Efficiency of e-learning in higher education

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Abstract:

The report includes bibliographic study on the essence of the e-learning effectiveness, the factors influencing it and the methods for its calculation. On the basis of surveys in University of Chemical Technology and Metallurgy, studies and statistical dispersion analysis is proven the link existence between the way of training - traditional, blended and electronic and student’s success. With the help of correlation quotient this link was evaluated. A survey on the student’s assessment for the advantages of the different training ways was held. Conclusions and recommendations for extending the application of modern forms of education in high schools in Bulgaria are given.

Education of highly qualified specialists is a considerable investment. The assessment of the efficiency of investments in education is a prerequisite for their sound management. This paper contains a bibliographical review and study on the efficiency of e-learning, the factors influencing such efficiency, and the methods of calculation. The students scores during the process of education are one of the indicators for the efficiency of this form of study. The authors use statistical dispersion analysis to evaluate the influence of the education method – classical, mixed, and distance learning – on student scores. They also performed a questionnaire study among students of the University of Chemical Technology and Metallurgy on the advantages of different education types. The conclusions and recommendations section of the paper outlines ways of increasing the efficiency of e-learning.

“E-learning is learning supported or enhanced through the application of Information and Communications Technology” [1]. The method is widely used because of its advantages. “It increases the speed of learning – by 50% compared to traditional forms of study, according to the analyzes”. [2]. “E-learning provides a way of faster education at a lower price, with higher accessibility and clear accountability for all participants in the study process.” [3].

The terms “effectiveness” and “efficiency” are both used in the theory and practice of assessment of e-learning results. Efficiency is an indicator based on the ratio of obtained results and invested resources, while effectiveness is related only to the result of training. According to Rumble: “Efficiency is the ratio of output to input.”[4]. “Effectiveness is concerned with outputs.”[5].

At the end of each term of study, an exam under the form of test for the evaluation of students’ knowledge on the study topics is carried out at the University of Chemical Technology and Metallurgy. A preliminary questionnaire is used to split the students in three different groups according to the study method – traditional, mixed, and electronic. The questionnaire accounts for the degree to which students have been present at lectures and the degree of usage of electronic study materials.
Dispersion analysis is used in order to determine the statistical link between the study method and students’ score. The study method $x$ is treated as a factor-independent variable, which cannot be measured quantitatively, but only as a score on a weak scale. The student’s score $y$ at the test is quantitatively measurable and is represented numerically – strong scale. The hypothesis that the application of a specific study method – traditional, mixed, or electronic – influences students’ score is empirically tested.

Two hypotheses are defined for this purpose: a zero /$H_0$/ one and an alternative one /$H_1$/:

- $H_0$: there is no stable correlation between the study method and students’ score.
- $H_1$: the study method influences the students’ score at the test.

The significance level is set for $\alpha=0.05$.

After calculations of F-criteria, we obtain $F_{em}=5.98$ for the empirical characteristic of the hypothesis. The theoretical characteristic of the hypothesis $F_t=3.88$ is determined according to the F-distribution table.

The empirical characteristic shows higher value than the theoretical, which is in favor of the alternative hypothesis $H_1$. We can affirm with a degree of significance 0.05, that the study method as a factor exerts a significant influence on students’ scores. The strength of the correlation between the study method and students’ scores was determined using a correlation coefficient. The findings demonstrate that 50% of the differences in the obtained score are due to respective differences in learning methods.

We use a score coefficient to measure efficiency of e-learning, calculated as a ratio between the number of graduated students and the number of newly enrolled students at the University of Chemical Technology and Metallurgy. This coefficient shows a growing trend during 2006-2009. One of the reasons is the improved access of students to study literature on the University Web site. In 2008, an Electronic Study Literature Unit was created at the University of Chemical Technology and Metallurgy. There is a growing number of electronic papers on the University Web site and students use them more and more frequently.

Students are questioned with respect to their opinion on the efficiency of e-learning compared to mixed and traditional learning methods. The survey results demonstrate that students consider traditional education effective because of its high quality and the possibility of contacts with colleagues and lecturers. Students who practice e-learning appreciate the effectiveness of sparing money and time, but they feel isolated from their professors and colleagues. To increase the efficiency of education, universities can include in their programs the positive characteristics of traditional education, which are absent in e-learning. Different strategies are suggested in the literature. Gasker, J.A. and Cascio, [6] explore the role of electronic letters to intensify the “student-teacher” relationship. Hodgkinson, M. [7] proposes to carry out initial F2F traditional classes for e-learning students in order to introduce them to the field of study, to each other, and the teachers.

The following conclusions can be made on the basis of the study:

- The application of e-learning increases the efficiency of higher education and, as a result, brings down the number of the students dropping out from the course of study.
- 50% of the differences in students’ scores are due to the method of study – traditional, mixed, or e-learning. The strength of the explored link is significant.
- Students appreciate the high quality of education, the low costs and time economies, as well as the opportunities of communication with teachers and colleagues.

Additional studies are needed in order to evaluate the efficiency of e-learning. The main goals related to the improvement of higher education should be high quality, low financial costs, and flexibility. In the development and application of e-learning at the University of Chemical Technology and Metallurgy, it is necessary to look for efficient strategies.
combining the positive characteristics and minimizing the negative aspects of traditional and electronic learning methods

1. Learning and Skills Development Agency, 2005
4. The Costs and Economics of Open & Distance Learning, Greville Rumble, 1997, p.120
5. The Costs and Economics of Open & Distance Learning, Greville Rumble, 1997, p.161