

DEVELOPMENT OF MEDICAL STUDENTS' MATHEMATICAL ABILITIES FOR ANALYSIS AND SYNTHESIS THROUGHOUT THE E-LEARNING PROCESS

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The article examines the contribution of e-learning in the development of mathematical abilities for analysis and synthesis of medical university students. The author provides confirmation of e-learning effectiveness in students' mathematical abilities reaching and the development of abilities to synthesis and analytical skill. The intelligent application of the various elements of e-learning in educational process of higher educational institutions is proved to transfer thirty percent of students to a higher level of mathematical abilities for analysis and synthesis development, which is highly important throughout the students cognitive activities development and acts as a guarantee of successful self-education and inclusion into the system of continuous education where students are to solve professional problems by themselves, reaching academic, practical and professional goals. These data given by the author can serve as a basis for the introduction of new and wider usage of e-learning familiar forms and methods throughout the learning process in higher educational institutions.

Keywords: e-learning, effectiveness, mathematical abilities, analytical skill, mathematical abilities to synthesis, development, medical university

The stimulation of students' cognitive activity, maximal visualization and updating the learning material, individual studies optimization are to be considered as the main functions of modern e-learning process [1, 3, 4, 7]. E-learning various elements are the fundamental parts of high school educational process. However the e-learning effectiveness is still to be questioned. And the whole number of research directions of e-learning efficiency studies is taken nowadays [2, 5, 8]. Thus, earlier researchers have pointed out the usage of electronic didactic materials as the factor of students' progress in studies and stimulation of students' cognitive activities [6]. But the e-learning contribution into generation and development of students' skills is still questioned, especially if we talk about the aspect of mathematical abilities for analysis and synthesis.

The problematic importance is caused by the fact that mathematical skills, especially the abilities for analysis and synthesis, are to be considered as the fundamental part of successful professional activities which is highly important while searching for scientific methods, analysis and interpretation of research results. That is why we determined the purpose of our research as studying of e-learning role as an instrument of medical students' mathematical abilities development.

We chose the clinical psychology faculty students of medical university as an object of our research as development of students' analytical skills and mathematical abilities to synthesis is extremely important while searching for scientific psychological methods, analysis and interpretation of psychological research results.

We can point out several tasks of our research:

- to study clinical psychology students' analytical skills and mathematical abilities to synthesis at the initial stage of mathematics e-learning;

- to analyze clinical psychology students' analytical skill and mathematical abilities to synthesis at the final stage of mathematics e-learning.

Materials and methods of research

Testing of 30 first-year and second-year clinical psychology students was carried out. The first-year students were tested as the starters of mathematics e-learning. The second-year clinical psychology faculty students were involved into mathematical e-learning testing after passing the mathematical course examination.

The experiment was held in constant conditions for both groups of students: the research was held at 11 a.m. in the academic auditory. The research duration was about 20 minutes. The clinical psychology students performed the testing independently without using any electronic devices. The testing was built on the basis of Atmhauer intelligence structure test including the scale of mathematical abilities determination.

The subject was to be guided in each task condition and structure initially. That was a highly important element of successful testing. To estimate the different elements in the structure of the task, systematize them and define their hierarchy. The high level of analytical skills was demanded for these operations.

Except analytical skills the mathematical task conditions analysis required the high level of students' mathematical abilities to synthesis development, since the separate elements are to be united into the complexes. To answer the question, clinical psychology faculty students had to find the mathematical relations and functional associative nets between different elements of a problem.

So, the successful solution of the test task was the indicator of the developed mathematical abilities of the examinee to analysis and synthesis.

Results of research and their discussion

The examination results of clinical psychology faculty students' analytical skills and mathematical abilities to synthesis at the initial stage of mathematics e-learning are represented in the Table 1.

Table 1
Mathematical abilities development level to analysis and synthesis of clinical psychology faculty students

Level	The initial stage of mathematics e-learning	Final stage of mathematics e-learning
High	7%	13%
Average	29%	38%
Low-average	29%	44%
Low	35%	5%

35% of the first-year medical university students, starting mathematics e-learning showed the low analytical skills level. 58% of examinees showed an average and low-average levels of mathematical abilities development. 7% of the initial mathematics e-learning students showed the high level of abilities to analysis and synthesis (Fig. 1).

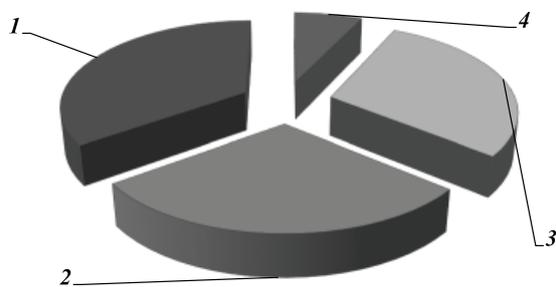


Fig. 1. Level of clinical psychology students' analytical skills and mathematical abilities to synthesis development at the beginning of mathematics e-learning:
1 – results of research and their discussion low level of mathematical abilities development (35% студентов);
2 – low-average levels of mathematical abilities development (29% студентов);
3 – average levels of mathematical abilities development (29% студентов);
4 – high levels of mathematical abilities development (7% студентов)

As Table 1 claims, after e-learning mathematics course of clinical psychology faculty students their analytical skills underwent essential changes. The number of low level mathematical abilities students decreased considerably: from 35 to 5%.

The number of the students showing a high abilities development level to analysis and synthesis was almost twice enlarged. 13% of such students appeared among second-year examinees in comparison with 7% of the first year students. Positive analytical skills development level dynamics was also observed among the average level students. This concrete group showed the 9% extension at the end of the math e-learning course in comparison with the initial stage: from 29 to 38% (Fig. 2).

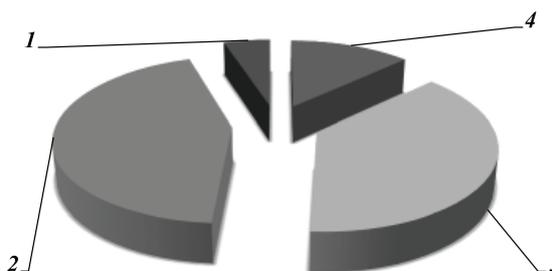


Fig. 2. Level of clinical psychology students' analytical skill and mathematical abilities to synthesis development at the final stage of mathematics e-learning:
1 – low level of development of abilities (5% of students); 2 – low-average level of development of abilities (44% of students); 3 – average level of development of abilities (38% of students); 4 – high level of development of abilities (13% of students)

The low -average level to the analysis and synthesis students number was also increased. The number of such students was enlarged nearly by 1,5 times: from 29 to 44%. Common growth of students groups with high, average and low -average levels of analytical skills happened due to transition of 30% of low abilities level group to the higher values of mathematical abilities, which undoubtedly shows the active influence of math e-learning on students' analytical skill and mathematical abilities to synthesis generation and development (Fig. 3).

The testing results comparison separately on each task offered to examinees shows that after mathematics e-learning course the students cope with test tasks much more surely due to the higher abilities level development to synthesis and analysis. The Tables 2 witnesses the fact, that after mathematics e-learning in the majority of questions (14 tasks from 20 that constitutes 70% of number of questions), the students' analytical skill and mathematical abilities to synthesis appeared much higher, than at the initial stage mathematics e-learning.

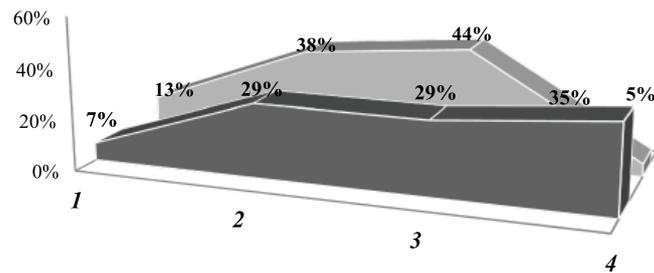


Fig. 3. Comparison of clinical psychology students' analytical skill and mathematical abilities to synthesis at the initial stage and at the final stage of mathematics e-learning:

1 – high level of development of abilities; 2 – average level of development of abilities;
3 – low-average level of development of abilities; 4 – low level of development of abilities

Table 2

The testing results comparison separately on each task offered to examinees

The task number offered to examinees	The number of examinees coped with test tasks surely (%)	
	1 year – students at the initial stage of mathematics e-learning	2 year – students at the final stage of mathematics e-learning
1	100	100
2	79	75
3	79	81
4	50	75
5	79	81
6	79	50
7	86	94
8	86	81
9	36	38
10	21	44
11	50	63
12	50	38
13	79	63
14	21	44
15	14	44
16	43	50
17	21	38
18	14	25
19	29	75
20	14	13

More than 80% of students who passed math e-learning course showed excellent result in five tasks from twenty offered that has constituted 25% of all questions, in comparison with the initial stage students who were able to perform only 15% rate. As a result of e-learning course the number of the students who had exact answer in six tasks from 20 (which is 30% of all questions) became as much as twice larger in comparison with mathematics e-learning initial stage students. The number of tasks which were answered correctly by less than a half of the initial stage mathematics e-learning students was at the 60% average (twelve tasks from twenty offered).

The correlation from 21 to 45% of the right answers can definitely be seen in 25% of tasks comparing initial stage and the end of the e-learning course. The final stage students of mathematics e-learning were not able to beat the initial stage students results only in three tasks from twenty (15% of quantity of questions), showing the same result. The comparison of testing results to the academic progress proves that the high level of analytical skills and mathematical abilities to synthesis allows the students to master the training material much better (Table 3).

Table 3

The comparison of testing results to the academic progress

	The testing results & result of the exam	The testing results & average mark during the academic year
valid	30	30
Spearman	0,589732	0,577140
p-value	0,000604	0,000841

All above proves the effectiveness of e-learning usage in aspect of mathematical abilities development to the analysis and synthesis.

Competently organized e-learning course in discipline “Mathematic” develops students mathematical abilities to synthesis, allows to generate and improve their analytical skills, transferring about one third of students to higher mathematical abilities level, provides strong discipline knowledge formation, and guarantees the professional competence of the modern specialist in the field of clinical psychology.

So, without any doubt the various e-learning elements usage throughout educational process of high school is necessary and reasonable, especially, keeping in mind a fact that variety of forms and methods of e-learning allows to develop the students’ cognitive activity.

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