantly.

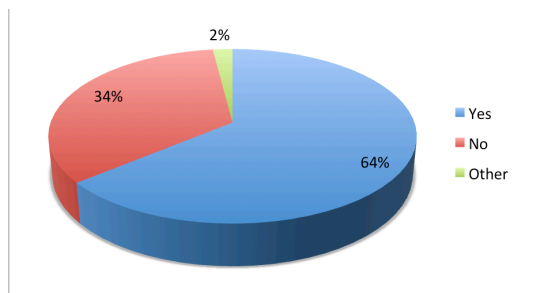


Fig.4 Credibility of information sources

We are glad that our students take the credibility of information sources in programming courses into account (64%), but still a large part of student does not think about the credibility of online sources (34%). The statement “It does not matter from where it is” is not a good perspective for our students. We had one example of this principle on our course when one student wanted to use example code from the MSDN network on UNIX programming course.

### 4.2 Quality of sources

The most important feature of the information sources is their quality. A well-written program is functional and efficient. Students often look only for functionality of programs and do not study the structure of programs. This is not a good practice and it is not easy to eliminate it especially at faculties where special courses on programming effectiveness are not available. Results of our survey show that almost half of the students (46%) are interested only in functionality and in our opinion this number is very large. We often remind our students to study snippets they are using from Internet and think what they do in all steps.

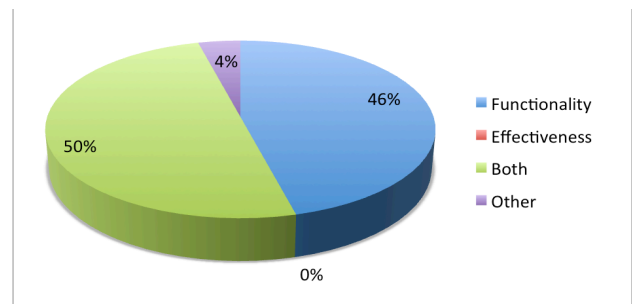


Fig.5 Quality of information sources

In other answers students wrote that they search for directions towards the correct solution of their problems. These students are willing to solve the problems alone with small help and do not want to use all information but only parts that they need. These types of students are probably the fastest learners with good analytical capabilities.

## 5 Lecture quality

The last question in our survey was about the lecture quality. We asked students if the quality of lectures influences search for resources on the Internet. The majority of the students (58%) thought that they do. The opposite answers are fairly close to half (42%) but we can say that quality of the lectures plays role in searching for the information sources for

practices or final exam. Graphical representation of answers is in the next figure.

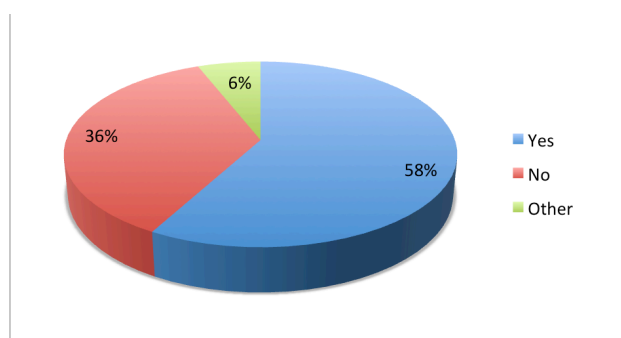


Fig. 6 Lecture quality and sources of information

In personal statements some of the students wrote that they search on the Internet only if the quality of study materials is worse than the answers they found online. Few of the students were uncertain in their answer and wrote less or maybe.

## 6 Conclusion

In this paper we have studied the information sources for programming courses using a survey on students that finished two or more programming courses at our faculty. The survey showed that students prefer online resources for preparing and working on practices. On the contrary, traditional approach is used when students are learning for final exams. Collaboration between students works in both cases.

Properties of information sources are often not considered by the students if they find them on the Internet. But the credibility and quality of the information sources should be always considered. Our survey showed that some of the students consider credibility of information sources indeed. It also showed the lack of program study. Almost half of the students are interested only in the functionality.

Most of the students also think that the quality of the lectures affect their search for resources on the Internet. In programming courses we could improve lecture materials with more snippets of programs, clearer explanation and links to online materials. External sources in lectures can lead students to credible materials with desired quality. Discussion about the properties of information sources should be taken seriously on programming courses especially at faculties where special courses on programming effectiveness are not available.

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