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Developing strategic thinking in servicemen by means of interacti ve learning

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Desenvolvendo o pensamento estratégico em militares por meio da aprendizagem interava

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Desarrollo del pensamiento estratégico en militares mediante el aprendizaje interacvo

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Abstract: *New global hybrid threats require innovative methods for developing strategic thinking in the servicemen, which makes the study of interactive learning technologies relevant. The aim of the research is to study the impact of interactive learning methods on the strategic thinking of future military personnel in higher education institutions (HEIs). The research employed the following methods: computer simulations with fixed response times, Foresight Assessment Tool, and testing (Team Strategic Thinking Measure, TSTM). Descriptive statistics, Mann-Whitney test, Wilcoxon test, analysis of variance (ANOVA), and t-test were used as statistical methods. Reliability and validity were tested using Cronbach's alpha coefficient. The study sample consisted of 120 people. The results showed that the experimental group (EG) significantly outperformed the control group (CG) in all TSTM indicators (p≤0.001). The level of strategic coherence increased by 26% (from 62.3±8.5 to 78.6±7.2 points, d=1.23). The number of innovative solutions doubled (from 2 to 4, r=0.42). The time to reach consensus was reduced by 33% (from 14.2±3.8 to 9.5±2.6 min, d=0.89), and communicative effectiveness improved by 30% (from 6.1±1.3 to 7.9±1.1 points, d=0.93). The greatest effect of interactive learning was recorded for strategic coherence (d=1.23). It was found that the use of interactive learning methods contributes to the development of strategic thinking of the servicemen, which is expressed in improved speed of decision-making, forecasting accuracy, increasing adaptability, and the effectiveness of team interaction. Prospects for future research include studying the long-term effects of interactive learning methods, the influence of individual characteristics of participants, as well as the development of personalized training programmes using new technologies.*

Keywords: *Military education. Higher education. Strategic games.*

Resumo: Novas ameaças híbridas globais exigem métodos inovadores para desenvolver o pensamento estratégico nos militares, o que torna o estudo de tecnologias de aprendizagem interativas relevante. O objetivo da pesquisa

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é estudar o impacto dos métodos de aprendizagem interativa no pensamento estratégico de futuros militares em instituições de ensino superior (IES). A pesquisa empregou os seguintes métodos: simulações computacionais com tempos de resposta fixos, Foresight Assessment Tool e testes (Team Strategic Thinking Measure, TSTM). Estatísticas descritivas, teste de Mann-Whitney, teste de Wilcoxon, análise de variância (ANOVA) e teste t foram usados como métodos estatísticos. A confiabilidade e a validade foram testadas usando o coeficiente alfa de Cronbach. A amostra do estudo foi composta por 120 pessoas. Os resultados mostraram que o grupo experimental (GE) superou significativamente o grupo controle (GC) em todos os indicadores do TSTM (p≤0,001). O nível de coerência estratégica aumentou em 26% (de 62,3±8,5 para 78,6±7,2 pontos, d=1,23). O número de soluções inovadoras dobrou (de 2 para 4, r = 0,42). O tempo para chegar a um consenso foi reduzido em 33% (de 14,2 ± 3,8 para 9,5 ± 2,6 min, d = 0,89) e a eficácia comunicativa melhorou em 30% (de 6,1 ± 1,3 para 7,9 ± 1,1 pontos, d = 0,93). O maior efeito da aprendizagem interativa foi registrado na coerência estratégica (d = 1,23). Constatou-se que o uso de métodos de aprendizagem interativa contribui para o desenvolvimento do pensamento estratégico dos militares, o que se expressa na maior velocidade da tomada de decisões, na precisão das previsões, no aumento da adaptabilidade e na eficácia da interação em equipe. As perspectivas para pesquisas futuras incluem o estudo dos efeitos a longo prazo dos métodos de aprendizagem interativa, da influência das características individuais dos participantes, bem como o desenvolvimento de programas de treinamento personalizados utilizando novas tecnologias.

Palavras-chave: Educação militar. Ensino superior. Jogos estratégicos.

Resumen: *Las nuevas amenazas híbridas globales requieren métodos innovadores para desarrollar el pensamiento estratégico en los militares, lo que hace relevante el estudio de las tecnologías de aprendizaje interactivo. El objetivo de la investigación es estudiar el impacto de los métodos de aprendizaje interactivo en el pensamiento estratégico del futuro personal militar en instituciones de educación superior (IES). La investigación empleó los siguientes métodos: simulaciones por computadora con tiempos de respuesta fijos, la Herramienta de Evaluación de Prospectiva y pruebas (Medida de Pensamiento Estratégico de Equipo, TSTM). Se utilizaron estadísticas descriptivas, la prueba de Mann-Whitney, la prueba de Wilcoxon, el análisis de varianza (ANOVA) y la prueba t como métodos estadísticos. La confiabilidad y la validez se probaron utilizando el coeficiente alfa de Cronbach. La muestra del estudio consistió en 120 personas. Los resultados mostraron que el grupo experimental (GE) superó significativamente al grupo de control (GC) en todos los indicadores TSTM (p≤0,001). El nivel de coherencia estratégica aumentó un 26% (de 62,3 ± 8,5 a 78,6 ± 7,2 puntos, d = 1,23). El número de soluciones innovadoras se duplicó (de 2 a 4, r = 0,42). El tiempo para alcanzar el consenso se redujo un 33 % (de 14,2 ± 3,8 a 9,5 ± 2,6 min, d = 0,89) y la eficacia comunicativa mejoró un 30 % (de 6,1 ± 1,3 a 7,9 ± 1,1 puntos, d = 0,93). El mayor efecto del aprendizaje interactivo se registró en la coherencia estratégica (d = 1,23). Se observó que el uso de métodos de aprendizaje interactivo contribuye al desarrollo del pensamiento estratégico de los militares, lo que se traduce en una mayor velocidad en la toma de decisiones, precisión en las previsiones, mayor adaptabilidad y eficacia en la interacción en equipo. Las perspectivas de investigación futura incluyen el estudio de los efectos a largo plazo de los métodos de aprendizaje interactivo, la influencia de las características individuales de los participantes, así como el desarrollo de programas de formación personalizados mediante nuevas tecnologías.*

Palabras clave: *Educación militar. Educación superior. Juegos estratégicos.*

1 INTRODUCTION

The relevance of the development of strategic thinking in current military and educational realities is undeniable. The ability to effectively analyse situations and make informed decisions under uncertainty is a key factor in success in various fields of activity. In the context of training military specialists, strategic thinking is a fundamental basis for the development of resource management skills. It enables predicting potential threats and plan long-term actions. Strategic thinking encompasses cognitive processes, including analysis, forecasting, decision-making, and adaptation to dynamic conditions.

The study focuses on assessing the effectiveness of role-playing games and simulations in forming the strategic thinking of future military personnel. It takes into account modern trends in military training, in particular the emphasis on innovative teaching methods (Horiacheva, 2024). The importance of developing strategic thinking is confirmed by the research data. Modern research demonstrates the positive impact of interactive methods on

the effectiveness of military training and work in simulation environments (Dixit et al., 2021; Kania, 2022). However, despite their advantages, there is a need to take into account the cognitive characteristics of military students during the education. The level of their IT training and the effectiveness of the technological tools used are also important (Tytova; Mereniuk, 2022).

Interactive learning methods contribute to the development of flexibility, adaptability, and the ability to respond quickly to new challenges (Chovriy *et al*., 2024a). At the same time, despite the empirically confirmed positive results, the question of their optimal integration into educational programmes remains open. Our study will determine the effectiveness of the conditions for their implementation to achieve maximum educational effect (Chovriy *et al*., 2024b).

The experimental pedagogical conditions of the study were developed taking into account international standards of military education. In particular, the North Atlantic Treaty Organization's (NATO) STANAG 2597 recommendations on the use of interactive simulations for the development of operational thinking were applied (NATO, 2021). The training modules were in line with the principles of the Organization for Economic Co-operation and Development (OECD) "21st Century Skills Framework", with an emphasis on the development of cognitive flexibility and adaptive management (OECD, 2019). The training procedure integrated elements of the UN Peacekeeping Intelligence Handbook programme, in particular on the development of preventive thinking under uncertainty (UN DPO, 2022). The assessment system took into account the EU Military Education and Training Standards (EMETS) competency framework, in particular the indicators of strategic foresight and command coordination (EEAS, 2020).

Despite the growing importance of strategic thinking in military training, the issue of the effectiveness of interactive methods for its development is poorly studied. There is a need to determine optimal approaches to the use of role-playing games and simulations, taking into account the cognitive characteristics of military specialists. Insufficient adaptation of these methods to educational programmes may limit their impact on the development of strategic thinking in the face of real challenges.

The academic novelty of the study is the integration of international NATO and OECD standards into the development of interactive methods for military education. The effectiveness of the adaptive combination of C3Fire, Foresight Assessment Tool (FAT) and TSTM simulations for the development of strategic thinking of officers was proved for the first time. The originality of the approach is confirmed by the development of its own assessment system, which combines EMETS indicators with local educational realities.

The hypothesis of the study is that the use of interactive learning methods significantly increases the level of strategic thinking of the servicemen. The aim is to investigate the impact of interactive learning methods on the strategic thinking of the servicemen, identifying key changes and conditions for their effectiveness. The aim involves the fulfilment of the following research objectives:

a) Determine the impact of interactive learning methods on the development of strategic thinking;
b) Investigate changes in strategic thinking when using interactive technologies;
c) Establish conditions that ensure the effectiveness of interactive learning.

2 LITERATURE REVIEW

Strategic thinking is one of the key elements of professional training of military personnel, which provides the ability to analyse complex situations, make optimal decisions, etc. The features of the modern information environment, the dynamics of changes in military technologies and the need for a prompt response to non-standard threats require new approaches to training. Interactive learning methods based on the active involvement of students are considered an effective tool for the development of strategic thinking in the servicemen.

2.1. CONCEPTUAL FOUNDATIONS OF STRATEGIC THINKING IN THE MILITARY FIELD

According to Loishyn *et al.,* (2024), strategic thinking is considered as a cognitive process that combines the ability to analyse, synthesize and predict based on a systemic approach. According to researchers, this type of thinking in the military sphere is aimed at solving problems related to the protection of state interests and the effective use of military resources. The theoretical foundations of strategic thinking, as Kornberger and Vaara (2022) showed in their study, are based on the principles of systematicity, flexibility, multi-level analysis, and a creative approach. The military context adds features that involve taking into account factors such as asymmetric threats, innovations in weapons and technology, as well as moral and psychological aspects of military personnel. In comparison with the aforementioned studies, the works of Danielsson (2022) and Åse and Wendt (2021) consider the understanding of modern posthumanist concepts as an element of strategic thinking. Our study states that a serviceman's strategic thinking should be based on critical analysis and understanding of military affairs, and not necessarily on knowledge of the legacy of posthumanism.

2.2. INTERACTIVE LEARNING METHODS AS A TOOL FOR DEVELOPING COGNITIVE SKILLS

According to Tuma (2021) and Anthonysamy (2021), interactive learning methods are based on active interaction between the teacher and the students, stimulating their independent work and developing critical thinking. The researchers include case studies, role-playing games, combat simulations, problem-based learning and team tasks to such methods. They can be used to create an environment that promotes the acquisition of new knowledge through practical activities, the development of the ability to make decisions in difficult conditions and team interaction. According to our findings, interactive technologies are indispensable for practicing operational and strategic scenarios in the context of military education. This makes it possible to train future military personnel in an environment as close as possible to real combat conditions. Many current simulation platforms, in particular C3Fire, are focused on tactical solutions, ignoring long-term strategic planning, which limits their use for the development of complex thinking. Interactive methods often do not take into account the individual cognitive characteristics of cadets, leading to uneven assimilation of the material.

2.3. EMPIRICAL EVIDENCE OF THE EFFECTIVENESS OF INTERACTIVE TECHNOLOGIES IN MILITARY EDUCATION

The results of recent studies indicate a significant impact of interactive methods on the development of strategic thinking in the servicemen (Hruzevskyi, 2023; Ivanjko *et al*., 2024). In particular, it was proved that the use of combat simulations increases the ability to multi-level analysis, reduces the level of stress during decision-making, and improves communication skills. However, there is still a need to expand the empirical base to determine the specifics of the impact of various interactive technologies on individual aspects of strategic thinking (Zhong; Zhan, 2025; Onu *et al*., 2024). The conclusions of the considered studies suggest improving the methodological base of studying interactive technologies in military education, which is of great value for our study. Besides, high requirements for technical equipment make these methods inaccessible to some military institutions, which limits the scale of their implementation.

2.4. UNDERSTUDIED ISSUES

Despite the considerable attention paid to interactive methods in military education, there are still some poorly studied aspects of their application. In particular, the issue of adapting methods to the cultural and psychological characteristics of different military contingents requires further analysis. It is also important to develop tools for assessing the effectiveness of interactive learning in real combat settings and study the long-term impact of such meth-

ods on the development of strategic thinking. Another important direction is the integration of the latest technologies, in particular artificial intelligence (AI) and virtual reality (VR), into the interactive learning process.

3 METHODS

3.1 DESIGN

The study is of empirical and theoretical, as it combines the analysis of academic sources with a practical assessment of the effectiveness of interactive methods in the development of strategic thinking. It also belongs to interdisciplinary research, as it combines elements of military pedagogy, cognitive psychology and educational technologies. The stages of the study and their content are presented in Figure 1.

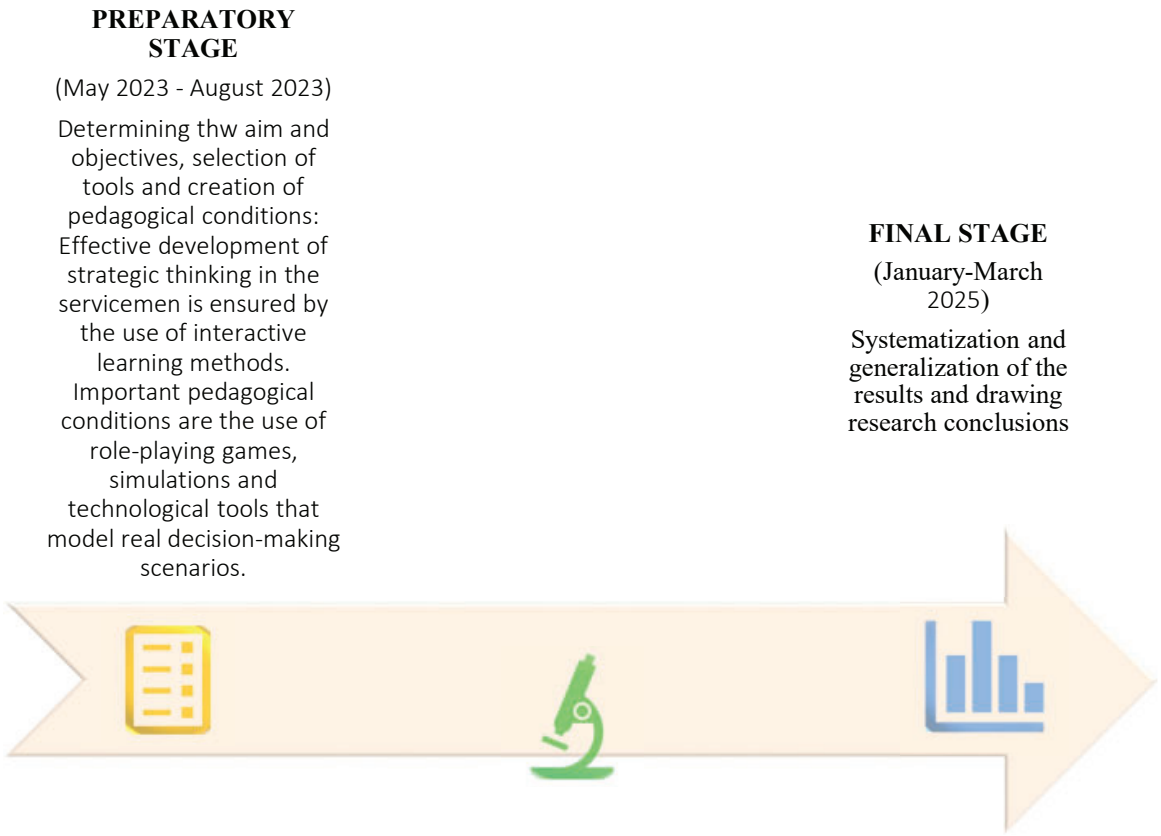


Figure 1 - Research stages

Source: Developed by the authors based on the results of the study (2025).

3.2 PARTICIPANTS

The study was conducted on a sample of 120 people. The sample was formed among 3rd-4th-year students of the Department of Higher Mathematics, Mathematical Modelling and Physics of the Educational and Scientific Institute of Information Technologies of the State University of Information and Communication Technologies (SUICT). The sample included students studying in a major related to mathematical modelling and having a basic level of knowledge of information and communication technologies. They had no previous experience of interactive learning using the methods under study. The sample was formed by the method of purposeful selection among students of the department. The participants were selected based on compliance with the inclusion criteria. Such a sample is explained by the fact that at this stage of study, students have basic knowledge of mathematical modelling, and a sufficient level of cognitive maturity for effective learning of interactive methods. The formed sample was divided into the CG and EG of 60 participants each. The groups were formed by drawing lots to ensure their homogeneity and uniformity. The study involved 10 instructors from among the university teachers.

The experimental pedagogical conditions of the study were based on the systematic integration of interactive methods into the training of officers. The study was conducted in specially equipped computer classrooms adapted for group work, where each participant had access to the C3Fire and FAT simulation platforms. The trainings were held as cyclical sessions (3 hours per week for 3 months), where theoretical modules alternated with practical simulations of real operational scenarios. The instructors used an adaptive approach, gradually increasing the level of complexity of the tasks from individual to complex team cases. An important aspect of the study was the creation of a safe learning environment where participants could freely experiment with alternative strategies without the risk of negative consequences.

The ethical aspects of the study involved fully informing the participants and the institution's administration about its purpose, risks and benefits, with the written consent of each respondent. The sample size of 120 future officers meets the minimum requirements for pilot studies, although larger studies are needed to generalize the findings. The sample size allowed for the detection of statistically significant differences, which confirms the reliability of the results.

3.3. DATA COLLECTION

The level of strategic thinking was determined by using independent, dependent and moderating variables. The duration of the training cycle and the type of interactive learning (simulations and role-playing games, brainstorming, and Conflict-Based Learning) were independent variables. The level of complexity of training scenarios was chosen as a moderating variable. The dependent variables were: speed of decision-making; flexibility of strategic planning; accuracy of forecasting consequences; indicators of adaptability to non-standard situations; effectiveness of collective strategic interaction. The following methods were used to study the dependent variables:

Computer simulations with fixed response time (C3Fire). The method is used to simulate dynamic situations that require strategic thinking. Participants work in a team to manage resources, develop strategies, and respond to changing conditions. Measuring response time to key events enables us to assess the speed of decision-making and adaptability of participants (Baber *et al.*, 2024). Cronbach's alpha coefficient $\alpha = 0.71$.

Foresight Assessment Tool (FAT) is used to assess the servicemen's ability to predict developments and make strategic decisions under uncertainty. The tool is applied for modelling future scenarios, analysing possible course of action and their consequences (Follesa, 2022). Cronbach's Alpha coefficient $\alpha = 0.77$.

Team Strategic Thinking Measure (TSTM). The method assessed strategic thinking in group interaction. The tool measures the

team's ability to collectively analyse, predict, and plan actions in complex situations (Srivastava; D'Souza, 2021). Cronbach's Alpha coefficient $\alpha = 0.73$.

The selected methods provide a comprehensive approach to assessing strategic thinking, including individual cognitive skills, the ability to predict future events, and the effectiveness of team interaction. Their use makes it possible to objectively measure the results of interactive learning in realistic and simulated conditions. The level of complexity of the developed training scenarios was also assessed.

3.4. ANALYSIS OF DATA

The methods of descriptive statistics were used at the stage of primary data analysis, in particular, calculating the mean, median, and standard deviation. They allowed obtaining generalized characteristics of the distribution of indicators in groups. So, general trends in response time and scale scores were identified.

The Mann-Whitney test was used to compare two independent groups on indicators that do not correspond to a normal distribution. The impact of interactive learning on the results of forecasting using FAT within one group was assessed using the Wilcoxon test. The mean values between groups on the results of FAT were compared using the t-test for independent samples, which is effective under normal distribution. The impact of interactive methods on strategic thinking in teamwork was assessed by using analysis of variance (ANOVA). The methods were chosen because of their ability to effectively compare groups on different types of data, in particular for normal and abnormal distributions. They allow for an accurate assessment of the impact of interactive methods on the development of strategic thinking in the experimental conditions.

The reliability of the instruments was checked by using the Cronbach's Alpha coefficient in order to assess the internal consistency of the scales. A Cronbach's Alpha value above 0.7 indicates good reliability of the instruments. The validity of the instruments was tested using the internal consistency criterion in order to assess how interconnected the scale elements are.

3.5. INSTRUMENTS

The C3Fire programme was used to simulate data for the purpose of modelling dynamic situations and measuring the response time of participants. The FAT was used to collect and analyse the results for assessing the ability to forecast. The data were processed out using SPSS statistical packages. The Matplotlib and Seaborn Python libraries were used to visualize the results.

4 RESULTS

The results presented in Table 1 reflect the study of the effectiveness of interactive C3Fire simulations for developing strategic thinking in future military personnel. Key indicators of the CG and EG after the training cycle are compared. Statistical criteria assess the significance of differences between the groups for all parameters of the study.

Table 1 — Comparative results of strategic thinking assessment using the C3Fire method

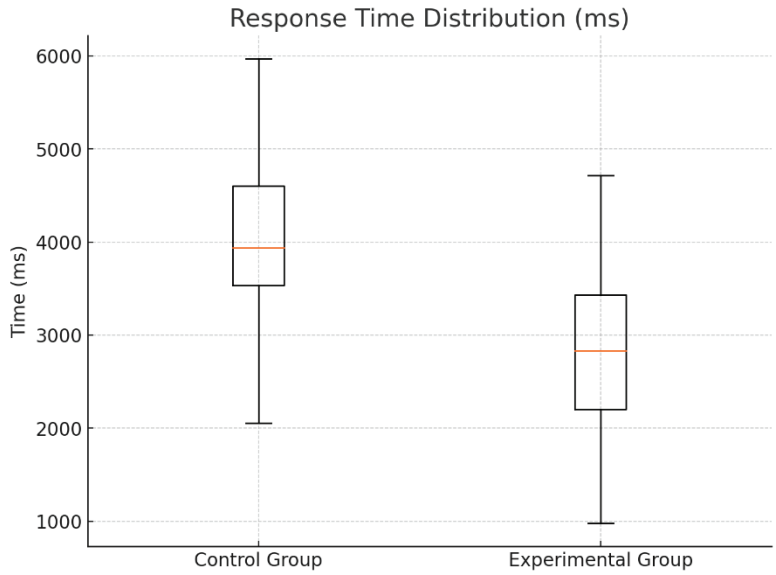
Indicator	CG (n=60)	EG (n=60)	Statistical test	Value	p-value
Response time (ms), M±SD	4200 ± 1120	2900 ± 980	Mann-Whitney U-test	U = 210	$p < 0.01$
Decision accuracy, Me (IQR)	6.2 (5.3–7.1)	7.9 (7.2–8.5)	Mann-Whitney U-test	U = 185	$p = 0.003$

Adaptability, M±SD	3.1 ± 0.9	4.7 ± 1.2	Student's t-test for independent samples	t(58) = 5.6	p < 0.001
Team interaction efficiency (ANOVA)	-	-	F(1.58)	F = 12.4	p < 0.001

Source: Created by the authors of the research (2025).

The EG demonstrates statistically significant improvements in all indicators compared to the CG. Response time decreased by 1300 ms ($p < 0.01$), decision accuracy increased by 1.7 points (median, $p = 0.003$), and adaptability improved by 1.6 points ($p < 0.001$). ANOVA confirms the effect of interactive learning on the team ($F = 12.4$, $p < 0.001$, $\eta^2 = 0.18$). Figure 2 shows the distribution of reaction times (in milliseconds) for the CG and EG.

Figure 2- Response time distribution in the CG and the EG



Source: created by the authors of the research (2025).

The graph shows the distribution of response times for the CG and EG, demonstrating differences in central tendency and variability. The EG is characterized by a lower median response time and less variability compared to the CG. This indicates faster and more stable performance. The differences are determined by the effectiveness of the technique applied to the EG, which could have contributed to improving their adaptive skills or speed of information processing. The next step was to study the strategic forecasting of the respondents (Table 2).

Table 2 — Assessment of strategic planning of the CG and EG participants

Parameter	CG (n=60)	CG (n=60)	Result	p-value
Forecasting accuracy (score 1-10), M±SD	5.8 ± 1.2	7.4 ± 1.1	t(58) = 5.2	p < 0.001
Number of alternative scenarios, Me (IQR)	3 (2–4)	5 (4–6)	U = 190	p = 0.002
Consequence analysis time (s), M±SD	45 ± 12	32 ± 9	t(58) = 4.8	p < 0.001

Notes: Significance level α = 0.05

Source: Created by the authors of the research (2025).

The EG showed higher forecasting accuracy (Δ+1.6 points), greater variability in scenario generation (Δ+2 options), and faster analysis of consequences (Δ-13 seconds). All differences are statistically significant (p < 0.01). Next, strategic thinking in group interaction was studied. For this purpose, a study was conducted using the TSTM method, which is presented in Table 3.

Table 3 — Study of strategic thinking in group interaction in the CG and the EG participants

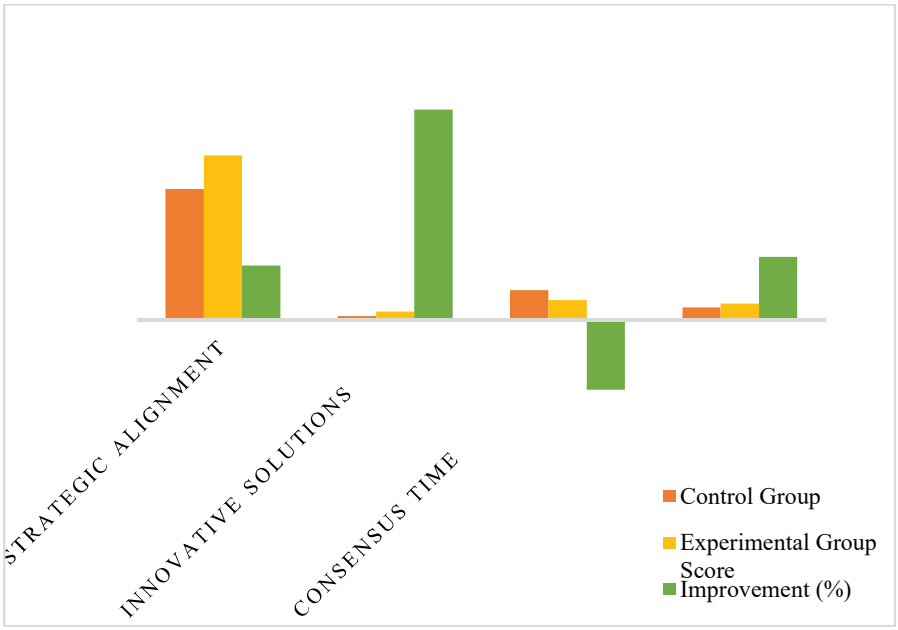
Parameter	CG (n=60)	EG (n=60)	Result	p-value	Effect size
Strategic Coherence Index (0-100 points), M±SD	62.3±8.5	78.6±7.2	t(58)=7.82	p<0.001	d=1.23
Number of innovative solutions, Me (IQR)	2 (1-3)	4 (3-5)	U=165	p=0.001	r=0.42
Time to reach consensus (min), M±SD	14.2±3.8	9.5±2.6	t(58)=5.67	p<0.001	d=0.89
Evaluation of communicative effectiveness (1-10 points), M±SD	6.1±1.3	7.9±1.1	t(58)=5.94	p<0.001	d=0.93

Source: Created by the authors of the research (2025).

The EG showed a significant improvement in team strategic thinking compared to the CG. The level of strategic coherence increased by 26%, which indicates more effective coordination of actions. The number of innovative solutions doubled, which demonstrates the development of a creative approach to solving problems.

The EG teams reached consensus 33% faster, which indicates an improved ability to make operational collective decisions. The quality of communication improved by 30%, which confirms the effectiveness of interactive methods in developing interaction. All differences are statistically significant (p < 0.01), which confirms the effectiveness of the applied approach. Figure 3 presents a visualization diagram of the comparison of team strategic thinking.

Figure 3- Comparison of team strategic thinking according to TSTM



Source: created by the authors of the research (2025).

The results demonstrate a significant improvement in strategic thinking in the EG compared to the CG, as confirmed by statistically significant differences ($p<0.001$). The largest increase is observed in the Innovative Solutions category (+100%), which may indicate an increase in creative approach to decision-making after the training. The reduced time to reach consensus by 33% indicates improved team interaction, which is important for strategic planning under uncertainty.

5 DISCUSSION

The obtained results of the study confirm the effectiveness of interactive learning methods for developing strategic thinking in the servicemen. They fully confirm the hypothesis of a positive impact of interactive methods on strategic thinking. Statistically significant improvements in all indicators ($p<0.01$) are consistent with the predicted effects. In particular, the findings of Antrobus and West (2022) emphasize the positive impact of such methods on team interaction, in particular on increasing the number of innovative solutions. At the same time, the researchers draw attention to possible limitations associated with slowing down the development of individual analytical skills if excessively focused on group processes. The increased adaptability of participants during training is consistent with the findings of Lazarus *et al.*, (2024), which indicates the development of flexibility of thinking under uncertainty. The variation in results may be determined by different levels of training of the study participants. So, the obtained data emphasize the importance of applying a differentiated approach to interactive learning, taking into account the individual peculiarities of the participants.

The obtained results partially correlate with the results of the study by Bekesiene and Varžinskas (2024), which demonstrated the effectiveness of military simulators. However, they significantly differ from the data of Vahdatikhaki *et al.* (2024), which indicate the limited effectiveness of simulators for beginners. The nonlinear learning dynamics, in particular, the detected acceleration of progress after 4-5 sessions, is consistent with the findings of Al-Mutairi (2021). At the same time, the observed "plateau" after 8 sessions recorded by Geier (2024) emphasizes the need for additional research on the optimal duration and intensity of training to ensure sustainable progress.

It was confirmed that the qualifications of instructors, technical support and individualization of training are the key factors of effectiveness, which is consistent with the results of Eskandary et al. (2023). However, the results of Wagner et al. (2021) demonstrate that qualitative methodology can compensate for technical limitations, expanding the possibilities of applying interactive methods in a variety of settings. The findings open up new perspectives for further research to optimize curricula taking into account available resources.

Comparative analysis with other studies shows that the effectiveness of interactive methods depends on the context of their application. The obtained results confirm the conclusions of Tröhler (2023) about the high effectiveness of such methods in military training. At the same time, the study of Joyce (2022) shows their lower effectiveness in civilian training programmes. The identified discrepancies only emphasize the need to take into account the specifics of the educational environment when implementing innovative methods.

The theoretical implications of the study are to deepen the understanding of the process of developing strategic thinking in the servicemen through interactive learning methods. The results clarify theoretical models of adaptive thinking, identify the importance of team interaction for improving innovative solutions and forecasting under uncertainty. The study supports existing theories regarding the cumulative effect of interactive learning and the relationship between the level of training of participants and training results. The practical implications of the study are to introduce interactive learning methods (C3Fire, FAT, TSTM) into standard military training programmes for officers. The results prove the need to integrate at least 4-5 training sessions to achieve noticeable progress in strategic thinking. Optimization of training programmes should take into account individual levels of training, as the effectiveness of the methods varies significantly for beginners and experienced specialists. The findings give grounds to determine the optimal conditions for introducing such methods into military practice, in particular to reduce possible limitations in the case of a low level of initial training of participants.

6 LIMITATIONS

When interpreting the results of the study, a number of limitations must be taken into account. First, the limited sample size may affect the generalizability of the results. The study included only 120 mid-level officers, without taking into account age, gender, and cultural characteristics, which limits the extrapolation of the findings to other categories of servicemen. Second, the methodological framework of the study covered only a three-month observation period and a limited set of interactive methods (C3Fire, FAT, TSTM). This does not allow for a full assessment of the long-term impact and effectiveness of alternative approaches. A third significant limitation is the potential impact of exogenous factors. Parallel training programmes, variability in the technical equipment level, and subjectivity of expert assessments could introduce systematic errors into the interpretation of the results. Finally, the theoretical framework of the study narrowed the operationalization of strategic thinking, not taking into account all its possible dimensions and the cultural and linguistic features of the use of assessment tools.

7 RECOMMENDATIONS

For the effective integration of interactive learning methods into military training, it is recommended to:

A) Apply methods that combine computer simulations and group interactive trainings to develop strategic thinking.
B) Develop personalized training programmes that take into account the level of training of participants and their individual peculiarities in order to optimize the effectiveness of training.
C) Ensure constant updating of the technical base and training materials, in particular simulators and interactive tools, to adapt to changes in training goals and needs.

D) Conduct regular assessment of training results in order to determine the most effective strategies and methods in military training.
E) Train instructors in the use of interactive technologies, focusing on methodologies that promote the development of critical thinking and collective interaction.

8 CONCLUSIONS

The obtained results are relevant for the training of servicemen and managers, as they confirm the effectiveness of interactive learning in the development of strategic thinking and team interaction under uncertainty. The results of the study confirm a significant improvement in strategic thinking in the EG. In particular, the strategic coherence of the participants of this group was 26% higher (78.6±7.2 points) compared to the CG (62.3±8.5), which indicates a significant effect ($d=1.23$, $p<0.001$). The number of non-standard approaches to solving problems doubled (4 versus 2), which indicates the development of innovative thinking ($r=0.42$, $p=0.001$). The time to reach consensus was reduced by 33%, which indicates more effective team interaction ($d=0.89$, $p<0.001$). Communicative efficiency improved by 30% (7.9±1.1 vs. 6.1±1.3 points), which also has a strong effect ($d=0.93$, $p<0.001$). In general, it can be stated that interactive learning significantly improved all aspects of command strategic thinking ($p\leq0.001$), and the most pronounced changes occurred in the area of strategic coherence. The results can be used to improve military training methods, taking into account their individual characteristics, as well as to develop recommendations for instructor qualifications and technical support. The prospects for further research include studying the long-term effects of interactive learning methods on the development of strategic thinking in various conditions, in particular under stress and high uncertainty. Studying the influence of individual characteristics of participants, such as the level of motivation and previous experience, on the effectiveness of the use of interactive methods is also promising. The development of new methods for personalizing training programmes taking into account the heterogeneity of the level of training of participants is a promising direction of research. It is also important to integrate innovative technologies, such as virtual and augmented reality, to optimize learning outcomes.

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