

Ensuring High-Quality Professional Training for Future Tactical Air Force Pilots in Combat Flight through the Pedagogical System's Effectiveness Justification

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KEYWORDS

Effectiveness of the pedagogical system; Control measurement; Pedagogical experiment; Public health; Tactical air force; Professional training component

ABSTRACT

This article presents an in-depth analysis of the efficacy of the pedagogical system in providing high-quality professional training for prospective tactical air force pilots. The study encompasses the evaluation of cognitive, operational, motivational and conative, and physical components of professional training for combat flights through an extensive pedagogical experiment. Two distinct groups, namely the experimental group (EG) and the control group (CG), comprising a total of 190 participants, were established for the experiment. The assessment of professional readiness among KNAFU student pilots for combat flights involved the examination of criteria, indicators, and levels associated with each component. The experimental process entailed both quantitative measurement and qualitative interpretation of the outcomes. The study uncovered noteworthy enhancements in professional training for future tactical air force pilots, encompassing intellectual domain, simulator training quality, operational proficiency, motivational and conative aspects, physical capabilities, and psychophysiological elements. These findings contribute to the progression of military pilot education and carry positive implications for public health. By refining the training programs and pedagogical approaches for military pilots, the implemented measures can indirectly impact public health by ensuring the deployment of highly skilled and mentally resilient pilots to safeguard national security. This study underscores the interdependence between professional training for tactical air force pilots and broader public health objectives, underscoring the significance of holistic education and training approaches in the military domain.

1. Introduction

pilots in combat flights necessitates a comprehensive approach to verifying its effectiveness. This meticulous approach, which encompasses all components that form the foundation of professional training for future tactical air force pilots on combat flights, instills confidence in the validity of our research. The incorporation of public health principles into this evaluation broadens the scope to encompass not only the technical skills and knowledge required for pilot training but also the mental and physical well-being of the pilots. Through the integration of public health considerations, such as stress management techniques, physical fitness programs, and psychological support services, the pedagogical system can better prepare future pilots for the challenges they may encounter in combat scenarios, thereby enhancing their overall performance and resilience. Relying on the results of a pedagogical experiment to justify the effectiveness of the pedagogical system in ensuring the quality of professional training for combat flights (Kalnysh et al., 2021) is crucial. Furthermore, it is advisable to ensure that the components of the pedagogical experiment align with the components of professional training for combat flights of future tactical air force pilots. The identification of such components involved analyzing relevant scientific sources. Thus, according to Kulakova (2006), professional readiness encompasses various components, including motivational, conative, cognitive, emotional, and operational aspects, as well as properties and mental states concerning professional tasks and external circumstances (Kulakova, 2006). These components are classified into two groups: 1) components that determine professional characteristics of readiness (such as planning and content, motivational, control and evaluation, managerial aspects) and 2) personal qualities of a specialist (adaptive, emotional and conative, mobilization, communication attributes). In the analysis of the structure of professional readiness among student pilots for professional activity, Kernytsky (2008) includes the following components: motivational (the dominant psychological attribute of a student that shapes their attitude towards learning and their future profession), cognitive (the knowledge-based product of an individual), operational (a set of professional knowledge, skills, abilities, and significant competences), emotional and conative (the capability for self-regulation in a profession characterized by high risk and stress), and professionally important personality qualities (Kernytsky, 2008).

Koval (2017) and Sofiiian et al. (2024) suggest viewing the component composition of professional readiness as a structured set of interconnected and interdependent elements. These elements include motivational and value-based components (motivation as the defining factor in personality, influencing behavior and encompassing the most significant characteristics of readiness for professional activity), cognitive and intellectual components (internal regulators representing specialized knowledge necessary for productive activity, learning abilities, and focus on mastering the specifics of the field, leading to a professional worldview), normative and operational components (a set of skills and abilities ensuring effective decision-making in professional activities), and personal and communicative components (a collection of professionally significant personal qualities) (Koval, 2017). A comprehensive analysis of the aforementioned scientific advancements has led to the opinion that there is a significant theoretical contribution in identifying the constituents of professional training for combat flights among future tactical air force pilots. Specifically, it is most suitable to incorporate the following components in such training: cognitive, operational, motivational and conative, and physical (Marchenko, 2020). The evaluation of each of these components is conducted using specific methodologies. Consequently, the objective of this study is to validate the efficacy of the pedagogical system in ensuring a high standard of professional training for future tactical air force pilots. This will be achieved by implementing a comprehensive pedagogical experiment to assess the cognitive, operational, motivational, and physical dimensions of professional training for combat flights among prospective tactical air force pilots.

Public Health Perspective

Incorporating insights from aviation, public health, psychology, and education, it is important to consider how public health principles could be used to improve the effectiveness and quality of pilot training programs in combat aviation. A seminal inquiry by Grandou et al. (2019) and Mozolev et al. (2021, 2024) delves deeply into the intricate correlation between physical fitness and cognitive aptitude among military personnel, thereby elucidating the profound influence of individual health and wellness factors on operational readiness and mission accomplishments. By underscoring the significance of maintaining optimal physical and mental well-being, this scholarship underscores the critical role assumed by public health measures in reinforcing the capacity and resilience of tactical air force pilots in high-stress settings. The scholarly work of Rucker III (2020) scrutinizes the crucial domain of stress management within the aviation milieu, thereby accentuating the pivotal function fulfilled by effective coping strategies and mental health support mechanisms in augmenting pilot's decision-making, situational awareness, and overall performance outcomes. By assimilating evidence-based methodologies from the domain of public health into pilot training curricula, educators and instructors can equip prospective aviators with the requisite tools and resources essential for navigating the multifaceted challenges inherent in combat flight operations. Expounding upon these foundational insights, the research endeavors undertaken by Goss (2011) and Floss et al. (2021) underline the transformative potential inherent in holistic training paradigms that integrate public health education and wellness promotion initiatives into the tapestry of pilot development programs. By nurturing a culture of physical fitness, mental resilience, and emotional intelligence among air force trainees, these studies evince the tangible benefits emanating from a comprehensive and integrated approach to professional training that transcends technical proficiency to encompass the broader spectrum of pilot well-being and operational effectiveness. Consequently, by embracing a holistic and interdisciplinary approach that accords precedence to the well-being and resilience of aviators, training programs can foster a new generation of military professionals equipped with the competencies, acumen, and mindset requisite for excelling in the demanding and dynamic expanse of modern aerial warfare.

International Perspective

Salas et al. (2017) performed a comprehensive investigation of pedagogical strategies used in training military pilots across different countries, unequivocally demonstrating the paramount importance of integrating simulation-based training and scenario-based learning to significantly enhance the effectiveness of professional training for tactical air force pilots. Moreover, Gopher et al. (2017)

provided compelling insights into the critical role of instructor expertise in pedagogical systems for combat flight training in a cross-cultural context, unequivocally emphasizing the indispensable nature of highly skilled and experienced instructors in ensuring the quality and effectiveness of training for future tactical air force pilots. Li and Harris (2007) executed a thorough case study on air force pilot training in China, focusing on the direct and profound impact of pedagogical interventions on enhancing tactical decision-making skills. Their research unequivocally illuminated the effectiveness of specific pedagogical approaches, such as scenario-based training and debriefing, in elevating the quality of professional training for future tactical air force pilots, thereby holding direct and practical implications for the field of military pilot training. Furthermore, Paile and Gell (2013) meticulously examined the pedagogical systems employed in combat flight training across international military academies, conclusively underscoring the critical importance of incorporating cross-cultural perspectives, disseminating best practices, and adopting innovative training methods to emphasize the global relevance of these strategies, thus ensuring the effectiveness and quality of professional training for future tactical air force pilots. Dinçer (2023) delved into innovative pedagogical approaches in air force pilot training programs worldwide, unequivocally emphasizing the exceptional value of incorporating experiential learning, simulation technologies, and adaptive training methods to elevate the effectiveness of professional training for future tactical air force pilots. Thus, these researchers unequivocally emphasize the critical importance of integrating simulation-based training, scenario-based learning, instructor expertise, pedagogical interventions, cross-cultural perspectives, and innovative approaches to optimize the training process and substantially enhance the skills and readiness of future tactical air force pilots.

Critical Analysis

The current research reveals discrepancies and gaps that require further exploration. One inconsistency pertains to the specific pedagogical strategies used in pilot training. Studies by Lateef (2010) and Islamova et al. (2021) advocate for simulation-based training, asserting that flight simulators offer a safe environment for pilots to hone their skills. Simulations enable pilots to practice maneuvers, emergency procedures, and combat scenarios without the risks of actual flights. Conversely, Kearns et al. (2017) argue for a combination of scenario-based learning and hands-on experience, emphasizing the importance of real flight experience in developing proficiency and decision-making skills. These conflicting findings make it challenging to determine the most effective approach for training future tactical air force pilots. Another area for improvement in the literature is the transferability of skills and knowledge from training simulations to real-world combat flight situations. While Clifford et al. (2019) contend that simulations enhance decision-making skills for real combat scenarios, Tichon and Wallis (2010) question the simulators' ability to replicate the complexities and high-stress situations of actual combat. Investigating the extent to which skills acquired through training simulations can be effectively applied in combat situations is essential for evaluating the pedagogical system's effectiveness. The literature needs a comprehensive understanding of the role of individual differences in pilot training effectiveness. Cognitive abilities, personality traits, and prior flight experience influence how pilots respond to different pedagogical approaches. Understanding these factors and their interaction with pedagogical approaches can help tailor training programs to individual learners' unique needs and characteristics, thereby enhancing training effectiveness. The existing publications primarily focus on training practices within a single country or specific military organization, limiting the generalizability of findings. An intriguing area for further investigation is to adopt a more comprehensive international perspective. Comparing training practices across different countries and military organizations can reveal cross-cultural differences and identify best practices that can be adapted and implemented in various contexts. This approach would enrich the pedagogical system and contribute to a more holistic understanding of effective training methods for tactical air force pilots. Therefore, addressing these discrepancies and gaps through comparative studies, exploring the transferability of skills, considering individual differences, and adopting a more inclusive international perspective will lead to a more comprehensive understanding of effective pedagogical systems for

training tactical air force pilots, ultimately resulting in improved training outcomes and the development of highly skilled and proficient pilots.

2. Methodology

To conduct the experimentation, two groups were created in a cyclic manner: (1) the experimental group (EG) and (2) the control group (CG), with a total of 190 participants. The experimental group, consisting of 94 people, was directly exposed to the experimental intervention during the study. Conversely, the control group, comprising 96 people, did not participate in the experiment. However, their results were compared with those of the experimental group to assess the extent of the intervention's impact, validate the findings, and calculate the effectiveness of the implemented measures. The groups were formed based on related educational programs, with students in the experimental group expressing their voluntary participation in the experiment without prior knowledge of its ultimate pedagogical goal or expected outcome. Students from the same training course in a related educational program were naturally assigned to the control group. This ensured a randomization element in the study, which is a statistical procedural component used to mitigate the influence of random factors. The assessment and evaluation of the professional readiness of student pilots at KNAFU for combat flights were conducted based on the criteria, indicators, and levels associated with each component of the pedagogical system introduced to ensure the quality of professional training for future tactical air force pilots.

The Experimental Procedure Consisted of the Measures

Qualimetric Measurement: Initial assessment of readiness: This measurement aimed to gather primary empirical data for future comparison and tracking of changes in professional readiness for combat flights. It was conducted at the start of the experiment, serving as an introductory control measurement without considering the pedagogical impact of the newly introduced measures. The measurement was conducted under the same conditions and using the described methods for both the experimental and control groups. **Final assessment of readiness:** This measurement aimed to obtain control empirical data to test the effectiveness of the pedagogical system in ensuring the quality of professional training for combat flights. It was conducted at the end of the experiment, considering its impact on the experimental group and comparing the results with the measurement data of the control group trained using the traditional system of professional training. The measurement followed the described methods. The results of the initial and final testing in both the experimental and control groups were compared to identify local quantitative patterns. The results after the final testing in the experimental and control groups were also compared for reliability and validity. **Qualitative interpretation of measurement results:** Comparison of quantitative measurement results with the developed system of criteria, indicators, and levels of professional readiness components for combat flights of future tactical air force pilots. Determination of identified qualitative local patterns and new pedagogical provisions based on the results of implementing the pedagogical system in the real educational process to ensure quality professional training for combat flights. Analysis of the obtained results to verify alignment with the objective of the experimental study and confirm the general hypothesis.

3. Results and discussion

The results of the pedagogical experiment, aimed at substantiating the effectiveness of the pedagogical system in ensuring the quality of professional training for combat flights of future tactical air force pilots, should be summarized in the context of individual components of professional training. In this case, we will focus on the assessment of the cognitive component of professional readiness. In order to facilitate the calculation of the results, we utilized a conversion scale to convert the scores obtained from the R. Amthauer's intelligence structure test into WAIS test IQ units (Table 1). This allowed for a standardized comparison of the cognitive component measurement results between the experimental and control groups during the initial and final assessments.

Table 1. The comparative analysis of the results of measuring the cognitive component in the experimental and control groups during the initial and final assessments

Group	Test results (in %)			Results by IQ levels (in %)				
	High level	Satisfactory Level	Unsatisfactory level	Very high	High	Intermediate	Low	Very low
Initial control assessment								
EG (“-”)	13	79	8	0	28	64	8	0
CG (“-”)	19	71	10	0	23	67	10	0
Final control assessment								
EG (“+”)	16	84	0	0	33	67	0	0
CG (“+”)	19	73	8	0	22	70	8	0
Deviation (in %)								
EG	+3	+5	-8	0	+5	+3	-8	0
CG	0	+2	-2	0	-1	+3	-2	0
Average arithmetic deviation (in %)								
EG	0	0	0	0	1	1	0	0
CG	0	0	0	0	0	0	0	0

Deviation in the quantitative comparison of the results of measuring the cognitive component in the experimental (EG) and control groups (CG) during the initial and final assessments were as follows:

- For the EG, there was a 0% deviation in test results and a 1% deviation in IQ levels.
- For the CG, there was a 0% deviation in both test results and IQ levels.

In interpreting the results, we considered the comprehensive nature of the test, which enables the determination of not only the overall level of intelligence on the IQ scale but also the relative expression of various intellectual abilities and specific types within the structure of intelligence. For instance, the dominance of verbal intelligence (V indicator) is essential for professions related to the human-human system (such as doctors and teachers), while the dominance of numerical abilities (N indicator) is crucial for professions related to the human-symbol system (such as IT professionals). Predominance of spatial reasoning abilities (S indicator) is most typical for professions within the human-equipment/human-machine system (primarily for operators of complex systems). Creative occupations related to the human-nature system require high demands on verbal (V), numerical (N), and spatial (S) abilities. This allowed us to identify individuals among the student military pilots in the EG with the highest cognitive profile potential. General intelligence level indicators (based on the IQ scale of the WAIS test) normally distribute within the range of 70 to 130 IQ, encompassing 95% of all values. In the context of our study, specific IQ values, according to widely recognized differentiation worldwide, indicate the following:

- IQ below 70 (very low level of intelligence) – significant difficulty in solving intellectual tasks in professional activities and obtaining higher education.
- IQ from 70 to 85 (low level of intelligence) – the ability to perform minor intellectual tasks successfully with existing empirical knowledge and skills.
- IQ from 85 to 100 (average level of intelligence) – a zone of uncertainty; predicting success in higher education and professional activities requires consideration of other personality characteristics.
- IQ from 100 to 130 (high level of intelligence) – the potential to perform a significant number of complex intellectual tasks in most professional fields.
- IQ above 130 (very high level of intelligence) – the ability and opportunity to engage successfully in

any professional activity across a wide intellectual spectrum.

Considering the high intellectual demands of the military pilot profession, the minimum IQ level should be considered as 100 (preferably 115, as individuals at this level, according to the above differentiation, are recommended to possess special higher education qualifications). Another significant aspect of our intelligence test is as follows: completing less than 60% of tasks correctly suggests a speed-oriented intellectual inclination, while completing over 75% indicates an inclination towards accuracy. Quantitative measurements of the cognitive component in the experimental (EG) and control groups (CG) during the initial assessment revealed the following:

- 1) The baseline general intelligence level of both EG and CG students did not significantly differ, with a deviation in indicators of less than 1%.
- 2) IQ scores ranged from 85 to 129, which is generally within the norm for university students. However, considering the intellectually demanding nature of the military pilot profession, the lower limit may be slightly low, accounting for the early stages of their studies.
- 3) The structure of the intellectual sphere for students in both groups showed certain characteristics:
 - There was a dominance of the V (verbal abilities) indicator, indicating an imbalanced choice of specialization or potential difficulties in cognitive development of professional knowledge, skills, and abilities.
 - The S (spatial abilities) indicators were relatively weak, necessitating significant pedagogical attention during the educational process.
 - The N (numerical abilities) indicator was well-developed, partially compensating for the aforementioned imbalances.

Quantitative measurements of the cognitive component in the experimental and control groups during the final assessment revealed the following:

- 1) The overall intelligence level of EG and CG students, with different conditions (experimental and traditional), did not significantly differ, with a deviation in indicators of 1.1% in test scores and 2.1% in IQ levels, which can be considered within the statistical margin of error.
- 2) IQ scores still fell within the range of 85 to 129, within the reference norm.
- 3) Changes and differences in the structure of the cognitive sphere were observed for both groups of students:
 - There was an increase in the number of EG students with dominance in the S (spatial abilities) indicator or an increase in its share within the cognitive sphere structure. This indicates the positive pedagogical impact of the implemented measures.
 - No visible changes in the distribution of cognitive characteristics were observed among CG students, confirming the previous observation.
 - The N (numerical abilities) indicator remained stable in both groups.

The quantitative comparison of the results of measuring the cognitive component of professional readiness for combat flights of future tactical air force pilots in the experimental (EG) and control groups (CG) allows us to formulate the following preliminary insights:

1. The overall intelligence level of students, assessed using both Amthauer test scores and IQ units, remained unchanged under experimental conditions. This finding is in line with the consensus among

the modern scientific community regarding the genetic determination of intelligence and the impossibility of qualitative improvements throughout an individual's lifetime (Colom et al, 2013; Hunt, 2011; Deary, et al., 2010; Haier, 2013).

2. The identified qualitative positive dynamics of the spatial component of the intellectual sphere in the students of the experimental group, in contrast to the lack of such progress in the control group, signifies the effectiveness of the pedagogical system developed and implemented to ensure the quality of professional training for combat flights of future tactical air force pilots, particularly in terms of the impact of profiling on the educational process.

3. The analysis of the EG students' results in terms of subtests suggests visible progress in the development of their heuristic (subtests 1, 3, 6) and epistemological (subtests 2, 7) abilities. Additionally, the improvement observed in subtest 9 as a result of the experimental intervention indicates the practical orientation of their cognitive sphere, which influences organizational abilities.

4. There is also a positive trend in the ratio of students with high and medium levels of intelligence criterion indicators, indicating an increase in the number of students achieving high levels of intelligence formation.

The assessment of the operational component of professional readiness was conducted under tightly regulated conditions in a higher military educational institution, specifically during the 3rd and 4th years of study. The evaluation was based on the results of simulator training using complex simulators of the L-39 training aircraft and the Mi-8 transport and combat helicopter (Kushnyr, 2009). The purpose of this assessment was to measure the students' proficiency and competence in operating these simulators. The measurements were conducted at the beginning, referred to as the initial primary assessment, and at the end, referred to as the final basic simulator training assessment

Table 2. The control comparison of the results obtained from measuring the operational component in both the experimental and control groups

Group	Results according to the KNAFU assessment (in %)				Results of formation of the operational component (in %)		
	Excellent	Good	Satisfactory	Unsatisfactory	High	Sufficient	Insufficient
Initial primary simulator training							
EG ("–")	17	47	35	1	26	73	1
CG ("–")	15	40	42	3	22	75	3
Final basic simulator training							
EG ("+")	22	64	14	0	40	60	0
CG ("+")	18	46	34	2	27	71	2
Deviation (in %)							
EG	+5	+17	-21	-1	+14	-13	-1
CG	+3	+6	-8	-1	+5	-4	-1

The analysis of the results from the control comparison allows us to draw the following preliminary conclusions regarding the impact of the introduced pedagogical system on the quality of professional training for combat flights of future tactical air force pilots, specifically in terms of the operational component of their professional readiness:

1. There is a noticeable improvement in the quality of simulator training among EG students, as

evidenced by the following trends:

- An increase in the number of students who achieved the maximum result, on average by 3%, compared to the CG. This improvement was even more significant, at 5%, when comparing the two types of simulator training. In contrast, the CG only saw a 3% increase in this indicator.
- An increase in the number of EG students who attained a sufficient level of proficiency in the operational component, specifically in the categories of "good" and "excellent," by 14% compared to the CG. Additionally, there was a 5% improvement when comparing the two types of simulator training.
- There were no EG students whose level of proficiency in the operational component was deemed insufficient according to the initial experiment, whereas such students remained in the CG. This indicator remained unchanged when comparing the two types of simulator training.

2. The most significant improvement in training quality within the EG, where the pedagogical system was implemented, can be observed in the increase of students receiving "excellent" and "good" grades. This trend indicates that the majority of students in the group possess satisfactory piloting skills, including maintaining altitude, speed, compass course, proficient manual and automatic control of the aircraft, quick mastery of flight elements, and the ability to tactically assess non-instrumental flight information through a systematic review of external space. This indicator also suggests potential prospects for reducing the dropout rate of future military pilots based on praxeological criteria during their studies at higher education institutions, which is vital for supplying the Air Force of Ukraine with skilled flight professionals. The assessment of the motivational and conative component, which corresponds to the axiological criterion of professional readiness, was conducted using the motivational method developed by Zamfir (1983) and the conative diagnostic methodology by Stambulova (2019). The measurement included the use of specific indicators and levels developed by the researchers (as presented in Table 3 and Table 4).

Table 3. The results of measuring the motivational indicator of the motivational and conative component, according to Zamfir Method, in both the experimental and control groups during the initial and final control assessments

Groups	Levels of the indicator formation		
	High	Sufficient	Insufficient
initial control assessment			
EG (94 persons)	34	41	20
CG (96 persons)	22	50	24
Overall result	37	44	22
(in %)	23	52	25
final control assessment			
EG (94 persons)	48	42	4
CG (96 persons)	22	57	17
Overall result	51	45	4
(in %)	23	59	18
Deviation according to the results of the initial ("–") and final ("+") control assessments (in %)			
EG (94 persons)	+14	+1	-18
CG (96 persons)	0	+7	-7

Table 4. The results of measuring the conative indicator of the motivational and conative component, according to Stambulova Method, in both the experimental and control groups during the initial and

final control assessments

Groups	Levels of the indicator formation		
	High (31-40 points)	Sufficient (20-30 points)	Insufficient (0-19 points)
Initial control assessment			
EG (94 persons)	31	54	9
CG (96 persons)	27	57	12
Overall result	33	57	10
(in %)	28	59	13
Final control assessment			
EG (94 persons)	45	48	1
CG (96 persons)	29	54	13
Overall result	48	51	1
(in %)	30	56	14
Deviation according to the results of the initial ("-") and final ("+") control assessments (in %)			
EG (94 persons)	+15	-6	-9
CG (96 persons)	+2	-3	+1

The measurement of the motivational indicator of the motivational and conative component of students' professional readiness revealed the following:

1) The initial control measurement showed no statistically significant difference in the basic level of this indicator between students in the experimental group (EG) and the control group (CG).

2) The positions identified by the results of the final control assessment are significant for determining the effectiveness of the implemented pedagogical system of ensuring the quality of professional training for combat flights of future tactical air force pilots. The following trends were observed:

- There was a 14% increase in the number of EG students with a high level of motivation, while this indicator remained the same in the CG.

- The number of EG students with an unsatisfactory level decreased by an average of 18%, compared to a decrease of 7% in the CG (unchanged from the initial control measurement).

3) Both groups demonstrated improvement in the level of motivational indicator formation, but the EG showed greater growth compared to the CG. Additionally, the number of EG students with calculated optimal motivational complexes ($VM > ZPM > ZNM$ and $VM = ZPM > ZNM$) was higher than in the CG, indicating a stronger motivation towards the future professional activity among the former group.

The results of measuring the conative indicator of the axiological criterion showed the following:

1) The initial control measurement revealed no statistically significant difference in the basic level of this indicator between students in the EG and the CG.

2) Significant differences in the level of formation of the indicator were observed in the EG students, who were exposed to the experimental influence, during the initial control assessment:

- There was a 15% increase in the number of students with a high level in the EG, compared to a 2% increase in the CG.

- The number of students with a sufficient level decreased by 6% in the EG due to their excellent results, whereas it decreased by 3% in the CG.

- There was a significant decrease of 9% in the number of students with an unsatisfactory level in the EG, while there was a 1% increase in the CG.

3) The EG cadets demonstrated a predominance of generalized conative abilities over their expression, which is more relevant to their future professional activity. This indicates their potential for consistent and stable conative actions in all aspects and manifestations, particularly in combat flights.

The assessment of the physical component of professional readiness was conducted through qualimetric measurement, utilizing the author's comprehensive physical test and the diagnostic method of self-assessment of the functional state known as "WAM" (developed by Doskin et al., 1973) The measurements were performed during the initial and final control assessments of both the experimental and control groups (Table 5).

Table 5. The results of the physical component measurement using the author's comprehensive test, indicating the performance of the experimental and control groups during the initial and final control assessments

Groups	Quantitative distribution by the results of general physical functional qualities testing by levels			Quantitative distribution by the results of the test of special physical professional-oriented qualities by levels		
	High	Sufficient	Insufficient	High	Sufficient	Insufficient
Initial control assessment						
EG (94 persons)	29	65	0	34	60	0
CG (96 person)	21	75	0	35	61	0
For the whole test (in %)	31	69	0	36	64	0
	22	78	0	36	64	0
Final control assessment						
EG (94 persons)	39	55	0	45	49	0
CG (96 person)	24	72	0	41	55	0
For the whole test (in %)	41	59	0	48	52	0
	25	75	0	43	57	0
Deviation according to the results of the initial ("–") and final ("+") control assessments (in %)						
EG (94 persons)	+10	-10	0	+12	-12	0
CG (96 person)	+3	-3	0	+7	-7	0

The results of the initial and final control assessments of the physical component of professional readiness in both groups reasonably indicate the following:

1) The basic (initial) parameters for the formation of general physical functional qualities (GPFQ) and special physical professionally oriented qualities (SPPOQ) were statistically the same among

students in the experimental group (EG) and the control group (CG).

2) However, there was a significant gap in the initial parameters of GPFQ and SPPOQ between the two groups:

- The dynamics were assessed based on the increase in the number of individuals with a high level of formation, with a significance of 35% for GPFQ and 65% for SPPOQ.
- The EG demonstrated an increase in the number of students with a high level by 10% for GPFQ and 12% for SPPOQ, compared to a 3% increase in the CG for GPFQ and a 7% decrease for SPPOQ.

3) The advancement of the formation of the relevant qualities, as indicated by the results of the author's comprehensive physical test, was 7% for GPFQ and 5% for SPPOQ in the EG, compared to the CG. This suggests the effectiveness of the implemented pedagogical system for ensuring the quality of professional training for combat flights of future tactical air force pilots compared to the traditional system.

4) The results of the diagnostics of the operational self-assessment of the functional state, as per the "WAM" methodology (well-being, activity, mood), indirectly confirmed the above conclusions. Specifically, 85% of the students in the experimental group demonstrated a positive functional status.

Regarding the assessment of the psychophysical component of professional readiness, the assessment was conducted twice, taking into account the specific indicators measured at the beginning and end of the study, according to Pashkovsky (2017). The results are presented in Table 6.

Table 6. The results of the control measurement of the psychophysical component based on the method of scaled assessment by Kokun et al. (2022) in both the experimental group and the control group

Groups	Levels of the indicators formation		
	High (81-100)	Sufficient (41-60)	Insufficient (1-20)
Initial experiment			
EG (94 persons)	62	18	14
CG (96 persons)	43	43	10
Overall result (in %)	66	19	15
	45	45	10
Final experiment			
EG (94 persons)	77	15	2
CG (96 persons)	44	45	7
Overall result (in %)	82	16	2
	46	47	7
Deviation in the overall result in the EG ("+") and CG ("-")			
EG (94 persons)	+16	-3	-13
CG (96 persons)	1	+2	-3

The empirical data obtained allow us to conclude the following:

- 1) There was a quantitative difference in the high level between the results of the experimental group (EG) and the control group (CG) in the initial experiment, with a 36% advantage for the EG.
- 2) Neither the CG nor the EG had individuals classified with an additional level of formation of indicators in the psychophysiological component of professional readiness, indicating a more stable

and positive psychophysiological state in the former group. This stability is crucial for future professional activities.

The empirical data from the assessment of the psychophysical component of professional readiness in the study highlight several outcomes with implications for public health in the context of training future tactical air force pilots: (i) The significant quantitative difference in the high level indicators between the experimental group (EG) and the control group (CG) in the initial experiment, with a 36% advantage for the EG, suggests that the pedagogical interventions implemented in the EG were effective in enhancing the psychophysical component of professional readiness. This result accentuates the importance of tailored training techniques that consider pilots' holistic well-being, aligning with public health promotion principles. (ii) The absence of people classified with an extra level of development of indicators in the psychophysiological component in either the control group (CG) or experimental group (EG) indicates a stable and positive psychophysiological condition in the control group. This is imperative for sustaining optimal health and performance in future professional endeavors. Such an observation underscores the critical significance of monitoring and upholding the psychophysical well-being of pilots to ensure their preparedness and resilience in challenging operational environments.

According to the primary data from the qualimetric measurement, it has been established that the experimental influence in the experimental group (EG) led to qualitative changes in the structure of students' intellectual sphere, specifically in the cognitive component. These changes are manifested in the increased presence and dominance of spatial reasoning abilities within the cognitive sphere, which is of fundamental importance for the military pilot's profession. This indicates the significant pedagogical impact of the introduced measures. Furthermore, there is a positive trend in the ratio of students with high and medium levels of intelligence criterion indicators, with an increasing number of students reaching the high level. The empirical evidence verifies progress in the development of heuristic and epistemological abilities among EG students, as well as a practical orientation of their intellectual sphere, which contributes to their organizational capabilities. These findings further confirm the effectiveness of the experimental intervention on the cognitive component of professional readiness among EG students. Notably, there has been significant improvement in the quality of simulator training in terms of an increased proportion of students performing at a high level in educational tasks. This improvement is observed in the operational component indicators, which indicates sufficient formation. Additionally, there has been noticeable enhancement in the motivational and conative indicators of the praxeological criterion of professional readiness, reaching a high level. This progress, particularly in the generalization of conative qualities, significantly enhances the potential of students in combat flights. These findings collectively highlight the positive impact of the implemented measures on various components of professional readiness among students in the experimental group. The study achieved an advance in the formation of relevant physical qualities, compared to the CG, in terms of general physical functional qualities and special physical professionally oriented qualities, which directly indicates the effectiveness of the measures introduced during the experiment as compared to the traditional system. It managed to achieve an improvement in the indicators of the psychophysiological component of professional readiness as compared to the results of the CG. Thus, the above conclusions provide reasoned grounds to assert that the effectiveness of the developed and implemented pedagogical system of ensuring the quality of professional training for combat flights of future tactical air force pilots has been experimentally confirmed. We have made significant progress in developing our participants' physical attributes, outperforming the control group. Our focus has been on improving general physical abilities and specialized physical qualities essential for effective performance. Our measures have resulted in a noticeable enhancement of the participants' overall physical functionality. The study confirms the positive impact of our experimental measures on the participants' readiness, thereby validating our teaching system's effectiveness. The significance of this study lies in the empirical evidence supporting the accuracy and efficiency of our teaching system. It is specifically designed to provide high-quality professional training for future

tactical air force pilots engaged in combat flights. By surpassing the results of the control group, the study confirms the effectiveness of our teaching system in improving the physical attributes necessary for successful combat flight missions. Also, the research significantly contributes to the scientific community by improving our understanding of factors influencing professional combat flight training.

Conclusion and future scope

The study's success in advancing the formation of relevant physical qualities compared to the control group is clear evidence of the effectiveness of our measures. The findings provide valuable insights into the efficiency of our teaching system and contribute to the broader field of professional training for tactical air force pilots. This study serves as a foundation for further research and development in this area, ultimately leading to the continued enhancement and refinement of training programs for combat flights. The scientific novelty of this research lies in substantiating the effectiveness of the teaching system in ensuring the quality of professional training for future tactical air force pilots engaged in combat flights.

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