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Impacts of Moodle on electrical engineering courses: opportunities and challenges

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Abstract: *Paper explores the influence of Moodle learning platform on the learning process of electrical engineering courses at University 'Goce Delcev' and makes the comparison between obtained results at several courses when Moodle was implemented as learning tool and not. The paper analysis based on survey results and data processing by statistical software package SPSS17, proved that transformation of teaching methods at high education institutions by implementing e-learning methods is going into right direction resulting in improved quality of learning and student satisfaction.*

Keywords: *e-learning, Moodle, University 'Goce Delcev'*

1. Introduction

During recent years, e-learning platforms as a part of Learning Management System (LMS) are becoming increasingly sophisticated by showing potential as an effective way of improving the learning process. Conducted researches in the last quarter of 2010 indicate that LMS market has settled around five products: Moodle, Sakai, Blackboard, Desire2Learn and eCollege. Some of these products are commercial while others are considered as open source software. Sometimes the open source software is misunderstood as 'free' software. To comply with open source license, the code must not only be free, but others must be given the right to modify and redistribute it for free. Choosing the right e-learning platform is a responsible and challenging task. In 2008 introduction of e-learning platform at University 'Goce Delcev' was a pilot project and decision was made to be implemented as open source software. Reasons behind this decision were several: low financial costs, system flexibility and expandability, low financial risk in case of failure of the whole project, possibility to use the already employed personal in IT department for software maintaining and administration. In higher education, Moodle's reputation also stems from the academic community's values of freedom, peer review, and knowledge sharing. Supporters say that Moodle helps educators create an effective collaborative online-learning community using sound pedagogical principles for a very low cost [1]. You can easily and quickly install it, it can scale up to accommodate a large user base, and it provides typical LMS features

present in most similar commercial products. Moodle updates are common, the development community is very supportive, and its universal use is providing reliable learning solutions. All above mentioned advantages of Moodle have largely contributed towards its implementation as an e-learning platform at University 'Goce Delcev' and consequently at Electrotechnical Faculty.

2. Advantages and disadvantages of IT technology supported learning

E-learning platforms have transformed the ways the teachers teach and students learn. E-learning can be used as supportive instrument with blended learning or as a minimum instrument in distance learning. But in both cases learning resources must be interactive as need for interaction is one of the basic pedagogical principles and the domination of non-interactive resources is not helping in achieving good learning outcomes [2]. This transition of teaching methods had made it possible students to take part in the learning process, while the role of the teacher is that of "conductor" orchestrating and guiding students in education. Within this project, university professors have to modify the subjects and methodology involved in teaching/learning. In the process of realization of electrical engineering courses, we approach to the e-learning method developed in the following way:

- We created electronic courses, consisted of attached lectures and exercises as basic learning materials, supplementary materials, scripts, a collection of exercises and electronic books. The courses enable papers and homework to be attached.
- Computer exercises where simulation software is used for simulation of operation of electronic circuits are published as electronic workbooks attached in the electronic courses where each exercises can be prepared in advance by the student from theoretical point of view and results can be written and recorded in the workbook during simulation classes. One example of simulation exercise of diode rectifier and obtained results is presented on Fig.1.
- Speed of communication between professors, collaborates and students increased through the use of tools for collaboration and communication, setting up discussions forums etc…

In the process of transformation of lecturing we observed the following benefits:

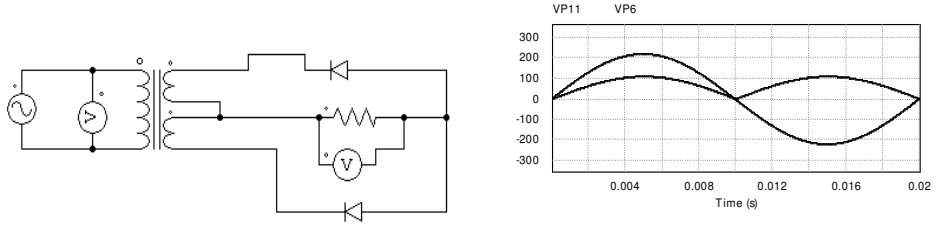
- Lecturing materials as well as electronic books were available to students at any time free of charge.
- The students are not forced to 'take' notes at lectures and exercises and they can become active participants in teaching process.

- In learning process communication with other participants is possible without physically meeting them which saves time and money.

In this process we met some difficulties in following nature:

- Using e-learning requires basic knowledge and computer skills. Without basic computer literacy, e-learning would be difficult. It is necessary to posses adequate computer equipment because the slightest technical problem will affect the student's concentration [3].

- E-learning requires student's greater responsibility. Students should by themselves estimate how much time they need for learning certain contents and they should motive themselves.



a) Circuit diagram b) Result from exercise

Fig.1 Example of rectifier circuit exercise implemented in Moodle platoform

7. 3. RESEARCH METHODOLOGY AND ANALYSIS OF RESEARCH RESULTS

First part of the study adopted a survey research approach. The research utilized questionnaire conducted among fifty one students at Electrotechnical faculty. Thirty one students were students of the final fourth year of study, fifteen were students of third year and five were students of second year. Purpose of the survey was to gather students response regarding several important issues related to implementation of web based e-learning: e-learning usage by the students, improvement of quality of learning process, faster and more reliable accesses to all relevant course information due to e-learning courses and influence of e-learning to achieved study results. Survey has given an insight in student opinion and their acceptance of e-learning as a supporting tool of traditional classroom learning. Second part of the study is based on the analysis of obtained achievements of students in February exam term for year 2012 regarding subject 'Circuits analysis' when the lecturing was realized with classical teaching methods compared to achievements of students in February exam term for year 2013 for the same subject when lecturing was supported by e-learning. Data processing is done by statistic package SPSS 17.

In Table 1 are presented results of conducted survey regarding use of e-learning by the students. Presented results are clearly pointing out that all

participants in the survey 51 are using Moodle (100 %). There is no record that Moodle is not used by the students. Evidently, Moodle is very popular among the students and they have adopted it very easily. Further investigation in survey was focused on impact of e-courses and e-learning on quality of studying, achieved results and improved means of gathering all relevant information. In Table 2 are presented results of the survey regarding improved access to all relevant information from student's point of view.

Table 1. Moodle use

		Frequency	Percent	Valid Percent	Cum. percent
Valid	YES	51	100	100	100
	NO	0	0	0	0
	Never heard about e-learning	0	0	0	0
	TOTAL	51	100	100	100

Table 2. Faster access to all relevant information due to e-learning

		Frequency	Percent	Valid Percent	Cumulative percent
Valid	YES	49	96,078	96,078	96,078
	NO	1	1,96	1,96	98,038
	No opinion	1	1,96	1,96	100
	TOTAL	51	100	100	

According to the further survey results 78% of students confirmed that e-courses have positive influence to quality of learning and achieved results. Second part of the research is devoted to analysis of the data obtained from exams in February exam term at two different years 2012 and 2013 for subject 'Circuit analysis' when there was not e-learning course as a supporting tool to classical learning method and when there was a e-learning course respectively. Results from the exam in year 2012 are presented in Tables 4 and 5 and for the year 2013 in Tables 6 and 7 respectively. In Table 4 are presented general data regarding number of passed and failed students while in Table 5 are presented results regarding achieved grades from the exam. In Macedonian high education system student grades are on the level from 5 to 10 and for exam to be passed a minimum grade of 6 is needed. From Tables 4 and 5 it is clear that 92% of the students has passed the exam and the average grade from all passed students is 6,64 for year 2012. In Tables 6 and 7 similar analysis is repeated for year 2013 where percentage of passed students is 84,6 and the average grade is 7. Increase of average grade from year 2012 to year 2013 according to the results from Tables 8 and 10 is nearly 0.36 %.

Table 4. The achievements of students in February exam term for year 2012

	Frequency	Percentage	Valid percentage	Cumulative percentage
Passed	23	92	92	92
Failed	2	8	8	100
Total	25	100	100	

Table 5. Results of passed students in February exam term for year 2012

		Frequency	Percent	Valid Percent	Cum. Percent
Valid	5	2	8.0	8.0	8.0
	6	9	36.0	36.0	44.0
	7	11	44.0	44.0	88.0
	8	2	8.0	8.0	96.0
	9	1	4.0	4.0	100.0
	Total	25	100.0	100.0	

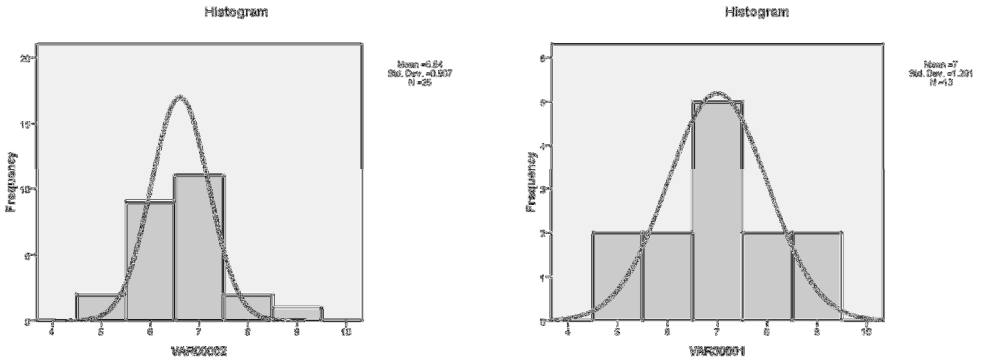
Table 6. The achievements of students in February exam term for year 2013

	Frequency	Percentage	Valid percent	Cumulative percentage
Passed	11	84,6	84,6	84,6
Failed	2	15,38	15,38	100
Total	13	100	100	

Table 7. Results of passed students in February exam term for year 2013

		Frequency	Percent	Valid Percent	Cum. Percent
Valid	5	2	15.4	15.4	15.4
	6	2	15.4	15.4	30.8
	7	5	38.5	38.5	69.2
	8	2	15.4	15.4	84.6
	9	2	15.4	15.4	100.0
	Total	13	100.0	100.0	

On Figure 2 is presented distribution of function which presents the achieved grades from February exam term in years 2012 and 2013.



a) year 2012 b) year 2013

Fig. 2 Distribution of function from achieved grades in years 2012 and 2013

In order to see weather the results from exams are improved when e-learning is used following hypothesis are set:

- Hypothesis H_0-there is no significant statistical difference between student achievements when e-learning is used and when is not used.
- Hypothesis H_1- there is significant statistical difference between student achievements when e-learning is used and when is not used.

Hypotheses are tested with Chi-Square test (χ^2). Results from testing are presented in Table 8. In order zero hypothesis H_0 to be accepted it is necessary parameter Asymp. Sig. to be bellow 0.05. In contrary, zero hypothesis is rejected. According to the performed test of χ^2 based on the data from Tables 5 and 7 parameter Asymp. Sig. is 0,028 which mean that zero hypothesis is rejected and alternative hypothesis H_1 is accepted. The Chi-Square test has proved that there is a significant statistical difference between learning outcome when students are using e-learning and when they are not using it.

Table 8. Test Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.888[a]	4	0.028
Likelihood Ratio	14.551	4	0.006
Linear-by-Linear Association	.000	1	1.000
N of Valid Cases	13		

4. Conclusion

Educational system in Republic of Macedonia has gone under major changes during last decade. Competition among state and private universities and huge expansion of IT services and web technologies have led to new and innovative services offered to the students. One of those services is e-learning implemented at University 'Goce Delcev' on Moodle platform since 2008. Results form conducted survey among students has proved that all of the students (100%) are using Moodle in any form. Results from statistical analysis have proved increase of average exam grade of 0.36 percent when e-learning is used compared to the case when it is not used. These facts give a further impulse to expand even more the IT services offered to the students since they are accepting and evaluating them highly positively.

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