

Competence approach in teaching the discipline "Life safety and environmental protection"

Sergey Pushenko^{1,*} and Vera Aksenova²

¹Don State Technical University, 344000 Rostov-on-Don, Russia

²Ural State Law University, 620066 Ekaterinburg, Russia

Abstract. The article outlines quantitative criteria of students' performance results in the course of studying the subject 'Life Safety' in the times of online education. The process of education is conducted using the competency-based approach and presupposes the evaluation of performance with the help of 3 levels: basic (adaptive), independent (productive), competent (creative). The evaluation of the indicators of students' knowledge and skills was done using a modular rating system. The discipline is taught in 2 main ways: lectures and seminars. The assessment of students' knowledge was conducted using progress tests, mid-term and final tests. The article provides Spearman's rank correlation coefficient which indicates a very high level of correlation between the ratings of students' achievements in different Modules of the course. The results indicate that using online education to prepare Bachelor's degree students for their final test in the subject 'Life Safety' was effective, there were no serious disadvantages; which leads to a tentative hope of integrating online education into regular education in the future.

1 Introduction

An urgent change to online education which happened as a result of the COVID-19 pandemic made it necessary to have an online educational system, which includes online libraries and other resources available for the learners irrespective of their location. It necessitated adapting the traditional materials to the new format, i.e. using tests and uploading them onto the online platform of the university as well as recording video lectures. This shift has influenced the choice and creation of test materials and ways to measure students' knowledge as well as the ways how final assessment is conducted. Various higher educational establishments had to deal with this problem which is the reason why online education is such a widely discussed topic nowadays [1-11]. The subject 'Life Safety' has become especially pertinent for all people in the times of this pandemic [14].

The particular course in question 'Life Safety' has been taught at the Ural State Law University since 2009 and is still considered one of the core subjects. In its course students learn what to do in case of emergencies, how to prevent them, and patterns of behavior that would ensure their safety. The length of the course is 72 academic hours and as a result of

* Corresponding author: ver.axenova@yandex.ru

having covered this course, students are supposed to have certain competencies, such as general cultural competence which means that they should be able to use the main methods of protection of staff and citizens from potential consequences of accidents, catastrophes, and natural disasters.

The realization of the government standard of higher education Bachelor's degree of students of 'Jurisprudence' departments says that this qualification is to be taught with the use of competence approach and a student can achieve several levels of competence. Namely, basic (adaptive), independent (productive), competent (creative).

The first one of these three is used to describe students who:

- have limited declarative and procedural knowledge in a certain area,
- know and can follow the patterns of behavior in typical situations,
- have limited motivation to achieve the goal, characterized by the hidden need to use the said knowledge and techniques.

The independent level can be applied to students who:

- have certain declarative and procedural knowledge in a certain area,
- are capable of making decisions in a new situation, using the necessary knowledge and applying familiar patterns of behavior,
- have a regular need to improve their current level of knowledge and experience, an interest in their profession and can potentially explore their profession even further.

The last, competent level characterizes students who:

- have systemic, declarative, procedural, and methodological knowledge in a certain area, and other adjacent fields of knowledge,
- are capable of making decisions in non-standard situations,
- have a stable interest in their profession,
- have a need to improve their professional and general competencies,
- see information as the main source of knowledge in their profession.

2 Materials and methods

Both theoretical and empirical methods were used in the current research. The former ones include the analysis of the higher educational standards as well as a literature review. The latter ones consist of the analysis of how effective testing with the help of online platforms was and what effect it had on how successfully students gained knowledge. The results are presented in bar charts; the methods of data analysis are as follows: graphic, correlation, and regression. The research participants were 128 Bachelor's degree students of the State and International Law Institute of the Ural State Law University.

The assessment of students' performance was done with the help of a modular-rating system [12-17]. The values were the results of mid-term, progress, and final test. The mid-term rating is the combination of how students worked on the seminars, progress test rating, and rating of research work on the given topics. The work on the seminars included oral presentations on the studies topic, discussions of individual research projects, work in small groups to do research work and make notes on some topics. The sum of all of these activities comprised the seminar rating. The test rating comprised the points students got for all the test tasks per module.

3 Results

The results can be seen in Fig. 1, Fig. 2, and Fig. 3 below. According to the data in Fig.1, Fig. 2, and Fig. 3 we can conclude that the percentage of students who have a Basic level is 14% for Module 1, 17% for Module 2, and 2% for Module 3. The following number of

students managed to acquire an Independent level: 42% for Module 1, 37% for Module 2, 16% for Module 3. 30% for Module 1, 37% for Module 2, and 16% for Module 3 managed to get the Competent level.

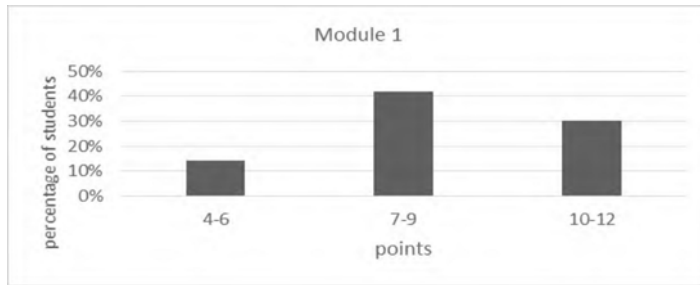


Fig. 1. Students' results in 'Life Safety' mid-term test Module 1

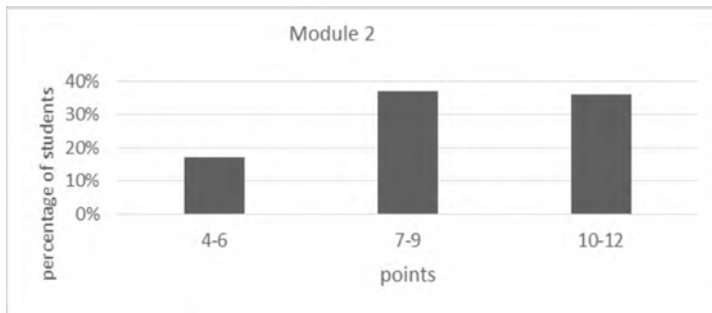


Fig. 2. Students' results in 'Life Safety' mid-term test Module 2

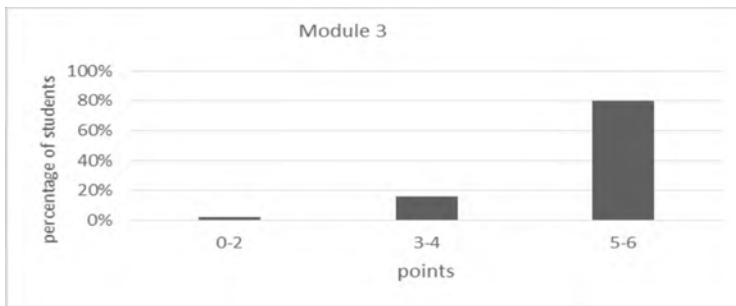


Fig. 3. Students' results in 'Life Safety' mid-term test Module 3

4 Discussions

The data show that a considerable number of students have obtained the knowledge and algorithms of applying the knowledge in typical situations 16-40%. 30-80% were able to learn patterns of behavior and apply them in non-standard situations which are typical for their region.

A causal correlation that is not evident in every particular case but in general when there is a considerable amount of observation is called stochastic. A correlation in general is an example of stochastic connection. It establishes a change in the median value of a variable with the change of factorial variable.

The qualitative criteria of how closely some factors are connected are shown in Table 1.

Table 1. The qualitative criteria of strength of correlation

Value of the correlation coefficient (rs)	Strength of the correlation
more than 0.3	weak
from 0.3 to 0.5	moderate
from 0.5 to 0.7	noticeable
from 0.7 to 0.9	high
more than 0.9	quite high

The correlation coefficient can have values from -1 to 1, when $rs=1$ there is a direct correlation and when $rs=-1$ there is an indirect correlation. If the correlation coefficient equals zero, it means that there is no correlation between the given values. The closer the absolute value of the correlation coefficient is to one, the stronger the correlation between the variables is.

In order to determine whether there is a correlation between the factorial (students' performance during the seminars) and resultative variables (progress tests, mid-term tests, and final tests) its nature and directions, we used the graphic, correlation, and regression methods of analysis [9]. We determined that there is a close to a linear association of the given variables. The higher a students' rating for tests, the higher the values for mid-term and final tests.

Table 2 shows the criteria of assessment of the strength of the association of the rating for seminars, progress tests, mid-term tests, and final rating.

Table 2. Assessment criteria of the strength of association of mastering the discipline

Variables	Spearman's rank correlations			
	The correlations are significant at the level $p < 0,05$			
	Seminar rating	Progress test rating	Mid-term rating	Final rating
Seminar rating	1,00	0,61	0,84	0,80
Progress test rating	0,61	1,00	0,92	0,82
Mid-term rating	0,84	0,92	1,00	0,92
Final rating	0,80	0,82	0,92	1,00

5 Conclusions

The data show that all the connections are important. The following conclusions can be drawn:

- there is a considerable impact of students' performance in seminars on their progress test rating $rs = 0,61$,
- their performance has a major influence on their mid-term, and final rating $rs = 0,84$ and $rs = 0,80$ respectively,
- progress test rating has a strong impact on the mid-term, and final rating $rs = 0,92$, $rs = 0,82$ respectively.

The correlation of students' progress tests, mid-tests, and final tests results in this subject at the Ural State Law University has been studied quite extensively [1, 2]. It has been shown that there is a strong correlation between factorial and resultative variables when the educational process is conducted in the traditional way, offline.

The online course for the discipline was developed in six months. Not only was the process of acquiring knowledge and skills of working on the platform challenging, but also the constant search for new tools of control of task completion.

The results show that there are no considerable drawbacks to conducting the discipline online as all the necessary competencies have been developed. Integration of the online component into the traditional format of education is bound to happen. Thus, it seems appropriate to continue looking for ways of adapting the existing materials to the online format which in all likelihood will lead to improvement of the quality of task completion and will give students a chance to gain the necessary knowledge themselves, using a whole variety of resources in addition to the traditional books and resource materials.

References

1. V.I. Aksenova, A.T. Mineeva, N.A. Pervukhin, The practice of applying the modular-rating system for assessing knowledge as a means of improving the quality of education in the discipline "Life Safety. Collection of materials of the VI All-Russian meeting of heads of departments on education in the field of technosphere safety, life safety, environmental protection and environmental management, **10(12)**, 221-226 (2017)
2. V.I. Aksenova, N.A. Pervukhin, *Competence approach in teaching the discipline "Life safety". Safety as a factor of sustainable development of society: collection of scientific papers* 110-117 (2019)
3. I. Bafadal, J. Juharyanto, A. Nurabadi, I. Gunawan, *Principal leadership and its relationship with student learning achievements: A regression analysis. Proceedings of the 3rd International Conference on Educational Management and Administration (CoEMA 2018)* 156–158 (2018) <https://doi.org/10.2991/coema-18.2018.38>
4. W. Bao, covid -19 and online teaching in higher education: A case study of Peking university. *Human Behavior and Emerging Technologies*, **2(2)**, 113–115 (2020) <https://doi.org/10.1002/hbe2.191>
5. G. Basilaia, D. Kvavadze, Transition to online education in schools during a SARS-CoV-2 coronavirus (COVID-19) pandemic in Georgia. *Pedagogical Research*, **5(4)** (2020)
6. O. Chernenko, Modern pedagogical technologies in higher education. *Pedagogy and Education Management Review*, **2**, 52–59 (2020) <https://doi.org/10.36690/2733-2039-2020-2-52>
7. J. Crawford, K. Butler-Henderson, J. Rudolph, B. Malkawi, M. Glowatz, R. Burton, P. Magni, S. Lam, COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching*, **3(1)**, 1–20 (2020) <https://doi.org/10.37074/jalt.2020.3.1.7>
8. J. I. Daoud, *Multicollinearity and regression analysis. Journal of Physics: Conference Series*, 949, 012009 (2017). <https://doi.org/10.1088/1742-6596/949/1/012009>
9. P. Hünermund, B. Louw, On the nuisance of control variables in regression analysis. ArXiv:2005.10314 (2020) <http://arxiv.org/abs/2005.10314> (last accessed 2021/03/21)
10. L. Ibyatova, K. Oparina, E. Rakova, *Modular approach to teaching and learning english grammar in technical universities. SOCIETY. INTEGRATION. EDUCATION. Proceedings of the International Scientific Conference*, **1(0)**, 139–148 (2018). <https://doi.org/10.17770/sie2018vol1.3229>
11. P. K. Jena, Impact of covid-19 on higher education in India (SSRN Scholarly Paper ID 3691541) *Social Science Research Network* (2020) <https://papers.ssrn.com/abstract=369154> (last accessed 2021/03/21)

12. G. Martínez-Sierra, J. García-García, M. Valle-Zequeida, C. Dolores-Flores, High school mathematics teachers' beliefs about assessment in mathematics and the connections to their mathematical beliefs. *International Journal of Science and Mathematics Education*, **18(3)**, 485–507 (2020) <https://doi.org/10.1007/s10763-019-09967-2>
13. T. V. Masharova, T. V. Malova, L. Varanetskaya, Specifics of the educational process organization at universities when training students for midterm assessment in the worldskills format. *SHS Web of Conferences*, **79**, 02014 (2020) <https://doi.org/10.1051/shsconf/20207902014>
14. S. L. Pushenko, Work safety - memories of the future. *Life*, **10**, 52-54 (2013) (In Russ.)
15. N. Skrobach, V. Petryna, O. Shapoval, V. Vyshyvanyuk, Learning and teaching support for modular-rating educational system. *Archive of Clinical Medicine*, **26(1)** (2020) <https://doi.org/10.21802/acm.2020.1.5>