The influence of using e-learning tools on the results of students at the tests

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Abstract

The paper describes the e-learning tools introduced to enlarge the range of background studying tools for students in the obligatory course Law basics at the University of Economics, Prague. Furthermore the paper analyses the influence of introducing e-learning tools on the results of students at the progress test of this course. The analysis compares the results of questions from the area of law where the tool was provided in a pilot version with the results of questions, where the e-learning tool was not provided. The results from the previous year, when the e-learning tool was not available at all are examined and compared too. We expect the positive influence of using e-learning tools on the results of students would be confirmed and if yes we will continue in further e-learning tools development.

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1. Introduction

The University of Economics, Prague (UEP) is the biggest public university of economics in the Czech Republic. Students of all branches of economics studies at the UEP are acquainted at least with basic principles of law in general and with the main principles of the commercial law in the course Law basics.

This course is assured by the Department of Business and European Law and is obligatory for all students of the UEP. The course is attended by approximately more than 2 000 students per academic year. The main aim of this course is to provide students with necessary basic knowledge of law especially in the field of the theory of law, theory of state, civil law and main principals of contract law. Special focus is put on business law at the national and also European level.

This knowledge is necessary for further consecutive courses in all study programs at UEP and should be useful for students after finishing their studies at their work and also in a daily life.

The knowledge of students is checked at final oral examination. To successfully pass the course students should be acquainted with basic terms of theory of law; they should identify the applicable legal provisions, know the basic types of contracts, determine the differences among types of business companies and identify the conditions for liability and the consequences of breaching obligations.

To ensure the high level of standard and the highest possible benefit of the course for students any possible improvements are constantly considered. One of the improvements was the introduction of the system of progress testing of students which is done by computerized tests in the mid-term and at the end of the course. In case of failing one of the tests students are enabled to resit the test once. When failing both of the tests or when failing the resitting test the student fails the whole course and has to repeat it following semester.

The computerized method of progress testing of students helps the lecturers to continuously analyse the results of students at progress tests and at final exams at the same time. It also enables the lecturers to gain other useful
data for further analysis of problematic issues, parts of the course, misleading questions or differences among particular lecturers.

One of the improvements the lecturers would like to introduce as well is to provide students an e-learning tool that would enable them to continuously check their knowledge after each lecture, to better understand each topic and to better prepare themselves for progress tests and final exam.

Provided e-learning materials should also help students to deal with the impacts of the process of recodification of private law in the Czech Republic which has been effective since 1st January 2014. The old Civil Code and the Commercial Code were derogated and replaced by the new Civil Code and the Companies Act. New legal regulation has brought many changes having direct impact on many areas of Czech private law especially on entrepreneurs because business law was the area with the most significant changes. The new Civil Code regulation has also unified the main principles of law of obligations which were unclearly spread both in the old Civil Code and the Commercial Code till the end of 2013.

It is necessary to deal besides other things with fundamental changes concerning Czech Limited Liability Company (s r. o.) and Public Limited Company (a. s.) new rules for company’s statutory body members or dissolution of corporations as legal entities especially regarding the differences between the new and old legislations.

E-learning materials could therefore help students better understand the consequences of mentioned legal changes and their impacts.

The e-learning tool was elaborated and provided to students in pilot version in previous semester only in certain topics (areas of law) that are presented to students during the course.

The analyses of results of students at progress computerised tests in case of the set of questions concerning these areas and in case of questions from the areas that were not covered by the e-learning tool and their in-depth comparison are discussed further in the article. The elaboration of e-learning materials for all lectured topics will be decided based on the results of the research. The differences in particular types of questions which are included in the computerised test will be also analysed and discussed.

2. Literature Review / Research rationale

In the literature there exist many studies which examine the influence of provision the e-learning tools to the results of students.

Fatih Baris and Tosun described the influence of using e-tools in the education process at the high school and concluded the positive influence of this tool on students.

Heath described the benefits and also disadvantages of creating and developing of electronic portfolios which could be used for different purposes.

Horovčák et al. conclude that electronic version of testing presents modern and effective form of feedback from students to teacher and that electronic testing has its own unique place in the whole education process.

Stanescu et al. also prove the advantages of an e-learning tool that permits generation of questions from the certain base of question defined previously.

Viciana et al. describe a computerized system that allows researchers creating, applying and tabulating surveys and paper instruments in an automatized way and consider them as a useful tool since it permits to input data with higher precision and no need for previous codifications.

Dindar et al. also describe the role of multimedia in education and in testing of students.

Deep research of using multiple choices testing at entrance exam for University of Economics in mathematics which is also computerized was conducted by Klůfa who perceives multiple choices testing as optimal and objective for entrance examinations at University of Economics, Prague.

3. The context of the study and the research questions

The main aim of the paper is to analyse the data available from computerized system of testing of students in the obligatory course Law basics before and after providing the e-learning tool for them in some areas of lectured topics and to verify if the provision of the tool has had some impact on the results of students at the progress tests. For this purpose the essay shall discusses following hypothesis at first.

H1: The provision of the e-learning tool has got a positive impact on the correctness of answers of students at the progress test.

When providing the e-learning materials for students only in some areas of lectured topics we presume that students could rely on provided materials and will concentrate primarily on these topics and their results in questions from other topics will therefore tend to get worse. To analyse this presumption following research hypothesis is discussed:
H2: The provision of the e-learning tool only in some areas of lectured topics has got a negative influence on results of students in case of questions from the areas of law where the tool was not provided.

To verify the influence of the provision of the e-learning tool it is also necessary to compare the results of students in case of questions from the area of law where the tool was provided in a pilot version with the results of students in case of questions, where the e-learning tool was not provided. In this context we pose following research hypothesis.

H3: The differences in correctness of answers of students in areas where the e-learning tool was provided are more positive than the differences in correctness of answers of students in areas where the e-learning tool was not provided.

To confirm and validate the findings of the analyses and exclude other influences we would also like to verify the results by comparing them with the control sample results from the previous year when the e-learning tool was not available. For this purpose the last two hypotheses are brought up.

H4a: We presume that the differences of average correctness of answers at regular test and at the resitting test from last year when the e-learning tool was not available are not significant.

H4b: The differences in correctness of answers of students in areas where the e-learning tool was provided are more positive than the differences in correctness of answers of students at the test from the previous year.

4. Changes in the correctness of answers after additional study materials were provided

After above mentioned considerable changes of Czech legislation which has been effective since 1st January 2014 the content of lectures of the course Law basics had to be revised and the content of the lectures deeply modified and adapted to new recodified legislation. Together with this the question base of the computerised progress testing had been examined and largely revised too.

After the changes were applied the results of students got significantly worse and many of them failed especially the second progress test, which is focused mainly on business law. The e-learning tool was therefore prepared afterwards and provided to students before the resitting test.

The research was carried out afterwards by analysing the data collected from the results of all students at the second (regular) progress test and from all students at the resitting second test, when the e-learning tool was available. In the pilot version the e-learning tool was available for topics covering 153 questions out of 447 questions in total. For each question of the test the correctness rate at the regular test and at the resitting test was examined. Afterwards the correctness of answers on each question from regular test was deducted from the correctness of answers on each question at resitting test.

Table 1 describes the analysis of results from part of the test where the e-learning tool was available in pilot version. This part covered 153 questions which were distributed into three categories according to the type of the question (choice question with one correct answer, choice question with multiple correct answers and open question) and for each type of question the average correctness of answers before introducing the e-learning tool (at the regular test) and after (at the resitting test) and its differences were examined.

<table>
<thead>
<tr>
<th>Type of question</th>
<th>Number of questions where the tool was available</th>
<th>Average correctness of answers before tool was provided (%)</th>
<th>Average correctness of answers after tool was provided (%)</th>
<th>Difference in average correctness (percent points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice with one correct answer</td>
<td>71</td>
<td>48.63</td>
<td>67.46</td>
<td>18.83</td>
</tr>
<tr>
<td>Choice with multiple correct answers</td>
<td>54</td>
<td>33.01</td>
<td>53.13</td>
<td>20.13</td>
</tr>
<tr>
<td>Open question</td>
<td>28</td>
<td>47.61</td>
<td>67.03</td>
<td>19.42</td>
</tr>
<tr>
<td>Total</td>
<td>153</td>
<td>43.10</td>
<td>62.33</td>
<td>19.23</td>
</tr>
</tbody>
</table>

Derived from Table 1 we can see that average correctness of answers differs for each type of question and especially at choice questions with multiple correct answers which are more difficult to answer the average correctness was around 33 % before the tool was provided. Despite this fact we can see that after the provision of the tool the average correctness of answers increased in average by around 20 percent points at each type of question. As a result of findings as described above we can confirm H1 and state that the provision of the e-learning tool to students helped to increase the average correctness of answers at the test from 43.10 % to 62.33 % and the average correctness grew by 19.23 % percent points.
5. Changes in the correctness of answers in case the additional study materials were not provided

We presume that the provision of the e-learning materials only in some areas of the course could have caused negative impact on the correctness of answers on questions from the other areas where the e-learning tool was not provided. We have therefore decided to deeply examine also the answers on this part of questions, (294 questions out of 447 questions in total) in Table 2.

<table>
<thead>
<tr>
<th>Type of question</th>
<th>Number of questions where the tool was not available</th>
<th>Average correctness of answers at regular test (%)</th>
<th>Average correctness of answers at resitting test (%)</th>
<th>Difference in average correctness (percent points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice with one correct answer</td>
<td>115</td>
<td>52.56</td>
<td>51.41</td>
<td>-1.15</td>
</tr>
<tr>
<td>Choice with multiple correct answers</td>
<td>163</td>
<td>30.70</td>
<td>39.96</td>
<td>9.25</td>
</tr>
<tr>
<td>Open question</td>
<td>16</td>
<td>41.50</td>
<td>60.13</td>
<td>18.62</td>
</tr>
<tr>
<td>Total</td>
<td>294</td>
<td>39.88</td>
<td>45.53</td>
<td>5.66</td>
</tr>
</tbody>
</table>

The Table 2 describes the comparison of results at regular the test and at the resitting test. In this case, where the e-learning tool was not provided the results of students did not get worse. The average correctness of answers in case of this set of questions increased from 39.88 % to 45.53 % and the average of correctness grew by 5.66 percent points. Partial results are slightly negative in case of choice question with one correct answer (difference is minus 1.15 percent points) on the other hand the results are quite positive at open question (increase by 18.62 percent points).

We can conclude that students underestimate a little their situation before the resitting test at the choice questions with one correct answer but in general we can conclude and reject the H2. The provision of the e-learning tool only in some areas of lectured topics did not have a negative influence on the results of students in case of questions from the areas where the tool was not provided.

6. Comparison of the correctness of answers on questions with and without study materials provided

To deeply analyse the influence of introducing the e-learning tool we would like to compare the results of students in case of questions from the lectured topics where the tool was provided in a pilot version with the results in case of questions, where the e-learning tool was not provided as it is shown in Table 3.

<table>
<thead>
<tr>
<th>Type of question</th>
<th>Difference in average correctness of answers on questions with the tool (percent points)</th>
<th>Difference in average correctness of answers on questions without the tool (percent points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice with one correct answer</td>
<td>18.83</td>
<td>-1.15</td>
</tr>
<tr>
<td>Choice with multiple correct answers</td>
<td>20.13</td>
<td>9.25</td>
</tr>
<tr>
<td>Open question</td>
<td>19.42</td>
<td>18.62</td>
</tr>
<tr>
<td>Total</td>
<td>19.23</td>
<td>5.66</td>
</tr>
</tbody>
</table>

Results summarised in Table 3 confirm that the positive difference of average correctness of answers on questions where the e-learning tool was subsequently provided is higher than on questions where the tool was not available. Only in case of open questions the correctness comparing regular and resitting test increased regardless the provision of the e-learning tool. Students probably concentrate on this type of questions before the resitting tests more, because this type of question is the most difficult to answer.

Summarizing the results we can confirm our presumption at H3. The average correctness grew by 19.23 percent points in case of questions included in the e-learning tool and by 5.66 in case of questions not covered by the materials when comparing the regular and resitting test.

7. Verification of the changes in the correctness of answers comparing the results from the previous year

To verify the data gained by previous analyses we would like to exclude other possible factors that could influence the differences in average correctness at regular test and resiting test. We are therefore going to compare the data with the control sample of results of students from the previous year (2013) when the e-learning tool was not available. We presume that the differences of average correctness of answers at regular test and at the resitting test from last year would not be significant. At the same time we presume that when comparing the difference of average correctness of answers on questions after the provision of the e-learning tool this year and
the differences of average correctness of answers at regular test and at the resitting test from last year the positive influence of the e-learning tool will be confirmed.

**Table 4** Comparison of difference in average correctness of answers with results from the previous year

<table>
<thead>
<tr>
<th>Type of question</th>
<th>Number of relevant questions 2013</th>
<th>Average correctness of answers regular test 2013 (%)</th>
<th>Average correctness of answers resitting test 2013 (%)</th>
<th>Difference in average correctness of answers 2013 (percent points)</th>
<th>Difference in average correctness of questions with the tool 2014 (percent points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice with one correct answer</td>
<td>35</td>
<td>67.00</td>
<td>66.13</td>
<td>-0.87</td>
<td>18.83</td>
</tr>
<tr>
<td>Choice with multiple correct answers</td>
<td>62</td>
<td>46.23</td>
<td>43.34</td>
<td>-2.90</td>
<td>20.13</td>
</tr>
<tr>
<td>Open question</td>
<td>2</td>
<td>72.97</td>
<td>71.43</td>
<td>-1.54</td>
<td>19.42</td>
</tr>
<tr>
<td>Total</td>
<td>99</td>
<td>54.11</td>
<td>51.96</td>
<td>-2.15</td>
<td>19.23</td>
</tr>
</tbody>
</table>

As indicated in the Table 4 differences in average correctness of regular and resitting test were slightly negative in previous year and the average correctness was almost the same at both tests and at each type of question. We can therefore confirm hypothesis H4a and conclude that there are no other influences that could affect the differences in average correctness at regular test and resitting test.

We can also confirm the hypothesis H4b and state that the positive impact of provision of the e-learning tool is relevant also in this case.

At the same time we can see that the average correctness of answers was notably higher last year which confirms our presumption that the tests were further more demanding this year due to the significant changes in legislation but this question was not the subject of our research.

**8. Limitations**

The presented study has also some limitations. The e-learning tool was provided in the course of the semester before the resitting test. In the study the results of regular and resitting test are compared and the correctness rate between these tests could differ. Based on the comparison of correctness rate on the control sample from previous year this limitation was disproved.

The research was influenced by above mentioned fundamental legislative changes which caused that large part of question base had to be changed. When comparing the data from current year with the data from previous year only the questions which remain were included. Despite this fact we consider the scope of the research and the number of questions as sufficient.

The provision of supplementary study materials in the course of the semester before the resitting test we do not consider as entirely convenient and students passing the resitting test got an advantage than the students who successfully passed the regular test before. The e-learning tool was provided only in pilot version and only for part of the topics presented at the course on the other hand. The main aim of its provision was to help students to overcome the difficult situation of legislative changes. The results of pilot version of provided tool are further examined and the outcomes will be used in favour for future students. For the following semester the e-learning materials is planned to be provided for all topics and in a sufficient advance.

**9. Conclusion**

We have discussed all research hypotheses questions posed in the paper. We can conclude that the e-learning tool was successfully introduced into the Law Basics course in the pilot version. The research confirmed that the provision of the e-learning tool for students has got positive influence on their results at progress test. At the same time the presumption that provision of the e-learning tool could have a negative impact on students who will rely only on this materials was disproved. The results of the research were confirmed by analysing the data also on control sample from previous year where it was proved, that the correctness rate did not change at all without providing the e-learning tool.

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