Computer Modelling of Educational Process as the Way to Modern Learning Technologies

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Abstract. Today's young people, who make up the student community, are very experienced in many issues that affect their surroundings. Therefore, each educational institution should be able to introduce new forms and methods of communication with young people, their learning, that widely involve innovative technologies, activate the creative component of education, increase the independence of students, preparing them for the future profession. This is especially true for the preparation of maritime industry specialists, whose professionalism and competence not only the preservation of the vessel and the performance of its tasks at hand depend, but also the health and, even, the life of the entire crew. Modern educational innovations offer a wide range of different software tools. But only teacher should to choose his own methodology of discipline-teaching based on what trajectory most closely matches the maximum effect of this training. Therefore, modelling of such methodology in needs of deep analyse of both the learning support systems and the student's attitude towards using of the latest information technologies in the educational process.

Keywords: computer modeling of educational process, interactive teaching forms, distance learning system, competency, competence-based education.

1 The general problem statement and its actuality

Extensive use of information and communication technologies (ICTs) at education is a requirement of time today. Comprehensive informatization requires of introduction of these changes also in organization of training students' activities, which implementation would contribute to activation of educational and cognitive activities, increasing the effectiveness of their acquisition of new knowledge, development of creative activity and skills of collectively coordinated actions. The questions of innovative technologies introduction in the educational and pedagogical process with the purpose of formation of positive motivation of the study are relevant, as it is necessary to form, on the one hand, new approaches to the teaching, and on the other hand, new approaches of knowledge, acquisition of competences on the chosen speciality.

Most importantly, for implementation of this issue is the informality choice of learning technology, which is based on ICTs, scientific justification of strategies aimed at expanding forms of self-education and individualization of the learning process.

Therefore, the Department of Information Technologies, Computer Systems and Networks (ITCSN) in own work has introduced an analytical study aimed at confirming or rejecting one pedagogical idea or another. The strategy of using innovative technologies on teaching of disciplines of ITCSN's department exactly, which by it's appoint has to be the leader in the introduction of modern technologies at the educational process, is formed on the basis of that analysis.

Experience of implementation new pedagogical forms and methods at the educational process suggests concluding that for their effective practical use it is necessary to fulfil a many important requirements, namely, the existence of strategy on which an adaptive learning trajectory must be built, an environment that is able to satisfy to users requirements, to correspond to the tasks entrusted to it, and training cadets about working in this environment on an individual schedule.

Object of research is computer modelling of educational process on the basis of the distance learning site of KSMA. The feature of the platform MOODLE, on which the site has developed, is the possibility of the introduction any forms of education and control knowledge, availability of constant information exchange of all participants of the educational process.

Subject of research is the newest conceptual approaches to using opportunities of the modern information environment, taking into account the specificities of the educational process of training specialists at Kherson State Maritime Academy.

Objective of the work is on development of the using modern information environment methodology based on computer modelling of the strategy of ICTs introduction at the educational process of KSMA for improving the quality of cadets' training.

These scientific and practical tasks were performed to achieve the objectives:

1. Analysis of pedagogical experience in the scope of use modern learning technologies.
2. Study of the specific aspects of distance learning system application at KSMA for training of marine specialists.
3. Conduct a scientific and pedagogical experiment to test the hypothesis of level formation of subject competencies during training sessions using of the distance learning platform.
4. Statistical analysis of the implementation results of the interactive learning model.
5. Development of the methodology of using the modern information environment, which was built on the platform MOODLE on the basis of a confirmed model for training cadets on disciplines of the ITCSN's department.
6. Development of webpage's structure of the ITCSN's department on the site of distance learning, which meets the requirements for improving the quality of the training of cadets and students of the KSMA on the disciplines of the ITCSN's department.
7. Arrangement of the webpage content and provision of academy teachers and cadets with the opportunity of convenient use of the modern information environment.
8. Introduction of interactive forms of teaching into conduction of laboratory and practical lessons on the disciplines of the ITCSN department.

9. Ensuring of the quick access to results of current or final control of knowledge on disciplines of the department in environment of the MOODLE, the analysis of results in terms of training process's quality improvement of the future maritime specialists.

In the applied aspect, this research aims at developing of methodology of using modern software product, which consumption will allow to solve an important scientific and practical task: using of modern innovative and information technology in education to improve the quality of the training specialists of maritime industry due to introduction of distance learning at KSMA.

2 Analysis of recent research and publications, which launched the solution to this problem

The scientific works of some Ukrainian and foreign researchers were dedicated to the problem of organization and implementation of distance learning: H. Becker, V. Bykov [1], N. Morze, V. Oliinyk, Ye. Polat, Yu. Tryus [2] and others.

Having analyzed the publications by D. R. Garrison [3], G. Kravtsov [4], V. Kukharenko [5], O. Rybalko, it can be noted that the use of ICT opportunities in the educational process requires organizational, research and methodological work in the implementation of modern strategies, forms and methods of distance learning.

The works of O. Pometun [6], O. Sichkaruk [7] are dedicated to the characteristics of interactive learning technologies and the description of the pedagogical experience of application of interactive teaching methods in higher school.

Problems of introduction of computer modelling in the study of informatics disciplines paid attention to foreign and Ukrainian specialists A. Bochkin [8], O. Markovich [9], I. Teplytskyi [10, 11], S. Semerikov [12], N. Valko, N. Osipova [13], Y. Samchynska [14].

The analysis of the works of the above-mentioned authors shows that the problem of the development of subject-oriented and professionally-oriented competences of future specialists of maritime industry stands insufficiently studied. Today, the analysis of the effectiveness and justification of the methodical system of application of distance learning system into the training of cadets needs further research.

Today the use of interactive multimedia learning tools is in fact a standard element in the education system of any educational institution. But the experience of application of such training tools for the training of future maritime specialists is practically absent. The analysis of publications led to the conclusion that the development of methodology of the modern distance learning platform is necessary, due to the specific aspects of the training of maritime specialists. The possibility of interactive communication with the teacher and, in general, the increase of the educational level of a seafarer remotely (as he/she spends much time outside the training institution) is very important. All these can be implemented precisely by means of distance learning programs.

3 Solving basic problems

KSMA as most of educational institutions not only in Ukraine, but also in the world, chose learning management system (LMS) MOODLE as a platform for realization of project "Distance learning system". This system allows not only to introduce of learning individualization, to develop of adaptive trajectories for each user, but also to move further, maximally using this system capabilities. It's very important for such an educational institution as maritime academy, because specific of this higher educational establishment involves long-term shipboard training for cadets who are studying full-time. So, one of the tasks of project implementation is to give cadets, who are at the practice training, the opportunities not to interrupt theoretical training and even to take part in discussing important issues in chat mode. But today just submitting of quality educational material to a student is not enough, therefore Department of Information technologies, Computer Systems and Networks of KSMA took over responsibility of introducing interactive learning technologies at the educational process.

The interactive learning is a learning that occurs on condition of the constant, active interaction of all participants in the learning process. This is coaching, mutual learning (collective, group, coaching), where both parties (the one who teaches and the one who studies) are equal subjects in the learning process, they understand what they do, know, carry out. Directly, the organization of interactive learning involves the modelling of various real-life situations, the problem-solving based on the analysis of corresponding conditions and situations, the use of role-play games. All interactive technologies are divided into four groups: frontal technologies, collective-group learning technologies, situational learning and learning in discussion. All these technologies, firstly, are vital for cadets studying in the academy, and secondly, they can be implemented on the DLS of KSMA.

As a result of application of interactive technologies, the favourable conditions are created for an effective cognitive process, thus interactive learning can speed up the process of assimilating the material, as it affects both the student's consciousness and his/her feelings, actions, and practices.

The teachers team of the ITCSN's department has developed own methodology for introducing a distance learning system based on the platform MOODLE as a result of thorough analysis of pedagogical experience in the use of modern training technologies and taking into account the specifics of the training specialists of maritime industry. Some corrections were made during test that is by conducting of classes according to proposed methodology which, in general by our opinion, have done the whole learning process more structured, understandable, natural, and most importantly, this learning approach was positively accepted those for whom it was developed, that is, the academy's cadets. After a while, most academy departments supported the innovations of the ITCSN department and began to actively use the latest technologies in the educational process. So, we present a learning model with the support of innovative features of LMS MOODLE.

Exactly the ITCSN department was a founder and executor of the project "DLS of KSMA". The first step to implementation of this project was a choice of the platform LMS MOODLE and creation of the site structure in according to specifics of training

at a marine institution. It is hierarchically and represents of input sequence: the academy – the faculty – the department — the discipline. Moreover, each teacher has a choice: either, teacher posts learning materials onto his web page, then cadet chooses the teacher and the corresponding discipline, or the teacher posts materials onto the discipline pages, then cadet chooses the discipline and teacher accordingly. For itself, the ITCSN department has chosen the second option.

Modelling of the process of computer training is the meticulously calculated relationship between the teacher's activity and independent work of the student (cadet). At the stage of introducing innovative technologies into the educational process the role of a teacher as a tutor, coordinator of the learning process is more important than ever. The author's materials of discipline will be read by the cadet directly on the web site of distance learning, using his own access to the materials as a course participant. Teacher at the lessons focuses cadets' attention on the most important points of the topic, explains how to properly use materials, which forms of control are provided by the plan.

Results of experiment were laid in the basis of modelling, which purpose was to find out the impact of the newest methods of training on the level of mastering the material by cadets, increasing their independence in its processing, interest in the results, consolidate the skills of using the acquired knowledge in the decision of professional problems. To conduct the experiment, it was necessary to select a certain number of participants, these were first-year cadets of full-time and part-time study of Navigation Faculty and Marine Engineering Faculty. The main requirement for such a totality of participants is a qualitative homogeneity. The members of the totality can be compared with each other only in relation to that sign (in our case, it is the level of the formed subject competences), which becomes the subject of the study.

The use of most statistical methods is based on the idea of using a random totality of probationers from the total number of those on which conclusions can be disseminated, in our case, these were all 100% of first-year students, which is due of the real learning process during which we conducted the experiment.

The first stage, an asserting experiment was conducted during 2016-2017 education year. The purpose of the asserting experiment was to find out the level of formation of the necessary competencies of cadets, the level of mastering the system of basic methods of mental activity and the ability of cadets to a productive independent work. The results of the asserting experiment allowed to reveal the level of knowledge, skills and abilities of cadets on such disciplines as "Information Technologies", "Information Technologies in Marine Engineering" and "Information Technologies in Navigation".

In a significant part of the cadets there was a gap between theoretical knowledge and the ability to apply its in practice, in solving new non-standard or professionally-directed tasks. The reasons for the instability of the acquired skills are the passivity of the cadets in studying and fixing new material, the lack of positive motivations for training, the impossibility of taking into account the individual characteristics and abilities of each cadet from teachers' side, the lack of necessary self-control and lack of control at all stages of mastering the complex of competencies from teachers' side.

The organization of the experiment allowed to receive an accurate quantitative assessment of the research results. In particular, the actual level of knowledge, skills

and abilities on the department's disciplines was revealed and with great accuracy, a comparative analysis of the level of competency formation taking into account various categories and factors was conducted with the help of elements of variation statistics. A quantitative type of data variation was used for obtain objective data: discrete variation – the final estimates of the cadets by subject was evaluated, and the continuous – the average marks of current assessments of cadets from each single topic.

The variational series were built by the average grades of cadets and the final estimates. For constructing a discrete variational series in the analysis of the final estimates we obtained a frequency distribution table on the set of observed values of the investigated value and the variational curve (Table 1).

Table 1. Frequency distribution

Grade points (W)	30-59	60-63	64-73	74-82	83-89	90-98	99-100
Number of cadets in the control group (f1)	16	36	63	78	38	13	6
Number of cadets in the experimental group (f2)	6	29	71	82	41	14	7

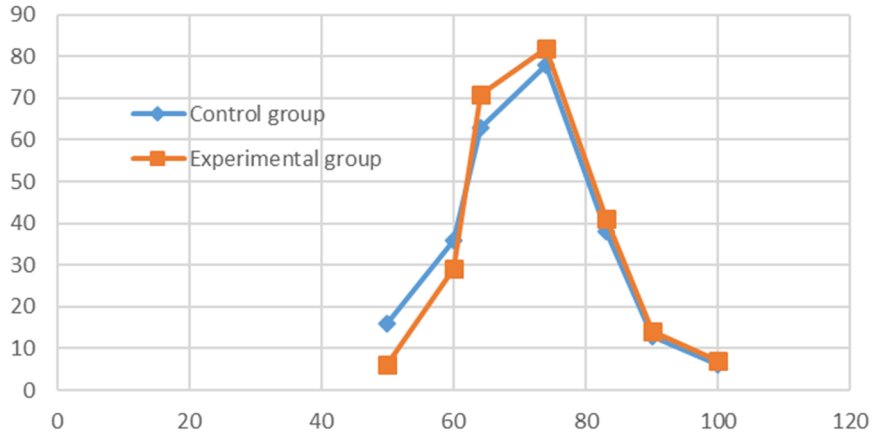


Fig. 1. Variational curves

The variational and statistical indicators were calculated for versatile and full characteristics of the variation. One of them is the weighted average value or the average of variation values of a specific set:

$$M = \sum \frac{f_i \cdot W_i}{n} \quad (1)$$

The average of variation values will be closer to the values that occur more often. Therefore, first of all, you should expect to get most of the values close to this value in future observations. The average doesn't fully characterize the series, because the different variational series may have the same average value. Consequently, the essential characteristics of the distribution are also the characteristics of the frequencies

scattering, in particular the standard deviation (σ) of the observed values of the investigated value from the arithmetic average, and the dispersion (D) is the measure of variation. To characterize the degree of series variation, the standard deviation of variations was determined by the formula:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} (X_i - M)^2}{n-1}} \tag{2}$$

The average error of the arithmetic average was calculated by the formula:

$$m = \pm \frac{\sigma}{\sqrt{n}} \tag{3}$$

The arithmetic average and standard deviation are the best characteristics of the group. The first is a generalized indicator of the achieved level of the group on average, and the second – the score of variation.

After calculating a number of variational and statistical indicators, the relative average error of the arithmetic average, which is an indicator of the relative accuracy of the study, was found. This value indicates to the degree of correspondence numerical values which were found in the study with the values that characterize the phenomenon being studied:

$$P = \frac{100 \cdot m}{M}\% \tag{4}$$

Table 2. Variational and statistical indicators

	Weighted average (M)	Average arithmetic error (m)	Mean standard deviation (σ)	Relative average error of the arithmetic mean (P)
Control group	3,754	0,04554	0,72	1,21%
Experimental group	3,860	0,03949	0,624	1,02%

Conclusion: The value of variation and statistical indicators of the studied variational population can be extended to the whole population (at $P < 2\%$ – the accuracy is high).

The lower the absolute value of the relative accuracy of the study, the more accurate the study, the better obtained statistical indicators.

Let the hypothesis H_0 asserts that the level of the formation of subject competences during conducting training sessions using the distance learning platform and interactive forms of work doesn't exceed the effectiveness of the traditional method of teaching discipline. We will assume as a hypothesis H_1 the opposite assertion to the hypothesis H_0. The final works were conducted in the experimental and control groups, by results of which the criteria statistics were calculated. Here is an example of the results of one of the final work (Table 3).

The critical value of criteria statistics was found by the formula:

$$T_{cr} = \alpha \cdot \sqrt{\frac{n_1 + n_2}{n_1 \cdot n_2}} \quad (5)$$

where n_1=n_2=140, α=1,36. We get: T_{cr}=0,162.

The experimental values of statistics were calculated according to the formula:

$$T_{\exp} = \frac{1}{n} \max \left(\sum f_2 - \sum f_1 \right) \quad (6)$$

Table 3. Statistical indicators

The number of correct answers	Abs. frequency of the experimental sample (f_1)	Abs. frequency of the control sample (f_2)	Accumulating frequency $\sum f_1$	Accumulating frequency $\sum f_2$	Σf_2-Σf_1
5	15	9	140	140	0
4	44	25	125	131	6
3	77	96	81	106	25
2	4	10	4	10	6

Since $max(\Sigma f_2$-$\Sigma f_1)$=25, then T_{exp}=25/140=0.179.

Since $T_{exp} > T_{cr}$, then the hypothesis H_0 was discarded in accordance with the decision rule for the two-sided Kolmogorov-Smirnov criterion and the hypothesis H_1 was adopted.

The obtained results allowed to state the positive impact of the introduction of modern learning technology on the quality of training future maritime specialists, and to continue the formation of a strategy that would increase the degree of cadets' competencies after the completion of the course.

The main source of motivation is the professional interest of the student as a result of which the educational activity characteristics a high level of activity.

The interactive learning allows to implement an individual approach to the training of each cadet, taking into account his/her level of training, personal qualities, such as the speed of perception of information, its comprehension, the ability to use this information in solving his/her professional tasks. Today, the concepts of adaptive learning, personalization of learning, individual learning paths are widely discussed in the field of distance learning, blended learning and e-learning. Therefore, the introduction of modern technologies into the educational process allows to develop an individual learning path for each cadet. Of course, the essential condition of the adaptive learning is a desire of the trainee to acquire new knowledge, make every effort to achieve his/her goal – acquiring of essential knowledge necessary for his/her professional activity.

Nowadays it is not enough for the teacher to be competent in the field of the discipline he/she teaches, present theoretical knowledge in the class. It is necessary to meet the requirements of the modern educational process. The teacher often acts only as the organizer of the learning process, the leader of the group, creating conditions for the initiative of the cadets. The interactive learning is based on the experience of the youth, on their direct interaction in the field of professional experience. All participants of the learning process interact with each other, share information, solve problems

together, simulate situations, evaluate the actions of the others and their own behavior, immerse into the real atmosphere of business cooperation in dealing with problems.

Using of network technologies promotes not only the acquisition of knowledge, skills, forms of professional behavior by cadets (students), but also the formation of a certain structure of personal qualities. The study of the conditions of formation of the future specialists' professional competence by means of network technologies allowed to determine that the introduction of a academic and learning kit which contains distance courses developed by means of MOODLE using a modular approach, the presentation of knowledge as a dynamic, multimodal structure in the formation of which the students take part, enhances the student's experience of self-replenishment and renewal of professional knowledge, personal involvement in this process and responsibility for it. Modular training is based on active, flexible approach to determining the sequence of learning material presentation, and the module itself is defined as an integral system that combines the training content and the technology of mastering it. An important criterion for constructing a module is the structuring of the student's activities in the logical sequence of acquisition of knowledge: perception, understanding, comprehension, memorization, application, generalization, systematization of acquired knowledge.

Accordingly, the implementation of distance learning forms and methods contributes to the individualization of the professional development process, stimulates higher education student to work independently, forms their informational culture, sets for mastery of innovative means of obtaining and applying information, in particular, the possibilities of distance learning contribute to formation of professional competence of future specialists of the maritime industry.

The National System of Higher Education Standards clearly specifies the requirements for qualifications and provides a list of socially and professionally relevant knowledge, skills and competences which demand from graduate of institution of higher education not only the national labour market but and the European Community. The National Qualification System, in particular its components - National and branch qualification frameworks shall be the basis for the implementation of a competence-based approach in higher education. The compliance of the quality of graduates' training with the requirements of the industry standard of higher education shall be determined by socio-personal, general scientific, instrumental and professional competencies. The implementation of competently communicative approach at the educational process requires not so new subject content [15] as different pedagogical technologies.

The results of research were presented at the All-Ukrainian and International conferences, published in the popular scientific journals and posted on the distance site of KSMA by electronic link http://www.mdl.kma.ks.ua/.

The efficiency of using interactive teaching methods by discipline "Information technology" can be shown on the example navigation tasks, which is encountered in practice of navigator. That is, the conducting navigation calculations during plan of ship's transition using opportunities MS Excel. The consolidation of practical skills of getting a numerical result by analytic description dependents of parametrics of some technical process is goal of work. Given the coordinates of the points of ship's transition

A, B, C, D, E, F (longitude λ_i and latitude φ_i). Needs to determine course for each ship's transition and its distance run by each transition. In this case, of course, the coordinates are given in the form in which it is accepted in the performance of navigation calculations (see Fig. 2).

Moving the ship "Eagle 3"						
Transition point	Coordinates					
	latitude			longitude		
	degrees	minutes		degrees	minutes	
A	57	25,00	N	20	26,00	E
B	57	55,60	N	20	30,00	E
C	58	23,60	N	21	34,90	E
D	58	5,70	N	22	43,70	E
E	57	14,60	N	22	33,00	E
F	57	5,00	N	22	0,00	E

Fig. 2. Initial data are entered in the table.

The mathematical model of the task is a, in the fact, two formulas – determination of absolute value of the course and distance run:

$$tgC_i = \frac{DLong_i \cdot \cos(\varphi_{cp_i})}{DLat_i} \tag{7}$$

$$S_i = \sqrt{(\varphi_{i+1} - \varphi_i)^2 + ((\lambda_{i+1} - \lambda_i) \cdot \cos(\varphi_{cp}))^2} \tag{8}$$

The round system calculation of direction is used in navigation for determination of direction of ship's movement (course) and determination of direction from the ship to the shore marks, neighboring ships and other (bearing).

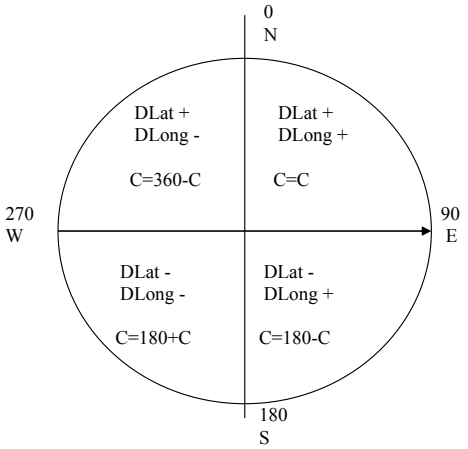


Fig. 3. The round system calculation

It would seem that, there are initial data, calculation formulas – it is possible to proceed of execution. But cadet won't cope with this task without teacher's explanations. At the first, initial data must be converted into a form which will be suitable for conducting calculations. For this we take into account that 1 minute is a 1/60 part of degree. Therefore, latitudes and longitudes are recounting and difference of latitude (DLat), difference of longitude (DLat) and middle latitude (φ_m).

Now we need to use the formula (1) for determination of the course taking into account that course C_i is under the sign of the tangent, so, for calculating of the course we have to use inverse function to tangent – arctangent. Next, arctangent function returns result in radians that is in linear units (arc length). Therefore we must to convert result in degree measure of angle measurement. As by the task condition needs find of the course, we calculate the absolute value (ABS) of the resulting value (see Fig. 4).

Moving the ship "Eagle 3"

Transition point	Coordinates									
	latitude			longitude						
	degrees	minutes		degrees	minutes		latitude (degrees)	longitude (degrees)	difference of longitude	middle latitude
A	57	25,00	N	20	26,00	E	57,42	20,43	0,07	57,67
B	57	55,60	N	20	30,00	E	57,93	20,50	1,08	58,16
C	58	23,60	N	21	34,90	E	58,39	21,58	1,15	58,24
D	58	5,70	N	22	43,70	E	58,10	22,73	-0,18	57,67
E	57	14,60	N	22	33,00	E	57,24	22,55	-0,55	57,16
F	57	5,00	N	22	0,00	E	57,08	22,00	-22,00	28,54

Fig. 4. Performing calculations

On the next stage we need to determine ship course on the each transition. For this will be use round system calculation of direction (Fig. 3). Here is obviously the use of the logical apparatus (the logical function "IF"). And the final, needs calculate distance between points. The formula of distance's calculating (8) is very simple, with the exception of a small nuance: result of calculation of the right part obtains in degrees and the left part (distance traveled) is measured in nautical miles. As ship transition on 60 nautical miles match to changing the position of the vessel by one degree, obtained result by formula (8) needs to multiply by 60. The calculations are done correctly. Now we can plot a course (see Fig. 5).

Moving the ship "Eagle 3"

Transition point	Coordinates								
	latitude			longitude					
	degrees	minutes		degrees	minutes		modules	courses	distance
A	57	25,00	N	20	26,00	E	4,00	4	30,67
B	57	55,60	N	20	30,00	E	50,72	51	44,23
C	58	23,60	N	21	34,90	E	63,69	116	40,39
D	58	5,70	N	22	43,70	E	6,39	186	51,42
E	57	14,60	N	22	33,00	E	61,79	242	20,31
F	57	5,00	N	22	0,00	E	18,70		

Fig. 5. Calculating ship course and distance between points of ship transition

If cadet was absent on the classroom lesson for good reason or didn't fully master the topic, he can easily independently understand the task solution using interactive materials created by teachers and uploaded on the distance learning site. The monitoring of cadets' visits of the pages of the site by disciplines of the department shows that most cadets are actively using innovations in the learning process and results of performing of the individual tasks which recorded in an electronic journal, confirm the hypothesis of raising the level of assimilation of the material by the cadet when teacher gave full information provision of the discipline and methodically substantiated the combination of classroom, individual and independent work of the cadet.

The systematic implementation of the test control at the learning process is an essential part of the reformation of views on results of higher education which should to be variety on training forms, to have the practical-applied character and differ in the scope of interdisciplinary tasks.

We'd like to mention that a complex final testing is a complete set of tests that involves testing of competencies of several different disciplines at the same time. This test reveals the quality of the integrated training of a future seafarer, his ability to interpret various professional tasks. For example, the final test in navigation course included the questions of different disciplines: navigation, theory of ship construction, celestial navigation, electrical and radio navigational equipment and others. Some questions were in the English language.

The final assessment consisted of two equal components: assessment of current student's progress by the teacher (from 0 to 50 points); independent assessment (the result of testing is automatically calculated by the system, the maximum score is 50).

The objective of the final assessment in the form of a final testing is a detection of the cadets' level of knowledge, skills, competences and level of readiness to compete in the labour market of the maritime industry. This method of knowledge check firstly provides the students with an opportunity to evaluate their own level of knowledge, and secondly, it familiarized the cadets with the testing procedure that is conducted by different crewing companies. This is confirmed by the fact that the training and assessment of cadets' knowledge is carried out in an integrated manner, taking into account the requirements to the competence-based training of future maritime specialists. The systematic application of such tests creates favorable conditions for the training of future maritime specialists in terms of employment testing by national and foreign crewing companies.

A survey was conducted among first-year students based on the results of the training in the current academic year. The questionnaire included both questions concerning to the directly use of the distance learning system and questions on the estimation of the level of material assimilation taking into account the use of interactive technologies. More than a hundred cadets participated in the survey. They have been asked to give an objective personal evaluation of the structure and methodology of training in the IT department.

The questionnaire contained 25 questions. The table presents some diverse examples of questions (Table 4).

Table 4. Questionnaire for cadets

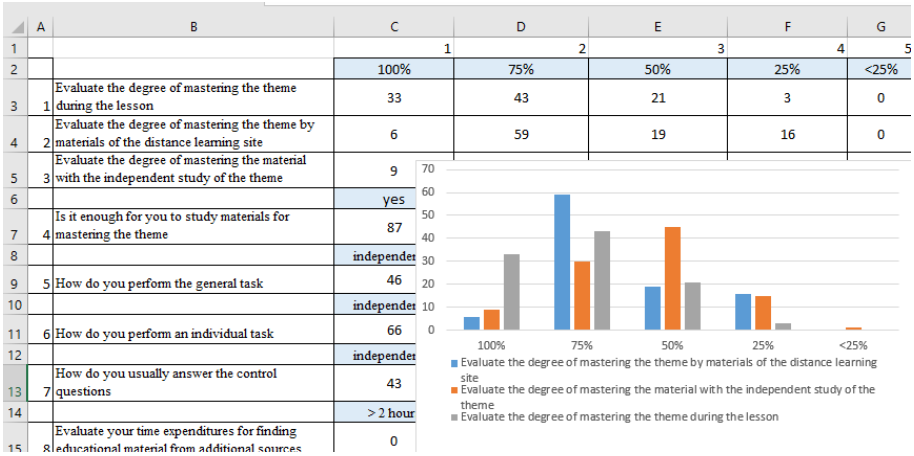
1	Evaluate the degree of mastering the theme by materials of the distance learning site	– 100%, – 75%, – 50%, – 25%, – less than 25% of the training material
2	How do you perform an individual task?	– independently, – partly on your own, – with the help of other cadets, – only under the direction of a teacher
3	Evaluate your degree of mastering the study material	– high, – sufficient, – average, – low
4	How do you organize your own work?	– I always do it myself, – do it with the help of other cadets, – perform it using of additional educational materials, – do it sometimes, – I don't perform it
5	How long does it take for you to complete the tasks after reading the interactive materials on the topic?	– more than 2 hours, – from 1 hour to 2 hours, – from 30 minutes to 1 hour, – less than 30 minutes.
6	Choose the appropriate option to complete the sentence (Self-assessment of the acquired knowledge). After completing the module (course) I ...	– have a clear idea of the cognitive outcomes of my learning activities; – clearly imagine what competencies (skills and abilities) have mastered; – imagine where I will be able to apply the existing competencies in the future; – the learning process became conscious, and therefore more effective; – performed automatically without imagining any further application.

The following conclusions were made based on the results of the survey:

1. To questions about the estimation of the usefulness of active and interactive methods of teaching (the degree of mastering the topic during the classroom session, using the materials of the distance learning site, joint discussion of the teaching material, the use of multimedia computer equipment, etc.) were answered: no use – 0%; insignificant degree – 10%; sufficient degree – 71%; high degree – 19% of cadets.
2. For questions about the approximate assessment (in percentage) of professional competencies, skills and abilities obtained in the study of disciplines by modern learning methods compared to the traditional methods of learning, 78% supported the use of interactive learning systems, 16% used the opportunities of the distance learning site from time to time, 6% preferred to use printed methodological materials.
3. To questions about the interaction (asking for help to other cadets or helping them to study the material, teamwork on assignments) 10% answered "almost never", 54% answered "sometimes", 26% answered "often", and 4% answered "constantly", the

others couldn't decide on the answer.

4. The reduction of the learning time using multimedia equipment on the classroom session (according to cadets' estimates) was 82% on average.
5. All cadets were positively evaluated the effectiveness of the use of training and interactive materials posted on the distance learning site when they self-studying the topic.



	A	B	C	D	E	F	G
1			1	2	3	4	5
2			100%	75%	50%	25%	<25%
3	1	Evaluate the degree of mastering the theme during the lesson	33	43	21	3	0
4	2	Evaluate the degree of mastering the theme by materials of the distance learning site	6	59	19	16	0
5	3	Evaluate the degree of mastering the material with the independent study of the theme	9				
6			yes				
7	4	Is it enough for you to study materials for mastering the theme	87				
8			independer				
9	5	How do you perform the general task	46				
10			independer				
11	6	How do you perform an individual task	66				
12			independer				
13	7	How do you usually answer the control questions	43				
14			> 2 hour				
15	8	Evaluate your time expenditures for finding educational material from additional sources	0				

Fig. 6. Survey results

4 Conclusions and directions for further research

For today, the modern learning technologies have become available for use in the educational process of any educational institution. But the analysis of LMS MOODLE possibilities has shown that a science-based approach to computer modelling of educational process is most effective mean of creating own methodology, that would combine traditional and innovative forms of knowledge acquisition by cadets taking into account the competence approach and specifics of the training specialists of marine industry, whom are competitive at the world labour market.

The results of the scientific and pedagogical experiment of testing the hypothesis of level formation of subject competencies during classroom and extracurricular activities using the distance learning platform proved that the structure meets the requirements both of the, who create necessary conditions for the cadets' qualitative training, and for cadets who become more motivated at the obtaining knowledge process and their application in solving professional problems.

As a consequence of the obtained results, it was determined that when performing the procedure for introducing a distance learning system at the educational process of KSMA special attention should be focus in equal on the creation of the educational and methodological materials for cadets self-study, a high quality testing system for checking their knowledge and interactive forms of distance learning.

The interactive learning methods on the basis of DLS MOODLE of KSMA have a

positive impact on the quality of cadets' training, the development of their professional competencies necessary for a successful competition on the world labour market.

Today, the first results of the implementation of the competency-based approach into the learning process already exist. The connection of the results and competencies is a complex question that requires much attention. The commitment to the results of education is an urgent problem for modern Ukrainian higher school and requires the integration of academic and vocational education, the recognition of qualifications obtained in the process of higher education and the development of lifelong education.

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