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Enhancing Collective Military Training: Integrating the Laser Battlefield System for the Lithuanian Land Forces

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Abstract

This study examines the use of simulation systems in military training of the Lithuanian Armed Forces. It identifies significant gaps between the capabilities of current simulation systems and the needs of effective combat training, and highlights the need for improvements to help soldiers analyse complex situations and adapt to modern battlefield dynamics. The study confirms the need for further research to investigate how Multiple Integrated Laser Engagement System (MILES) can be more effectively integrated into Lithuanian military training programmes and how they can be tailored to specific national needs, including the possible adaptation of the MILES to the Lithuanian Land Forces.

KEY WORDS: *collective military training, soldiers' competencies, laser battlefield system, realistic combat scenarios*

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5. Introduction

Military training through simulation systems has become increasingly pertinent within the contemporary security landscape. The dynamic nature of global political shifts and the emergence of non-conventional threats present significant challenges to national defense strategies [1,2]. These developments underscore the necessity for rapid adaptation to evolving operational environments and the ability to address increasingly complex threat vectors. Continuous learning and the enhancement of skill sets are therefore paramount for military personnel to maintain operational effectiveness [3-7].

Simulation-based training systems offer a sophisticated means of preparing soldiers by replicating a wide array of scenarios that accurately reflect real-world threats and conflict situations [3,8,9]. These systems are particularly critical in the current geopolitical context, where conventional warfare tactics may no longer suffice. The ongoing reconfiguration of the global security architecture—driven by rising interstate tensions, the formation of new alliances, and the proliferation of asymmetric threats such as terrorism, cyber warfare, and hybrid operations—demands that military forces possess the agility to adapt swiftly and operate under novel and unpredictable conditions [10]

In this context, the role of simulation systems in military training is integral to national security imperatives[11,12]. These technologies enable the continuous refinement of soldiers' competencies, ensuring they are equipped to manage a diverse spectrum of conflict scenarios. Additionally, such training enhances cognitive skills, fostering critical thinking, sound decision-making under duress, and cohesive teamwork—attributes that are essential in high-stakes environments.

Moreover, advanced training methodologies facilitated by simulation systems are vital for ensuring that military personnel are adequately prepared to confront emergent challenges [13,14]. Modern combat operations necessitate not only physical endurance but also a high degree of intellectual and technological acumen [15]. Therefore, it is imperative that military training is sustained throughout the duration of a soldier's service, to preserve a state of high readiness and to ensure the military's capacity to effectively counter future threats [16].

The research work that was made in the Lithuania contributed to the exploration of simulation systems in military training through published research results on the Lithuanian Armed Forces. The published scientific article titled "Simulators Usage Assessment for Higher Military Readiness" [13], critically examined the alignment between the needs of combat training and the current capabilities of simulation systems within the Lithuanian military. The researchers identified significant gaps in how these systems meet the expectations for enhancing combat readiness, particularly in enabling soldiers to accurately analyze complex situations and adapt to modern battlefield dynamics [17- 19].

These studies also underscore the potential for improving the utilization of existing simulators to better serve the training objectives of the armed forces.

On an international scale, the topic of military simulation systems has been the focus of extensive research. Notably, Bruzzone and Massei [8], in their seminal work "Simulation-Based Military Training," provided a comprehensive analysis of the evolution from ancient to contemporary simulation systems in military contexts. They emphasized the critical role of these systems in enhancing military preparedness by facilitating the creation of realistic training scenarios that foster the development of essential knowledge and skills. Complementing this perspective, Sadagic and Yates [20], in their article "Large Scale Adoption of Training Simulations: Are We There Yet?" addressed the challenges and opportunities associated with the widespread implementation of simulation technologies in the military sector. Conducted studies demonstrated that simulation systems represent a pivotal component of contemporary military training and defense strategy. These systems not only enhance the efficacy of training protocols but also equip soldiers with the necessary skills to adapt and respond to the rapidly evolving global security environment. Moreover, there was highlighted that the primary barriers to effective adoption are not technological deficiencies but rather organizational and structural challenges, such as insufficient awareness of the capabilities of these technologies and inadequate support from upper management.

Despite the substantial body of research on the application of simulation systems in military training, there remain critical areas that warrant further investigation. Specifically, more research is needed to assess the impact of particular simulation systems on the development of military skills and competencies. In the Lithuanian context, additional studies are essential to explore how these technologies can be more effectively integrated into military training programs and how they can contribute to the overall enhancement of training quality. This research is vital for ensuring that simulation systems not only meet current training needs but also evolve to address emerging challenges in modern warfare. So, this study not only evaluates the strengths and limitations of simulation systems but also explores the potential for their more effective integration into the training programs of the Lithuanian Land Forces to enhance military training outcomes. Additionally, the research specifically examines the adaptation of the Multiple Integrated Laser Engagement System (MILES) to meet the unique needs and challenges faced by the Lithuanian Land Forces. This focus is critical, as while simulation systems are widely employed across global military forces, each nation's military operates under specific conditions and requirements. To ensure optimal effectiveness in military training, these unique national and organizational contexts must be carefully considered and addressed.

6. Method of Investigation

The research methodology employed in this study was designed to provide a comprehensive understanding of the use of the Multiple Integrated Laser Engagement System (MILES) in the Lithuanian Armed Forces through a dual approach involving both qualitative and quantitative analyses (see Fig. 1). The qualitative component of the study involved conducting structured interviews with MILES experts to identify the system's strengths and weaknesses. This approach allowed for an in-depth exploration of expert perspectives, revealing insights into how MILES performs in various aspects of military training, including its effectiveness, limitations, and potential areas for improvement.

Fig. 1. The Multiple Integrated Laser Engagement System (MILES), a training system used by military forces to simulate the realities of combat in a safe and controlled environment.

For the quantitative analysis, data was gathered through a structured questionnaire administered to users of the MILES system. This survey aimed to capture user experiences and opinions on the system’s application in collective military training. It focused on assessing the perceived impact of MILES on training effectiveness and identifying any challenges encountered during its use in exercises.

The integration of qualitative and quantitative methods provided a robust framework for understanding the specific challenges and opportunities associated with MILES within the context of the Lithuanian Armed Forces. The qualitative interviews offered nuanced insights into the expert assessments of the system, while the quantitative data provided a broader perspective on user experiences, ensuring a comprehensive evaluation of MILES in both theoretical and practical terms. This methodological approach facilitated a detailed analysis of MILES's application, contributing to the development of strategies for optimizing its integration into collective training exercises.

6.1. Study Participants and Data Collection Method

The research was conducted through an analysis of responses from Lithuanian Armed Forces (LAF) platoon commanders, deputy platoon commanders, and company commanders, collected via a structured questionnaire survey. This survey was disseminated across various LAF units that utilized the MILES system during 2023, with data collection taking place in December 2023 and January 2024.

The quantitative data collection phase was initiated through collaboration with the Training and Doctrine Board's Collective Training Unit, which provided access to detailed records regarding the deployment of the MILES system throughout 2023. These records offered critical insights into the allocation and operational use of MILES across different Land Forces units, allowing the identification of specific periods and units engaged in military training using this system. Based on this documentation, a targeted selection of Land Forces units was made to ensure that the sample was representative of the broader population. The selected units were then contacted to participate in the study by completing the questionnaires. During this process, each respondent received a thorough briefing on the study's objectives, methodology, and ethical principles, with particular emphasis on the importance of maintaining anonymity and confidentiality. This detailed briefing ensured that all participants were fully informed about the study's purpose and their rights, thus fostering an environment of informed consent and ethical integrity. The rigorous approach to participant engagement not only reinforced the ethical standards of the research but also enhanced the reliability of the collected data by ensuring that respondents were well-informed and comfortable with their participation.

In the qualitative research phase, the Training and Doctrine Board's Collective Training Unit played a crucial role in identifying key specialists with expertise in the MILES system. This collaboration provided direct access to professionals deeply involved in the operation and implementation of MILES. These experts were individually approached to schedule interviews at times convenient for them, ensuring minimal disruption to their professional responsibilities. Before each interview, participants were thoroughly briefed on the study's objectives, research methodology, and ethical considerations. Special attention was given to ensuring the anonymity of the participants, which is fundamental to maintaining the integrity of the research process. The briefing was designed to ensure that all experts were fully aware of the study's nature and scope, thereby enabling them to provide informed consent. This meticulous approach to ethical briefing not only adhered to the highest standards of research ethics but also created a transparent and trusting environment, which is essential for obtaining rich, reliable qualitative data. By ensuring that participants were well-prepared and comfortable, the research process was able to enhance the depth and reliability of the qualitative data collected. The careful consideration of ethical principles and thorough participant briefings are critical in qualitative research, as they directly impact the validity and credibility of the study's findings.

6.2. Research Methodology

Conducting military field training is an essential component of soldier preparation, as it enables the acquisition and maintenance of the combat readiness required for operational effectiveness and the continuous development of critical military skills. However, collective military training presents numerous challenges that can impact its overall effectiveness. This research problem was centred on enhancing the efficiency of collective training within the Lithuanian Land Forces and optimizing the integration of the Multiple Integrated Laser Engagement System (MILES) [21,22]. So, these investigations involved a comprehensive examination of both the theoretical and practical dimensions of simulation systems in military training, with a specific focus on the collective training context of the Lithuanian Armed Forces. The primary objective of this research was to evaluate the efficacy and identify potential issues associated with collective military training when utilizing the MILES, based on feedback gathered from user surveys.

The quantitative component of the research was designed to systematically assess three core aspects, each representing a critical dimension of collective military training. These aspects were organized into the following three analytical blocks:

1. Impact of MILES on the Effectiveness of Military Training [23-25]. This block included nine statements and was focused on determining how the integration of MILES influences the overall effectiveness of military training exercises, with particular attention to its role in enhancing combat readiness and skill development. To measure these nine statements Likert's five-point scale was used, the 1 indicated 'being strongly disagree' and 5 indicated 'being strongly agree'. The internal consistency of this block was evaluated by Cronbach's alpha coefficient which was 0.882.
2. MILES as a Tool for Realistic Simulation and Teamwork Development: This aspect was evaluated by ten statements the extent to which MILES contributes to creating a realistic training environment that fosters the development of teamwork skills among soldiers. The system's ability to simulate real combat scenarios was assessed in terms of its effectiveness in preparing soldiers for collaborative tasks during actual

operations. To measure these ten statements Likert's five-point scale was used, the 1 indicated 'being strongly disagree' and 5 indicated 'being strongly agree'. The internal consistency of this block was evaluated by Cronbach's alpha coefficient which was 0.900.

3. Risk Reduction During Field Exercises with MILES: The final block included two statements examined the role of MILES in mitigating risks during field exercises. This involved analysing whether the use of MILES enhances safety protocols and reduces the likelihood of training-related incidents, thereby contributing to a safer training environment. These two statements were measured by Likert's five-point scale, the 1 indicated 'being strongly disagree' and 5 indicated 'being strongly agree'. The internal consistency of this block was evaluated by Cronbach's alpha coefficient which was 0.809.

Through these analytical blocks, the research aimed to provide a comprehensive quantitative research evaluation of MILES as a training tool, identifying both its strengths and areas for improvement within the context of collective military training.

The qualitative component of this study was conducted through a rigorously structured interview process, wherein experts evaluated specific criteria derived from the theoretical framework concerning the application of MILES in the development of soldiers' skills. The evaluation of MILES within the study centered on two critical dimensions: the development of readiness for real military action and the enhancement of teamwork skills. These dimensions are essential for assessing the effectiveness of MILES as a training tool within the military context, and each was broken down into specific criteria to provide a comprehensive analysis.

I. Developing Readiness for Real Military Action

This aspect of the evaluation focused on how effectively MILES prepares soldiers for the realities of combat, addressing the following criteria:

- *KV1: MILES Provides a Realistic Training Environment*. The realism of training environments is crucial for effective military preparation. MILES was evaluated on its ability to simulate real-world combat conditions, including the replication of battlefield dynamics such as enemy engagement, terrain challenges, and the consequences of tactical decisions. By creating a realistic environment, MILES helps soldiers acclimate to the stress and unpredictability of actual combat, which is essential for maintaining composure and making sound decisions under pressure.

- *KV2: MILES Offers an Immersive Training Experience.* Beyond realism, immersion is key to engaging soldiers fully in the training process. MILES was assessed on its ability to create an immersive experience that captures the attention and focus of participants. This involves sensory engagement, such as the use of realistic sounds, visual stimuli, and immediate feedback, all of which contribute to a training experience that closely mirrors real combat. Immersion in training scenarios helps soldiers develop the mental and emotional resilience needed for real-world operations.

- *KV3: MILES Delivers Actionable Feedback*. Feedback is a vital component of effective training, as it allows soldiers to learn from their actions and improve performance. MILES was evaluated on its capacity to provide immediate, clear, and actionable feedback on soldiers' performance during exercises. This includes information on hits, misses, and tactical errors, which soldiers can use to refine their skills. The system's feedback mechanisms are designed to be informative without disrupting the flow of training, thereby supporting continuous learning and improvement.

- *KV4: MILES Enhances Readiness for Real-World Scenarios*. The ultimate goal of military training is to prepare soldiers for real-world missions. MILES was assessed on how well it translates training experiences into enhanced readiness for actual combat situations. This includes evaluating whether soldiers trained with MILES demonstrate improved tactical awareness, decision-making skills, and overall preparedness for the challenges of real operations. The system's effectiveness in bridging the gap between training and actual deployment is critical for ensuring that soldiers are ready to perform under the pressures of real combat.

- KV5: MILES Reduces the Inherent Risks Associated with Real Field Trainings. Safety is a paramount concern during military training. MILES was evaluated on its ability to reduce the risks inherent in live field exercises, such as accidental injuries or fatalities, by providing a safe yet realistic alternative. The system allows soldiers to engage in combat simulations that mimic real scenarios without the physical dangers of live ammunition. This capability not only preserves safety but also enables more frequent and varied training opportunities, thereby enhancing overall readiness without compromising soldier welfare.

II. Development of Teamwork Skills

The second key dimension focused on how MILES contributes to the development of essential teamwork skills among soldiers. Effective teamwork is critical for military success, and MILES was evaluated on the following criteria:

- *PM1: MILES Facilitates the Development of Tactical Thinking*. Tactical thinking involves the ability to assess situations, anticipate enemy actions, and make strategic decisions. MILES was assessed on its effectiveness in developing these cognitive skills within a team context. By simulating complex combat scenarios, MILES challenges soldiers to think critically and work collaboratively to achieve mission objectives. The system's design encourages soldiers to consider the broader tactical picture and to coordinate their actions with teammates, fostering a deeper

understanding of battlefield strategy.

- *PM2: MILES Enables Learning Through the Analysis of Mistakes*. The ability to learn from mistakes is crucial for continuous improvement in military operations. MILES was evaluated on how well it supports this learning process by providing opportunities for soldiers to review and analyze their performance after each exercise. The system's feedback allows soldiers to identify errors, understand their consequences, and adjust their tactics accordingly. This iterative learning process helps soldiers refine their skills and avoid repeating mistakes in future operations.
- *PM3: MILES Enhances Teamwork Capabilities*. Effective teamwork requires not only individual competence but also the ability to operate cohesively as a unit. MILES was evaluated on its role in enhancing these teamwork capabilities by promoting communication, coordination, and mutual support among soldiers. The system's simulations are designed to require collaborative problem-solving and joint decision-making, which are essential for successful team operations in real combat. MILES encourages soldiers to rely on each other's strengths and to work together towards a common goal.
- *PM4: MILES Equipment is Durable*. The durability of training equipment is crucial for maintaining the continuity and effectiveness of military exercises. MILES was evaluated on the robustness of its components, including their ability to withstand the rigors of repeated use in various environmental conditions. Durable equipment ensures that training can proceed without interruptions due to equipment failure, thereby maximizing the efficiency of the training process.
- *PM5: MILES Equipment is User-Friendly*. User-friendliness is an important consideration for any training system. MILES was assessed on the ease with which soldiers can learn to operate the equipment, including the time required to master its functions and the intuitiveness of its design. A user-friendly system allows soldiers to focus on the training objectives rather than on technical difficulties, thus enhancing the overall effectiveness of the training. MILES's design aims to be accessible to soldiers with varying levels of technical expertise, ensuring that all participants can engage fully in the training process.

The evaluation of MILES across these two dimensions—readiness for real military action and the development of teamwork skills—provides a comprehensive understanding of its effectiveness as a military training tool. By analyzing specific criteria within each dimension, the study highlights both the strengths of MILES in preparing soldiers for real-world combat and the areas where it can be further optimized to enhance training outcomes.

6.3. Study Data Processing

To address the research problem comprehensively and ensure the robustness of the findings, the study employed triangulation. Triangulation involved using multiple methods to validate the results, ensuring that the application of one method corroborated the findings of another. This approach helped harmonize qualitative and quantitative elements of the study, providing a more nuanced and reliable understanding of the research questions.

Expert Opinion Assessment Using Kendall's W. In this study, data were collected from experts through a highly structured survey. Each of the five experts participating in the study was asked to rank and rate a set of criteria in order of importance. This data was then compiled and used for further analysis. First, the level of agreement among the experts was assessed. For this purpose, the Kendall's W coefficient was applied. The statistical software package IBM SPSS 29v was used for the analysis, which offers a reliable means of calculating Kendall's W, allowing researchers to quantify the degree of agreement between experts. The software also provides a significance test to determine whether the observed agreement is statistically significant or whether it may have occurred by chance. The agreement between the experts' opinions was assessed by Kendall's W, which directly affected the reliability of the findings of this study. Thus, using Kendall's W, the level of agreement between the experts' opinions was assessed with statistical precision and the most important criteria were identified.

Quantitative data processing. Following the descriptive data analysis, a sequence of statistical tests were conducted to validate and further explore the data. The first step was reliability testing, a crucial component in the validation of any survey or questionnaire-based research. This testing was performed to assess the consistency and stability of the measurement instrument, ensuring that it reliably measures the intended constructs. Cronbach's alpha, one of the most commonly used methods for assessing internal consistency, was employed for this purpose. This coefficient was calculated for each of the three sets of blocks used in the study, ensuring the reliability of the data collected.

Subsequently, the Kruskal-Wallis H test was applied to identify statistically significant differences based on the frequency of training completion. Additionally, Exploratory Factor Analysis (EFA) was employed to identify latent factors within the data. Finally, a linear regression analysis was conducted to identify the key factors influencing competency development with MILES. All statistical analyses were performed using SPSS Statistics software version 29.0. This comprehensive approach ensured a robust evaluation of the data, providing reliable insights into the factors affecting strategies for enhancing training efficiency with MILES technology.

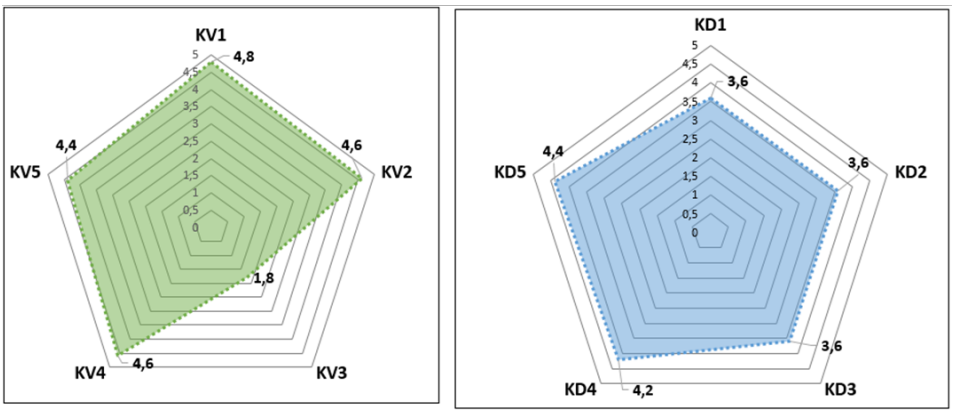
7. Results of the Conducted Research

7.1. Evaluation of MILES effectiveness by Experts

Following analysis design five experts were surveyed to provide their evaluations, aiming to determine the effectiveness of collective military training using the MILES equipment and to explore opportunities for enhancing system integration within the Land Forces of the Lithuanian Army (LFLA). Since the determination of the most important criteria must be based on the Kendall coefficient, the information in collected from experts' survey was used to assess the coincidence of the expert opinions. In order to find out whether the answers of the experts who participated in the study can be relied on, the IBM SPSS 29v package was used and the compatibility of expert opinions was assessed by focusing on two main blocks: (1) Developing readiness for real military action, and (2) Development of teamwork skills.

Thus, in order to assess MILES' influence in developing the readiness of soldiers serving in the Lithuanian Armed Forces for real military actions (block (1)), five criteria were presented: MILES provides a realistic training environment (KV1), MILES provides an immersive training environment (KV2), MILES provides feedback (KV3), MILES increases preparedness for real-world situations (KV4), and MILES reduces the risk of real field training (KV5). The results of Kendall's W coefficient calculations showed that calculated coefficient W=0.616 confirmed a fairly good enough coincidence of the opinions of the experts included in the study, since "Asymp. Sig." has a value of 0.015<0.05, which indicates the need to accept the hypothesis put forward that in this case the coefficient is statically significant.

Therefore, taking into account the assessment of the criteria presented by the experts, a diagram of the significance of "the influence of MILES in developing the readiness of soldiers to carry out real military actions" was compiled. Since each criterion was assigned ranks (specialists evaluated the statements made on scales from 1 – "it does not matter at all" to 5 – " very important"), it is possible to clearly, schematically depict which competencies are successfully developed with the help of MILES (see Fig. 2 a).



(a) (b)

Fig. 2. The experts' opinions in radar chart. (a) Development of readiness for actual military operations: KV1: MILES provides a realistic learning environment; KV2: MILES provides an immersive learning environment; KV3: MILES provides feedback; KV4: MILES increases readiness for real situations; KV5: MILES reduces the risk of real field exercises. (b) Development of teamwork skills: KD1: MILES helps develop tactical thinking; KD2: MILES allows you to learn from mistakes; KD3: MILES improves teamwork; KD4: MILES equipment is durable; KD5: MILES equipment is easy to use.

Based on a graphical analysis of the averages of expert opinions (see Fig. 2 a), it can be said that the experts' least agreed with the statement of KV3 "Feedback is provided with the help of MILES." Analyzing the explanations given by them, it can be seen that this problem arises from the systematization of information, since, as Expert 2 states, "There is a lack of a systematic way to analyze and provide feedback, and therefore its effectiveness is limited."; on the competence possessed by instructors, since Expert 3 states that "Effective feedback is important, but often depends on the competence of individual instructors."; and due to the fact that, due to the technical characteristics, direct feedback is not entirely correct, which is what the Expert 4 "MILES laser propagation speed 300 thousand km. times larger than bullets, this distorts the firing at moving targets, and the penetration of the laser is zero, which leads to no exactly correct direct feedback." It's also because the technical capabilities of the laser beam used by MILES when firing into the distance are limited, as Expert 5 also states, "When shooting into the distance – the laser expands to such a level that with one shot it becomes possible to cover with a laser the whole body of another soldier, which is not accurate." Therefore, this means that using MILES creates a lack of obtaining correct and high-quality feedback, which is very important for a soldier in order to further improve his qualifications and competencies.

In addition, all experts agreed with KV1's statement "MILES provides a realistic teaching environment", since the average of the ranks for this criterion is 4,8 out of 5 (see Fig.2 a). Experts have highly rated the system because it helps to simulate real battles during a 'battle', according to Expert 1 "MILES simulates the real conditions of combat, allowing soldiers to experience situations that are close to reality, but without real danger." and Expert 5 "MILES creates a very large realistic

environment during the 'battle' itself.". This means that MILES, in the opinion of experts, is an excellent system for achieving a realistic learning environment.

Thus, to assess the development of teamwork skills, experts were asked to evaluate five statements: MILES helps develop tactical thinking (KD1); MILES allows learning from mistakes (KD2); MILES improves teamwork (KD3); MILES equipment is durable (KD4); MILES equipment is easy to use (KD5). The analysis results are presented in Fig. 2b. The results of Kendall's W calculation (W=0.507) confirmed that the agreement among the experts included in the study is statistically significant, as the "Asymp. Sig." value of 0.038 is less than 0.05. This indicates that the hypothesis put forward is supported, demonstrating that the experts' opinions meet statistical requirements.

The degree of agreement among the experts allowed us to identify that they most strongly agreed with the statement that MILES equipment is easy to use (KD5). Experts noted that "The equipment is designed to be used in various situations, and therefore is universal enough and easy to apply, allowing users to quickly master the basic functions." The criterion related to the durability of the equipment, "MILES equipment is durable" (KD4), also received strong support. According to the experts, equipment that is heavily used requires additional maintenance to keep it operational. The analysis showed that, with slightly lower scores, experts evaluated criteria such as MILES helping to develop tactical thinking (KD1), MILES allowing learning from mistakes (KD2), and MILES improving teamwork (KD3).

7.2. Quantitative Evaluation of MILES effectiveness by System Users

Conducting military field exercises is a necessary and very important part of the training of soldiers, since the exercises allow soldiers to acquire and maintain the necessary combat readiness and develop the available skills. There are many challenges to the collective training of soldiers. The purpose of this research paper was to assess the effectiveness and problems of collective military training using MILES, according to a user survey. This study evaluated three main aspects, which were divided into three essential blocks of collective training of soldiers: (i) The Influence of MILES on the Effectiveness of Military Training; (ii) MILES Creates a Realistic Sense of Exercise to Develop Teamwork Skills; (iii) Risk Mitigation in Field Exercises Through MILES Integration.

7.2.1. The influence of MILES on the effectiveness of military training evaluation

The set of questions that was focused on the influence of MILES on the effectiveness of military training was focused on evaluating nine statements concerning the effectiveness of the Multiple Integrated Laser Engagement System (MILES) in enhancing military training outcomes. The distribution of responses revealed minimal disagreement with the positive impact of MILES, as evidenced by the lack of responses in the "I completely disagree" (1) and "disagree" (2) categories. On the other hand, there was a significant concentration of responses in the "Agree" (4) and "I completely agree" (5) categories, reflecting strong confirmation of MILES's contribution to effective military training. All statements, particularly those ranging from K47 to K56, bring in a high level of agreement, with over 90% of respondents either agreeing or strongly agreeing (see Fig. 3).

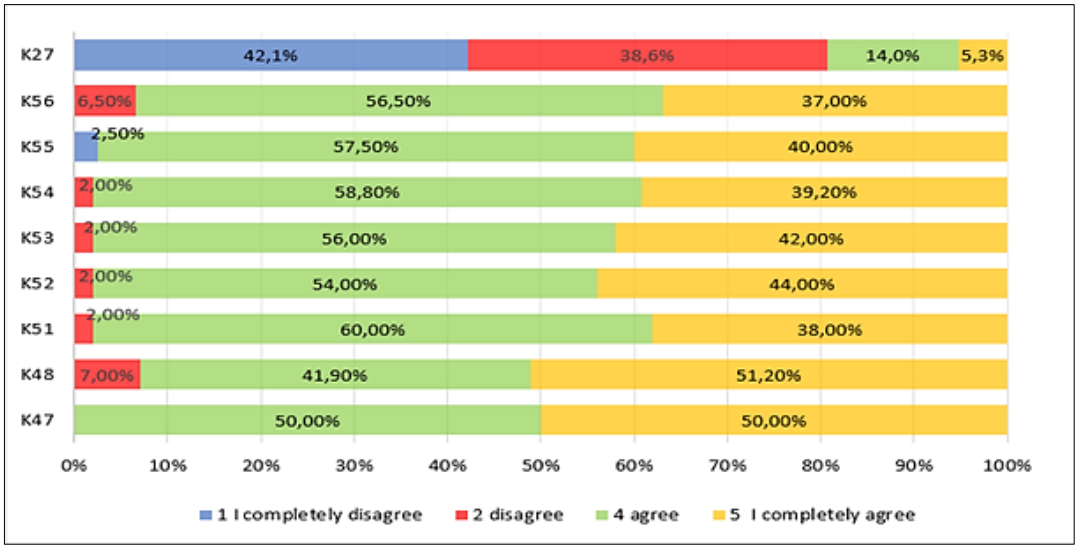


Fig. 3. Respondents' opinions the MILES impact on military training effectiveness.

This consensus underscores the recognition of MILES as a critical tool that substantially enhances the effectiveness of military training, particularly in complex or realistic operational scenarios. The high level of agreement highlights the system's perceived value in preparing soldiers for real-world challenges. However, the evaluation of the statement K27, "*MILES availability is sufficient*," revealed a significant shortfall in the availability of the system to meet training demands.

Specifically, 42.1% of respondents strongly disagreed, and 38.6% disagreed, indicating that the current availability of MILES does not adequately support the needs expressed by the respondents.

The high regard for the effectiveness of collective training facilitated by MILES, coupled with the substantial demand for such exercises, suggests a strong consensus among respondents that MILES is a valuable asset for military training and operational planning. The findings indicate that while MILES is widely recognized for its positive impact on training efficacy, there is a critical need to address the shortfall in its availability to fully capitalize on its benefits (see Fig. 2).

7.2.2. MILES creates a realistic sense of exercise to develop teamwork skills

The second block of criteria in the study received substantial support from the participating soldiers, indicating a broad consensus that the Multiple Integrated Laser Engagement System (MILES) is an effective tool in collective military training (see Fig. 4). The positive reception of these criteria underscores the system's perceived value in enhancing the realism of training exercises and improving soldiers' tactical skills, both of which are crucial for effective military preparedness.

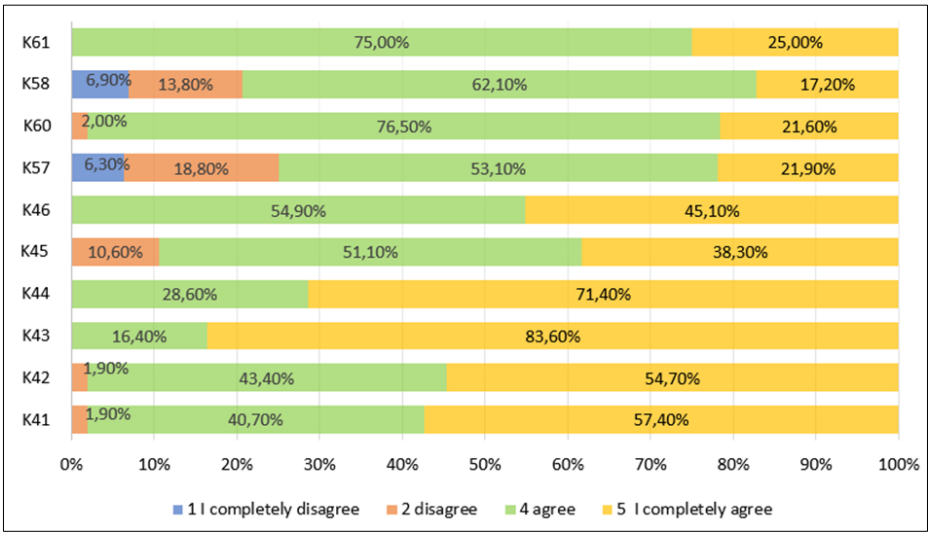


Fig. 4. Respondents' perception of the realistic environment created by MILES in military training.

However, it is important to highlight the findings related to two specific criteria: K58, which assessed the technical reliability of MILES equipment, and K57, which evaluated the durability of MILES under conditions of intensive use. Both criteria received notable disapproval, with over 20% of respondents expressing disagreement. This level of discontent suggests that respondents harbor concerns regarding the technical soundness and durability of MILES equipment, particularly when subjected to rigorous, sustained use. These findings point to a potential disconnect between the overall perceived effectiveness of MILES in military training and concerns about its technical robustness. The respondents' doubts about the reliability and durability of the equipment may indicate underlying issues within the system or a mismatch between the system's performance and user expectations. This divergence warrants closer examination, as it highlights critical areas where the quality and durability of MILES equipment may require significant improvements. In-depth analysis of these responses is essential to identify specific areas for enhancement and to ensure that MILES meets the high standards necessary for intensive military applications. Addressing these concerns will not only improve the system's technical performance but also align it more closely with the needs and expectations of its users, thereby maximizing its effectiveness in military training contexts.

7.2.3. Kruskal-Wallis H Test to Assess Differences in Responces

As a result of the descriptive analysis, differences in opinions were noted, leading to the selection of the Kruskal-Wallis H test to further evaluate respondents' opinions based on their military ranks and the number of times they had participated in exercises with MILES. The study found no statistically significant differences. This was confirmed by the Kruskal-Wallis H test when opinions were analyzed based on the number of exercises attended, with a chi-square value of $\chi^2(2)$ and a p-value greater than 0.05 (the significance level) across all groups of statements: "The influence of MILES on the effectiveness of military training" (8 statements), "Developing teamwork skills with MILES" (10 statements), and "The influence of MILES on risk reduction during training" (2 statements).

Additionally, the Kruskal-Wallis H test examined the differences in respondents' opinions according to their military ranks, and the results showed no statistically significant differences ($\chi^2(4)$, $p > 0.05$) for all twenty statements evaluated. This suggests that, despite the descriptive analysis (see Fig. 3 and Fig. 4) revealing certain challenges in the effectiveness of military training using MILES in the education of soldiers, these challenges do not vary significantly based on military rank or exercise frequency. Therefore, while MILES is an effective tool for enhancing the effectiveness of collective military

training, there are also areas that need improvement to achieve the highest possible level of efficiency. In conclusion, MILES positively impacts the effectiveness of military training and creates a realistic exercise environment, but it does not significantly reduce risks during field tactics exercises.

7.2.4. Risk Mitigation in Field Exercises Through MILES Integration

The analysis of the data relating to the respondents' assessments of risk decrease during training exercises using MILES (Multiple Integrated Laser Engagement System) revealed a nuanced distribution of opinions. Criterion K50, which addresses the assertion "MILES reduces the risk of incidents during training," received a notable endorsement from 60.4% of participants. Specifically, 10.4% of respondents fully agreed, while 50% agreed with the statement. This substantial level of agreement indicates a significant perception among respondents that MILES contributes to a decrease in incident risk during training.

On the other hand, the evaluation of Criterion K49, which queries whether "MILES reduces the risks associated with real field exercises," shows a more complex picture. Here, 10.2% of respondents completely disagreed and 28.6% disagreed with the statement. In contrast, 38.8% agreed and 22.4% fully agreed. This distribution suggests a less uniformly positive view of MILES in the context of field exercises.

The difference in responses indicates that while there is general agreement on MILES' effectiveness in reducing training incidents, there is less consensus regarding its efficacy in mitigating risks during field exercises. The variation in opinions may stem from comparisons between exercises conducted with and without MILES. Respondents might have perceived that MILES equipment does not offer significant advantages over traditional training methods, which use similar imitation ammunition but do not involve MILES. This assessment implies that MILES' effectiveness in risk reduction is viewed with some skepticism, and its advantages are not universally recognized.

Overall, the analysis suggests that while MILES is positively regarded in terms of reducing risks during training sessions, its impact on risk reduction in real field exercises is subject to more uncertainty, with some respondents acknowledging benefits and others questioning its relative effectiveness compared to conventional training approaches.

7.2.5. Strategies for Enhancing Training Efficiency with MILES Technology

The conducted Exploratory Factor Analysis let to identify four key latent factors that determine the effectiveness of collective military training using MILES: LA1 – MILES promotes effective teamwork; LA2 – MILES makes responsiveness in difficult situations more efficient; LA3 – MILES easy to use; LA4 – MILES promotes greater involvement of soldiers.

To assess how collective military training can be enhanced through the use of MILES (Multiple Integrated Laser Engagement System), a regression analysis was conducted. A multi-criteria regression model was developed with the dependent variable being the effective utilization of MILES (L1). The independent variables included four key latent factors. Following the requirements for linear regression, three of these variables—namely, "Effective Teamwork" (LA1), "Rapid response in difficult situations" (LA2), and "Reduction of risk during training" (L3)—were found to be statistically significant (see Table 1).

Table 1.
Coefficients of the training efficiency enhancement Model

Variables	Unstandardized coefficients		t – value	Sig. p –value	95% Confidence Interval		Importance (IMP)
	β	Standard Err.			Lower	Upper	
Intercept	3,983	0,061	65,174	0,000	3,861	4,106	
LA1	0,497	0,022	22,221	0,000	0,452	0,542	0,606
LA2	0,372	0,021	17,724	0,000	0,330	0,414	0,386
L3	0,046	0,018	2,550	0,014	0,010	0,082	0,008

Notes: LA1 – MILES promotes effective teamwork; LA2 – MILES makes responsiveness in difficult situations more efficient; L3– MILES decrease of risk during training.

The model's reliability was substantiated by a high determination coefficient ($R^2 = 0.945$) and a robust F-test statistic ($F = 333.078$, $p < 0.000$). This indicates a strong explanatory power of the model. The results demonstrate that to optimize the efficiency of military training using MILES, the statistically significant factors are as follows: Effective Teamwork (LA1) with a standardized coefficient (β) of 0.497 ($p < 0.01$); Rapid Response in Difficult Situations (LA2) with a standardized coefficient (β) of 0.497 ($p < 0.01$); Reduction of Risk During Exercises (L3) with a standardized coefficient (β) of 0.046 ($p < 0.01$). The model further evaluates the impact of these variables on the dependent variable (L1) by analyzing the coefficients of importance (IMP), as detailed in Table 1. The calculated coefficients disclose that "Effective Teamwork (LA1)" has the most significant impact on improving the effectiveness of collective military training with MILES, with an influence coefficient of IMP = 0.606. This analysis highlights the critical factors that contribute to enhancing training outcomes with MILES, emphasizing the importance of effective teamwork, quick decision-making under pressure, and risk reduction during

exercises. In the context of military training and the use of the MILES, the developed model demonstrated that three key factors—teamwork (LA1), quick response in difficult situations (LA2), and risk reduction during exercise (LA3)—account for 94.9% of the observed improvement in the effectiveness of collective military training. This high explanatory power suggests that these factors are critically important for enhancing training outcomes:

- Teamwork (LA1): Effective collaboration among soldiers is essential for successful military operations. The model highlights that the ability to work cohesively in a team significantly contributes to the overall effectiveness of training. Teamwork ensures that tasks are completed efficiently, resources are utilized optimally, and strategic goals are achieved. By fostering a strong sense of collaboration and mutual support, soldiers can better coordinate their efforts during actual missions.
- Quick response in difficult situations (LA2): The capacity to make rapid and effective decisions under pressure is another crucial factor identified by the model. Training scenarios that simulate high-stress conditions help soldiers develop the ability to respond swiftly and accurately to emerging challenges. This skill is vital for maintaining operational effectiveness and achieving mission objectives in real-world combat situations.
- Risk reduction during training (LA3): Minimizing risks during training exercises is important for ensuring the safety of soldiers and the success of the training program. By focusing on risk reduction, the MILES helps to create a controlled environment where soldiers can practice their skills without unnecessary danger. This approach not only enhances the learning experience but also prepares soldiers for managing risks in actual combat situations.

The model's findings suggest that repeated use of MILES is beneficial for military training. Regular exercises with MILES allow soldiers to refine their teamwork and rapid response skills, leading to improved decision-making during real military operations. The integration of these elements into training programs ensures that soldiers are better prepared to handle the complexities and demands of their roles. General, the emphasis on teamwork and rapid response, coupled with effective risk management, underscores the importance of these skills in the military context. Mastery of these areas through repeated MILES based training ultimately contributes to the success and security of military operations.

4. Conclusions

The study revealed that the effectiveness of the Multiple Integrated Laser Engagement System (MILES) can be attributed to several critical factors that enhance military training outcomes. Firstly, MILES significantly contributes to the realism of training exercises, which is essential for preparing soldiers for actual combat scenarios. The realistic nature of these simulations allows soldiers to experience and respond to conditions that closely mirror those they may face in real-world operations, thereby improving their overall combat readiness.

Secondly, the system plays a pivotal role in fostering the development of teamwork skills within military units. The collaborative nature of MILES exercises necessitates that soldiers work together cohesively, thereby enhancing the effectiveness of the unit as a whole. Teamwork is a fundamental component of military success, and MILES supports the cultivation of these critical skills.

Thirdly, MILES contributes to the enhancement of soldiers' capabilities, particularly in the areas of tactical thinking and execution within realistic exercise scenarios. The system's ability to simulate complex combat situations allows soldiers to develop and refine their tactical decision-making skills in a controlled environment, which is crucial for their performance in the field.

However, the analysis of survey data also highlighted several areas where improvements are necessary. A significant finding was the inadequacy in the number of available MILES systems, which limits their accessibility and widespread use in training programs. This scarcity of resources could hinder the ability of military units to engage in frequent and comprehensive training exercises, thereby affecting the overall preparedness of soldiers.

Additionally, the study identified several problem areas as reported by system users and experts. One of the key issues is the lack of immediate feedback on the effects of weapon use during simulations, which is essential for soldiers to understand and learn from their actions in real-time. Furthermore, the technical reliability of the equipment was another concern, with users reporting occasional malfunctions or inconsistencies that could disrupt training sessions.

The comprehensive approach of this study has not only highlighted the benefits and challenges associated with the use of MILES but has also contributed to improving the overall quality of collective military training. By addressing these issues, the study offers valuable insights into how to better prepare soldiers for the demands of their roles in various future operational contexts, ensuring they are equipped with the necessary skills and knowledge to succeed.

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