

# Evaluation of test results during online and face-to-face learning

**Abstract:** During last year all universities all around the world had to switch to online teaching. It was a big challenge for teachers as well as students. This paper presents the results of a comparative research of exam results of students during the winter semester 2019, when we taught face-to-face, and the winter semester 2020, when we taught online using MS Teams. The research was conducted on a course of mathematics at Prague University of Economics and Business. The aim of this paper was to determine whether the online teaching and face-to-face teaching had influenced exam results. Despite the many complications at the beginning of the online period, we found out that students had dealt with the situation.

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## Introduction

In this article, we compared results of exams in mathematics in the winter semester 2019 and 2020. We were interested if there would be some differences between scores depending on face-to-face (FTF) or online learning. We focused on students of the Faculty of Informatics and Statistics (FIS) at Prague University of Economics and Business (VŠE) who had to complete the course “Mathematics for Informatics” (MFI). This course is finished by an exam which consists of an oral and a written part.

During a semester, students had to write one test consisting of four problems. In the case of FTF learning, students wrote this test at school, and they could get up to 20 points. During the period of online learning, students wrote this test at home and they uploaded a handwritten solution in MS Teams. In this case, they could get up to 12 points for this test and another 8 points they gained for homework. There is not any lower limit for tests. These points are sum to the points from the final exam. From each part of the final exam (oral, written) can be obtained 40 points. This means that the grand total of score is 100. To pass the exam students need 60 and more points.

## Materials and methods

For testing independence of two categorical variables, we used Chi-square test of independence. We calculated with a contingency table with the dimension 2x2, where we would calculate the strength of association with the coefficient of association. We did the analyses with the significance level 5%. We state the following hypotheses:

$H_0$ : The success rate of students of MFI does not depend on the type of learning (FTF or online).

$H_1$ : The success rate of students of MFI of mathematics depends on the type of learning.

## Results

### Evaluation of the first test

In the winter semester 2019, there were 424 students of MFI course. In the winter semester 2020, there were 478 students enrolled in the course.

In Figure 1, we see how many students received each score in the test in the winter semester 2019 and in Figure 2, there are scores of students in 2020. During the online teaching period students were more successful. The mean value goes up from 11 to 13 and the number of inactive students significantly decreased.

Figure 1: Test evaluation in the winter semester 2019

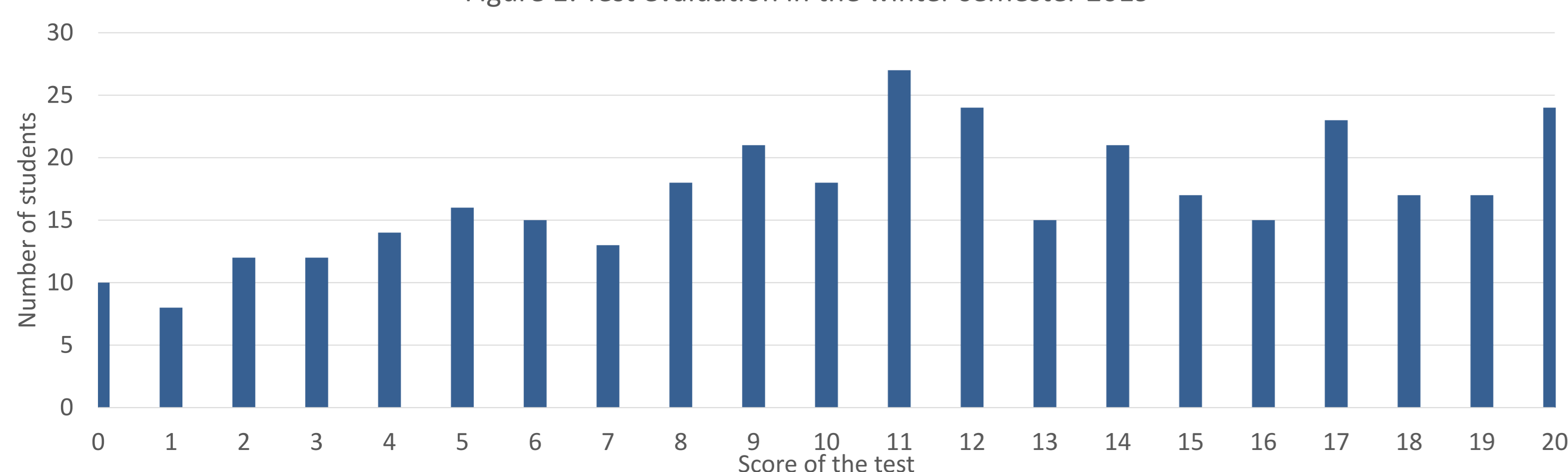
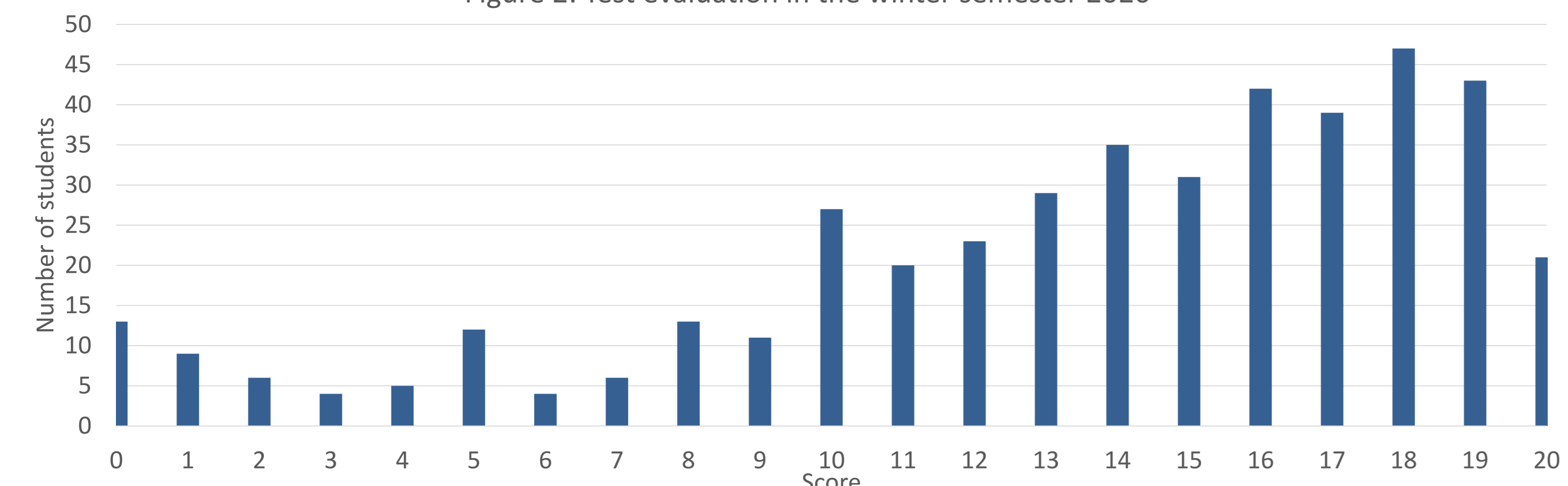


Figure 2: Test evaluation in the winter semester 2020



### Evaluation of the final exam

In 2019, 29% of enrolled students did not try to pass the exam. These students left the university or did not feel confident to pass the exam and did not come to try it. We observe that 19% of active students did not pass the exam. The mean value of the exam was 2.5.

In the winter semester 2020, 15% of all students did not try to pass the exam. Comparing with the last year, the mean value increased slightly to value 2.6.

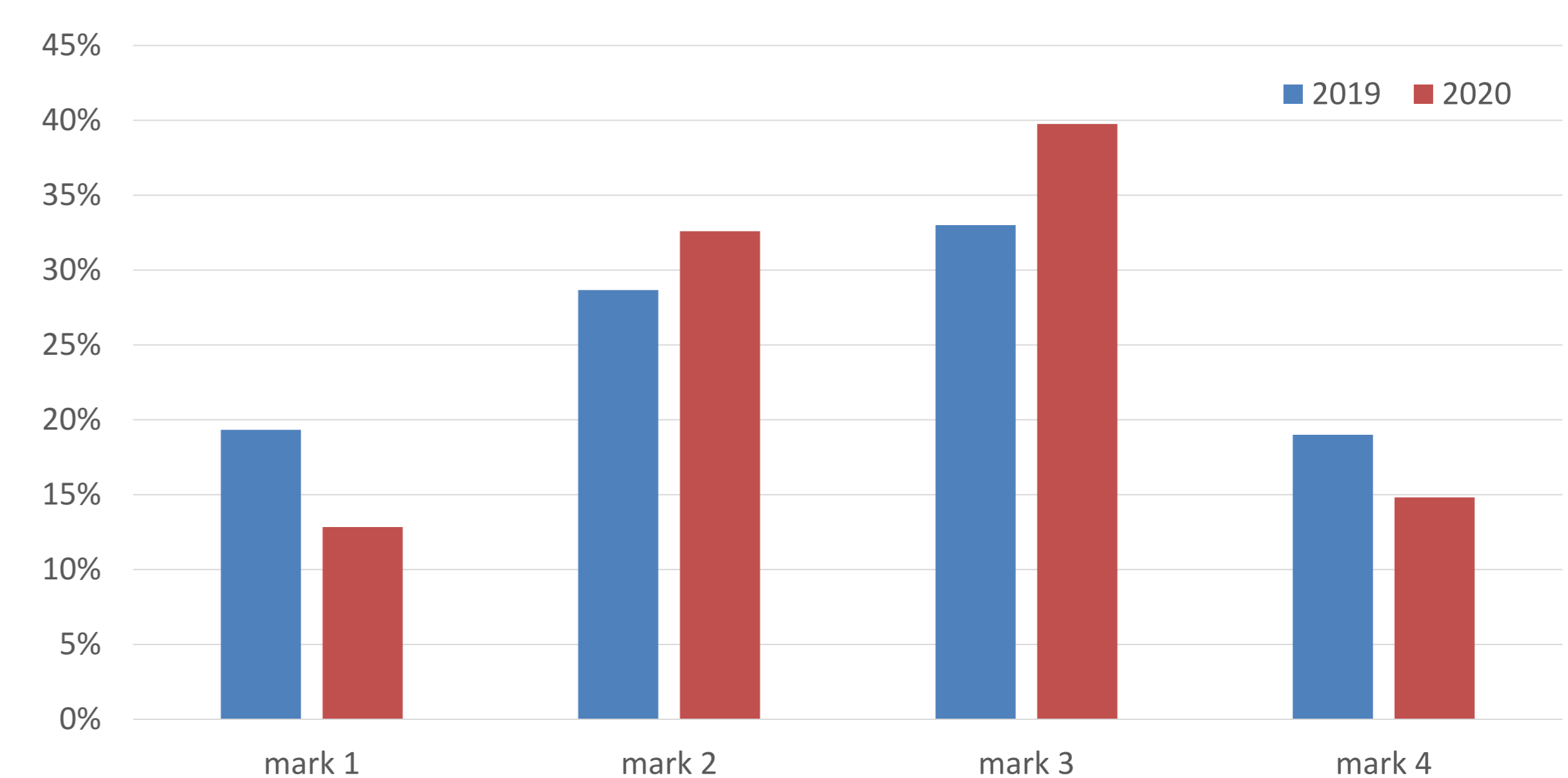
In Table 1, we divided students into successful and unsuccessful groups. Successful students are those who passed the exam with the grade 1-3.

Table 1: Number of successful students during the exams

Number of students	unsuccessful	successful
2019	57	243
2020	60	345

Using the Chi-square test with the significance level 5%, we did not refuse  $H_0$ . The Chi-square critical value for a significance level of 5% is 3.84 and Chi-square test statistic is 2.18. Thus, there were not significant changes of success rate during the winter semester 2019 and 2020. We can see that the distribution of marks was very similar, see Figure 3, and the mean value of marks only slightly increased.

Figure 3: Comparing the evaluation in the winter semester 2019 and 2020



## Conclusion

At the beginning of the winter semester 2020, we were worried whether the online learning would be suitable for students. From above implies that despite the concern, students' success rate did not change. We confirmed that during the online teaching period students were more successful in the first test. In the final exams there were not statistically significant differences. The biggest difference was between numbers of students who did not come to try to pass the exam. It decreased from 29% to 15% of all enrolled students. We think that it was thanks to online learning. We assume that there were more encouraged students who tried to pass the exam. These research results are useful for teachers to assure that there were not any big problems with online learning.

## References

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