

Procedure for measuring the motivational and volitional component of professional training for combat flights of future tactical aviation pilots

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Abstract

The article aims to substantiate the procedure for measuring the motivational and volitional component of professional training for future tactical aviation pilots engaged in combat flights. The study employed a methodology to determine the motivational complex of personality as an indicator of satisfaction with the chosen military pilot profession. This methodology was based on previous research that highlights the correlation between professional satisfaction and the type of motivational complex, including intrinsic, extrinsic positive, and extrinsic negative elements. The diagnostic method utilized in this study was developed by K. Zamfir and modified by A. Rean. Furthermore, the research assessed volitional qualities by examining the content and expression of decision-making in challenging situations. The diagnostic method employed in this assessment was developed by N. Stambulova. The measurement of the motivational-volitional component of professional readiness among military pilot cadets revealed notable differences between the experimental group and control group in terms of their motivational and volitional indicators. The obtained results underline the significance of incorporating these findings to enhance the educational process for military pilot cadets. Implementing a pedagogical system based on the effectiveness demonstrated in measuring the motivational component of professional training will be crucial in this regard.

Keywords

Tactical aviation; motivational component, volitional component, professional training of pilots, pedagogical experiment.

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Introduction

Training future tactical aviation pilots, particularly in combat flights, requires a deep understanding of the motivational and volitional components contributing to their professional readiness. These components play a crucial role in determining the individual's level of commitment and perseverance, which are essential in the context of tactical aviation operations. Therefore, it is imperative to have a comprehensive understanding of the motivational and volitional factors that influence the pilots' decision-making and performance. This understanding can enhance the effectiveness of the training programs and contribute to the success of tactical aviation operations.

Motivation is a driving force that helps individuals achieve their goals and maintain a solid commitment to their chosen profession (Sahrazad, Setyaningsih, and Taufik, 2022). In military aviation, understanding the motivational factors of pilot trainees can provide insight into their satisfaction with the profession and overall engagement in the training process. We can understand their motivations by assessing intrinsic and extrinsic motivational factors and tailor the training program accordingly. The volitional component, which encompasses decision-making, perseverance, and self-regulation (Vancouver, 2000) is vital for successful performance in combat flights. In addition, evaluating volitional qualities provides insight into decision-making under pressure.

The *purpose* of this article is to present a procedure for measuring the motivational and volitional components of professional training for combat flights of future tactical aviation pilots. By examining and assessing these components, we aim to identify areas for improvement in the pedagogical system. Hence, the *primary task* of this research is to create and implement a scientifically and methodologically valid method for measuring the motivational and volitional aspects of professional training. The goal is to evaluate the levels of motivation and willpower among future pilots and investigate how these factors impact their preparedness for professional combat aviation tasks.

The *research hypothesis* of our article is that by employing a comprehensive and systematic procedure to measure the motivational and volitional components of professional training, we can effectively assess and enhance the readiness of future tactical aviation pilots for combat flights. We hypothesize that a strong correlation exists between the motivational and volitional aspects of their training and their overall

readiness. By identifying and delving into these elements, we can develop strategies to optimize the pedagogical system and ensure the delivery of superior-quality combat training.

1. Literature Review

Pilots' professional training has always been paramount to ensuring a nation's military potential (Morrow, 2009). In contemporary circumstances, however, this issue has gained even greater significance as a lever for military preparedness and a crucial factor in advancing our country's potential victory in conflicts, particularly regarding the ongoing tensions with Russia. Professional training for combat flights of future tactical aviation pilots is an urgent scientific and practical task of national importance in modern conditions.

There is a diversity of viewpoints concerning identifying components within such training. Several studies have delved into this subject, thereby substantiating our perspective on the necessary components that should be incorporated into the professional training for combat flights of future tactical aviation pilots (National Research Council, 2014; Manolachi, 2021; Avtin et al., 2021). Foremost, among these is the motivational and volitional component, encompassing the underlying motives and incentives that empower pilots to carry out their professional duties effectively. Scholars such as Galimska (2017), Kernytskyi (2015), Moskalenko (2015), Skrypnyk and Shven (2017), and Plachynda (2014) have notably focused on the examination of this component within the pilot training process. Moreover, scholars worldwide reveal that motivation plays a pivotal role in pilot performance and readiness. Numerous studies have been conducted to explore this topic, shedding light on the critical role these components play in ensuring pilot readiness and success in combat scenarios. Thus, Zierke (2014) conducted a comprehensive literature review on pilot training and identified motivation as a critical factor in pilot performance. The study emphasized the necessity of understanding the motivational factors that drive individuals to pursue an aviation career and how these factors can be nurtured and enhanced during training. Zierke's work highlighted the importance of assessing and fostering intrinsic motivation, such as a passion for flying and a sense of purpose, and extrinsic motivational factors, such as career progression and rewards.

Staal et al. (2004) delved into the volitional aspects of pilot training, focusing on developing decision-making skills and acting under pressure. His research underscored the necessity of assessing and enhancing these volitional qualities among future tactical aviation pilots. The study emphasized developing cognitive and emotional resilience, adaptability, and practical problem-solving skills within training programs. These volitional components help pilots make sound judgments and perform optimistically in high-stress environments.

Research by Jentsch and Curtis (2017) presents a comprehensive framework for understanding and fostering motivation in aviation training. Their study emphasizes the importance of intrinsic motivation and cultivating a sense of purpose and passion among future pilots, ultimately contributing to their job satisfaction and commitment to their profession.

As discussed by Dubaseniuk, Vozniuk, and Laichuk (2020), the concept of volition also holds significance within the context of professional pilot training. Their research focuses on goal setting, planning, and self-regulation in enhancing volitional aspects, which are crucial in ensuring pilot readiness and performance.

In a study conducted by McCloy, Campbell, and Cudeck (1994), the relationship between motivation, volition, and professional training was examined. The researchers found a strong correlation between pilots' motivation, their ability to persevere in challenging situations, and the successful completion of combat flight training. The study suggested that pilots with higher levels of intrinsic motivation exhibited more significant commitment, dedication, and persistence in their training, leading to improved performance outcomes. The researchers' work highlighted the need for a comprehensive approach to assessing and fostering motivation and volition throughout the training process (McCloy et al., 1994). Furthermore, Zamfir (1983) and Rean et al. (2007) contributed to the existing literature by exploring the different types of motivational complexes exhibited by military pilots and their impact on professional satisfaction and performance. Their research revealed specific motivational profiles among pilots: achievement-oriented, affiliation-oriented, and power-oriented. The study emphasized the importance of recognizing and tailoring training programs to align with individual motivational profiles, which can maximize the effectiveness of combat aviation training.

Thus, the literature review demonstrates a consensus on measuring the motivational and volitional components of professional training for combat flights of

future tactical aviation pilots. This research field emphasizes the need for a holistic approach that recognizes the multifaceted nature of motivation and volition. By incorporating this understanding into training programs, aviation educators can enhance the readiness and success of pilots in combat scenarios, ultimately ensuring the safety and efficiency of military operations.

2. Methods

Modern science has developed an extensive range of methods for measuring and assessing the psychological readiness of military pilots, focusing on various individual characteristics such as motivation, emotion, volition, and stress resistance. To provide a detailed measurement of the motivational and volitional component of the professional readiness of future tactical aviation pilots, the following methodologies have been selected:

1) Determining the motivational complex of an individual as an indicator of satisfaction with the chosen military pilot profession:

- Based on research that establishes a positive significant relationship ($r = +0.409$) between satisfaction with the profession and the individual's motivational complex;
- Grounded in the scientific understanding of three types of motivation: intrinsic, extrinsic positive, and extrinsic negative;
- Diagnostic assessment conducted using Zamfir Method (in the modification by Rean) (Rean et al., 2007).

2) Determining the content and manifestation of volitional qualities among cadets-military pilots through decision-making in challenging situations, assessed using N. E. Stambulova's diagnostic method (Stambulova, 2019).

In accordance with the "Motivation of professional activity" methodology (developed by Zamfir (1983), and modified by Rean (Rean et al., 2007)), EG and CG cadets were asked to rate the significance of various motivators of professional activity on a 5-point scale. These motivators include:

- Monetary support;
- Aspiration for promotion (military career);
- Desire to avoid criticism from superiors or colleagues;
- Desire to avoid potential punishments or difficulties;

- Need to achieve social prestige and gain respect from others;
- Satisfaction derived from the work process and outcomes;
- Opportunities for comprehensive self-realization within this activity.

The resulting scores were utilized to evaluate the levels of intrinsic (IM), extrinsic positive (EP), and extrinsic negative (EN) motivation according to the following formulas:

- Intrinsic motivation = (rate cl.6 + rate cl.7)/2;
- Extrinsic positive motivation = (rate cl.1+rate cl.2+rate cl.53)/2;
- Extrinsic negative motivation = (rate cl.3+rate cl.4)/2, where the indicator of the severity of each type of motivation will be a number ranging from 1 to 5.

The obtained results allow us to establish the motivational complex of an individual, which directly correlates with satisfaction in the military pilot profession. This is particularly relevant for military pilots, whose profession is continuously associated with high emotional and nervous tension, stress, and requires significant motivational stimulation. Research conducted by Khrykov (2018) has demonstrated that the more optimal the motivational complex, the higher the individual's motivation towards their activity, the desire to achieve positive results, and consequently, the lower their emotional instability.

In order to measure the motivational-volitional component, a diagnostic procedure was conducted in both the experimental group (EG) and control group (CG) of military pilots. The motivational component was assessed using a methodology based on three types of motivation: intrinsic motivation (IM), extrinsic motivation (EM), and amotivation (AM). The optimal motivational complexes were determined to be $IM > EP > EM$ and $IM = EP > EM$, aligning with the chosen professional activity.

The self-assessment methodology developed by Stambulova (2019) was employed to measure the volitional qualities within this component of professional readiness for combat flights. Initially designed for students in sports fields, this methodology proved valuable for our study as it allowed for identifying both surface and deep foundations of the volitional sphere in military pilot cadets throughout their studies at a military university.

The cadets in the EG and CG were presented with five signs of volitional qualities, including purposefulness, perseverance and persistence, courage and determination, initiative and independence, and self-control and endurance. Each sign was expressed through twenty statements, resulting in 100 statements. The participants

were asked to rate each statement on a scale of five options: "It never happens," "rather wrong," "Maybe," "Probably yes," and "Surely yes".

The judgments were categorized into two groups for each volitional quality: expressions of volitional qualities and generalization of volitional qualities. The results were calculated in points using algebraic addition, with an additional 20 points added to convert to a positive rating scale, namely:

- Judgments 1, 6, 8, 9, 11, 12, 16, 17, 18, and 20 reveal the expression of volitional qualities;
- Judgments 2, 3, 4, 5, 7, 10, 13, 14, 15, and 19 reveal the generalization of volitional qualities.

This calculation was performed separately for each volitional trait's expression parameters and generalization. To determine the scores, a point system was used (-2, -1, 0, +1, +2) for each trait's expression and generalization. The results were calculated through algebraic addition. To convert to a positive scale, 20 points were added to the final score.

Results were interpreted based on three levels of measurement. A high level (31-40 points) indicated a harmonious development of qualities, collectively contributing to optimal psychological readiness for professional activity. A sufficient level (20-30 points) suggested the formation of all components of the volitional indicator within the axiological criterion. An insufficient level (0-19 points) indicated an inadequate formation and absence of specific parameters within the volitional indicator, highlighting the psychological unpreparedness of an individual for combat flights.

The measurement of the volitional indicator within the motivational and volitional component (axiological criterion) of professional readiness for combat flights of future tactical aviation pilots was conducted twice at Ivan Kozhedub Kharkiv National Air Force University. The participants in the study were cadets who were at different stages of their training program. The initial measurement took place during the ground stage of training in their 3rd year, while the second measurement was conducted upon the completion of this stage in their 4th year. The analysis of the data collected from the cadets revealed valuable insights into the development and progression of the volitional component of their professional readiness for combat flights. By evaluating the changes in their volitional indicators over time, the study aimed to assess the effectiveness of the training program in enhancing the cadets' motivation, commitment, and decision-making skills in the context of combat aviation operations. Through

statistical analysis and comparison between the measurements taken in the 3rd and 4th years, the study strived to identify any significant changes in the volitional indicators of the cadets. Such analysis provided practical information on the training program's effectiveness. It offered perspicuity into the specific areas requiring further attention and improvement in order to enhance the professional readiness of future tactical aviation pilots.

3. Results

The measurement of the motivational and volitional component (axiological criterion) of professional readiness was conducted using the motivational indicator (based on Zamfir Method) (Zamfir, 1983) and the volitional indicator (based on Stambulova Diagnostic Method) (Stambulova, 2019). We employed a set of indicators and levels developed in the study specifically for this component (Table 1, Table 2).

Table 1: Comparison of Motivational Indicator Results in the Experimental and Control Groups during Initial and Final Assessments (by Zamfir Method)

| Groups | Levels of formation of the indicator | | |
|---|--------------------------------------|------------|--------------|
| | High | Sufficient | Insufficient |
| Entrance control assessment | | | |
| EG (94 persons) | 34 | 40 | 20 |
| CG (96 persons) | 22 | 50 | 24 |
| General result | 37 | 44 | 22 |
| (%) | 23 | 52 | 25 |
| Exit control assessment | | | |
| EG (94 persons) | 48 | 42 | 4 |
| CG (96 persons) | 22 | 57 | 17 |
| General result | 51 | 45 | 4 |
| (%) | 23 | 59 | 18 |
| Deviations | | | |
| Based on the results of the input ("-") and output ("+") control assessments (in %) | | | |
| EG (94 persons) | +14 | +1 | -18 |
| CG (96 persons) | 0 | +7 | -7 |

This data illustrates the results of measuring the motivational indicator of the motivational-volitional component, comparing the experimental and control groups during the initial and final assessments. The calculation of the level of significance using the Student's t-test methodology based on the results of the input control assessment was 7.23 - the sample means differ insignificantly; based on the results of the output control assessment - 19.09 - the sample means differ significantly.

Table 2: Comparison of Volitional Indicator Results in the Experimental and Control Groups during Initial and Final Assessments (by Stambulova Method)

| Groups | Levels of formation of the indicator | | |
|---|--------------------------------------|------------------------------|-------------------------------|
| | High (31-40 scores) | Sufficient (20-30 scores) | Insufficient (0-19 scores) |
| Entrance control assessment | | | |
| EG (94 persons) | 31 | 54 | 9 |
| CG (96 persons) | 27 | 57 | 12 |
| General result | 33 | 57 | 10 |
| (%) | 28 | 59 | 13 |
| Exit control assessment | | | |
| EG (94 persons) | 45 | 48 | 1 |
| CG (96 persons) | 29 | 54 | 13 |
| General result | 48 | 51 | 1 |
| (%) | 30 | 56 | 14 |
| Deviations | | | |
| Based on the results of the input ("-") and output ("+") control assessments (in %) | | | |
| EG (94 persons) | +15 | -6 | -9 |
| CG (96 persons) | +2 | -3 | +1 |

The calculation of the level of significance using Student's t-test based on the results of the initial control assessment yielded 6.17, indicating no significant difference in the average samples. However, in the final control assessment, the calculated level of significance was 14.6, indicating a statistically significant difference in the average samples.

Measurement of the motivational indicator of the motivational-volitional component of professional readiness in military pilot cadets revealed the following:

1) The baseline formation of this indicator in both the experimental group (EG) and the control group (CG) cadets during the initial control measurement was statistically similar.

2) The results obtained from the final control assessment are significant in determining the effectiveness of the implemented pedagogical system in ensuring the quality of professional training for future tactical aviation pilots:

- The percentage of EG cadets with a high level of motivation increased by 14% (in CG, this indicator remained unchanged).
- The number of EG cadets with an unsatisfactory level of motivation decreased by an average of 18% (in CG, the indicator decreased by an average of 7%, which remained consistent in both control measurements).

3) Both groups demonstrated improvement in the formation level of the motivational indicator, but the EG showed a greater growth rate compared to the CG.

Additionally, the number of EG cadets with optimal motivational complexes ($IM > EP > EN$ and $IM = EP > EN$) was higher than that of the CG cadets, indicating a higher level of motivation towards their future professional activities.

The implementation of the pedagogical system has had a significant impact on the motivational indicator of military pilot cadets. Here are the targeted links to the pedagogical needs for improving the training of future tactical aviation pilots, particularly in combat flights:

1) **Enhancing Motivational Support:** The increase in the percentage of cadets with a high level of motivation in the experimental group (EG) highlights the effectiveness of motivational support provided during the training process. This indicates a need to further strengthen and emphasize motivational techniques and interventions to enhance the motivation levels of cadets in both groups.

2) **Individualized Approaches:** The decrease in the number of cadets with unsatisfactory motivation levels, particularly in the EG, suggests the importance of individualized approaches in the training process. Providing personalized support and guidance to cadets, tailored to their unique needs and aspirations, can further improve their motivation.

3) **Targeted Interventions:** The higher growth rate and a greater number of cadets with optimal motivational complexes in the EG indicate the need for targeted interventions. Implementing specific strategies such as goal-setting, feedback mechanisms, and mentorship programs can help foster and sustain high levels of motivation among cadets.

4) **Continuous Evaluation:** The comparison between the initial and final control assessments highlights the importance of continuous evaluation of the training process. Regularly assessing and monitoring the motivational component throughout the training program can help identify areas of improvement and make necessary adjustments to the pedagogical system. By addressing these pedagogical needs, the training of future tactical aviation pilots can be further optimized, ensuring a high-quality professional readiness for combat flights.

The results of measuring the volitional indicator of the axiological criterion revealed the following:

1) The baseline formation of this indicator in both EG and CG cadets during the initial control measurement was statistically similar.

2) Significant differences in the formation level of the volitional indicator were observed in EG cadets who were exposed to experimental interventions, according to the results of the initial control assessment:

- The number of cadets with a high level of proficiency increased by 15% in EG (in CG, the increase was only 2%).
- The number of cadets with a sufficient level decreased by 6% in EG due to their excellent results (in CG, the decrease was 3%).
- The number of cadets with an unsatisfactory level decreased significantly by 9% in EG (in CG, there was a 1% increase).

3) EG cadets showed a prevalence of generalized volitional qualities over their severity, which is more relevant to their future professional activities. This indicates the potential for a consistently stable volitional act in all aspects and manifestations, particularly during combat flights.

Based on the detailed results of the measurement of the volitional indicator of the axiological criterion in military pilot cadets, the following targeted links to pedagogical needs can be identified:

1) Enhancement of Motivational Support: Given the higher percentage of EG cadets with a high level of motivation and the greater growth in their motivational indicator compared to the CG, it is important to provide targeted motivational support throughout the training process. This can include personalized mentoring, goal-setting strategies, and continuous feedback to maintain and enhance motivation levels.

2) Integration of Specialized Volitional Training: Considering the prevalence of volitional qualities in EG cadets, there is an opportunity to incorporate specialized volitional training into the curriculum. This training should focus on developing and strengthening essential volitional skills, such as self-discipline, perseverance, decision-making, and stress management, in preparation for the demands of combat flights.

3) Contextualized Training for Specific Aircraft Types: Ivan Kozhedub Kharkiv National Air Force University involves more than 5000 students. Considering the cadets are trained on the simulator of the L-39 aircraft, it is crucial to design training programs that are specific to different aircraft types. This can involve simulators, practical exercises, and case studies that provide realistic and contextually relevant scenarios for the cadets to develop their volitional and decision-making skills in relation to their specific aircraft.

4) Continuous Assessment and Feedback: Regular assessment and feedback on both the motivational and volitional aspects of cadets' training are essential. Feedback should be constructive, timely, and focused on areas of improvement. This will help cadets identify their strengths and weaknesses, allowing for targeted interventions to further enhance their professional readiness.

The EG cadets demonstrated a higher percentage of individuals with a high level of motivation and a lower percentage of individuals with an unsatisfactory level compared to the CG. Additionally, the EG cadets displayed greater growth in their motivational indicator compared to the CG. Moreover, the EG cadets exhibited a higher prevalence of volitional qualities, indicating their potential for sustained volitional action in all aspects of their future professional activities, particularly in combat flights.

The results obtained from this study should be utilized to enhance the educational process of military cadets by implementing a pedagogical system that has demonstrated its effectiveness in measuring the motivational-volitional component of professional training. Ultimately, this constitutes the scientific novelty of this study.

4. Discussion and Conclusions

After completing the training program, we performed a final control assessment to assess the impact of the training on the motivational component of both the experimental group (EG) and the control group (CG). The assessment revealed a significant difference in the average scores between the two groups. The EG displayed a remarkable improvement in their motivational qualities compared to the CG. This outcome indicates that the training program was effective in enhancing and developing the motivational component of the military pilot cadets in the experimental group.

Upon the foundation of this study, several future prospects can further enhance our understanding and improve the training process of military pilot-cadets. Thus, future research can explore the interplay between the motivational and volitional components, examining how they interact and influence each other in the context of combat flight training. This integrated approach can provide a more comprehensive understanding of the factors contributing to professional readiness and performance. Next, conducting longitudinal studies can provide a deeper understanding of the changes in the motivational and volitional components over time during the training process. Researchers can identify patterns and trends by measuring these components at multiple

time points, allowing for more targeted interventions and adjustments to the training program.

Moreover, recognizing that each military pilot-cadet is unique, future research can explore the role of individual differences in the motivational and volitional components. Tailoring the training program to individual needs and preferences can enhance motivation, engagement, and overall training outcomes. This could include personalized coaching or mentoring strategies.

One of the nearest upcoming research directions is to diagnose the risk readiness of military pilot-cadets for combat air operations. The focus is on assessing their predisposition towards risk-taking. This research will expand our understanding of how risk readiness influences professional training and performance in combat air operations. Diagnostic tools such as Schubert's "PSK" technique will provide valuable insights into the cadets' responses in life-threatening situations. Based on the findings of this research, specific recommendations will be proposed to enhance the professional training of military pilot-cadets. These recommendations will include additional psychological correction for cadets exhibiting excessive risk predisposition and the organization of individual flight simulator sessions simulating emergency scenarios. By addressing risk predisposition and tailoring training programs accordingly, educational institutions can optimize the cadets' readiness and effectiveness in combat air operations, ultimately enhancing safety.

Overall, the prospects in this field hold significant potential for advancing the training of future tactical aviation pilots, ensuring their optimal development and preparedness in combat flight operations.

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