

Formation of critical thinking in preparation future air transport specialists

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Abstract. The research describes the possibilities of critical thinking, its influence on the motivation for the formation of social and professional competencies. The relevance of the research is that today the formed critical thinking affects the success of graduates, their demand among employers and is a key indicator of assessing the quality of university activities. The novelty of the research consists in the development of technology for the forming of critical thinking among students of flight specialties, proof of its effectiveness in the practice of the educational process is provided. The methods of forming critical thinking among students during the implementation of the basic discipline «Physical Culture and Sports» are considered, which provide, in addition to optimizing the psychophysiological states of students, the development of social qualities - initiative, independence, competence, the ability to think critically, which affect the motivation to achieve results not only in physical training and sports activities, but also in professional aviation training. The practical significance of the research lies in the intensification of professional and applied training of students of aviation universities, which will help any student to navigate in the future profession and will eventually give the opportunity to manage the safety of aircraft flights.

1 Introduction

The modern world is changing, science is developing, new technologies are being introduced, the principles of the profession are changing, the educational process of higher education is improving, and it depends on university professors and students how the transport of the future will operate [1,2]. Transport needs professionalism and competence in the profession, highly qualified personnel, and by choosing this profession, a transport specialist, along with doctors, teachers and representatives of other specialties, must possess, store and carry the concepts of human values, because these specialists bear enormous responsibility for people's lives.

The transport family, which includes more than 2 million specialists, has large-scale tasks of high-quality renovation of the transport infrastructure, which must be solved together and in the shortest possible time. In the modern conditions of the changing world, the problem becomes significant not only to produce something, but also to create, and for

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this task, it is necessary to be a creative person, and, consequently, to be able to think critically. Criticality as a qualitative characteristic of thinking is extremely in demand in modern society, which is recognized by specialists in various fields of activity [3-6].

Currently, reforms in the sphere of Russian society, including in the aviation industry, affect a wide range of problems of adaptation of graduates of aviation higher education institutions to the conditions of professional activity. Aviation today is one of the key technological sectors of the Russian economy and the strategy of training transport specialists should be based on the most modern technologies [7].

The main task set by the transport industry is the high-quality training of aviation personnel, and the sum of knowledge, skills, competencies acquired within the compass of university walls is a reliable foundation for a future successful professional career. Today, close attention is paid to education, designed to become a strategic basis for the improvement of human society, there is an increase in the volume of new information necessary for full-fledged activity [8,9]. Therefore, the basis of modern inclusive education should be methods and techniques for the development of such forms of thinking that will help the student navigate the world of information, distinguish the correct version from the false one, find the causes of errors, that is, think critically. New professional thinking will be required from future specialists, only then the prospects for professional growth open up [10, 11]. There is an urgent demand for professionals capable of mental activity in a changing life and critical thinking is a necessary element of this activity [12]. Since higher education is based on a systematic approach to knowledge creation, such training is possible for those who are motivated to work, think critically, and have the patience to solve problems. Having developed professional knowledge, skills and abilities based on a competent approach, a student becomes capable of a broad perception of the world [13].

The main requirement for high-quality education in the aviation industry at all times has been the close cooperation between the educational organization, the employer and the state, today these mechanisms are being improved [14-16]. The established contacts make it possible to fully implement the entire system of vocational training, attract additional resources for the development of the university's potential in the field of educational services, and open new areas of development. By this relationship, the quality of training of university students, the level of their demand in the industrial labor market and the innovative potential of civil aviation in general is ensured.

In the leading aviation universities, the priority task is to modernize educational programs in accordance with the requirements of employers, which requires: mobilisation of resources for the professional training of aviation personnel; creation of motivational conditions for quality management of education; «embedding» modern technologies in the educational process. Today, the success of graduates and their relevance to employers are becoming key indicators for assessing the quality of educational activities of a transport university.

The wisdom of studying the topic of developing critical thinking among students – future aviation specialists is that the role of a transport higher educational institution is becoming more significant at the present stage, as long as life makes us to respond to changes in the economy, politics, education, take new decisions, increase the amount of information necessary for full-fledged effective activity. Future specialists are required to have new professional thinking, mobility, competence, tolerance, independence.

In psychological and pedagogical literary sources, certain aspects of the development of critical thinking are considered [17,18], it is shown that critical thinking of students is an important part of professional competence, but there is clearly not enough studies on the formation of critical thinking in the aviation field among students of flight specialties.

An analysis of the activities of university graduates shows that at the initial stage of their professional careers, many of them do not know how to implement the qualities of a

thinking specialist in practice [19,20]. In addition, there is an opinion among a large part of the higher-education teaching personnel that critical thinking develops only as a result of many years of professional experience. However, studies of transport specialists do not confirm a direct relation between work experience and the level of critical thinking.

Russia considers the safety of air transport and the efficiency of aviation activities to be the highest priority of civil aviation, national and economic independence, which directly depend on the quality of training of a transport specialist. Special attention in the educational process of students should be paid to increasing the ideological maturity, activity, and culture of aviation personnel. Students should be focused on self-improvement, communication, initiative, the ability to set goals and achieve them in a competitive struggle. However, it is often noted that some students cannot effectively make decisions in situations of uncertainty, do not know how to resolve conflicts, negotiate, communicate, realise and take responsibility for their actions. In this context, in the conditions of accelerating changes in the labor market, the issues of developing general cultural competencies, including critical thinking of a transport specialist, are of particular importance.

The novelty of the research consists in the development of technology for the forming of critical thinking among students of flight specialties of aviation university, proof of its effectiveness in the practice of the educational process. The proposed technology for the development of critical thinking is focused on basic postulates in combination with innovative solutions. Currently, such a technique does not find proper application in the training programs of students of aviation universities, and therefore the urgent task of vocational education is to update the means and methods of forming critical thinking.

We believe that one of the effective ways of forming critical thinking among university students is its forming by methods and means of the basic discipline «Physical Training and Sport».

The purpose of the study: to develop a technology for the development of critical thinking of students of the university of civil aviation as the basis of social and professional competencies.

Research objectives:

1. Validation of the relevance, expediency and significance of the development of critical thinking of aviation university students;
2. To develop the features of the development of critical thinking in the educational process of students of flight specialties of an aviation university through the basics of the discipline «Physical Culture and Sports»;
3. To diagnose the critical thinking of students of flight specialties and evaluate the effectiveness of the developed technology.

2 Methods and organisation of research

The study was conducted at the Department of Physical and Psychophysiological Training of the St. Petersburg State University of Civil Aviation named after Chief Marshal of Aviation A.A. Novikov. The students of the 3rd year of the Faculty of Flight Operations (FFO) were involved in pedagogical experiment, being pursuing a degree in "Organisation of flight work" - experimental group (EG) and students of the Faculty of Air Transport Management (ATM), being pursuing a degree in "Technology of transport processes" - control group (CG). The experiment was conducted in the 2021/2022 academic year, a total of 50 classes were conducted with students of the experimental groups (in EG according to the developed technology, focused on the development of critical thinking, in CG – according to the generally accepted curriculum.

Methods used: analysis of psychological and pedagogical literary sources, observation, survey, testing, expert assessment, pedagogical experiment, methods of mathematical statistics using the reliability criterion according to T. Student.

The experiment used methods of developing critical thinking: brainstorming, intellectual warm-up, basket of ideas, "mutual questioning", Kipling's method, role-playing project, "circles on water", "Cluster", the method of control questions. The important points were: students' activity, work with the development of communication skills, motivation for self-education, the ability to think critically.

To assess critical thinking, the Lauren Starkey methodology [21], adapted for students by E.L. Lutsenko [22], has been used, as well as observation and expert evaluation for the correct processing of the results obtained in the study. The Lauren Starkey test is designed to identify how well a student use critical thinking skill, the test helps to identify weaknesses in critical thinking skills and indicates problems that should be worked on. There are 30 alternative questions in the test, a key has been developed to check the answers and tasks are specified when choosing the wrong answer. The overall assessment of the level of critical thinking was formed depending on the percentage of completed tasks, observation of students, as well as the mandatory use of expert assessment, which indicated the importance of an essential feature of critical thinking. The reliability and correctness of the results obtained was ensured by the complex application of the above methods.

3 Obtained results

The analysis of the educational process at the aviation university shows that today we work in conditions of digitalisation, mobility, information modeling and it is very important to create modern technologies, promote creative ideas, including through critical thinking.

The analysis of psychological and pedagogical literature shows that a transport specialist who owns the elements of critical thinking is able to:

- analyze questions and reactions that are vital;
- evaluate and interpret information qualitatively;
- check the decisions made by reliable criteria;
- assess the possible consequences of the decisions taken;
- to show a significant level of communication in solving complex problems, justifying their point of view, etc.

In our study, based on the methods and means of the basic discipline «Physical Training and Sports», when developing the technology for the forming of critical thinking, we took as a basis that critical thinking is most effectively manifested with an individual approach based on the current psychophysical state of a student with subsequent correction depending on the dynamics of performance. In the course of physical training and sports activities, special attention was paid not only to the development of psychophysiological readiness of the student and strengthening his health, but also to the development of certain strong-willed qualities - initiative, independence, mobility, discipline and others that affect the motivation to achieve high professional results.

In the developed methodology, attention was paid to the ability of students to think, it was important to achieve from the student not just technically correct performance of physical exercises and mechanical repetition of the training load, but the development of thinking, the ability to analyze the theory, methodology and means of physical training. Students, increasing their level of preparedness, studied the peculiarities of performing physical exercises, focusing on improving various muscle groups, the intensity and rationality of the load, methods of recovery, learned to draw conclusions, recognise the problem, develop inductive thinking.

During the development of critical thinking, attention was paid to the formation of qualities: perseverance in finding information, calmness in difficult situations, the ability to compromise, focus on results and more. Critical thinking has always been associated with a problematic situation, which was clearly manifested in physical training and sports activities. The professor acted as a coordinator of the work: directed the efforts of students in a certain direction, collided various judgments, created conditions for taking independent decisions.

An important direction in the development of transport universities is the actualisation of educational programs and the formation of students on the basis of critical thinking of social and professional competencies. The principal moments in the development of critical thinking through the use of means and methods of physical culture were:

- ✓ search for effective, optimal ways to solve the problem;
- ✓ ability to ask correctly about methods, principles, means of training;
- ✓ providing the necessary amount of information and exercises for the application of knowledge;
- ✓ search for creative, inclusive solutions in the field of physical training and sports;
- ✓ activity and perseverance of students in academic and independent classes;
- ✓ students' ability to demonstrate communication skills in various sports;
- ✓ motivation for self-improvement, self-education, self-development;
- ✓ the student's focus on improving sports and professional competencies.

The research evaluates the critical thinking of students using the L. Starkey method at the beginning and end of the academic year (Table).

Table 1. Dynamics of the basic criteria of critical thinking of students of the Faculty of Flight Operations of the Aviation University.

Test scales	Beginning of the academic year average value \pm standard deviation	End of the academic year average value \pm standard deviation	Confidence criterion	Confidence level
Ability to Focus Observation	1.01 \pm 0.09	1.09 \pm 0.11	0.57	>0.01
Inductive Thinking	1.65 \pm 0.11	2.15 \pm 0.14	2.94	<0.001
Brainstorming Ability	0.53 \pm 0.15	0.98 \pm 0.15	2.14	<0.01
Ability to Find an Information	1.36 \pm 0.21	2.33 \pm 0.25	3.03	<0.001
Formation of Problematic Judgments	0.68 \pm 0.13	0.87 \pm 0.14	0.95	>0.01
Goal Setting	1.33 \pm 0.21	2.09 \pm 0.22	2.50	<0.05
Diagnose the True Problem	0.96 \pm 0.25	1.94 \pm 0.27	2.72	<0.01
Facts Assessment	1.31 \pm 0.25	1.81 \pm 0.25	1.43	>0.01
True Problem Definition	0.53 \pm 0.23	0.89 \pm 0.26	1.06	>0.01
General Level of Critical Thinking	9.36 \pm 1.39	14.15 \pm 1.49	2.34	<0.05

The results show that the overall level of critical thinking of respondents corresponds to the norm. By the end of the academic year, when using the developed technology in the educational process, a significant increase in results was obtained on the scales: «Inductive Thinking», «Brainstorming Ability», «Ability to Find an Information», «Goal Setting», «Diagnose the True Problem». In the study on the scales: «Ability to Focus Observation», «Formation of Problematic Judgments», «Facts Assessment» and «True Problem Determination», an increase in results was noted, but it is statistically unreliable.

The general level of critical thinking of students of the Faculty of Flight Operations during the experimental period under the influence of the developed technology significantly improved from 9.36 to 14.15 with a confidence criterion of 2.34 and a confidence level of < 0.05 .

A comparative analysis of the development of forms of critical thinking for the academic year among students of the Faculty of Flight Operations (EG) and students of the Faculty of Air Transport Management (CG) has been conducted in the Study. EG students participated in a pedagogical experiment using the developed technology for the development of critical thinking, CG students were engaged in the discipline «Physical Training and Sports» according to the generally accepted work program.

The data of the pedagogical experiment indicate a different level of development of critical thinking among students of the experimental groups (Fig.). EG students have a high level of critical thinking development in 9% of cases, an average level in 71% of cases and a low level in 20% of cases, so their activities are sufficiently meaningful and logical, they show perseverance in finding information, they are able to compromise, they are focused on results, sometimes students, assessing the situation, resort not to a rational solution, but to guesses or fantasies what is not a qualitative research for sure. The students of CG have a level of critical thinking, respectively, equal to 4%-55%-41%, which is significantly less than that of EG students. The obtained data were verified by statistical method: the value of the reliability criterion is 3.54 with a confidence level < 0.05 , which allows us to speak about the reliability of changes in the results due to the orientation of the educational process.

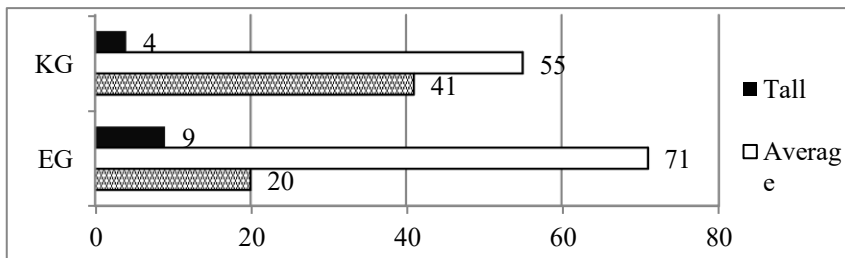


Fig. 1. Distribution of students of experimental groups by levels of development of critical thinking.

4 Discussion

In the study, we came to the conclusion that the technology of effective formation of critical thinking should imply the need for the student to develop a number of important skills, including:

- ✓ ability to plan their activities;
- ✓ be flexible to the receptivity of new ideas, ready to change your point of view based on facts;
- ✓ perseverance to achieve goals and achieve success in solving difficult tasks and problems;
- ✓ the ability and willingness to admit and correct their mistakes;
- ✓ the ability to discuss and observe yourself;
- ✓ ability to find compromise solutions;
- ✓ the ability to find the best solution from all possible options;
- ✓ ability to ask accurate and correct questions;
- ✓ ability to use the necessary amount and quality of information;
- ✓ the ability to appreciate original and creative ideas;

- ✓ ability to search for answers in various non-standard situations;
- ✓ ability to make informed decisions;
- ✓ ability to analyze, highlight the main and secondary, etc.

Our research shows that the developed technologies for the formation of critical thinking can be used on the subject material of the basic discipline of the university «Physical Training and Sport».

We believe that students with correct and sufficiently developed critical thinking will have advantages in the professional field compared to other transport specialists, they are motivated, more flexible in overcoming the difficulties of solving life and professional tasks, are able to extract and verify information, are capable of adequately solving non-standard aviation situations. During the training in the chosen specialty, using the methods of critical thinking, students focus on independent work, stimulating the process of professionalization, prepare for responsible decision-making, improve their qualifications and personal level.

It is proved that the meaning of learning is not only the transfer of knowledge, but also the ability to critically perceive this knowledge, communicate with each other, with a professor, instructor, mentor, work in a team. Currently, the aviation industry operates in rough and difficult conditions and the success of the industry largely depends on new approaches to the development of critical thinking. Today, air transport is not only a poly of attraction of innovative solutions, but also becomes the center of their generation. It is important not only to master, but also to create new technologies and competencies corresponding to them, to promote creative ideas, ensuring global achievements of Russian transport.

5 Conclusion

Today there is tough competition in the market of educational services, the strongest higher education institutions survive, especially in sectors of the economy that require high-tech innovations for the formation of professional competencies [23,24]. Nowadays, transport universities are faced with the task of further improving the educational process for the formation of professional competencies, which cannot be done without the formed critical thinking of transport specialists. Modern research proves that without the adoption of critical thinking as an obligatory goal of education and the norms of professional qualifications, our country will never become a strong state with a strong and healthy society.

The introduction of modern technologies into the educational process will increase the efficiency of students' education and support the leading positions of the transport industry in the country's economy.

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