

A POSTERIORI ANALYSIS OF THE BULGARIAN-ROMANIAN TACTICAL EXERCISE "DIRECT THREAT 2014"

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Abstract: *Evaluating the effectiveness of the use of modeling and simulation (M & S) in the training of naval cadets is a vital part of tactical preparation. Placing the proper tasks in preparation training process is the only way to meet the new challenges related to the increasing possibilities of the modern naval weapon systems and naval tactics. The posteriori analysis is a means of helping to assess the quality of individual and / or group simulator training.*

At the end of 2014 a Bulgarian-Romanian tactical exercise, "DIRECT THREAT" 2014 was conducted.

The purpose of this study is to apply a posteriori analysis to the training carried out at the "Naval Tactical Simulator" and "Ship Bridge" navigation simulator in order to show strengths and weaknesses of the exercise whose idea is to be an inherent part of preparation of the Bulgarian and Romanian naval cadets.

Key words: *posteriori analysis, modeling and simulation, naval tactics*

Introduction

Naval tactics is a science whose subject is the organization and management of a sea battle – the most superior form of preparing and conducting combat actions at sea. Its place in the theory of naval art is determined by the relations with naval weapon systems, strategic environment and the way of using of the warship's weapons.

The tactics of the Navy is a result from the tactics of naval weapon system [34, c.252] and the tactics of different classes of naval ships [30, p. 93]. Therefore, if we want to have real combat training, we need real simulation models which are able to ensure with a high probability the solution of the tasks in accordance with the maritime tactical publications.

1. A posteriori analysis as an assessment tool for simulation training

Evaluating the effectiveness of the use of M & S in the training of Bulgarian and Romanian naval cadets is a problem related to the lack of uniform criteria and methodology to assess the quality of individual and / or group simulator training.

2.Characteristics of the conducted research

The term "pedagogical research" has a strongly expressed integrative character because, in the very process of research, different, traditionally separated parts of many academic fields and areas of focus are united. From the point of view of its content, a given military-pedagogical research, professional, specialized and higher education can be covered to an equal degree [5, p. 36].

Likewise, such research can involve representatives of any academic field and area of focus whose fundamentals are taught. The essential and determinant thing in this case is that the research is pedagogical by content and aims which involves representatives of different sciences and institutions in order to conduct it successfully. It is by pedagogical research that efforts, knowledge and creative abilities of different specialists are integrated by common goals and tasks [5, p. 36].

The methods of pedagogical research are the other important element of terminology and methodology of pedagogical research.

It is known that the scientific method is a means for attaining certain knowledge in theory and practice, a means for the familiarization, study and alteration of the objective reality. In a structural aspect the scientific method is a system of regulating principles which direct the cognitive activity of the researcher to the objective truth. For this reason the scientific methods employed by each science for the familiarization and alteration of its subject have a profoundly heuristic nature, because they serve for gaining new knowledge as well as for the interpretation of this knowledge. [5, p. 36].

The basic principles of pedagogical research are: significance, reduction, minimization, analogy, representation, sameness, confirmation [as quoted in 98 according to 5, p. 40].

The main feature of empirical pedagogical research is that they serve for encompassing the alterations and the development of a personality in result of some kind of influence. The main peculiarity of an item of empirical research is that a purposeful organization established on a case-by-case basis yields empirical data for actually existing pedagogical phenomena and processes. These data are furthermore integrated in the process of describing, explaining or forecasting regarding the events, phenomena or processes of interest for the researcher. To this end, the data collation results in the formulation of hypotheses whose truthfulness is checked by way of experiments. This leads to the formulation of rules, principles, laws, trends, prognoses. [5, p. 44].

The goal of this study is to find the answer to the questions related to the quality of the conducted tactical simulated exercises by analyzing the results of the conducted training sessions.

Hypothesis: It is possible to enhance the efficiency and the quality of solved during the tactical exercise problems by correcting the existing scenarios and changing the pattern used to conduct the training sessions and evaluating the trainees.

The main reason for conducting an a posteriori analysis of the tactical exercise "Direct threat 2014" is the availability of the necessary quantity of acquired empirical data. The information available for analysis encompass data related to 24 trainees over the period of time 1-10 December 2014.

3. Description of the roles played by the trainees during the exercise

In the course of the training sessions the trainees play the following roles:

- Commanding Officer;
- Navigating officer;
- Communicating officer;
- Weapon coordinator.

The trainees are evaluated depending on their expertise, using the criteria related to multinational NATO standards and requirements. They are graded using a five-grade system with Fail (2,0) the lowest possible grade, and Excellent (6,0) the highest possible one.

4. Trainee evaluation criteria by role:

Commanding Officer(CO) –The criteria for assessment the role of CO include: profound knowledge of the documents regulating the multinational naval tactical procedures, command and control; tactical and maneuvering signals related to ensuring anti-submarine warfare (ASW), anti-air

warfare (AAW), anti-surface warfare (ASuW) and nuclear, biological and chemical (NBC) protection of the task force; precise control of the helm and machinery; organization of the internal communication among the combat crewmembers - reports and acknowledgments; proper command language; special orientation and decision-making in a real situation; reporting the taken actions; practical use of the documents regulating the multinational naval tactics, techniques and procedures; exercising the communication rules and documents; reporting the taken actions; keeping the logbook.

Navigator - plotting the combat evolutions of both sides completely and accurately, as well as solving the particular problems related to maneuvering; reporting the taken actions;

Communication Operator - operating the communication equipment; properly and complete utilization, evaluation, analysis and spreading of the obtained information; keeping the logbook; reporting the taken actions.

Weapon Coordinator - knowing the rules and commands used onboard naval ships; operating the naval weapon systems; reporting the taken actions.

5. Statistical analysis of the difficulty of the different roles.

In order to examine how adequate the scenarios are in respect to the purposes of the training, it is necessary to check the difficulty of the different roles that are played during the tactical exercise.

The difficulty of the task is determined by the percentage of trainees who have solved the problem correctly. The task difficulty is designated with the difficulty index of P [6, p. 176]. The higher index shows easier task, and a low index indicates that the task is more difficult. The index P is calculated using the formulae:

$$P = 100 \frac{N_R}{N}$$

Where: *P* is the difficulty index;

N_R – the number of persons who have solved the task correctly;

N – total number of the persons who have attempted the task [6, p. 176].

A task is assumed to have been solved correctly if it was graded with a number higher than or equal to the arithmetic mean of the grade received for the respective role.

The task is assumed to be easy if its difficulty level is $60 \leq P \leq 80$.

An average level of difficulty is assigned to tasks with a difficulty index in the range of $40 \leq P \leq 60$.

A difficult task is defined as ones with a difficulty index of $20 \leq P \leq 40$.

Tasks with a difficulty index $P \leq 20$ are defined as very difficult, and tasks with a level of difficulty $80 \leq P$ are to be disregarded [18, 28].

The main task during the tactical exercise was: Maneuvering of the ships; picture compilation and radar monitoring. The achieved results for all roles are shown in Table 1.

After calculating of the index of difficulty for different roles is obtained that the index of difficulty for role Commanding Officer is $P = 33.33$, for role Navigating Officer $P = 45$, for role Communicating Operator is $P = 50$ and the fourth role – Weapon Coordinator $P = 52$. As mentioned above, a task with an average or a high difficulty index is optimal for achieving the goals of the training. In this case, no changes to the scenario used to conduct the training session are required.

The summary results of the statistical analysis of all roles played during the exercise "Direct Threat 2014" are shown in table 1.

The conducted a posteriori analysis is based on all real-rated entities.

The table shows that the largest numbers of assessments are received from people appointed in role of CO - total of 24. The least number of people are estimated in role Weapon Coordinator - 21 people.

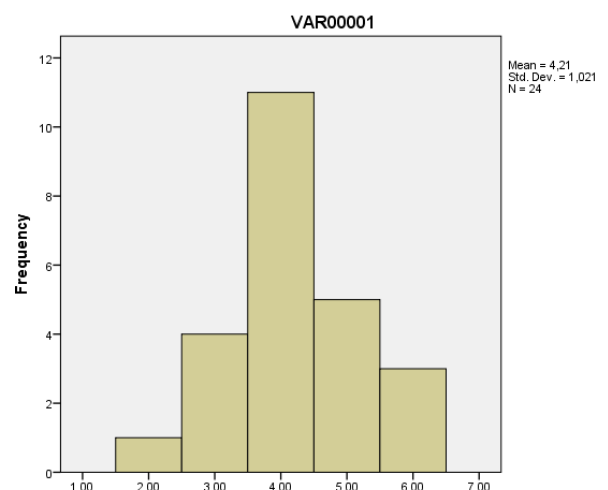
Table 1 Summary results

	VAR00001	VAR00002	VAR00003	VAR00004
N	24	22	22	21
Valid	24	22	22	21
Missing	2	4	4	5
Mean	4,2083	4,5000	4,5455	4,5714
Median	4,0000	4,0000	4,5000	5,0000
Mode	4,00	4,00	4,00	4,00 ^a
Std. Deviation	1,02062	,96362	,73855	,97834
Sum	101,00	99,00	100,00	96,00

With regard to the estimates obtained by the trainees appointed as Commanding officer (Table. 2) shows that the lowest score obtained is (2.0), while the highest is Excellent (6.0). The highest percentage are assessed with good (4.0) - 42.3%, while the least are estimated with excellent assessment (6.0) - 12.5% of students.

Table 2 Commanding Officer

VAR00001				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,00	1	3,8	4,2
	3,00	4	15,4	20,8
	4,00	11	42,3	66,7
	5,00	5	19,2	87,5
	6,00	3	11,5	100,0
Total	24	92,3	100,0	
Missing	System	2	7,7	
Total	26	100,0		



As was mentioned above the Index of difficulty for role of Commanding Officer gets $P = 33.33$, which means that the degree of difficulty of the role is "high", fact, which corresponds to the actual situation, which takes the commander of the ship requiring high responsibility, resourcefulness and leadership to solve the tactical mission and the objectives of the training.

The results of the evaluation of the trainees who were appointed in role "Navigator" during tactical exercise are

presented in Table. 3. The table shows that at least number of naval cadets - 13.6% have received the lowest assessment which in this case is (3.0). 18.2% of people got the highest assessment - excellent (6.0).

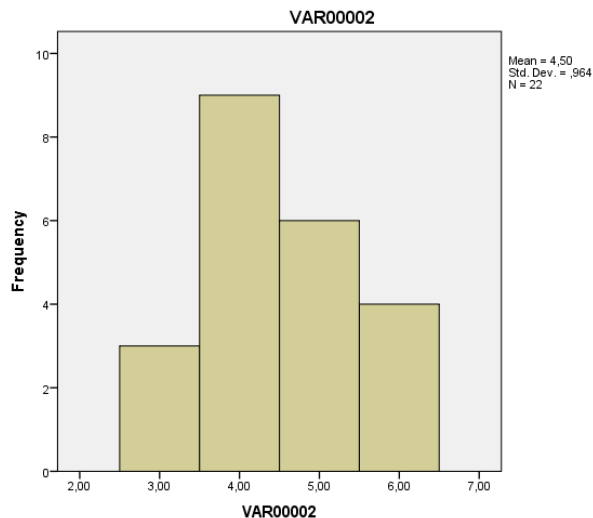
The largest percentage of the assessed trainees have received good (4.0) - 34.6%.

Unrated have remained 4 people.

Index of difficulty of the role is $P=45$, which means an average level of difficulty. Evidently the script is very good for practicing the role of Navigator.

Table 3 Navigation Officer

VAR00002				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3,00	3	11,5	13,6
	4,00	9	34,6	40,9
	5,00	6	23,1	64,0
	6,00	4	15,4	79,4
Total	22	84,6	100,0	
Missing	System	4	15,4	
Total	26	100,0		



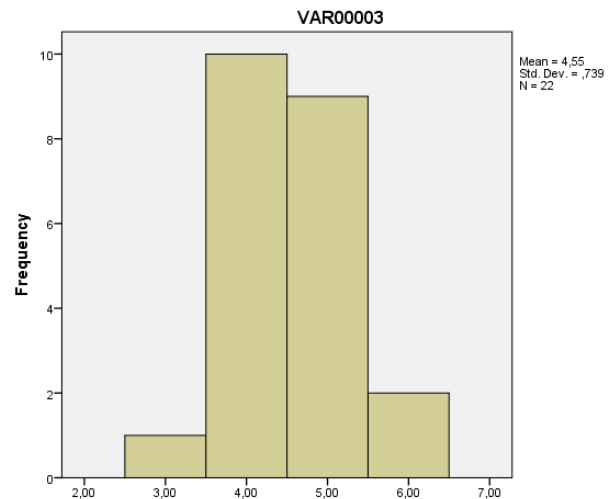
The results of the appointed in role Communication operator are shown in table 4. The lowest assessment for the trainees was (3.0). Fortunately this is the lowest percentage of the assessed trainees – 4.5%. 9.1% from naval cadets have been assessed with the highest assessment - excellent (6.0).

The highest percentages - 45.5% of students have received good (4.0).

Table 4 Communication Operator

VAR00003				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3,00	1	3,8	4,5
	4,00	10	38,5	43,0
	5,00	9	34,6	77,5
	6,00	2	7,7	85,2
Total	22	84,6	100,0	
Missing	System	4	15,4	
Total	26	100,0		

From the value of index P for this task – 50 we can conclude that the script is optimal for practicing the role of Communication operator.



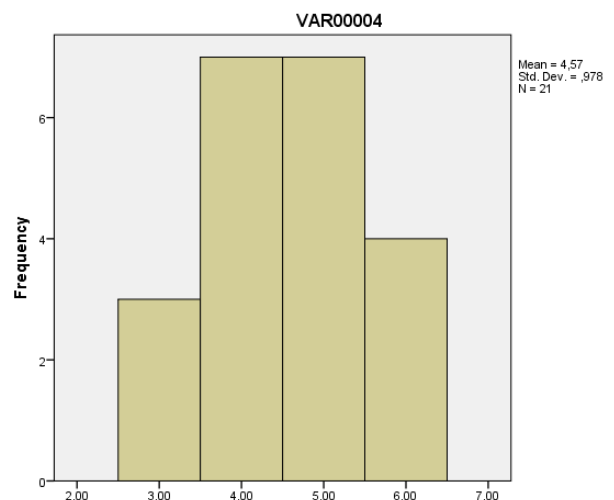
The results of the appointed in role Weapon Coordinator are shown in table 5. The lowest assessment for the trainees, appointed to Weapon Coordinators was (3.0), while the highest is excellent (6.0).

The highest percentage - 33.3% of students have received assessments good (4.0) and very good (5.0). The lowest percentage of people have received (3.0) - 14.3%, and after them are these with excellent grades - 19%.

The difficulty index $P=52$ shows average level of difficulty. This means that we do not need to make any changes in the pattern.

Table 5 Weapon Coordinator

VAR00004				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3,00	3	11,5	14,3
	4,00	7	26,9	41,4
	5,00	7	26,9	68,3
	6,00	4	15,4	83,7
Total	21	80,8	100,0	
Missing	System	5	19,2	
Total	26	100,0		



Conclusion

Final conclusion, which is required by the statistical analysis of the results obtained in practicing tasks during the exercise "Direct Threat 2014", is that created scripts work and they are useful for achieving the purposes of the tactical exercise. This results show that this kind of training is very useful. It is very important for Bulgarian and Romanian Naval Academies to continue to create and develop simulation training in order to keep the high level of preparation of naval cadets who, as future naval officers, can meet modern challenges in front of maritime security.

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