

# The effect of common network problems on students' academic performance in an eLearning-Environment <sup>\*</sup>

Lucas Laub<sup>1[6621331]</sup> and Alexander Perekhrest<sup>2[6379748]</sup>

Goethe University Frankfurt, 60323 Frankfurt a. Main, Germany.

**Abstract.** In the current light of the pandemic the worldwide use of eLearning-Software experienced an unprecedented boom. We state the question how common network problems influence the academic performance in an eLearning-Environment. To provide answers an online questionnaire with deliberate technical difficulties was constructed. Evaluating the performance of the test and control group did not show any significant differences.

**Keywords:** eLearning · Online-Learning · academic performance.

## 1 Introduction

When trying to transfer an already existing method on a relatively new platform, it's important to know the things that come with being on such a platform and the possible influences those things might have on the method.

In day-to-day usage of online platforms and services it's not uncommon to face some issues, whether it's execution, connectivity and so on. E-Learning-platforms are not particularly different to those. Therefore, we want to discuss, in this paper, to which extent these problems can influence the test-results of being on such an 'issue-infected' platform in contrast to a well running platform with no issues.

We tried to focus on the most frequent issues we faced in our experience of browsing on different platforms, which are defined by HTTP-status-codes, like 400 (Bad Request), 401 (Unauthorized), 403 (Forbidden), 404 (Not Found), 408 (Request Timeout), as mostly being 'client-errors'.

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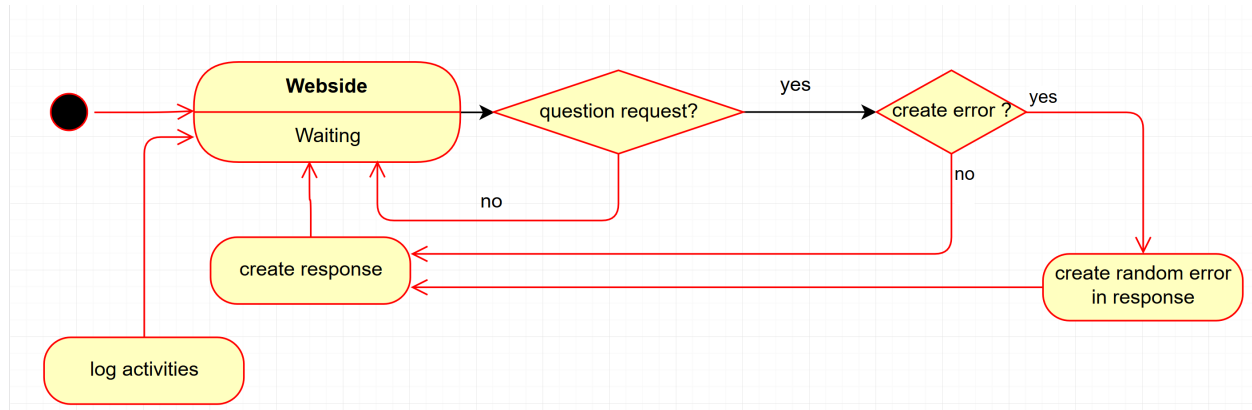
## 2 Materials and Methodes

### 2.1 Participants

The participants are students of the end of the 4 grade and consist of two groups the control group [CG] and the test group [TG]. Each group is made up by 50 girls and 50 boys for a total of 200 participants. It should be ensured that both groups prior to the experiment perform academically similar, if not a comparison post experiment will be difficult. Students of the 5th grade have the benefit of the already finished primary school. Which ensures experience in simple problem solving and reading comprehension. Futhermore in 4th grade we can still observe all academic capabilitys since the division of students happens in 5th grade.

### 2.2 Preperations

The experiment was conducted by creating a software implementing Fig. 1. This software allowed the tracking of *technical problems* introduced by the software itself as well as the points and answers scored by each participant. Additionally a room with an adequat number of computers with a fiber-connection to the server are needed, to rule out uncontrolled network problems. Half of the cumputers are manipulated and simulate the network problems with the use of the software.

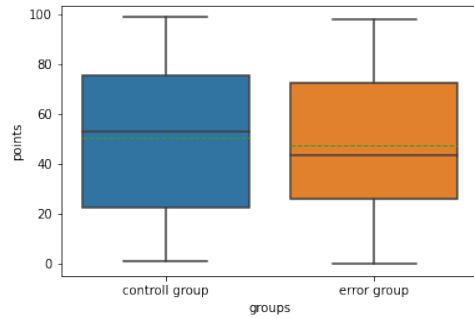


**Fig. 1.** A logic flow chart , representing how an implementation could operate. The black circle is the user interacting with the software. The webside would consist of two parts. A frontend handling user interaction and the creation of *bugs*. The backend responsible for saving the collected data and ensuring the frontend remains operationale.

### 3 Results

The results are displayed in chronological order of the analysis, there is no emphasis on the significance given by the order itself.

#### 3.1 Control Group(50f/50m) vs Error Group(50f/50m)

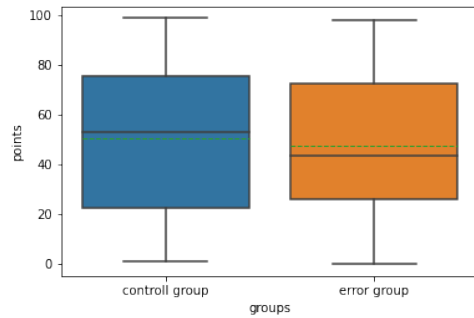


**Fig. 2.** The colored squares in the boxplot display the upper and lower quartile of points earned by the control group (50f/50m) and the error group (50f/50m). The green line marks the mean of all datapoints in the group. The gray line marks the median of the given group.

**Table 1.** The calculated median, standard deviation and t, p-values for the control group (50f/50m) the error group (50f/50m). The t, p-values were calculated by using a two-sided t-test.

	control group	error group
median	53.0	43.5
standard deviation	29.278	29.826
t-value	0.728	
p-value	0.467	

#### 3.2 Control Group(50f) vs Error Group(50f)

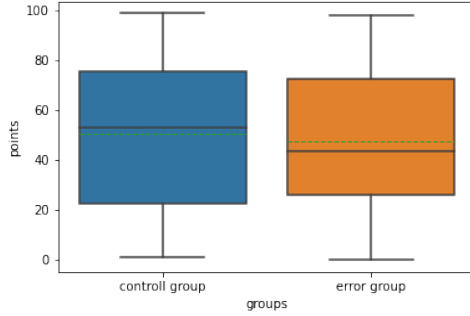


**Fig. 3.** The colored squares in the boxplot display the upper and lower quartile of points earned by the control group (50f) and the error group (50f). The green line marks the mean of all datapoints in the group. The gray line marks the median of the given group.

**Table 2.** The calculated median, standard deviation and t, p-values for the control group (50f) the error group (50f). The t, p-values were calculated by using a two-sided t-test.

	control group	error group
median	55.5	40.0
standard deviation	27.85	30.933
t-value	0.949	
p-value	0.345	

### 3.3 Control Group(50m) vs Error Group(50m)

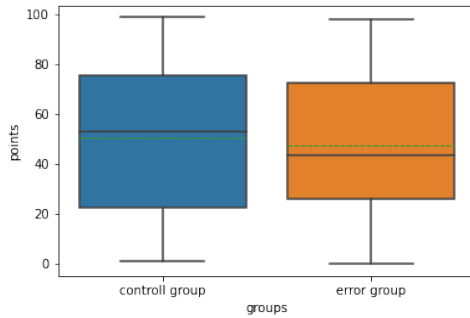


**Fig. 4.** The colored squares in the boxplot displays the upper and lower quartile of points earned by the control group (50m) and the error group (50m). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

**Table 3.** The calculated median, standart deviation and t, p-values for the control group (50m) the error group (50m). The t,p-values were calculated by using a two-sided t-test.

	control group	error group
median	52.5	50.5
standart deviation	30.638	28.495
t-value	0.08	
p-value	0.936	

### 3.4 Control Group(50f) vs Control Group(50m)

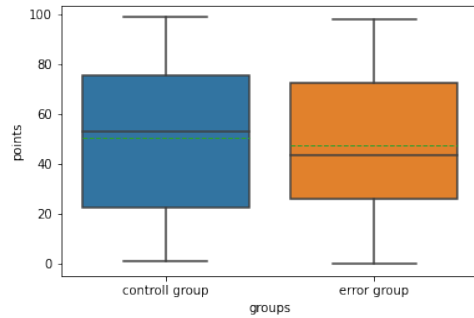


**Fig. 5.** The colored squares in the boxplot displays the upper and lower quartile of points earned by the control group (50f) and the control group (50m). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

**Table 4.** The calculated median, standart deviation and t, p-values for the control group (50f) the control group (50m). The t,p-values were calculated by using a two-sided t-test.

	control group(f)	control group(m)
median	55.5	52.5
standart deviation	27.85	30.638
t-value	0.101	
p-value	0.919	

### 3.5 Error Group(50f) vs Error Group(50m)

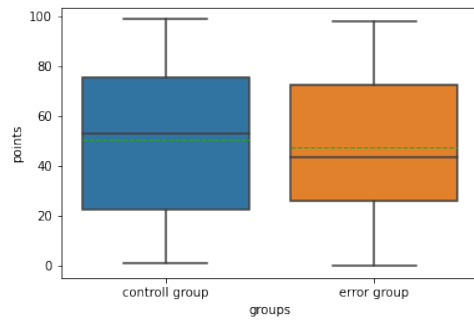


**Fig. 6.** The colored squares in the boxplot displays the upper and lower quartile of points earned by the error group (50f) and the error group (50m). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

**Table 5.** The calculated median, standard deviation and t, p-values for the error group (50f) the error group (50m). The t, p-values were calculated by using a two-sided t-test.

	error group	error group
median	40.0	50.5
standard deviation	30.933	28.495
t-value	- 0.759	
p-value	0.45	

### 3.6 Control Group(50f) vs Error Group(50m)

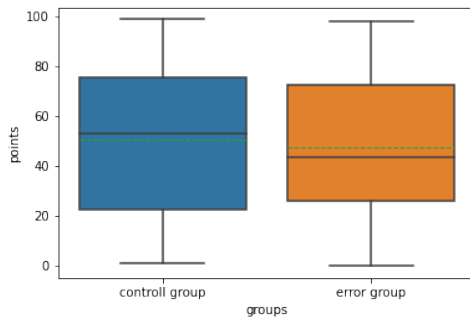


**Fig. 7.** The colored squares in the boxplot displays the upper and lower quartile of points earned by the control group (50f) and the error group (50m). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

**Table 6.** The calculated median, standard deviation and t, p-values for the control group (50f) the error group (50m). The t, p-values were calculated by using a two-sided t-test.

	control group	error group
median	55.5	50.5
standard deviation	27.85	28.495
t-value	0.19	
p-value	0.85	

### 3.7 Control Group(50m) vs Error Group(50f)



**Fig. 8.** The colored squares in the boxplot displays the upper and lower quartile of points earned by the control group (50m) and the error group (50f). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

**Table 7.** The calculated median, standart deviation and t, p-values for the control group (50m) the error group (50f). The t,p-values were calculated by using a two-sided t-test.

	control group	error group
median	52.5	40.0
standart deviation	30.638	30.933
t-value	0.81	
p-value	0.42	

## 4 Discussion

The collected data is very clear. Network problems do not affect students academic performance in a statistically firm manner.

The results can not be transposed on younger students. Since younger students might be unable to read properly or lack experience with problem solving in general. Futhermore can the data not be used to make an estimate for students with disabilities. However the performance of older students should be similar to the tested students.

The study can make a general statement on network problems. However not all possible problems are simulated. It is possible that a problem exists that does affect the academic performance of students significantly. Futhermore designflaws of the eLearning-Environment or limited to no access to a computer are problems that are overlooked or ignored. These problems require additional studys.

## 5 Conclusion

## 6 Refernces