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Issues in distance learning of programming

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Abstract

E-learning in the education system brings many advantages over traditional forms. This form of education also brings many difficulties that lead to less successful students while studying. The aim of this paper is to show the differences between teaching programming in the form of full-time and distance learning. The author describes the results of practical training using the LMS. He presents and compares the results of students in full-time and distance study. The research was conducted using a questionnaire method and a pedagogical experiment. The author shows the basic problems, difficulties and practical experience with these forms and its specifics in teaching of programming.

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Keywords: education, e-learning, programming, research, questionnaire, t-test.

1. Introduction

Department of Informatics and Computers and the University of Ostrava introduced distance learning teaching using e-learning methods in the academic year 1998/99, and in bachelor study program Applied Informatics. The main goal was to offer the opportunity to study hearing impaired candidates. The interest in this form of study soon showed also students without disability. Currently in the first year of undergraduate study received around a hundred students combined and distance forms. Department of Computer Science offers distance e-learning in the master study. The most important problem lies in abilities of students to manage their studies. Part of students is unable to plan well-proportioned schedule for learning. They often start to learn at the end of semester before course exam. They are

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requested to finish successfully several courses and that why they don't have enough time to complete all course requirements and often they fail in the whole study. [4]

An integral part of informatics education programming area. Students must gain not only theoretical knowledge, but also a lot of practical skills and experience. Therefore, programming courses divided into a theoretical part (usually lectures) and practical (seminar). Students are supervised by the teacher familiar with programming, writing code, individual components of the programming language, creating projects, and so on. These practical skills are needed to properly convey to the students in distance learning. [2] [3]

2. Comparison of full-time and distance learning

We used the method of questionnaire and pedagogical experiment. We want using the results of research to determine whether students' test results are dependent on distance or full-time study.

2.1. The methodology

Students completed a paper version of the questionnaire, which contained 8 questions and 2 tasks. The questionnaire contained content items, but also functional items, specifically items contact and control. Most of the items of the questionnaire were closed or semi-closed structured entries.

Questionnaires were sent out, but the individual respondents were personally sought to fill, to ensure a full return. The evaluation of the data obtained were used statistical methods. For analysis of the results in each item was measured as having detected data variability. We used a coefficient of variation. To interpret the results of the second stage classification was done t-test. [1] [5] For evaluating the results were used MS Excel and statistical software Wizard for the operating system Mac OS X and statistical software Statistics Visualizer for iPad.

Parts of the questionnaire were two practical tasks. The first task was to comment code in language Swift. This language is partly based on the C language and the student is not yet acquainted with him. The second task was to rewrite the code from language Swift to language C. Students could get for each task 0 to 10 points.

We compared the results of students in courses that focused on teaching programming. We used statistical methods. For comparison, the results of the two groups (distance and full-time students), we used the T-test: Two-Sample Assuming Equal Variances. Two sample t-test is used to compare the difference of two populations. This parametric test assumes that the variances are the same in both groups. This assumption we tested by the F-Test Two-Sample for Variances.

We have set up two hypotheses that describe study results in programming courses:

H1 - Distant students have worse study results than full-time students.

H2 - Distant students have less practical skills in designing programs than full-time students

2.2. The result of research

The questionnaire was completed and the experiment was attended by 35 students. Respondents studied bachelor program Applied Informatics. Distant students were 8, of which 63% were men and women were 38%. Their average age was 39 years. Full-time students were 27, their average age was 21 years. 89% were men and women were 11%. Distance students had an average attendance of 94%. Full-time students had a 78% participation in present education.

The next chart shows the average evaluation as student used certain parts of online courses in LMS Moodle. (1 = I did not use, 2 = helped a little, 3 = moderately helpful, 4 = most helped me). Evaluation of both groups are almost identical. They differ only in the use of video lectures and correspondence tasks. This was to be expected.

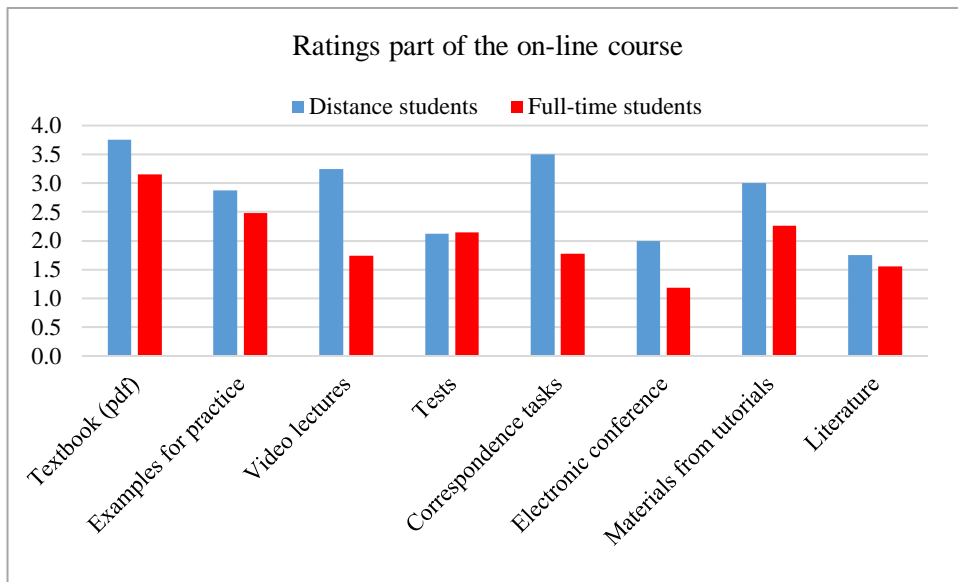


Fig. 1. Ratings part of the on-line course.

The following chart shows which teaching methods students prefer (1 = absolutely not satisfactory, 2 = rather does not, 3 = sometimes yes, sometimes no, 4 = fairly satisfied, 5 = absolutely suits). The individual columns show the average ratings in both groups. The preferences of the two groups did not differ significantly.

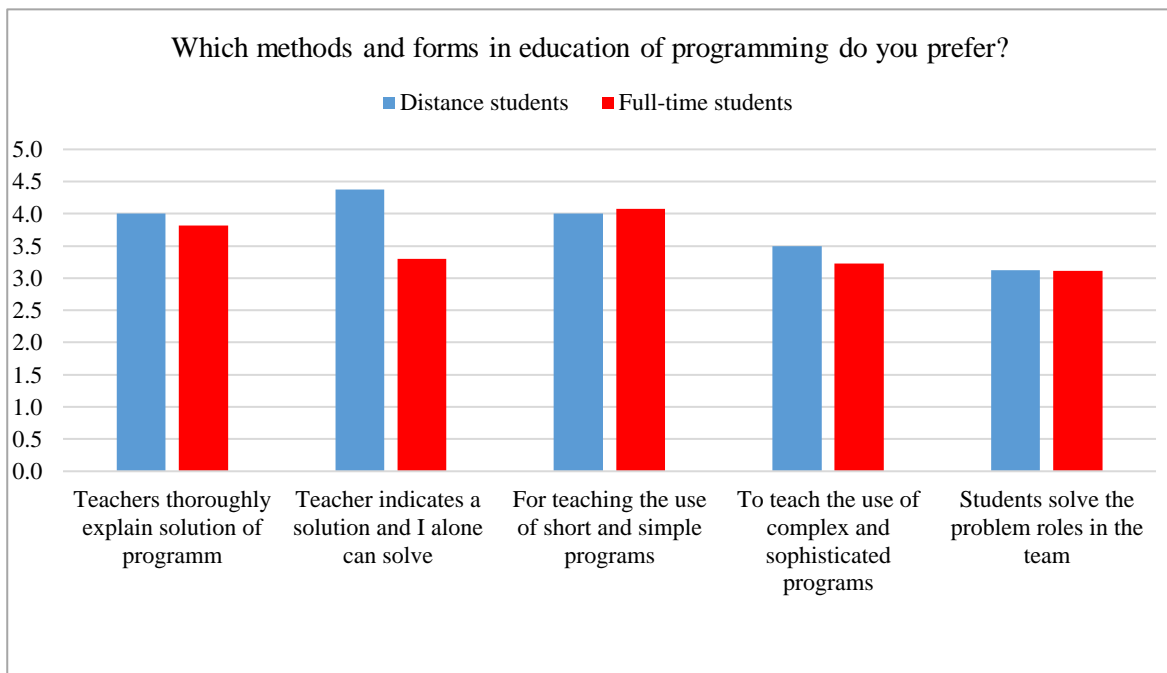


Fig. 2. Which methods and forms in education of programming do you prefer?

The next graph shows the frequency of individual student work. Students answered how often they create their own programs. Students who chose a different frequency, usually only programmed before the test or before submitting correspondence task. In both groups it is seen very small frequency independent creation programs.

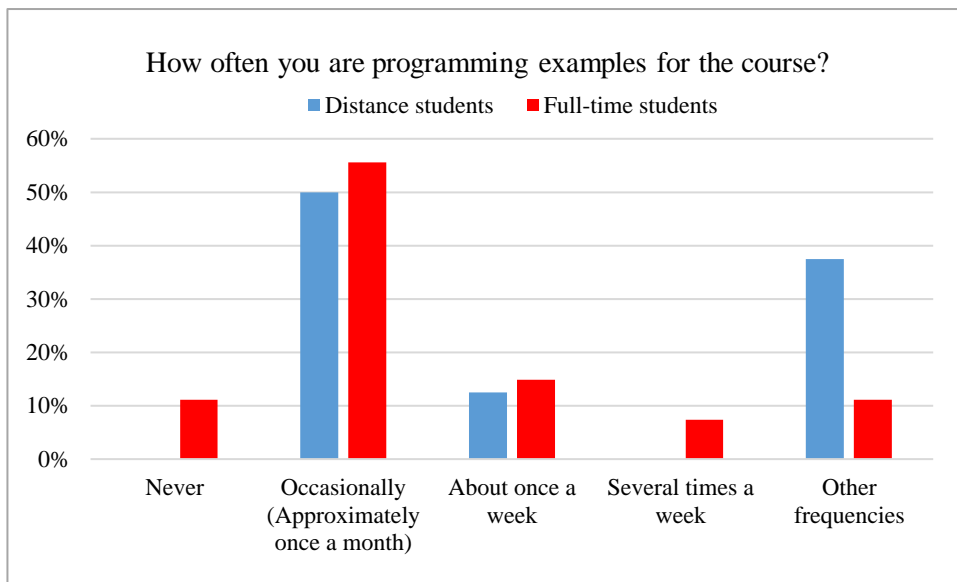


Fig. 3. How often you are programming examples for the course?

We compared the results of a student who solved practical tasks in languages Swift and C. For evaluation we used F-Test Two-Sample for Variances and T-test: Two-Sample Assuming Equal Variances. The results show that we can not reject the null hypothesis. Hypothesis number two is unproven. Both groups had similar results.

The following part of the paper describes the comparison of results of full-time students and distance students. Distance learning puts students at much higher demands than studying full-time. This is reflected in the results of the students. We can observe the differences between the group of distance learners and a group of full-time students. The difference is mainly in the first semester. The success rate of full-time students is 64% in the first semester. The success of distance learners is only 39% in the first semester.

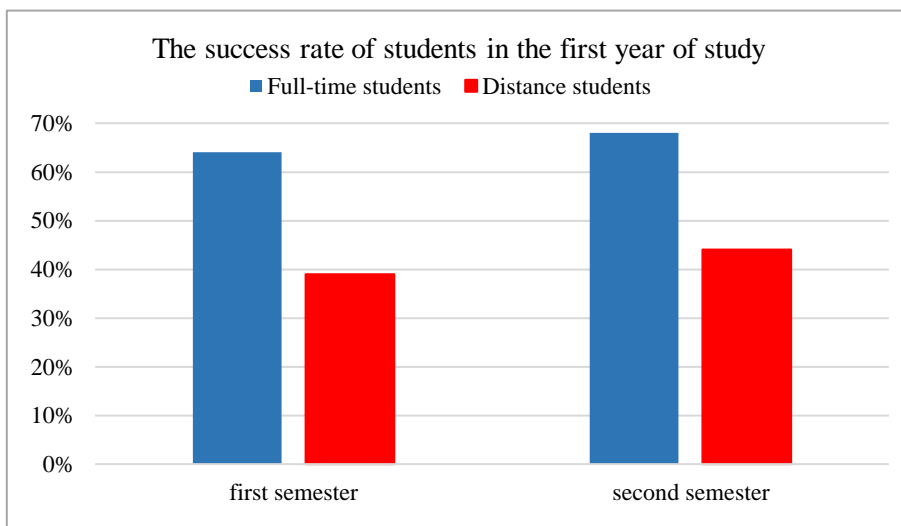


Fig. 4. The success rate of students in the first year

The next graph shows the percentage of students in course Programming in C++. Students typically enroll in this course in the fourth semester. The average of successful students in distance learning is 69% and in full-time study is almost 76%.

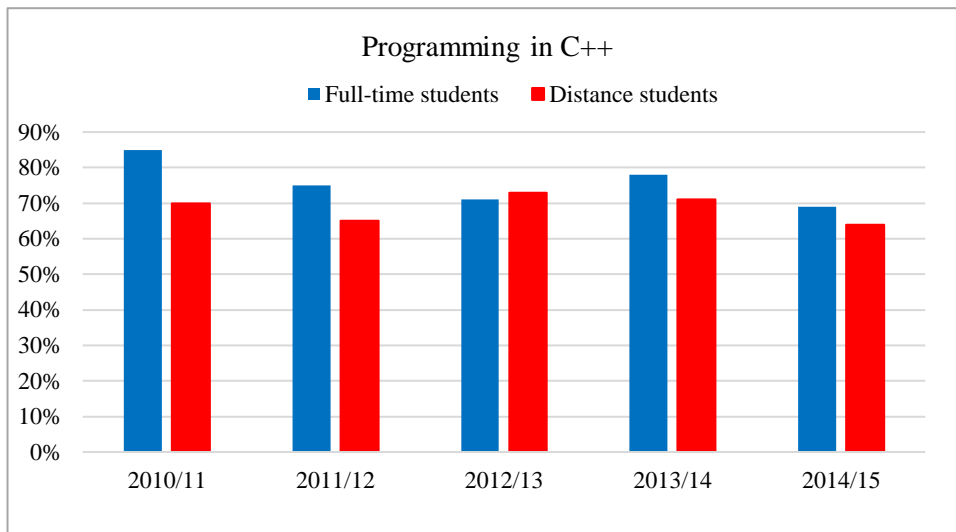


Fig. 5. Successful students in fourth semester

The following graphs show the results of students in courses in 2015. We've compared the results in certain courses of programming. They were courses: Basics of programming (typically first semester), Programming in C (typically third semester) and Object-Oriented Programming (typically third semester). Each student can receive a maximum of 100 points. For the success of the course, he must gain at least 51 points.

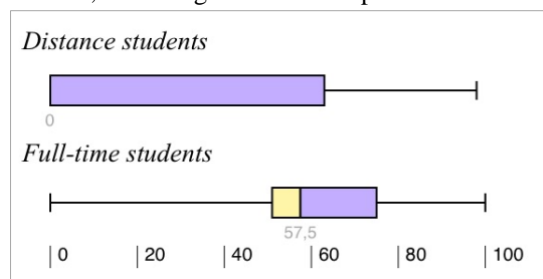


Fig. 6. Successful students in course Basics of programming

<i>t-Test: Two-Sample Assuming Unequal Variances</i>	<i>Distance students</i>	<i>Full-time students</i>
Mean	28,06	54,83
Variance	1366,06	829,06
Observations	52	66
P(T<=t) one-tail	0,00002	
t Critical one-tail	1,66123	
P(T<=t) two-tail	0,00004	
t Critical two-tail	1,98552	

Table 1. t-Test: Two-Sample Assuming Unequal Variances for course Basics of programming

First, we conducted F-test that we ensure that the variances in the two groups are identical. The test showed the great diversity of variances, so we made t-Test: Two-Sample Assuming Unequal Variances. Course Basics of programming: we can reject the null hypothesis based on the results in the table. The average number of full-time students are points higher than for distance learners.

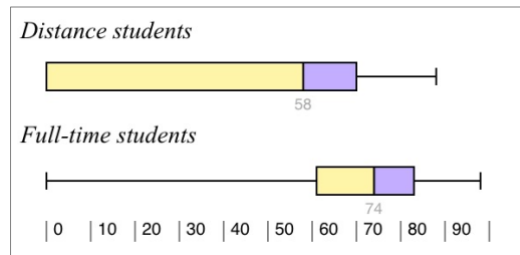


Fig. 7. Successful students in course Programming in C

For courses Programming in C and Object-Oriented Programming F-test confirmed compliance variances. Therefore, was further carried t-Test: Two-Sample Assuming Equal Variances. Course Programming in C: the results show that we reject the null hypothesis. Full-time students had better results than the distance students. In the group of distance learners is the part that received zero or very few points. A large part of distance learners not completed the course.

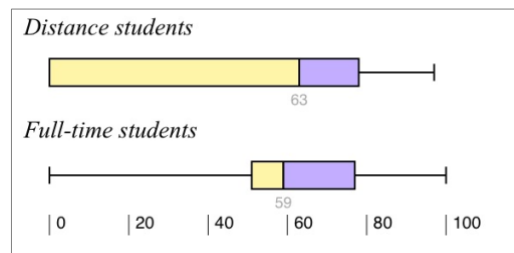


Fig. 8. Successful students in course Object-oriented Programming

<i>t-Test: Two-Sample Assuming Equal Variances</i>	Distance students	Full-time students
Mean	45,79	54,93
Variance	1421,21	880,62
Observations	28	55
P(T<=t) one-tail	0,12	
t Critical one-tail	1,66	
P(T<=t) two-tail	0,23	
t Critical two-tail	1,99	

Table 2. t-Test: Two-Sample Assuming Equal Variances for course Object-Oriented Programming

Course Object-oriented Programming: the results show that it is confirmed null hypothesis. Full-time students had about the same results as distance students. But in the group of the spacer it is also part of students who acquired zero or very few points. Previous results demonstrate the veracity of the hypothesis H1.

3. Conclusion

Teaching programming in distance study brings new problems. The research results show that distance students have worse outcomes than full-time students. Students, especially in the first years of distance learning have significantly poorer success rate than full-time students. Many distance students in the first semester will not come to the exam. It is therefore necessary to improve the quality of studies, offer a quality learning materials and ensure good governance study. To a considerable degree of improvement contributes use electronic conference rate and increase students' activity during the semester. It is advisable to insert solved examples, video tutorials and video lectures into online courses. The most important problem lies in abilities of students to manage their studies. Part of students is unable to plan well-proportioned schedule for learning. They often start to learn at the end of semester before course exam. They are requested to finish successfully several courses and that why they don't have enough time to complete all course requirements and often they fail in the whole study. Nearly 60% of the distance students do not successfully complete the first year. Full-time students are more successful. 66% of full-time students successfully completing the courses. Differences between the groups are small in subsequent semesters.

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