

The effect of common network problems on students academic performance in an elearning-Environment ^{*}

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Abstract. In the current light of the pandemic the worldwide use of eLearning-Software experienced an unrepresented 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 focused on common network issues. 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'.

2 Materials and Methods

2.1 Summary

To which extend do common networks problems in an eLearning-Environment influence the academic performance of students. This information can be used to re-evaluate the eLearning-Environment.

2.2 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 end of the 4th grade have the benefit of the already finished primary school. Which ensures experience in simple problem solving and reading comprehension. Furthermore in 4th grade we can still observe all academic capabilities since the division of students happens in 5th grade. Also primary school has the least differences in the curriculum between the federal states.

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2.3 Preparations

The experiment was conducted by creating a software implementing Fig. 1. This software[1] allowed the tracking of *technical problems* introduced by the software itself as well as the points and answers scored by each participant. A maximum of 100 points could be scored, these were needed to evaluate the performance of the students. Anymore name, gender, age, email, username and password were collected. These parameters were used to identify students and for further analysis. Other solutions which involved already existing software-suits were abandon due to lack of customization. Additionally a room with an adequate number of computers with a fiber-connection to the server are needed, to rule out uncontrolled network problems. Half of the computers are manipulated and simulate the network problems with the use of the software.

2.4 Procedure

The participants are welcomed and thanked for their time. The students were randomly selected for either the control group or the test group prospective known as the error group. Then the students where placed in front of a computer which was either manipulated or untouched based on their group. They then create an account and start solving the questions. After they finished all questions they log out. The students are rewarded with cookies and again thanked for their time.

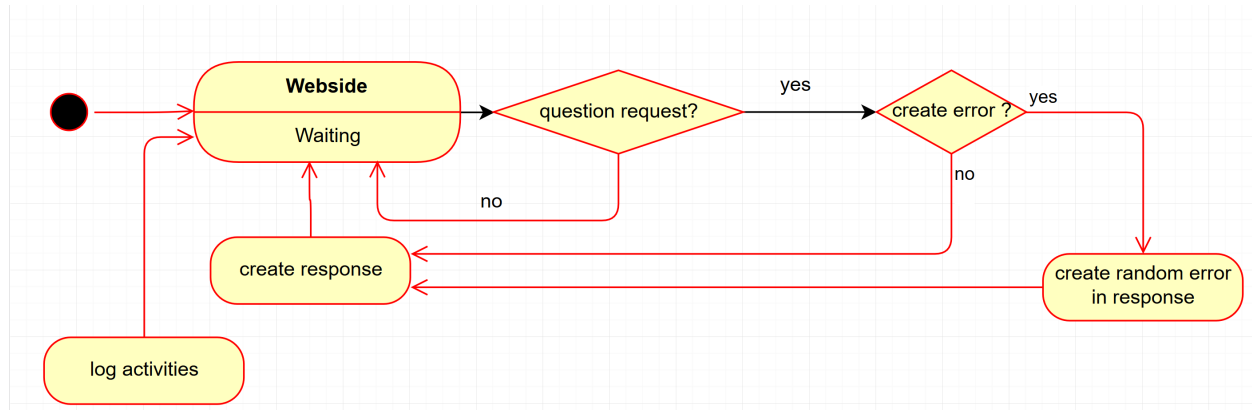


Fig. 1. A logic flow chart , representing how an implementation could operate. The black circle is the user interacting with the software. The website would consist of two parts. A front-end handling user interaction and the creation of *bugs*. The back-end responsible for saving the collected data and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

3 Results

The results are displayed in chronological order of the analysis, there is no emphasis on the significance given by the order itself. The following data is what we would expect in an actual experiment. To recreate the data see [1].

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

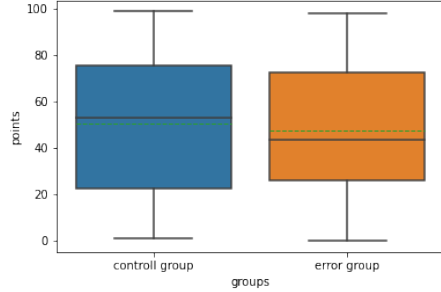


Fig. 2. The colored squares in the box-plot displays the upper and lower quartile of points earned by the control group (50f/50m) and the error group (50f/50m). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

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)

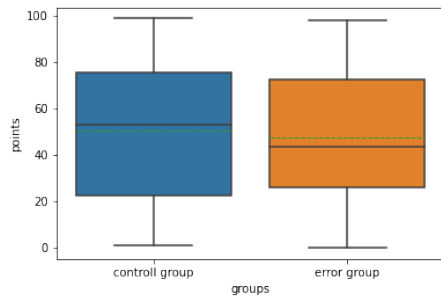


Fig. 3. The colored squares in the box-plot displays the upper and lower quartile of points earned by the control group (50f) and the error group (50f). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

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)

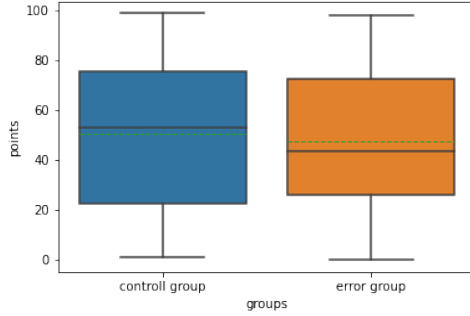


Fig. 4. The colored squares in the box-plot displays the upper and lower quartile of points earned by the control group (50m) and the error group (50m). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

Table 3. The calculated median, standard 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
standard deviation	30.638	28.495
t-value	0.08	
p-value	0.936	

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

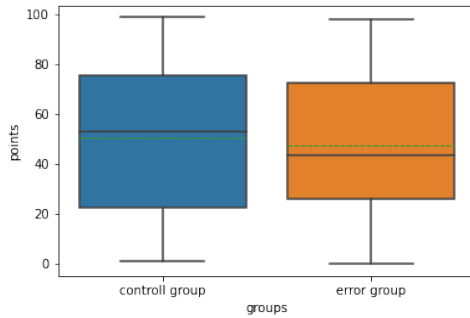


Fig. 5. The colored squares in the box-plot displays the upper and lower quartile of points earned by the control group (50f) and the control group (50m). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

Table 4. The calculated median, standard 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
standard deviation	27.85	30.638
t-value	0.101	
p-value	0.919	

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

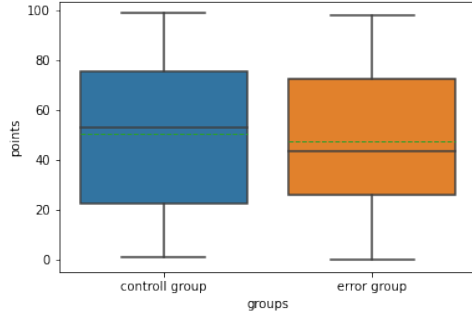


Fig. 6. The colored squares in the box-plot displays the upper and lower quartile of points earned by the error group (50f) and the error group (50m). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

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)

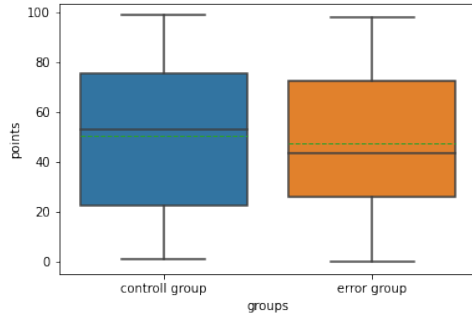


Fig. 7. The colored squares in the box-plot displays the upper and lower quartile of points earned by the control group (50f) and the error group (50m). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

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)

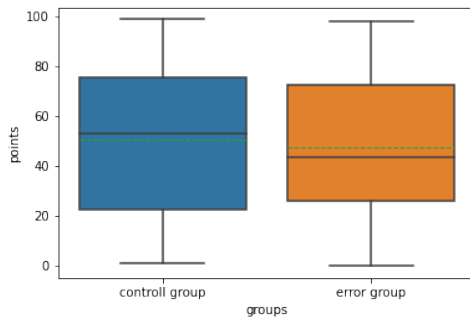


Fig. 8. The colored squares in the box-plot displays the upper and lower quartile of points earned by the control group (50m) and the error group (50f). The green line marks the mean of all data-points in the group. The gray line marks the median of the given group.

Table 7. The calculated median, standard 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
standard 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. Furthermore 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. Also long-term effects can not be discovered by this study since it is very time limited. Furthermore design-flaws of the eLearning-Environment are also overlooked or ignored. These problems require additional studies.

5 Conclusion

In this paper we could clearly see the impact of platform-issues on the students performance in an exam-scenario and it is not significant. There might still be certain aspect of long-term-effects, which we couldn't simulate due to our test setup, because there was a slight worsening happening when comparing our outcomes. Further studies should focus on the long-term effect of technical problems to deepen our understanding of the technology.

6 References

References

1. Github, <https://github.com/UebeI2lauf/insertcreativeName/tree/main/code>. Last accessed 8 Jul 2021