The Introduction of the Competence-based Approach in Educational Process of Training of Skippers

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Abstract. The competence-based professional education is the objective phenomenon in education brought to life by social and economic, political and educational and pedagogical factors. One's competitiveness at the modern job market usually depends on ability to operate new technologies, ability to continuous self-education and fast adaptation to various working conditions. Modern job market imposes the whole layer of new requirements on an employee which are taken into account on inadequate level or aren't taken into account at all in the training syllabus for specialist degree in different subject areas and in maritime education in particular. The main idea of the competence-based approach is that education has to provide not isolated knowledge and skills but to develop students' ability and readiness for future professional activity in various social and working conditions. The competence-based education, which has been introduced in many countries, is nevertheless a new way of organizing educational process in Ukrainian higher educational institutions. Because maritime education is of international nature, the introduction of the competence-based approach into cadets training program is of immediate importance nowadays. Search for effective forms of the educational process organization, which will allow combining the academic, practical and simulator trainings of specialists in this area, is an integral part of teacher's work at higher education institution.

Keywords. Competency, competence-based approach, competence-based education

Key Terms. Teaching Process, Information Communication Technology

1 The general problem statement and its actuality

The decree of President of Ukraine "On measures for priority development of education in Ukraine" dated by 30 September 2010 № 926 determined the number of measures for introduction the regulations in Ukraine, aimed at coordination the national system of education quality assurance with the general European system [4].

Based on modern society requirements, the education quality assurance should be based on the formation such competencies and skills in future specialists that enable to use practically knowledge and skills for the benefit of all Europe.

In the National Standard System of Higher Education the requirements and qualifications are clearly stated, the list of socially and professionally important knowledge, skills and competencies is provided, which are required from the graduate of high institution not only by the national labor market, but also by the European Community.

The National System of Qualifications should be the basis for the introduction of competence-based approach in higher education, including its components – the National and Branch qualifications limits. The National qualifications limits is implemented in order to:

— introduction of European standards and principles of education quality assurance with the requirements of the labor market competencies to professionals;
— ensure harmonization of standards of legislation in the field of education and social, labor relations;
— promote national and international recognition of qualifications acquired in Ukraine;
— establish the effective cooperation of sphere of educational services and the labor market. [3]

Conformity of the quality of graduates' training of high school with the requirements of branch standard of higher education is determined by social and personal (SPC), general scientific (GSC), instrumental (IC) and professional competencies.

The idea of competence-based approach in teaching was originated in the early 80th of the last century, the article by W.de Landshyeer "The concept of "minimum competency" was published in the journal "Perspectives. Question of Education"[8]. Initially, it was not the approach, it was the professional competence of the person as the aim and the result of education.

The competence in a broad sense is understood as "in-depth knowledge of the subject or mastered skill." In due course, there was expansion of the size and content of the concept. Since the end of the last century the scientists began to speak about competence-based approach in education (V.A.Kalney, A.M.Novikov, V.V. Serikov, S.E.Shishov, B.D.Elkonin etc.). [6, 7 10]. Today there are different approaches for understanding the core competencies. Some authors emphasize the personal properties, others - on the knowledge and skills that can be transferred to various conditions.

We will proceed from the fact that competence is the capability and readiness for the implementation of certain actions or functions and competence-based approach in education - a target orientation of educational process on the formation of competencies defined by branch standard, either socio-personal or professional.

The competency-oriented professional education - is an objective phenomenon in education, inspired by socio-economic, political, educational and pedagogical preconditions. At first, it is the reaction of professional education on the changes in the socio-economic sphere, the processes that have emerged with market economies. The

market puts forward the whole layer of demands to the modern specialist that are insufficiently included or not included in the programs of specialists training.

These new requirements are not hard connected with some discipline, they are interdisciplinary and universal. Its formation requires not only new subject matter, but other educational technologies. The competence-based approach allows to:

─ coordinate the purpose of study, which the teacher puts with students' goals;
─ unload students not by reducing the content, and by improving the part of individual self-education;
─ prepare students for conscious and responsible learning, the necessity of constant self-education;
─ and most importantly, in our view, provide the labor market by competitive specialists.

The object of the study is to determine the conditions and methods to formation of information competence for students that will promote assimilation of its professional skills.

Based on the objectives of the study were identified the ways of its solution.

The first phase of the study included the following types of work: bring the work programs in compliance with the STCW Code, IMO model course 7.02 and 7.04 and establishing the nature of interdisciplinary connections. In the second stage was done processing teaching methods of disciplines, also reviewed the content requirements for laboratory work in accordance with the competence approach and to implement interdisciplinary courses.

The third stage was dedicated to the order of evaluation procedure results obtained knowledge of students according to the content learned discipline, executed complex laboratory work to ensure appropriate skills

2   Solving basic problems

In our opinion, the introduction of competence-based approach in specialists training system is most important in marine industry, which is international in its essence. Specialists of maritime industry should comply with International Maritime Organization (IMO) irrespective of the country in which they got the education. The list of these requirements is in the International Standard of Training, Certification and Watchkeeping of Seafarers (STCW).The competence-based approach to multilevel training of marine specialists is the base of this document.

For example, we consider the STCW Code for marine electricians, there are two levels of training - electrician and electrical engineer. The document provides the basic functions for each level of specialty (e.g. at operation or support level) and competences are marked for each function, which should have the specialist. The higher level of specialist training, the greater the number of competences he should have. There is an example of part of STCW Code (Table 1).

Table 1. Specifications competencies specialty for marine electricians

№	Competence	National code competency	Requirements convention STCW	Level
Professional competence				
Specialized and professional competence				
1.	Safe use of electrical equipment	SPC-01	A-III/6	At support level
The general science competence				
1.	Basic knowledge of the fundamental branches of mathematics , to the extent necessary to own mathematical tools relevant industry knowledge, ability to use mathematical methods in their chosen profession.	GSC-2		At the level of exploitation
2.	Basic knowledge in computer science and information technologies; use software skills and skills in computer networks , the ability to create databases and use online resources.	GSC -3		At the level of exploitation

Today, the labor market dictates to education system what level of specialists' knowledge it needs. And competence-based approach is an attempt to bring in line the professional education and the requirements of employers. Competence-based approach suggests that the significant results of education are recognized outside the education system.

From the 2014-2015 school year in the Kherson State Maritime Academy the experimental research work in the integration of educational process on the basis of competence-based approach to the state education policy of Ukraine was started. [3]

All training departments of the academy are actively involved in the project. The teachers of department of information technologies, computer systems and networks have developed the new working program of courses in which the disciplines are considered as the mean of mastering the certain competencies within these disciplines.

Competence-based approach fixes and sets up the subordination of knowledge and skill sets. An important role in this process is computer science as a science and a subject, as competencies, which are formed during the study of the subject can be transferred to the study of other objects to create the integrated information space of cadets' knowledge.

To show the interdisciplinary connections the teachers of the department acquainted not only with the work programs of other disciplines, but also discussed with the leadership of faculties and departments the level of information culture should have the cadet for successful studying the special disciplines. As a result of this work in the discipline "Information Technologies", that studied on first year, new themes were added and the content of course "Computer Science for Skippers" has been revised and has acquired the applied nature.

The content of the course "Information Technologies" has two components:

1. Theoretical Computer Science, which is currently one of the fundamental areas of scientific knowledge, it forms the system-information approach to the analysis of the environment.
2. Information Technologies, which represent the methods and means of obtaining, transformation, transmission, storage and use of information. This component has extremely the important practical importance; it takes the social order of society to prepare the future professionals of the field of marine branch in the information world society.

The main purpose of the discipline "Information Technologies" is developing the information and communication competencies. The information and communication competence can be seen as a comprehensive ability to search, select the information, analyze, organize, represent, pass it; simulate and design objects and processes, implement projects, including in the area of individual and group activities. [5]

Most courses in computer science can be realized by means of competence-base approach. After analyzing the content of the courses we have identified the following competencies and described them from the point of view of the subject and with the aim to expand on other disciplines (Table 2).

Table 2. The list of competencies

The competence		Projection common objective competencies to curriculum subject
Key	**Generalized (common objective)**	
	Work with different media.	Skills of work with the applied software, multimedia reference books, electronic books, Internet resources.
	Use of information and telecommunication technologies.	The application of information and telecommunication technologies for solving a wide class of

The competence		Projection common objective competencies to curriculum subject
Key	**Generalized (common objective)**	
Information Competence		academic and applied problems.
	Job information (search, converting, storing, systematization, analysis and selection of information).	Information search in directories, search engines; conversion information (with graphics in text, with analog-digital); database design; work with different types of sorting; filtering, structuring the file system;
	The wording of the purpose, plan of action, awareness of the presence of certain requirements to the product of its activity.	Formulation of the goal in the study of certain subjects subject when creating the project, the choice of the theme report; writing the plan development and implementation of the project; understanding the software requirements, framework operation of databases; the formulation and description of its limitations.
	Possession of stylistic techniques	Create text documents, using the rules of presenting information in a presentation
Communicative competence	Dialogue the "man-machine"	Familiarity with the principles of constructing different types of interface (dialog boxes, menus and toolbars)
	Group work	Work on projects together, and in the group, performing different roles in a group interact in networks.
	Tolerance	Work in a network society, the use of telecommunication resources
Educational-cognitive competence	The ability to propose hypotheses, ask questions to the observed facts and phenomena, evaluate the initial data and planned result	Owning the technology problem solving with the help of a computer, computer modeling, formalization, numerous methods of problem solving, conducting computer experiment

The competence		Projection common objective competencies to curriculum subject
Key	**Generalized (common objective)**	
General cultural competence	The ability to issue the results of its activities, submit it at the present level	Knowledge of ISO require-ments for registration statements, build charts and graphs, create presentations
	Understanding the place of science in the system of other sciences	Awareness of the availability of certain software requirements, analysis of the advantages and disadvantages of information technology
	The ethics of labor and social relations	License for software, informa-tion security, legal responsibility for violation of legislation.
	Creation of conditions for self-realization, self-knowledge	The computer as a tool self-reflection (use test simulators), create your own information space), publishing, receiving au-thority in network society

The main task of the competence-base approach is to find out and to include in the educational trajectory that, without what the professional training can be happened, what is necessary and sufficient to know and be able to do the future professionals in the maritime industry. For this purpose we adjusted the content of educational mate-rial of disciplines by means of the implementation the tasks of following types:

— Tasks containing a large amount of text data and information presented in tables, charts, graphs, drawings, diagrams (transforming of information, work with differ-ent types of information).
— Tasks, in which it isn't clear to which area of knowledge it is necessary address to determine the method of action or the information (selection of the necessary soft-ware, the use of competencies in practice).
— Tasks, with a large number of tasks of different topics and different formats that require different algorithms for solving, forms of records of the answer.
— Tasks to optimize solutions.

Preferably it is necessary to use not formalized, but meaningful statement of the problem, so that the most difficult but important for getting the experience for solving problems, stage of formalization will be completed by the cadet.

For example, at learning the optimization, classic transportation tasks and use the capabilities of MS Excel for solving the tasks, formulas of specific functions and constraints are offered. But it is much more effective to give the applied task, for the solution of which the student should reasonable formulate the objectives, describe the

task and its limits in terms of selected technologies, create the information model of the task.

To generate activity algorithm for solving the tasks it is necessary to train cadets of the implementation of sequence of the following stages:

— Formation of the needs and intentions of a particular activity;
— Selection of required software and the way of activity;
— Planning of activities, description of restrictions;
— Implementation of actions;
— Analysis of the results.

Competence-base approach focuses on the use of knowledge and skills in the so-called extra-curricular, life situations, including in solving practical professional problems. The basis for the formation of competencies in students of 1 course is their experience, gained earlier in life and learning situations. But we must take into account the different levels of school knowledge in first-year student at updating knowledge in training lessons.

Therefore, the offering the individual tasks, tasks of different complexity, participation of students in project activities is the necessary ways to individualization of the learning process and encourage them to creative self-dependent scientific and practical work.

During the laboratory practical course "Information Technologies" in the first semester, the tasks of different difficulty levels can be presented and cadets can choose the tasks. This method will allow the cadets objectively determine their level of subject competence, well-prepared students will be able to realize the high potential, and students who has the poor basic training, avoid getting psychological trauma and motivate them to deepen knowledge. At the initial stage of training, the level of conformity cadets with the requirements prescribed for them is presented and it allows the teacher to adjust the methodical forms of teaching classes and forms of control according the results.

If we analyze the content of the discipline "Computer Science for Skippers" studied by the cadets of 2nd year of training, during the laboratory work, the subject competencies are formed that associated with the use of means of data processing presented in tabular form; using the computing techniques, mathematical and information modeling, business graphics can be purchased and secured in the study of this discipline. The content of the subject has interdisciplinary connections with many subjects, particularly with the disciplines: Ship computers and computer networks, Navigation information systems, Descriptive geometry and engineering graphics; Theory and construction of vessel, and others.

The basis for the formation of subject competencies is put at first year during studying the discipline Information Technologies. The study of functionality of spreadsheet (for example, Microsoft Excel) is intended, to explore the possibility of systematic presentation of information in tabular form and performance calculation works of any complexity, to demonstrate practical importance of informatics and implementation of interdisciplinary connections.

Further, the subjects of some laboratory works of the discipline "Computer Science for Skippers" are given:

Task 1. Calculation of the latitude variation, the longitude variation and the coordinates of points of departure and arrival of vessel

Task 2. Calculation of directions as to the geographic meridian and diametric plane of the vessel.

Task 3. Calculation of the arc's parameter of a great circle for mapping using MS Excel.

Task 4. Calculation and construction of static stability diagram using MS Excel (Figure 1).

Formulation of the problem. With Excel spreadsheet to perform calculations static stability shoulder and construct a diagram of static stability and dynamic stability diagram, constructed in the same coordinate axes.
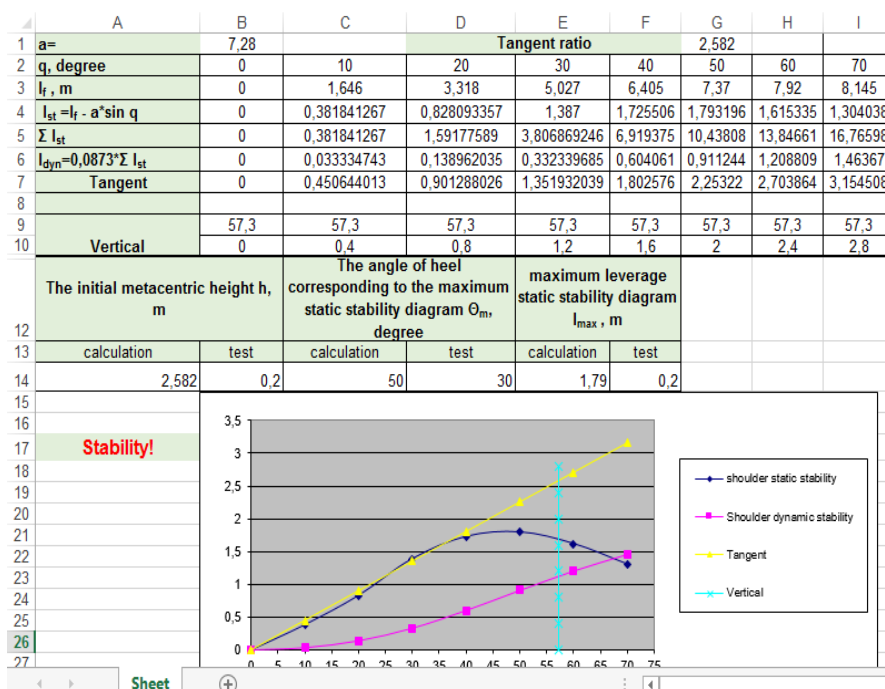
	A	B	C	D	E	F	G	H	I
1	a=	7,28			Tangent ratio		2,582		
2	q, degree	0	10	20	30	40	50	60	70
3	l_f , m	0	1,646	3,318	5,027	6,405	7,37	7,92	8,145
4	$l_{st} = l_f - a*\sin q$	0	0,381841267	0,828093357	1,387	1,725506	1,793196	1,615335	1,304038
5	$\Sigma\ l_{st}$	0	0,381841267	1,59177589	3,806869246	6,919375	10,43808	13,84661	16,76598
6	$l_{dyn}=0,0873*\Sigma\ l_{st}$	0	0,033334743	0,138962035	0,332339685	0,604061	0,911244	1,208809	1,46367
7	Tangent	0	0,450644013	0,901288026	1,351932039	1,802576	2,25322	2,703864	3,154508
8									
9		57,3	57,3	57,3	57,3	57,3	57,3	57,3	57,3
10	Vertical	0	0,4	0,8	1,2	1,6	2	2,4	2,8
12	The initial metacentric height h, m		The angle of heel corresponding to the maximum static stability diagram Θ_m, degree		maximum leverage static stability diagram l_{max} , m				
13	calculation	test	calculation	test	calculation	test			
14	2,582	0,2	50	30	1,79	0,2			
17	Stability!								

Fig. 1. Example of solving the cadets with MS Excel

Task 5. Calculation the course at navigating on LDC (large diameter circle).

Task 6. Calculation and construction of curve of total inertial error of gyrocompass, arises in resulting maneuvering.

Task 7. Calculation of coordinates of the vessel by the direct analytical method (by two measured heights) with the help of MS Excel.

Task 8. Calculation the assessment of the accuracy of vessel place by three equilateral bearings using MS Excel.

Task 9. Work with hydro meteorological data in MS Excel. Calculating the actual wind.

Task 10. Conducting the navigation calculations at planning of vessel voyage using MS Excel (Fig. 2).

Formulation of the problem. Given the coordinates of waypoints, you need to calculate the exchange rate to move in the next point, the length of each section of the route. It is also necessary to determine the total length of the route, as well as build a circuit-moving vessel.
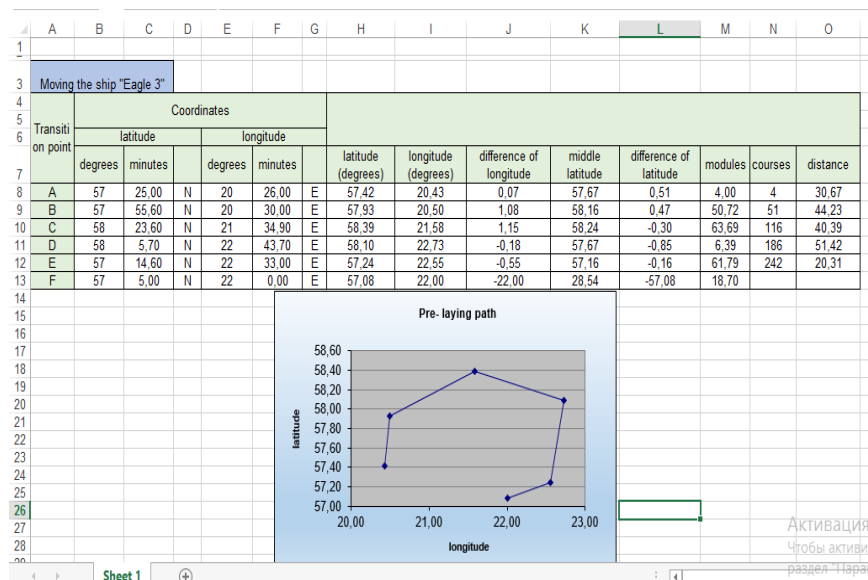
Transition point	Coordinates						latitude (degrees)	longitude (degrees)	difference of longitude	middle latitude	difference of latitude	modules	courses	distance
	latitude			longitude										
	degrees	minutes		degrees	minutes									
A	57	25,00	N	20	26,00	E	57,42	20,43	0,07	57,67	0,51	4,00	4	30,67
B	57	55,60	N	20	30,00	E	57,93	20,50	1,08	58,16	0,47	50,72	51	44,23
C	58	23,60	N	21	34,90	E	58,39	21,58	1,15	58,24	-0,30	63,69	116	40,39
D	58	5,70	N	22	43,70	E	58,10	22,73	-0,18	57,67	-0,85	6,39	186	51,42
E	57	14,60	N	22	33,00	E	57,24	22,55	-0,55	57,16	-0,16	61,79	242	20,31
F	57	5,00	N	22	0,00	E	57,08	22,00	-22,00	28,54	-57,08	18,70		

Fig. 2. Example of solving the cadets with MS Excel

As it turned out, the cadets have difficulties in solving meaningful problems, but solving them, they are acquiring invaluable experience of professional competence.

It should be changed not only the working programs of disciplines, content and methods of education, but also it should be realized that personality of the teacher, who uses competence-base approach, should meet certain requirements [9]:

− Set the goals and estimate the level of its achievement together with the cadets.
− Evaluate the achievements of students not only by the mark but by the meaningful description.
− Connect the investigating material with professional direction, everyday life and cadets' interests.
− Plan the lessons with all variety of forms and methods of educational work.
− Strengthen the knowledge and skills in educational and extracurricular practice.
− The ability personally to orient in the situation in the labor market.

‒ Take into consideration the cadets' ideas.
‒ Successfully solve own problems.

3   Conclusions and directions for further research

Competence-base approach makes the cadet a major participant of the educational process with his individual goals and objectives. This approach allows directing the educational activities to involve students in active, conscious activity, the development of information, communicative, educational, cognitive competencies and the development of the personal cadet's potential, forming self-appraisal, self-control and teacher's reflection that allows to achieve the better results in education.

It is the complex issue to connect the learning results and competencies, to which it should be paid much attention. The orientation on the results of education is now the urgent issue for Ukrainian high school, and it requires the integration of academic and professional education, recognition of the qualifications, getting in the process of higher education, the development of the education during whole life. Society should get used to the situation when the description of the results of the education will be provided in the language of competencies.

As a result, we note that the essence of the new paradigm of education can be characterized by the following factors:

1. The displacement of the main emphasis from mastering the large amounts of information to master the methods of continuous acquisition of new knowledge and the ability to learn independently;
2. The mastering of skills to work with any information, with mixed, contradictory data, forming the skills of independent, critical way of thinking;
3. The gradual change of the traditional principle "form of knowledge and skills" to the principle "to form professional competence."

Today there are already the first results of the implementation of competence-base approach in the educational process. One of the positive issues is the changes that have occurred in the redistribution of motivational aspects of cognitive and training activity of cadets.

During two academic years we observed the changes in the motivational component of the educational process, namely, we were interesting how the content of the course "Computer Science for skippers", the strengthening of applied direction of the discipline and the interdisciplinary connections of the courses affect on the interest of students, increase their motivation level. The following types of motives were selected:

‒ motives for avoiding troubles (traditionally they had the higher percentage of dominance);
‒ motives of the content of educational activity;
‒ motives of attitude to the learning process.

Questionnaires of the cadets showed what types of motives are dominant. The motives of the content of educational activity were put at the first place.

The data are given in the table (see. Table. 3) and represented in the diagram (Fig. 3).

Table 3. Motives of educational activity

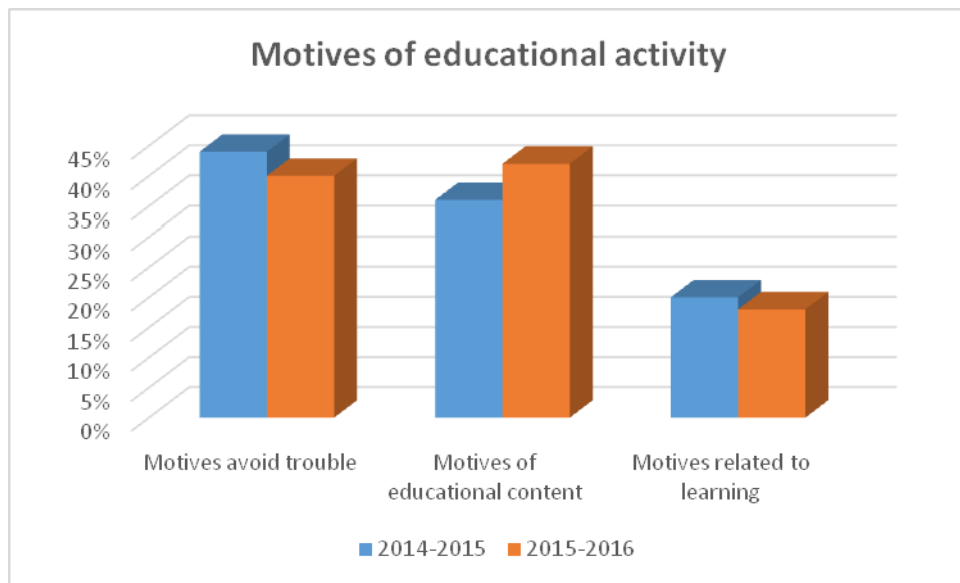| Study year	Motives avoid trouble	Motives of educational content	Motives related to learning
2014-2015	44%	36%	20%
2015-2016	40%	42%	18%

Fig. 3. Diagram of distribution motives of educational activity

In terms of implementation of competence-based approach into practice the training of specialists maritime industry, information literacy is the basis of formation of professional competence of students, promotes the informed use of information technologies for solving applied problems in finding and making decisions in predicting and analyzing the results of solving problems.

At this stage in the KSMA the experiment in the introduction of competence-base approach in the educational process is conducting.

Today we have the task to analyze the results of the experiment to further adjustment of educational material and forms of learning.

References

1. Complex of normative documents for the system development standards of a higher education. Annex 1 to order of Ministry of education of Ukraine dated 31.07.1998, No 285, with changes and additions. Bulletin "Higher education", 10 (2003)
2. The national classifier of Ukraine: Classifier of professions DK 003-10. Kiev (2010)
3. The Order of the Ministry of education and science of Ukraine № 1148 from 7.10.2014. Bulletin, 2 (2014)
4. The order of the President of Ukraine "on measures for the priority development of education in Ukraine", No. 926 (2010)
5. Baidenko, V. I.: Competence approach to the design of state educational standards of higher professional education (methodological and methodical questions): Methodical grant. Research center of quality problems of training of specialists, Moscow (2005)
6. Winter, I. A.: Key competences – new paradigm of result of education. Higher education today, 5, 14--20 (2003)
7. Competence in education: experience design, http://projects.ict.usc.edu/dlxxi/materials
8. Landseer, V.: The concept of "minimal competence. Prospects. Education. 1, 28--34 (1988)
9. Lebedev, O. E.: Competence approach in education. School technologies, 5, 19-23 (2004)
10. What is the competence approach in modern education? http://festival.1september.ru/articles