European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com

e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2022.03.39

FaR 2021
International Forum "Freedom and responsibility in pivotal times"

PROFESSIONAL FOREIGN LANGUAGE ALGORITHMS FOR THE ACTIVITY OF A MARINE ENGINEER

Vera F. Tenischeva (a)*, Yulia S. Kuznetsova (b), Elena N. Tsyganko (c),
Victoria A. Filonenko (d), Evgeniy V. Khekert (e), Marina A. Modina (f)
*Corresponding author

(a) Admiral Ushakov Maritime State University, 93, Lenin Ave., Novorossiysk, 353924, Russia, vic-ver@mail.ru
(b) Admiral Ushakov Maritime State University, 93, Lenin Ave., Novorossiysk, 353924, Russia, julx@bk.ru
(c) Admiral Ushakov Maritime State University, 93, Lenin Ave., Novorossiysk, 353924, Russia, lena_tsyganko@mail.ru
(d) Admiral Ushakov Maritime State University, 93, Lenin Ave., Novorossiysk, 353924, Russia, vicalexfilnov@mail.ru,
(e) Admiral Ushakov Maritime State University, 93, Lenin Ave., Novorossiysk, 353924, Russia, zur_mga@nsma.ru
(f) Admiral Ushakov Maritime State University, 93, Lenin Ave., Novorossiysk, 353924, Russia, marishamodina@yandex.ru

Abstract

The article substantiates the degree of responsibility of a seaman in the execution of algorithms for activities in a foreign language environment and considers tools of educational activities used to develop the communicative component of these algorithms. The article describes methods of integrating student communicative capabilities into the system of activities of a marine specialist in mastering algorithms for solving typical problems in a foreign language environment using simulators in accordance with the new generation standards and the International Maritime Convention. The need for developing a professional competence inextricably linked with successful labor activities is substantiated. The technology of training a marine engineer able to solve professional tasks through foreign language communication has been developed. The role of business games in modern training simulators is described. The component analysis of business game activities can be used to assess the professional competence development level. The role of subject, social and psychological contexts of a business game using the simulator is revealed, the results of experimental training are presented. They indicate the efficiency of algorithms for solving typical problems in a foreign language environment. The conclusion is made about the business game on the simulator as a system-forming factor of interdisciplinary integration and an important means of development of foundations of professional activities whose technology is regulated by foreign language communication. The standardization and algorithmicization of educational processes contribute to the development of control and self-control and ensure the safety of life at sea in a foreign language environment.

Keywords: Professional linguistic competence, simulator, component analysis

https://doi.org/10.15405/epsbs.2022.03.39
Corresponding Author: Vera F. Tenischeva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

In a critical era of new technical and technological opportunities, the avenues for further development of the education sector are changing.

On the one hand, the boundaries of freedom are expanding through access to information, acceleration and improvement of remote communication and data exchange, individualization and unlimited possibilities for creative approaches. On the other hand, in these conditions, the roles of teachers and students are changing. The teacher should motivate and guide the student in his active professional self-development, self-organization. In such conditions, adaptive abilities, flexibility, professional orientation and self-organization are tested.

Distance learning can be indispensable; however, not all areas can be covered by this form of education. An important role in training a specialist for professional foreign language communication is assigned to technical teaching aids: computers, automated systems, simulators, etc. (Abdurazakov et al., 2019; Servetnik et al., 2020; Skjerve & Bye, 2011; Zincir et al., 2017).

In the era of rapid high-tech development, significant advantages of simulator training for future mariners have emerged. Marine simulators have great opportunities in the development of professional skills, since they can be used to recreate technological processes.

The maritime industry is an international field, where people of different nationalities cooperate, are involved in intercultural communication; since English is the working language of the industry, there are difficulties caused by the lack of communication skills, misunderstanding of intercultural characteristics of interlocutors.

The International Maritime Organization is taking active measures to counter such problems: the standards of language training have been strengthened, activities of all services and teams are monitored at all stages, standard phrases of the maritime English language have been developed and systematized.

They can be considered as algorithms of communication that regulate the methods of performing labour operations and are mandatory for all participants in technological processes on the ship.

On the one hand, such standardization is a barrier to the language practice and individuality; on the other hand, in intercultural interactions, standard procedures expand possibilities of control and self-control, relieve stress and solve the above problems, enhancing the safety of ship works.

Paradoxically, through the designated restrictions and standards, new possibilities for managing complex processes of intercultural communication emerge. The degree of sailor's responsibility for the high-quality execution of technological algorithms is increasing.

A foreign language in professional activities of a marine transport engineer acts as a means regulating technological processes. The qualification requirements for the level of proficiency in a foreign language have been described in the state educational standards of the Russian Federation and international maritime conventions.

The International Convention on Standards of Training, Certification and Watch keeping of Seafarers (78/95" (Table A-III / 1) defines competences of a marine engineer. It assumes the use of English in written and oral forms when using on-board communication systems.

https://doi.org/10.15405/epsbs.2022.03.39
Corresponding Author: Vera F. Tenischeva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

Simulator training can develop professional competencies of mariners. The need for improving the training quality and using modern technologies is confirmed by the International Maritime Organization (IMO), classification societies and governments (Castells et al., 2016).

The simulator is a technical means of professional training intended for the development and improvement of professional skills and abilities of the operator to control an object by performing instrumental actions. It can be used in the learning process and as an examination tool (Zincir et al., 2017) and can recreate the communicative context of professional activities; however, the issues of development of operational mechanisms of professional competences, ways of integrating its foreign language component into the general system of regulation of simulator training activities are understudied.

In the training, four categories of simulating systems are used: category 1 – Full Mission type simulator; category 2 - Multi-Task type simulator; category 3 – Limited Task type simulator; category 4 - Special Task type simulator. Category 1 simulators are designed for complete immersion in professional activities with the greatest control of the simulation environment.

The engineering systems include realistic sound and visual effects, which allow you to practice procedures in both normal and emergency situations. Category 2 simulators are used to simulate the general environment and working conditions.

The purpose of category 3 simulators is to train for mastering specific tasks and recreate a model for a specific engineering system. Category 4 simulators are used to provide introductory training with the subsequent development of more complex tasks on other simulators (Kluj, 2017).

At the State Maritime University named after Admiral F.F. Ushakov, simulators of different categories are used (e.g., the multitask simulators Trans as 5000 and Diesel Sim Nor control allow for working out the algorithms with greater speed and efficiency).

The possibility of repetitions allows you to reproduce the current situation to clarify and discuss actions in normal and emergency situations (e.g., an emergency stop of the main engine, fire in the engine room, power outage, etc.). The simulator allows you to recreate the communicative context of professional activities (Balyaeva et al., 2019; Shverova et al., 2020).

2. Problem Statement

When studying at the university, future specialists faces the problem of operational adaptation to professional activities in the foreign language environment. This problem occurs when mastering typical production tasks with standard algorithms for controlling systems and methods of operational decision-making in "regular" and "emergency" situations. As an example, let us simulate the procedure for preparing the main engine for starting. This operation is based on original checklists developed in accordance with the requirements of the international maritime convention SOLAS.

The checklist is a flow chart for a specific technological operation.

The preparation includes a number of stages: obtaining permission in English from the chief engineer, preparing equipment and engines for start, checking the communication of the engine room with the navigation bridge and other control posts, English-language recording of orders of the chief engineer, watch officers and the captain, and results of all measurements and inspections.

https://doi.org/10.15405/epsbs.2022.03.39
Corresponding Author: Vera F. Tenischeva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

An analysis of students' activities at the beginning of training revealed the lack of readiness for the upcoming activities which was caused by the ignorance of the equipment testing algorithm; slow adaptation to the peculiarities of English pronunciation of the instructor and crew members; inaccurate performance of operations; the untimely decision-making in the event of a malfunction and making wrong decisions to eliminate it.

A survey showed that for 65.7% of students the most difficult assignments were troubleshooting tasks that require emotional agitation. The cadets lacked professional skills and were afraid of making grammatical or lexical mistakes.

In these conditions, a problem arises how the teacher should integrate isolated skills and abilities into the general system of labor activities when modeling and testing technological operations of the operator regulated by real foreign language speech activities.

A number of authors have also identified the lack of assessment methods (Ghosh et al., 2017; Sellberg, 2016).

3. Research Questions

The article studies methods for modelling and mastering technological operations of an engineer-operator, which are regulated by his foreign language speech as well as the peculiarities of developing marine engineers algorithms of activities in a foreign language environment according to the parameters of accuracy and efficiency in the simulator training.

4. Purpose of the Study

The study is aimed at developing a marine engineer competency in using technological algorithms in a foreign language environment in terms of accuracy and efficiency in the simulator training conditions.

5. Research Methods

The study was based on the theoretical analysis of literature, legislative and regulatory documents of the International Maritime Organization, a number of empirical (observation, individual and group conversations with cadets, questionnaires, testing, expert assessment, self-assessment, analysis of educational task performance, diagnostic and formative experiment) and statistical methods (scaling, component analysis and mathematical processing of the results).

Conducting the research in the field of simulator training (Tenischeva et al., 2019), we found out that group training is the highest level of preparation for professional activities of an engineer in a foreign language environment, since it involves business communication in solving operational problems in situations that simulate real professional activities, taking into account the communicative side of the group interactions.

Business games with a simulator are the most effective way to simulate professional situations in a foreign language environment. They allow you to recreate professional activities. In terms of the theory of contextual learning (Verbickij, 2017), the business game consists of two models - imitation and game

https://doi.org/10.15405/epsbs.2022.03.39
Corresponding Author: Vera F. Tenischeva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

(Verbickij, 2017). The simulator allows you to recreate the psychological context of the work of a marine engineer, simulates factors that cause mental and emotional-volitional stress.

The effectiveness of simulator training was studied at the State Maritime University named after Admiral F.F. Ushakov in 2020. The study involved 73 fifth-year cadets of the ship engineering faculty. Classes were held in the ninth semester by teachers of the special department and the department of the English language for a period of 108 hours.

Interdisciplinary activities were simulated and standard operations performed by a marine engineer on watch were practiced in the foreign language environment. The main algorithms of his activities were improved (preparation of the fuel system of diesel generators, main engine systems, compressed air systems, auxiliary boilers, etc.).

The results were assessed during the state exams through modeling standard and emergency situations in the foreign language environment on the automated ship power plant (SPP) DieselSim, which is an instructor's control panel; equipment of the central and other control posts of the power plant; a computer used to implement the mathematical model of the SPP in real time; as well as mnemonic diagrams of all systems and equipment of the engine room.

Using the control panel equipped with a display, the instructor can change the conditions and create problematic tasks, simulate emergency situations, introduce malfunctions, imitate noise in the engine room using sound amplifiers, change sailing conditions, ship loading, time scales, etc.

The cadets reproduced professional actions and solved professional problems using Maritime English. Each cadet was to inspect the engine and report about malfunctions to the engineer on watch; keep in touch with the "bridge" and perform joint actions to determine the disconnection of the remote control drive from the wheelhouse and prepare the engine for starting.

Each correctly performed action was accompanied by the lighting of indication lamps, turning on the noise imitating the operation of one or another system. The “failure” meant that the procedure was performed incorrectly. The cadet had to return to the previous stages and find out the reason. In solving the problem, it was determined how correctly and efficiently the algorithms of professional actions were performed in accordance with the situation, including communication in English.

To determine the level of professional training, we have developed a method for the component analysis of operator tasks in the foreign language environment.

Along with speech involvement and compliance with the rules of professional communication, components such as promptness of decision making (O) and accuracy of the simulated operation (T) were assessed.

In completing the task on the basis of foreign language information, the cadets were to independently determine the problem and find solutions. The results in the form of scores in conventional points "1" or "0", the sum of these points for the component assimilation and component assimilation indicators in percent were entered into the map of the component analysis presented in Table. 01 and in the test protocol. The parameters were assessed as expressed at the criteria of component assimilation from 85 to 100%. The component assimilation indicator was determined by formula:

https://doi.org/10.15405/epsbs.2022.03.39
Corresponding Author: Vera F. Tenischeva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

$$I_{ca} = \frac{P_{conv} \cdot 100\%}{OP},$$

Where P_{cnv} – the sum of conventional points awarded for this component as a whole; OP – the number of operations that make up this component.

The component analysis map is shown in Table 01.

Table 1. Component analysis map for solving a professional problem

Business game data	Components	
Operations	O	T
	Grades in conventional points («1» or «0»)	
1. Task analysis and decision making		
2. Performing a system maintenance action		
3. Report on actions taken		
4. Recording of the performed operation in the logbook, etc.		
Sum of conditional points for mastering the component		
Component assimilation indicator,%		

6. Findings

The advanced possibilities of safety and professional self-organization of a marine specialist were substantiated. They are determined by algorithms for activities of a seaman in the foreign language environment. Criteria for identifying the accuracy and efficiency of such algorithms have been developed; the levels of formation of algorithms for activities of a marine engineer in terms of accuracy and efficiency have been investigated. In the interaction of various components, the algorithms of professional activities of a marine specialist in the foreign language environment have been developed. The average component assimilation indicators based on the results of three business games are shown in Table 02.

Table 2. Summary table of average component assimilation indicators based on the results of business games

Business game, no.	component assimilation indicators, %		Overall average component assimilation indicators, %
	O	T	
1	46,54	51,38	48,96
2	72,45	76,63	74,54
3	87,00	92,42	89,71

The results of changes in the average component assimilation indicators (promptness of decision-making and accuracy of actions performed) reached 87 and 92.4%. Thus, it was possible to evaluate these parameters as the ones reaching the professional standards.

After completing the business games, 94.29 % of the cadets noted that they gained self-confidence when communicating with another operator in a foreign language, thus the teamwork skills in solving operational tasks reduced the level of mental stress.

As a result of participation in business games, the cadets reduced the level of mental tension, developed the ability to quickly perceive information and adequately perform professional actions in the foreign language communication.

In general, business games on the simulator held since 2016 have improved the training process of marine engineers; the average score of state examination marks increased by 0.43 points and amounted to 4,53 in 2020.

7. Conclusion

In the context of globalization, it is important to train marine specialists in accordance with the STCW Convention, which sets out international standards for qualifications, including high level professional competences based on the foreign language component.

The requirements of Russian standards and the STCW Convention can be met if professional modules incorporate business games on a simulator based on the integratively contextual pedagogical model that allows you to recreate technological processes in educational activities that are regulated by student's foreign language speech activities.

Designing business games on a simulator for special and foreign language disciplines based on the models of technological processes involves the development of methods to reproduce the subject, socio-cultural and psychological content of professional activities.

Business games are a system-forming factor of interdisciplinary integration, since they meet the new generation standards and the requirements of the STCW Convention; in business games, the readiness to work in the foreign language environment develops, which manifests itself in students' ability to solve professional problems in regular and stressful situations using a foreign language.

Standardization and algorithmicization of educational processes contribute to the identification of new opportunities for the development of control and self-control procedures and ensure the safety of life at sea in the foreign language environment.

Acknowledgments

Participants of the research project "The system of training a marine specialist for professional activities in the foreign language environment in accordance with the STCW Convention ("The Maritime State University named after Admiral F.F. Ushakov").

References

Abdurazakov, M., Gadjiev, D., Guseva, N., & Tokmazov, G. (2019). Fundamentals of formation in learning of research skills and its competence in teaching solving tasks using a computer. *Chebyshevskii Sbornik, 20*(2), 442–461.

Balyaeva, S. A., Hvingiya, T. G., & Kalinina, S. A. (2019). The problems of modernization of educational process at the marine university. *Bulletin Adyghe State University Series Pedagogy and Psychology, 2*(238), 15–21.

Castells, M., Ordás, S., Barahona, C., Moncunill, J., & Muyskens, C. (2016). Model course to revalidate deck officers' competences using simulators. *WMU Journal of Maritime Affairs, 15*(1), 163–185.

Ghosh, S., Bowles, M., & Ranmuthugala, D. (2017). Improving the validity and reliability of authentic assessment in seafarer education and training: a conceptual and practical framework to enhance resulting assessment outcomes. *WMU Journal of Maritime Affairs, 16*, 455–472.

Kluj, S. (2017). The Environmental Awareness in the Engine Room Simulator Training. *The 13th International Conference on Engine Room Simulatorsed* (pp. 35–38). Odessa Maritime Academy.

Sellberg, C. (2016). Simulators in bridge operations training and assessment: a systematic review and qualitative synthesis. *WMU Journal of Maritime Affairs, 16*(2), 247–263.

Servetnik, O., Pletukhina, A., Velts, O., Novikova, E., & Tsyganko, E. (2020). Requirements for learning automated information system. *Journal of Physics, 1691*(1).

Shverova, L., Zadorozhnaia, E., Avanesova, T., Gruzdeva, L., Gruzdev, D., & Popova, A. (2020). Maritime Technical English in Shaping the Professional Expertise of a Cadet in Accordance with National and International Law. *Journal of Crical Review, 7*(12), 1625–1634.

Skjerve, A. B., & Bye, A. (2011). *Simulator-based Human Factors Studies Across 25 Years. The History of the Halden Man-Machine Laboratory*. Springer-Verlag London Limited.

Tenischeva, V. F., Kuznecova, Y. S., Cyganko, E. N., Filonenko, V. A., & Pet'kov, V. A. (2019). Cross-disciplinary interaction technology in the foreign language environment as a means of professional seafarers training. *Scientific Notes of University of PF Lesgafta, 3*(169), 351–356.

Verbickij, A. A. (2017). *Theory and technologies of contextual education.* MCU.

Zincir, B., Dere, C., & Deniz, C. (2017). Scenario Based Assessment Method for Engine Room Simulator Courses. *The 13th International Conference on Engine Room Simulatorsed* (pp. 165–171). Odessa Maritime Academy.