TRANSNAV
http://www.transnav.eu
the International Journal
on Marine Navigation
and Safety of Sea Transportation
Volume 13
Number 1
March 2019

DOI: 10.12716/1001.13.01.07

# Simulation Methods of Designing Specialist' Qualification Improvement System

S.S. Moyseenko & L.E. Meyler
*Baltic Fishing Fleet State Academy of the Kaliningrad State Technical University, Kaliningrad, Russia*

ABSTRACT: Development of the specialists' professional competence can be achieved both directly during games and a post-game analysis. Since the continuing education system must respond quickly to changes in external and internal conditions it is necessary to adapt it to new conditions. This is possible when scientific and pedagogical staff of the university is ready to the project activity. In this regard the problem of teachers training for such activities is actual one. The most effective methods of such preparedness development are game methods and, in particular, business and simulation games. There are situations of "conflict" of interest during games as in real life and teachers of different subjects must search a compromise that satisfies basic learning goals. During the game, participants consider many variants for solving certain project tasks, methods of training schemes designing. It is very important in the sphere of maritime specialists training. Participants are often faced with a lack of methodological training that is an important motivating factor for self-development and new knowledge. Business and simulations games have an aim to develop readiness of teachers to design educational systems. The paper discusses the methodological approaches to the development of conceptual designs of professional business/simulation games for seafarers and managers of maritime transport and describes a business/simulation game scenario "Ensuring the safety of maritime cargo transportation". The problems of the game organization, a results analysis and developing measures to improve the system of training and self-improvement plans of participants are considered..

## 1 INTRODUCTION

Business and simulating games play an important role in processes of education. Many books and scientific papers are devoted to games designing and their realization in various fields of economy and industry (Campbell, 1980, Keys and Wolfe, 1990, Platov, 1991, Pidkasistiy, 1996, Anderson, 2009, etc.). But, professional development of maritime specialists supposes learning new theoretical knowledge and its actualization because of their activity is realized in "an aggressive environment" with a high probability of extreme situations occurrence. However, in actual practice of port activity, navigation and cargo transportation many theoretical developments are not often in demand (Belyaev, 1999). For this reason a specialist is not familiar sometimes with the relevant skills in the proper degree. Such a gap can be eliminated through "artificial/virtual" methods of knowledge actualization: training and business/ simulation games. The effectiveness of these methods is proved into practice (Moiseenko, 2004, Meyler and Moiseenko, 2009). The development of business games for maritime specialists requires high professionalism both from the developers themselves and from teachers/experts who lead the game and generate situations in the play activity of trainees.

The important task of selecting the training content has to be solved both during designing the game and in the process of its realization. It was suggested (Meyler and Moiseenko, 2010, Moiseenko and Meyler, 2011, Meyler et al., 2012) a method for the game content determination based on the principle of integration of diagnostic, simulation and expert methods. The diagnostic method allows to make an analysis of the existing specialist's level of training, opportunities, advantages and disadvantages of his self-development system. Using this method it is possible to study the development of the situation in the past, present and to identify trends, approximating them for future. It is identified the need for compensatory education as a result of the diagnostics of the specialist. In accordance with the given objectives the selection of the content can be corrected in the context of development plans.

Our investigations (Moiseenko and Meyler, 2009, 2010, 2011, 2012) show that he level of professional preparedness can be estimated by testing the ability to analyse various situations and to make adequate decisions. A considerable experience has been gained in estimating specialists' professional level in recent years. In particular, a new generation of training simulators allows modelling various situations at sea ports and in the process of cargo transportation (http://www.transas.ru/). However, issues of complex estimation of the professional level of specialists in the field of maritime transport management, including a psychological aspect, are not developed enough.

For a complex estimation of the professionalism level, it is necessary to develop criteria that can be represented as a "standard of a professional" (Campbell, 1980, Novikov, 1998, Melnitchuk and Yakovleva, 2000, Sergeev at al., 2003, Meyler and Moiseenko, 2007). Such a standard has to be an integrated image of the specialist linking his various features. Since the analysis of interactions occurring in the process of a specialist's activity can reveal more completely individual features, his training level and causes influencing on a decrease of his activity effectiveness, the structure of the "standard portrait" should include:

- requirements for a personality nature;
- professional features and knowledge,
- psychological features of a personality specific to the concrete work.

An analysis of existing methods (Nazarenko, 2007) of forming a specialist portrait shows that the most effective approach is the expert evaluation method in combination with the system-activity analysis method. The "standard of a professional" should be oriented to a specific area of his activity (for example, the Head of a sea port, a stevedore of a container terminal, a port Chief technologist, a Master of a container ship, etc.). In this regard, it is necessary to be guided by opinions of experts in the field of the activity for which the "standard of a professional" is created.

In the context of scientific and technological progress and a continuous "renewal of knowledge" individual personal educational values are becoming the priority. This process results in transition of the educational theory and practice from the paradigm of learning within which a person acts as an "object of learning impact" to the paradigm of lifelong learning, self-development and self-improvement of individuals. However, the process of continuous education and professional development will be effective only under condition of its controllability.

Hence, it is necessary to create certain conditions and management of the educational process. Real needs in the continuous development of professionalism, self-development and self-improvement of specialists determine the relevance of creation of the adaptive system of the continuous education (qualification improvement). The system which is being designed should be based on the principles of: systemacy, adaptability (rapid response and change), integration (e.g. into the global educational environment), accessibility, technological effectiveness and dynamism.

Practical implementation of these principles requires that the system has a high potential for self-perfection and its improvement through integration into the existing system of new high-tech modules. An adaptive continuing education (qualification improvement) specialist' system is "mobile" and must rapidly respond to changing internal and external conditions, new challenges. Thus, it is necessary to adjust the existing system and create new subsystems integrating them into the main system. A response to changes of conditions or challenges should be prompt. It is possible on condition that the academic staff of an institution of higher education will be prepared to carry out a project activity and possess scientific tools to optimize the design decisions.

In this regard, the issue of qualification improvement (teachers' training) for design activities is the most relevant. The most effective methods to develop readiness for the project activity are gaming techniques, in particular, business and simulation games. This statement is based on the results of the practical application of such games in the Institute for qualification improvement of the Baltic Fishing Fleet State Academy (BFFSA) and in the course of cadets training in the field of maritime transport (Meyler and Moiseenko, 2009, 2010, Moiseenko and Meyler, 2003, 2009, 2010).

A "conflict of interests" arises in the course of games as well as in real-life situations. In such situation teachers of different disciplines have to find a compromise for solving the main problem. For example, it is important to consider interdisciplinary connections while forming training systems. Games simulate the professional communication environment. During the game all the problems concerning rational organization (logistics) of interdisciplinary connections are solved more effectively. At the same time, participation of highly qualified experts allows teachers of special and general-theoretical sciences (applied mathematics, information technology, mechanics, cybernetics, etc.) to deepen their knowledge in new trends and their specificity. Thus, the actual task is to develop an appropriate model of a business/simulation game allowing to carry out multi-purpose game simulation experiments within the problem: creation of the person-oriented pedagogical qualification improvement system. Only the structural elements of

a fishing-industrial complex having both internal logistics links and links to the external environment are considered in the paper.

## 2 CREATING BUSINESS/SIMULATION GAME

### 2.1 *A methodological basis*

Such a work is essential for creation of new areas of qualification improvement, having no prototype. It is especially important when there is a need to improve the skills of experts in relation to the technical re-equipment of enterprises (ports, fleet), introduction of innovative technologies, etc. Creating business/simulation game (which is an analytical act) gives a researcher full understanding of the system being modelled. At the same time, the game can be regarded as an operationalization of hypotheses, theoretical positions and relationships which are known before the game is created (Pidkasistiy, 1996). During the development of a business/simulation game model, these theoretical positions are systematically summarized and supplemented so that the created game model becomes a virtual reflection of a studied object or a process. In some cases after creating such a model the investigated problem becomes so clear that there is no need for simulation experiment. Thus, there is the problem of professional readiness development of academics and specialists which are involved in educational processes. As a methodological basis, we use a systematic approach and methodological seminars and business/simulation games as educational technologies. In the games teachers have to develop a project of a pedagogical system of professional development. Thus, the process of teachers' qualification improvement in the context of development of competencies is launched. The goal of the game is development of knowledge and skills of teachers, researchers and professionals in the field of education to carry out project work connected with creation of new adaptive educational systems of qualification improvement.

The following scheme is proposed for designing the pedagogical system of qualification improvement of maritime specialists using business/simulation games:

- goals of forthcoming studies and designing are formulated;
- a team of teachers / professionals and experts is formed;
- hypotheses and theoretical concepts of the researched object or subject are put forward;
- hypotheses and theoretical concepts are made as a prototype of the expected outcome;
- a supposed structure of the solution is developed, i.e. to emphasize the issues and problems of the study which can have a variety of alternatives for their implementation;
- an analytical overview on the study problems is carried out;
- the information that it would be desirable to obtain is defined.

A business/simulation game has been created on the basis of the formulated hypotheses, theoretical concepts and relations in accordance with the set goals. It is necessary to clearly define the simplicity of a game development in relation to the reality, which makes it possible to change the planned game model in future in order to test hypotheses or new theoretical concepts:

- a team of participants and experts of a research group (they may be the same participants and experts) is created;
- programmes and plans for the game with fixed "points" of a control, the structure of the controlled parameters and variables are developed.

A business/simulation game is created as a self-developing system with adaptive properties which ensure the principle of an autonomy of subjects and episodes of the game. This principle provides the flexibility of the simulation model which makes it possible to "complete" and "adjust" the game for a specific group of participants and gives an opportunity to rationalise a training course plan, if the game is used for training purposes.

### 2.2 *A business/simulation game structure*

The process of designing the game has four main phases: preparation for the game, gathering initial information and development of the technical task, development of the project; its assessment, reviewing, the project defence; delivery of the project to the customer. The preparatory period includes a set of works related to the formation of reference literature, software for solving optimization problems, preparation of tasks; generation of disturbances that will be included into the game; specifying system of ratings, penalties and incentives; acting and discussing the game scenario with experts/arbitrators, etc. At this stage instructing the game participants takes place. The formation of project teams and the initial knowledge control of the project participants (if necessary) as well as methodological consultations are conducted. Designing pedagogical system for qualification improvement suggests development of a draft project of the system including such basic elements as a subject and an object of teaching, the process of teaching and self-development, the teaching content and the technology, methodological, methodical, technical and information support. Let's consider a business/simulation game structure shown in figure 1.

#### 2.2.1 *Brief description of the game*

The game process is managed by a specialist imitating the role of the project leader. There is also an expert group consisting of 2 or 3 people and maritime specialists working together with the leader. The specialists are representatives of companies for the personnel of which the system is created. It is reasonable to include in the group of experts a researcher/methodologist who would use the game as a tool for scientific purposes. Each group develops its own version of the system, discusses the various views of the participants and finds compromise solutions. Then each group prepares a summary and defends the own project. The group of experts reviews and evaluates all projects. Rewards and penalties are assessed in points. The points also assess and the quality of the projects. During the game there

is a break from time to time for a meeting of the game group management (the leader and the experts) when the game itself and claims are discussed. At the meeting it is possible to change members of the group if needed. At the end of the game the leader and the experts choose the winner of the game. The project options presented by different groups become then a basis for further discussion which is the subject of the postgame activity of experts and individuals involved (e.g. group leaders). A detailed analysis of the game and results of the research are performed during the postgame activity. After that the decisions on the use of the projects both for the further game development and for creating a real system of qualification improvement / continuing education are made.

The game participants are: the leader of the game (the project manager), methodologist, assistant, researcher, teachers and specialists who form project groups; an expert group which may also acts as client representatives and opponents of the project. All the participants are divided into groups according to their choice. Groups can include 3-5 people who choose the leader of the group.

The leader of the game formulates the goal and main objectives which are to be solved in the course of the game.

The main objectives include:

1 an analysis of the situation in post-graduate education and in terms of implementation of the ideas of continuing professional development, self-development and self-improvement;
2 formulation of contradictions and problems, setting up tasks in their logical relationship;
3 development of a draft project of the pedagogical system for qualification improvement:
   - development of the system ideology;
   - formulation of the main requirements for the designed system and efficiency criteria;
   - development of a process model of the system;
   - definition of inputs and outputs of the system, parameters, controllable and uncontrollable variables;
   - development of a structural model of qualification improvement;
   - development of a functioning algorithm of the system of qualification improvement;
   - definition of functional work places (demo version) and a set of technical devices;
   - carrying out simulation experiments on the use of the system;
   - checking the system for compliance with the conditions and requirements according to the eligible criteria;
   - assessment of the project.
4 calculation of the efficiency of the project.
5 the project defence.

### 2.2.2 *The game process*

When all the prescribed procedures have been completed, the project groups come into the main period of the game. To present the content of the game project the appropriate scheme blocks presented in figure 1 are commented below.

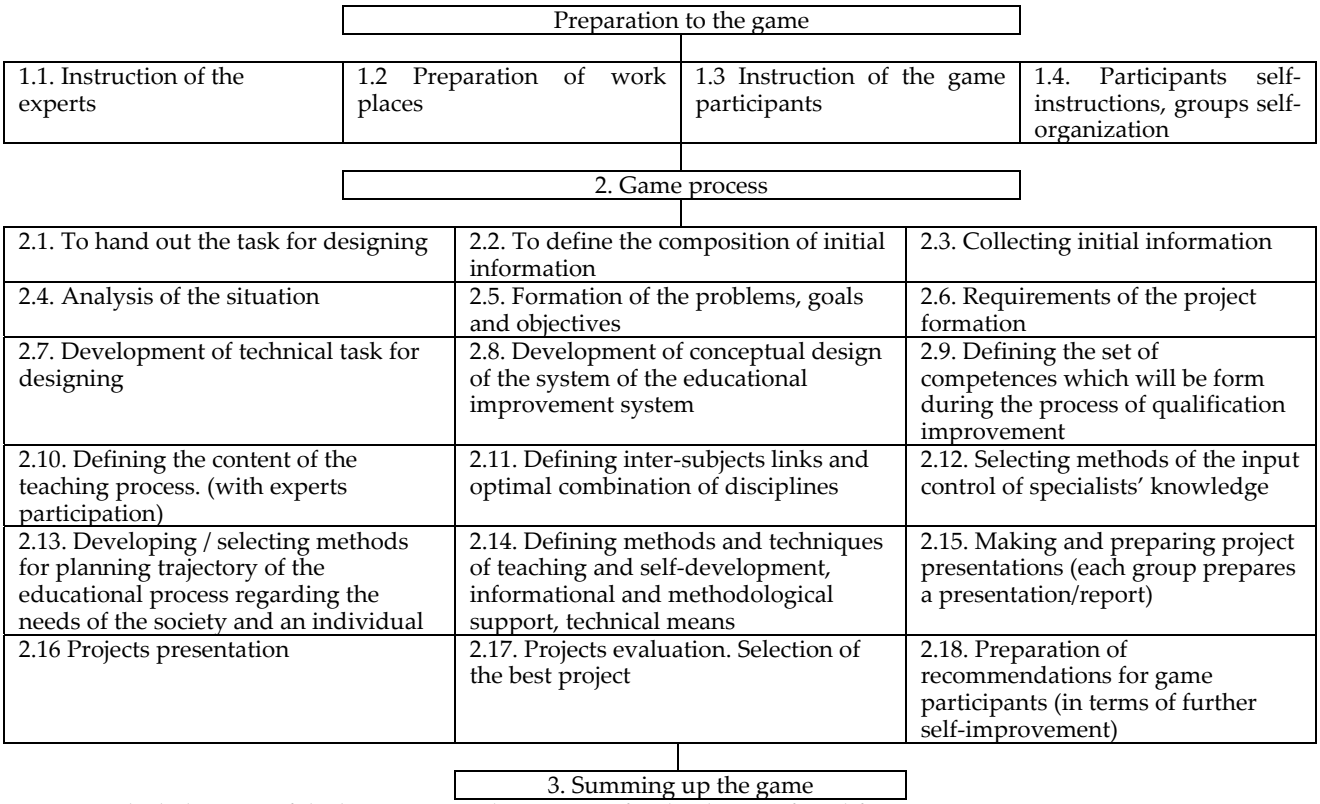

Figure 1 - Block diagram of the business/simulation game for the design of qualification improvement system

Blocks 2.1.-2.2. A project task is given by "a customer" to the each project group. The task contains information about the specialization of maritime specialists, training objectives and expected results. For example, the goal is forming competences in the field of innovative technologies implementation for container terminals or for the specialized vessels. The leader of the project group presents the task for designers in order to analyse the task, to define the content and sources of initial information needed for the development of technical task and the project.

Blocks 2.3.-2.7. The following works are carried out: gathering initial information, an analysis of the situation in ports and in the fleet. For example, innovative technologies and experience in specialists' training in the field of activity are analysed. On the basis of the analysis problems, goals, objectives and requirements for the project are formulated. The technical task for designing is then developed and agreed with the customer. After developing the technical task the project groups submit their brief progress reports to be discussed at a plenary session by all the game participants. In the reports it is necessary to prove the relevance and fundamental ability to perform the project task in accordance with the customer specifications. The designers should present their vision of the project at the level of abstraction and the possibility to work out alternatives. It is necessary to define which quality and effectiveness criteria are supposed to be taken into account. The fulfilled work will be assessed by experts/arbitrators.

Blocks 2.8.-2.9. The groups start designing. At the first stage the process model of qualification improvement system is developed. The main elements / modules and their main parameters, inputs and outputs of the system are defined. On the basis of an analysis of the activity for which specialists' teaching is planned, the game participants (teachers and experts) define and formulate the main competencies which should be mastered by specialists as the result of the teaching process.

Blocks 2.10.-2.11. On the basis of the analysis of a new type of activity in the field of which a specialist should acquire a complex of new competencies the structural component of the designed system is defined. Interdisciplinary links and logical chain of the teaching process are defined. Defining these links and volume of teaching courses should follow the logic of common sense, but not ambitions of teachers. Therefore the volume of study hours of teaching courses should be reasonably based on the priority and complexity of the acquiring competencies, and the course corrections will be performed after the results of testing experts. Options for determining the content of the study process should be agreed with the customer. After the customer's approval the groups continue their work on the project.

Blocks 2.11-2.13. Teachers-participants determine jointly with specialists and maritime experts interdisciplinary links and rational combination of courses. At the same time the following problems are solved: a) selection of the methods of input testing of specialists arriving for improving qualification, selection/development of methodological approaches to the process of qualification improving. A rational logistic chain/trajectory is developed virtually showing organization of the process of qualification improvement. In this case, it is important to show how the idea of person-oriented teaching will be implemented.

Blocks 2.14-2.16 Methods and techniques of training/self-development are selected on the basis of the analysis of the required competences, the educational and professional level of specialists. The methodological, informational, technical and technological support of the educational process is defined. The groups complete the developed projects, prepare their presentations and to report the results of the work at the plenary session.

Blocks 2.17-2.18. The game leader, experts and arbitrators determine the best project, the best project group, the best project designer. Summing up the game and its discussing, approving recommendations are made at the plenary session. The leader announces completion of the game.

### 2.3 *The business/simulation game "Ensuring the safety of maritime cargo transportation"*

As an example of designing a business/simulation game it is considered the methodological approach to the game the main purpose of which is formation of abilities and skills for managing processes of the cargo transportation safety (Moiseenko and Meyler, 2011). The following tasks are necessary to solve in order to achieve this purpose:

- determination of professional preparedness of specialists to act in difficult circumstances and unusual situations;
- development of skills for an analysis and decision-making during the process of the professional activity;
- study of integrative processes of the maritime engineer's professional preparedness formation;
- analysis of maritime safety ensuring problems and efficiency of fleet commercial operations.

A preliminary design of the business/simulation game is given in table 1. It is seen that the game provides simulating six plots directly linked to the game process. Participants get instructions and learn the game rules as a part of the first plot. At the same time the lead of the game, formulating goals of the game simulation experiment and analysing the situation, notes existing substantial contradictions between the desirable and realizable and thereby "running" problematization processes, goals setting and self-determinations.

Table 1. Scenario plan of the business/simulation game "Ensuring the safety of maritime cargo transportation"

| Plot | Episodes | Actions |
|---|---|---|
| 1. Preparation for the game | 1.1. Instructing the game organizers and experts.<br>1.2. Instructing the game participants, studying of regulations, systems of the game control and evaluation of participants actions.<br>1.3. Determination of play groups and roles distribution. | Theme, goals, tasks, area of responsibility, regulations. Instructing, distribution and study of materials, etc.<br>Clarification of the game governance, penalties and bonuses systems, etc.<br>Formation of play groups and roles distribution. |
| 2. Incoming control of participants knowledge and skills | 2.1. Participant's testing.<br>2.2. Definition of testing results. | Presentation of a test card to a participant of the game.<br>Explanation of the testing task and an evaluation procedure. |
| 3. A ship voyage planning | 3.1. Definition of initial information, its collection and analysis.<br>3.2. Route selection of the voyage to the port of loading/unloading.<br>3.3. Project and the ship cargo plan development according to the criteria of safety and effectiveness.<br>3.4. Planning ship stores, material and technical supply, crew completing and training for the voyage.<br>3.5. Ship voyage planning.<br>3.6. Planning safety actions. | A ship owner sends the ship's captain a telex containing instructions on the next voyage: ports of the ship loading/unloading, kind, type and quantity of cargo, special cargo characteristics, time for loading, loading/unloading rates, handling procedures of shipping documents, lay-time calculation, etc.<br>The captain of the ship distributes tasks to prepare the ship for the voyage. |
| 4. Loading the ship | 4.1. Coordination of a cargo plan with stevedores and the action plan for work safety providing and environmental protection.<br>4.2. Monitoring the condition status of cargo, its stowage in holds and storage, mounting, etc.<br>4.3. Control of hydrometeorogical conditions.<br>4.4. Drawing up primary shipping documents.<br>4.5. Drawing up protest letters in case of infraction of rules by stevedores in loading or delivery of cargo which has "defects ", as well as of the ship structures damage during loading. | The head of the game and experts performing the roles of shippers, agents, inspectors, surveyors, stevedores, etc. generate introductory data oriented to the growing complexity of the situation.<br>Situation of a conflict between the ship and the shipper regarding the quality of packaging and labeling cargo is created.<br>The situation of the ship structures or cargo damage due to negligence of dockers (crane operators) is initiated.<br>Participants of the game execute the required documents (notices, protests and acts of damage, etc.) and try to find compromise solutions.<br>Fixing knowledge and skills needed for solving professional problems and situations, definition of "gaps" in knowledge and skills. |
| 5. Issuing documents for cargo (Bills of Lading, cargo manifest, etc.) | 5.1. Issuing Bills of Lading, addition of remarks and lay-time commencement.<br>5.2. Drawing up permission for the ship to leave the port. | Experts initiate a conflict in terms of remarks including in the bill of lading, as well as in the act of laytime preparation.<br>The situation when port authorities' claims concerning technical condition of the ship, etc. are simulated. |
| 6. Preparation of the ship for leaving the port | 6.1. Implementation of actions in accordance with the regulations for navigation safety.<br>6.2. Definition of the time of the pilot's arrival onboard, the required number of tugs, a weather forecast, navigation conditions, etc.<br>6.3. Drawing up a statement of a fact the ship's readiness to a voyage. | Implementation of inspections in accordance with checklists.<br>Diagnostics of technical means, etc.<br>Discussing with the agent problems related to leave the ship at sea.<br>Clarification of the weather forecast and navigation conditions at the time of the ship leave.<br>Filling in the logbook and other forms of documents.<br>Experts initiate conflicts, complicate the situation.<br>Simultaneous fixation of the captain's and his mate's errors as well as errors of experts. |
| 7. Analysis and summarizing of the game. | 7.1. Organization of discussing the game results.<br>7.2. Estimation of the working groups' actions in the game.<br>7.3. Formation of the block of "gaps" in the knowledge and skills of the participants, typical mistakes and miscalculations. | Reports of the play groups leaders, self-evaluation of the actions of the game participants with an emphasis the attention on the occurred errors and the "gaps" in knowledge and skills, relation to the game and wishes.<br>The experimental material accumulated during the game is systematized and processed in |

| | | |
|---|---|---|
| | 7.4. Final selection of learning content and development of professionalism of marine specialists. | order it will be possible to carry out the procedure of training content selection, to build the system of subject knowledge and ways of their integration. |
| | 7.5. Specification of the training programs for specialists for the postgame period. | Training programs are corrected according to the results of the game experiment if participants continue training in play groups. |
| | 7.6. Consulting assistance to the participants of the game in development of their programs of self-development/self-designing. | Participants receive consulting assistance, including assistance in development of the program of self-training and self-development if they continue studies independently. |
| | 7.7. Development by the game organizers of the postgame activity program concerning the game and preparation of the report on the game simulation experiment | |
| 8. Postgame activity concerning the game . | 8.1. Processing the results of the game simulation experiment with a goal to determine dependences, rational methods of formation of the professional personality, knowledge of integration and configurators. | Results of the experiment are processed taking into account the earlier obtained data from other experiments of the same direction, that allows to accumulate the empirical material. |
| | 8.2. Conducting methodological seminars for teachers and experts. | Comparing the results, establishing dependences, confirmation of the previous results is considerable contribution to the development of our theoretical representations about the subject of the study. |
| | 8.3. Development of the complex of purpose-oriented programs of vocational development of marine specialists and ways to adapt these programs to a person. | |

The second plot provides preliminary estimates of participants' readiness to the game. In case of unsatisfactory test results it is assumed that such a result helps to intensify the process of motivation of specialists for developing professionalism. "Gaps" in knowledge and skills found as the test results are eliminated by the decision of the game leader. Thus, the compensatory function of education is realized, i.e. advices can be given to participants of the game and special literature for self-study may be recommended.

The third, fourth and sixth plots are extremely important because at these stages many of the major issues of navigation safety ensuring and sea cargo transportation are solved in real practise. It is assumed that not only typical real situations are fulfilled at these stages, but a complex of non-standard situations that happen rarely in real activity is simulated too. In cases of such situations appearance serious negative consequences can entail if adequate solutions will not be found by responsible specialists.

Thus, the task of the game leader and experts playing roles of officials, who can counteract the captain of the ship and other persons involved in the process of sea cargo transportation under certain conditions, is to generate episodes and situations "provoking" a conflict and thereby substantially complicating making a solution of professional tasks. At the same time, as "home prepared" tasks, as actions according to a present situation can be performed for generating the game situations. It allows to implement the game variation into the real game situation, i.e. the structure of the game has many degrees of freedom. Thus, the game adapts depending on the goals and specific problems requiring the solution. The game participants fix results of the analysis, calculations, decisions and the effect of these decisions. They take into account the specific conditions, the professional experience of all participants of the game group. The experts record the work of groups and individuals in the each episode and plot. Their duties include clear fixating errors, "gaps" in knowledge, abilities and skills of specialists and their ability to integrate with various kinds of knowledge for solving complex professional problems. In addition experts observe the behaviour of game participants in difficult situations.

During the game experts and the leader of the game analyse activities of participants and estimate their performance, identify areas of knowledge and skills in which it is useful to hold substantive and methodological consultations. For example, our experience in business/simulation games designing shows that there is practically always a need for methodological consultations in a systematic approach methodology, a system analysis, designing without prototypes, etc. (Moiseenko and Meyler, 2011). Decisions obtained for each plot are discussed by all participants of the game. Representatives of groups make reports where the idea of the design decision is revealed, as well its motivation and implementation methods with evaluation of possible consequences of the decision implementation. Speakers answer questions from experts and other participants of the game, fixing critical remarks and opponents' suggestions. Final estimates for each plot are determined after the public discussion of the play groups' reports. All working materials relating to the analysis of situations in each plot, developing design solutions, a decisions' motivation and a choice of the decisions implementing methods are given to the game leader for the further examination in accordance with the objectives of the game simulation experiment. Processing game results requires certain time. Therefore, it is possible to realise partially selection of the content of the training and professional development directly during the game, as it was mentioned above. But a careful analysis of the game materials is held in the postgame period. In the process of the analysis it is often possible to detect some important regularity, to get an understanding of

some of the integration processes, interdisciplinary system links and to evaluate the effectiveness of various knowledge integrating methods for professional problems solving. The experimental results allow to select the content of training and development of maritime specialists on the higher qualitative level, as well as to find new plots of the game and new opportunities for the whole game. An example of the training content selection and professional development of ships masters on the results of game simulating experiments is given in table 2.

Table 2. Matrix representation of the content selection scheme for maritime specialists training and development

| Plot or operation | Acts of activity | Subject knowledge | Skills and abilities |
|---|---|---|---|
| Ship's voyage planning | Route selection of the voyage to the port of destination | Hydrometeorology and oceanography.<br>Navigation and sailing directions<br>Cyclones and anticyclones, sea currents.<br>Aid to navigation, etc. | Be able:<br>to find sources of information;<br>to analyze synoptic chart data and long-term forecasts;<br>to determine risk factors and their assessment correlated to concrete constructive and exploitations characteristics of the ship, its purpose;<br>to evaluate the impact of the navigation conditions on the operating parameters of the ship;<br>to find necessary documents regulating cargo transportation,<br>to apply them;<br>to make the cargo plan showing the holds rotation during loading;<br>to perform calculations of stowage;<br>to calculate ship stability and sitting, bending moments and shear forces;<br>to assess the impact of the extreme conditions on the longitudinal and local strength of the ship, etc. |
| Planning measures to ensure the safety of maritime cargo transportation | The project and plan of ship loading | The theory of the ship.<br>Theoretical mechanics.<br>Strength of materials.<br>Regulations for the cargo transportation<br>Requirements of the international convention (SOLAS, MARPOL).<br>Ship's stability at high angles of heel, local and general ship's longitudinal strength, ship's unsinkability.<br>Requirements and recommended schemes of different cargo strapping.<br>International Sea Law.<br>International regulations related to navigation.<br>Rules of technical exploitation.<br>Fire safety rules.<br>Navigation safety rules.<br>Knowledge of rules and their application, basic legal acts (territorial waters, economic zones, etc.) | Be able:<br>to find necessary document, to assess its adequacy;<br>to the studied problem;<br>to apply creatively legal acts, regulations, recommendations in order to solve practical problems;<br>to present systemically whole range of measures to ensure the safety of maritime cargo transportation and to correlate everything with methods and means of these measures practical implementation.<br>to fix performance facts in the logbook. |
| Execution of shipping documents | Issuing the Bill of Lading | Commercial work in the merchant fleet.<br>Notion of the Bill of Lading, its kinds, and functions.<br>Master's remarks to the Bill of Lading concerning cargo quality or it's packing, etc. | Be able:<br>to issue the Bill of Lading correctly and formulate remarks (if there are any) in accordance with cargo insurer's recommendations;<br>to champion/to protect the commercial interests of the ship owner or the charterer in the case of a conflict with shippers;<br>to formulate claims and to justify them;<br>to prove invalidity of the claims to the ship. |

The matrix representation of the content selection scheme for maritime specialists training and development allows to realize a deductive method of the each plot analysis, differentiation of activities and subjects of knowledge required for their implementation. Further, it is possible to determine what skills and abilities of a specialist must have to solve professional problems and, therefore, what the specialist's skills and abilities it is necessary to develop to achieve a high level of professionalism.

## 3 CONCLUSIONS

The analysis of the experience of business/simulation games development and their use for purposes of qualification improvement shows that the games are special training grounds for testing the participants' behaviour and interaction. The simulation model of the professionally-oriented communication environment created in the games shows the processes of communication, searching a compromise and rational decisions, the adoption of innovative technologies, the study of the implications of group actions and (if required) the individual participants in dynamics. It should be noted that in simulation/business games conditions are created through the use of background knowledge to acquire new knowledge and its updating, i.e. enriching experience of practical implementation of knowledge.

Game forms of designing qualification improvement systems will be fruitful if teachers and experts/highly qualified specialists of companies – employers play a role of designers.

It enables to solve the three major problems:

1 to improve the skills of teachers and maritime specialists involved in terms of studying specific new activities, acquiring know-how of systematic projecting educational processes, improving communication culture;
2 to develop an "almost" optimal algorithm for designing educational systems for qualification improvement within new activities;
3 to develop optional projects which can be considered as prototypes and recommendations for adaptability to changing conditions.

The effectiveness of the game largely depends not only on its ideology and content-intensity, but also on the level of organization of the games. It is important that the system of motivation does not contradict the goals of the experiment and the participants themselves become researchers, assistants of experimenters and play an active role.

## REFERENCES


Anderson, Ph. H., 2009, Business Simulations and Cognitive Learning: Developments, Desires and Future Directions. Simulation & Gaming. 40(2), 193-216.

Belyaev, I.,O., 1999, Reforming maritime education in Russia. Maritime Fleet. No. 2, 28-35 (in Russian).

Campbell, D., 1980, Models of Experiments in Social Psychology and Applied Research (Moscow, Russia: Progress) (in Russian).

Keys, B., and Wolfe, J., 1990, The role of management games and simulations in education and research. Journal of Management. Vol. 16(2), 307-336.

Melnitchuk, O.A., and Yakovleva A.A., 2000, The model of a specialist. High Education in Russia, No.5, 19-23 (in Russian).

Meyler, L.E., and Moiseenko, S.S., 2007, Air cargo, sea transport, rail and road freighting in Kaliningrad: towards regional programmes MBA/MPA. In: Materials of integrated cross-modular learning programme of post-graduate education in the sphere of business and public administration (KalEdu), Vol. 1, (Kaliningrad, Russia: Immanuel Kant Russian State University), pp. 458–481 (in Russian).

Meyler, L.E., and Moiseenko, S. S., 2009, Theoretical and practical problems of transport specialists' training in the Baltic Fishing Fleet State Academy. Proceedings of the Baltic Fishing Fleet State Academy, 3(7), 81–88 (in Russian).

Meyler, L.E., and Moiseenko, S.S., 2010. Development prospects for the maritime transport complex of the Kaliningrad region and professional training. Proceedings of the 11th Annual General Assembly of the International Association of Maritime Universities, Pusan, Korea, October, pp. 220-229

Meyler, L.E., Moiseenko, S.S., and Fursa, S.M., 2012, Current problems of maritime transport complex development in the Kaliningrad region. Proceedings of the World Conference on Transport Research Society. Special Interest Group 2 - Maritime Transport and Ports Conference, Antwerpen, Belgium, May.

Moiseenko, S.S., and Meyler, L.E., 2003, Improving specialists' training in the field of transport organization and management on maritime transport. Proceedings of the Baltic Fishing Fleet State Academy: Logistics, organization and technology of cargo transportation, Vol. 56, 83-95 (in Russian).

Moiseenko, S.S., 2004, Socio-Pedagogical Conditions for Continuing Professional Education of Marine Engineers (Kaliningrad, Russia: Baltic Fishing Fleet State Academy), (in Russian).

Moiseenko, S.S., and Meyler, L.E., 2009, Game simulating experiments as a method of specialists' professionalism development in the field of a safety of navigation and cargo vessels handling in ports. Proceedings of the Baltic Fishing Fleet State Academy, 5(9), 130-137 (in Russian).

Moiseenko, S.S., and Meyler, L.E., 2010. Theoretical and practical problems of specialists' professional competence development in the field of maritime transport organization. Proceedings of the Joint International IGIP-SEFI Annual Conference, Trnava, Slovakia, September, Report 2383.

Moiseenko, S.S., and Meyler, L.E., 2011. Methodological approaches to the design of business games and definition of marine specialists training content. [in:] A. Weintrit & T. Neumann (eds), Human Resources and Crew Resource Management. Marine Navigation and Safety of Sea Transportation, CRC Press, Balkema, pp. 91-95.

Moiseenko, S.S., and Meyler, L.E., 2012. Simulation methods of system for specialists' continuing education designing. Proceedings of the 11th International Conference: Maritime industry, transport and logistics in the Baltic Sea Region states: new challenges and responses, Kaliningrad, Russia, May, pp. 165 – 168 (in Russian).

Nazarenko, N.A., 2007, Algorithm for constructing a generalized psychological portrait of the profession on the basis of factor analysis. Human Factor. Ser. The problems of psychology and ergonomics, Tver, No. 3 (in Russian).

NovikoV, A.S., 1998, Prospects for a system of continuing professional education establishing. Specialist, No. 1, 2-8 (in Russian).

Pidkasistiy, P.N., 1996, Game Technology in Learning and Development (Moscow, Russia: Russian Pedagogical Agency), (in Russian).

Sergeev, V.P., Ryazanova, L.A., Yaroshevskaya, K.N., and Kochiev, A.A., 2003, Modelling professional activity of a modern engineer. High Education in Russia, No.2, 60-64, (in Russian).

Platov, V.A., 1991, Business Games: Development, Organization, Conducting (Moscow, Russia: Nauka), (in Russian).

TRANSAS GROUP. http://www.transas.ru/products_and_services/