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Analyzing Level of International Humanitarian Law Knowledge and its Compliance Through Military Simulation Game

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***Abstract*— International humanitarian law in armed conflicts, the majority of whose contents originate from the results of the Geneva Convention, is the law used to protect human rights during an armed conflict. Based on research conducted by the International Red Cross Committee, video games that are now popular among the public, especially in the military genre, often ignore or contradict aspects of international law. This research was conducted to determine the knowledge of international law in armed conflict and its relationship to the level of compliance through military simulation video game scenarios. The scenario-based framework is a method used to develop game scenarios. The scenario was developed using an ARMA 3 video game editor and created to describe a situation of armed conflict where the respondent will take action whose results reflect the respondent's level of compliance with international law. Each respondent obtained two types of scores, the first is knowledge scores obtained from filling out questionnaires, and the second is compliance scores obtained from the results of running scenarios in the game. The score is divided into 12 parameters relating to aspects of international law in armed conflict. After the two types of scores are obtained, an analysis is carried out to determine whether the respondent's knowledge level influences the compliance level. The study's results showed that the respondent's knowledge and compliance levels were very high. The results of the comparative analysis show that only ten parameters have a level of knowledge that influences the level of compliance.**

***Index Terms*— International Law; Scenario; Video Game**.

I. INTRODUCTION

International Humanitarian Law has existed since the 19th century to protect non-combatants and minimize suffering and damage in a conflict. Three protocols in this law are written in the agreement at the Geneva convention, which has been continuously developed and updated until now. The first protocol is related to protecting victims of international armed conflicts. The second protocol is related to protecting victims of non-international armed conflicts. The third protocol is related to using additional special symbols [1]. This agreement requires that humanitarian law is part of the military and education program so that humanitarian law applies as widely as possible to the community.

Spreading knowledge of international humanitarian law is not enough to prevent violations of this law, so a complete integration of aspects and changes in the current civilization system is needed [2]. As many as 59% of teenagers who were survey respondents considered that torturing captives to obtain information was acceptable behaviour [3]. Knowledge and compliance with international humanitarian law are still low. However, the research does not mention video games, and the study provides insight into the attitudes of teenagers towards international humanitarian law for this research.

With hundreds of millions of active players worldwide, the video games industry has become a global phenomenon that transcends social, cultural, geographical, age and income brackets [4]. In contrast to passive media such as films, television and books, video games can significantly influence a person because they involve directly in the video game. One of the most popular video game genres is the military simulation genre. ARMA 3 is a realism-based, tactical military shooter video game developed and published by Bohemia Interactive. It was released for the Microsoft Windows PC platform in September 2013 and was later announced to be present on OS X and Linux in August 2015 [5].

With the increasing number of products and the number of military simulation video game players, this is certainly a problem because this can trigger and encourage players to carry out prohibited actions [6]. Military simulation video games offer players the to experience virtual warfare. However, many video game products of this genre are now lacking in providing an educational element of international humanitarian law and instead giving the wrong perspective on the actions its player must take to prioritize the entertainment element to increase sales.

Based on this problem, the research was conducted to determine how the level of players' knowledge of international humanitarian law affects the level of its compliance by using scenarios in military simulation video games as tools for this research [7].

II. METHOD

The research was carried out by developing scenarios first using the scenario-based framework methodology. The data obtained from the test results were analyzed using the Likert scale methodology.

A. Scenario Based Framework

A scenario can be understood as a means to change the game's initial state to its final state, following the main development trends, which are influenced by internal events and external activities as shown below:

- SI is the initial state of the game.
- T, predetermined development environment trend.
- E, predetermined internal event.
- A, external activities that have been carried out.
- SF, the game's final state after the scenario is terminated.

Scenario development often begins with an analysis of the present by determining the key factors influencing the considered system. Games and scenarios can build social structures or knowledge that, from a constructivist perspective, illustrate how future reality felt [8].

The scenario-based framework and development approach in Figure 2 and Figure 3 is a framework that can be used in the designing scenario of the simulation video game. Usually, the game manager or scenario designer chooses an activity before the game or scenario runs. And then, when the scenario starts, the player will decide based on the objective. If it reaches a specific result, the game manager can enter an event into the scenario to motivate the player to reach a goal. The following is a diagram of the framework of this method.

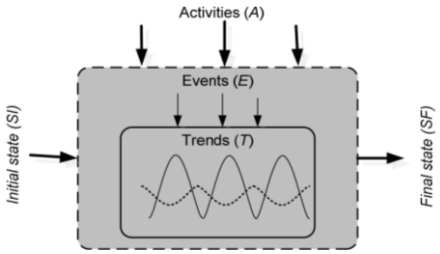

Fig. 1. Generic scenario structure

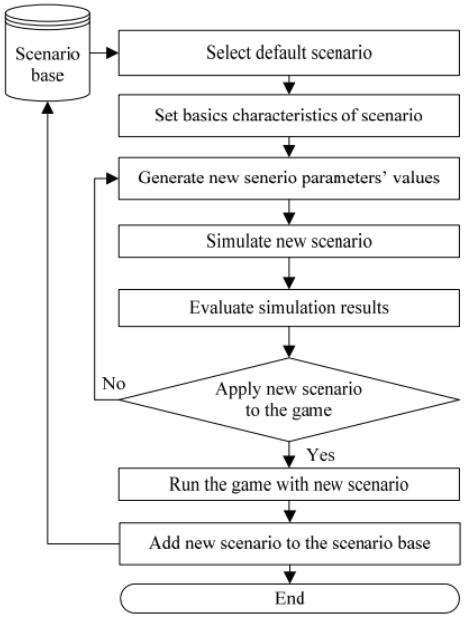

Fig. 2. Scenario development approach

The scenario-based framework method in video games is used to create games where players are placed in complex problem spaces that mimic real-world situations dan demonstrate how to design and develop a generic platform that enables rapid and flexible development and delivery of a wide variety of serious, scenario-based games that enable the acquisition of complex cognitive skills [9].

B. Scenario Development Methodology

The development of scenarios using the scenario-based framework method has nine steps consisting of [10]:

- System/object initial phase.
- Define goals.
- Define time steps.
- Estimate future states.
- Define rules for choosing future states.
- Choose the subsequent stage.
- Refine the initial state.
- Evaluate goal achievement degree.
- Check if the goal is achieved & terminate the procedure.

In this methodology, there are inputs and outputs for each stage, as shown in Figure 3.

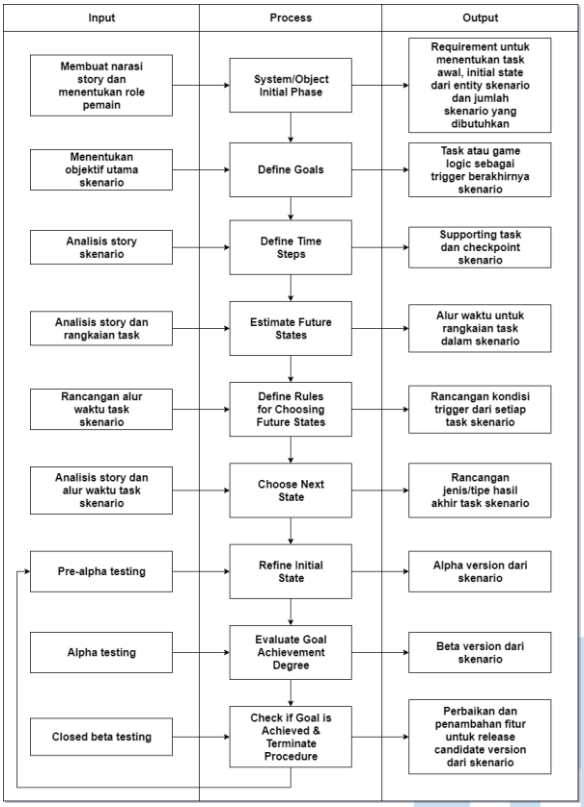

Fig. 3. Scenario development phases

C. *Data Analysis Methodology*

The data used for analysis were obtained from 2 sources: data from answering questionnaires and data from scenario completion. Data is divided into 3 test variables, each with four parameters [11]:

- Number of civilians killed by players directly.
- Number of prisoners of war that successfully secured by the player.
- Number of enemies the player identified before carrying out the attack.
- Number of civilians killed by players directly.

Variable 2 discusses post-conflict restoration and repair, measured by the following parameters:

- Number of scores the player gets in 1 specific scenario for this variable.
- Total score of successful humanitarian assistance given by players.
- Number of mine areas that the player has cleared.
- Total score of successful humanitarian assistance given by players.

Variable 3 discusses the protection and requirements of medical staff in conflict, measured by the following parameters:

- Total score of player's suitability in using medical equipment by international law.
- Total score for the level of use of weapons and ammunition by international law.
- Total score of the player participation rate in offensive and provocative attacks.
- Number of medical staff killed or medical equipment destroyed by players.

The score of each parameter in the questionnaire data is measured on a scale of 1 to 5, and the scenario data is measured on a scale of 1 to 10, which is then categorized into a scale of 1 to 5 according to Table 1 so that it can be compared with questionnaire data [12].

TABLE I. CATEGORY SCALE SCORE DATA SCENARIO

Score	0	1	2	3	4	5	6	7	8	9	10
Category Scale	1			2		3		4		5	

Data that has been wholly collected is analyzed through 7 calculation steps as follows:

- Determine max score value.

$$MS = RespondentCount \times 5 \quad (1)$$

- Calculate the percentage of the player's knowledge level of each parameter.

$$SP_n = \left(\sum P_n\right)/MS \quad (2)$$

- Calculate the percentage of the player's knowledge level from variables 1 to 3.

$$SVP1 = \left(\sum_{n=SP1}^{SP4} n\right)/4 \quad (3)$$

$$SVP2 = \left(\sum_{n=SP5}^{SP8} n\right)/4 \quad (4)$$

$$SVP3 = \left(\sum_{n=SP9}^{SP12} n\right)/4 \quad (5)$$

- Calculate the percentage of players' level of compliance from each parameter.

$$SK_n = \left(\sum P_n\right)/MS \quad (6)$$

- Calculate the percentage of the player's level of compliance from variables 1 to 3.

$$SVK1 = \left(\sum_{n=SK1}^{SK4} n\right)/4 \quad (7)$$

$$SVK2 = \left(\sum_{n=SK5}^{SK8} n\right)/4 \quad (8)$$

$$SVK3 = \left(\sum_{n=SK9}^{SK12} n \right) / 4 \quad (9)$$

- SPn, SKn, SVPn and SVKn values will be grouped according to Table 2, as shown below:

TABLE II. PERCENTAGE VALUE CATEGORIES

Percentage (%)	Category
0 - 20	Very Bad
21 - 40	Bad
41 - 60	Moderate
61 - 80	Good
81 - 100	Very Good

- Comparing the value of the player's knowledge level and the player's compliance level to determine whether the player's knowledge level has relevance to the level of compliance by finding the difference in the percentage.

$$D_n = SK_n - SP_n \quad (10)$$

The percentage relevance values are grouped by category in Table 3.

TABLE III. RELEVANCE VALUE CATEGORY

Percentage (%)	Category
0 - 20	Very Bad
21 - 40	Bad
41 - 60	Moderate
61 - 80	Good
81 - 100	Very Good

III. RESEARCH AND RESULTS

A. *Game Scenario*

The use case diagram in Figure 4 of the scenario developed for this research. Interaction in the scenario is only done by the player and the system to create automation so that researchers are not involved when players play video game scenarios.

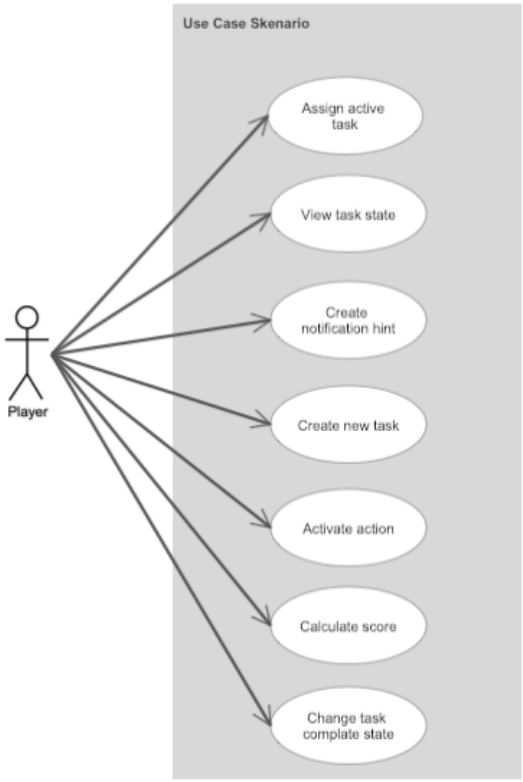

Fig. 4. Scenario use case diagram

Table 4 is an example of a task list for one of the developed scenarios. The left or centre column is the parent task, and the right column is given if the parent task has child tasks.

TABLE IV. TASKS LIST

Supplies delivery	Lift cargo (Building)
	Deliver cargo (Building)
	Lift cargo (Medical)
	Deliver cargo (Medical)
	Preserve cargo (O)
Demining	Connect to UAV
	Destroy mines
	Keep drones (O)
	End operation
Help IDAP	Talk to IDAP chief
	Transport patient
Help Altis PD	Talk to Commander
	Capture HVT
	Confirm & secure
Search & Rescue	Talk to team leader
	Find the convoy
	Talk to wounded police
	Find IDAP worker
	Rescue IDAP worker
Report	
Collateral damage	
Fire support ROE	

In the video game scenario, there is a scoring system to calculate player scores automatically. Each parameter in the research variable has a different scoring rule. Scoring system rules are created in the SQL script that is executed in the video game trigger.

The score of parameter number 3 in variable number 2 is used as an example, where the score for this parameter is obtained by the player when carrying out a demining task. This task instructs the player to clear the active mine area.

Fig. 5. Active mine area

The mine area in the scenario is built into five areas, as shown in Figure 5. Each area has a circular radius with dimensions of 50 meters x 50 meters, and 1 area has ten mines. Map markers are given to each mining area, with a red checkered line indicator if the area is still active or has not been cleared of mines.

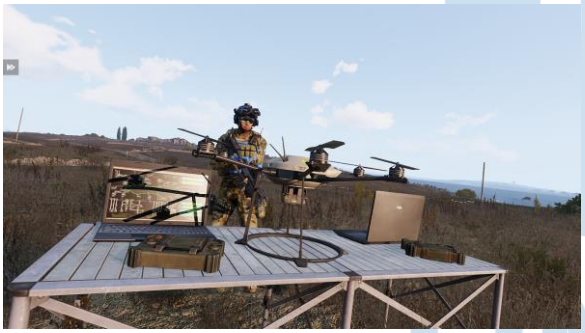

Fig. 6. Demining drone

The player's choice in choosing how to clear mines is not limited to scenarios such as approaching mines and turning them off manually or using demining drones, as shown in Figure 6.

```
Trigger: Expression
Condition
{["mine_", str(_x)] call BIS_fnc_inString} count (thisTrigger nearObjects
55) < 1;
On Activation
score_demining = score_demining + 2;
minefieldclear = minefieldclear + 1;
"marker_mine_area_1" setMarkerColor "ColorBlue";
hint "This minefield is clear";
```

Fig. 7. Mine area trigger

A trigger is used to determine if the area is clear of mines. Each area has a trigger, like in Figure 7, which is placed in the centre position of the area. The trigger will function as a counter to count the number of active mine objects in a circle radius of 55 meters x 55 meters from the trigger position.

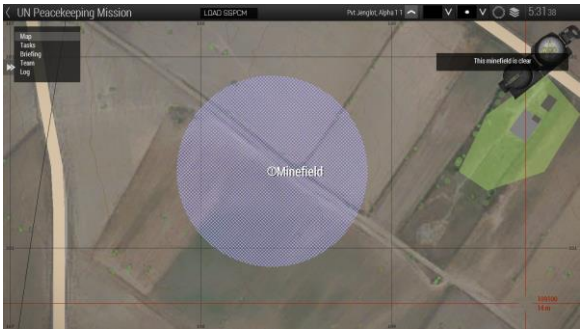

Fig. 8. Inactive mine area

If the number of mines in the trigger area is less than 1, then the mine area of the trigger is marked as clear of mines, the checkered line markers will turn blue as in Figure 8, and the player's points increase by 2. The variable in the script for this score is "score_demining". The score will be displayed to players when the scenario ends and exported into a log file for analysis in the next phase of this research.

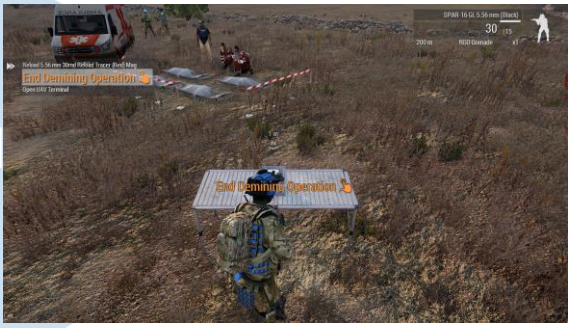

Fig. 9. Inactive mine area

Players must clear one area of the mine, while the other area is optional. To end the task, the player uses the interface in the laptop object on the scenario, as shown in Figure 9. If the player terminates this task using that interface, then the task cannot be resumed even if the player clears the remaining minefield area that has not been cleared.

B. Analysis Result

The steps are taken for testing the research subjects in figure 10. The subject must run the game tutorial first. If the subject does not experience difficulties and can pass the tutorial, then the subject can enter the testing phase. What the subject did at the beginning of the test was to fill in 12 points of a research questionnaire to measure the subject's level of knowledge of international law in armed conflict. After completing the questionnaire, the subject will run the whole scenario in 3 or more testing sessions.

After the test results in the form of scores from 20 subjects are obtained, the test results will be analyzed based on variables, parameters and methods that have been determined for this research. Before analyzing the variables and parameters of the test results, the max score is determined first. The Max score for analysis is

100, which is obtained from the multiplication between the number of respondents of 20 and the maximum score scale of 5.

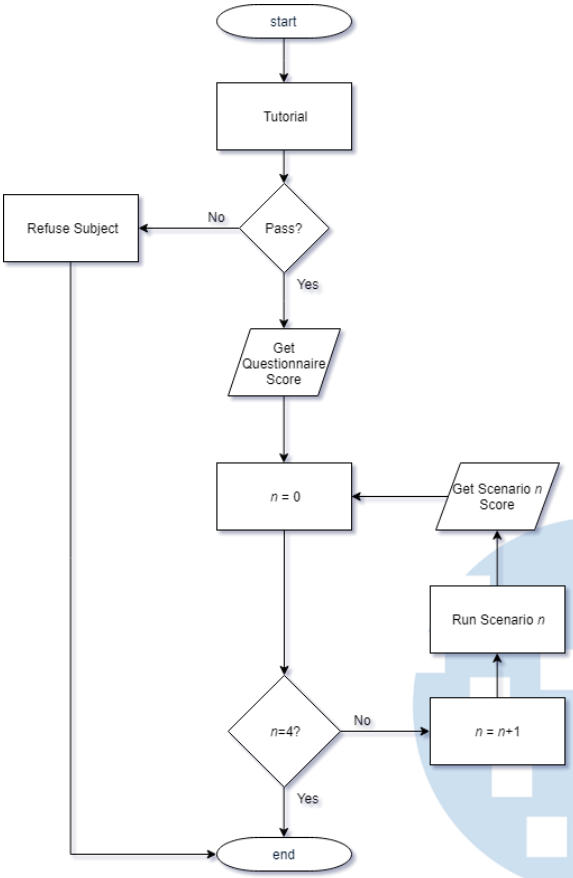

Fig. 10. Subject testing flowchart

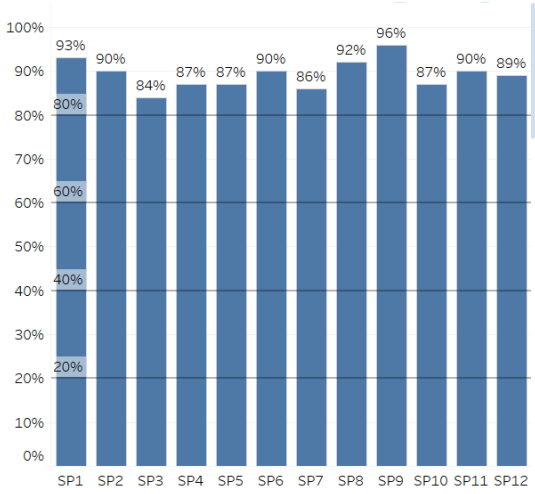

Fig. 11. Percentage of knowledge score of each parameter

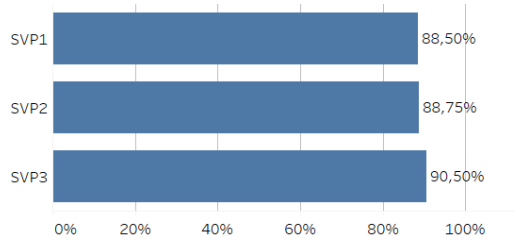

Fig. 12. Percentage of knowledge score of each variable

Based on the results taken from the questionnaire test, the subject met the excellent category for all parameters. In Figure 11, each parameter has an average score scale of 4.5. In figure 12, the percentage of subject knowledge level scores for variable 1 is 88.5%, variable 2 is 88.75%, and variable 3 is 90.5%. All variables fall into the excellent category. These results show that the subject has a very high knowledge of international law in armed conflict.

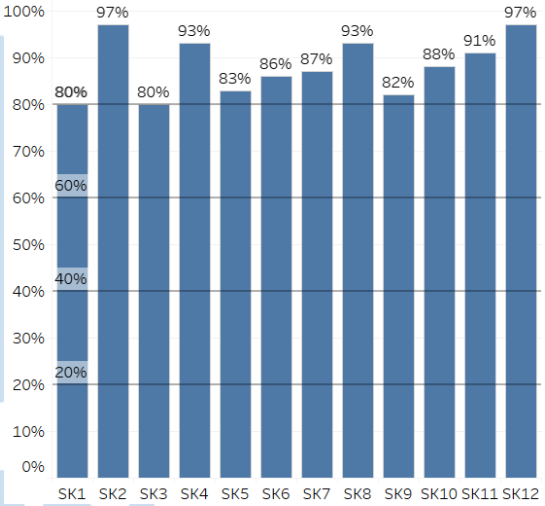

Fig. 13. Percentage of compliance score of each parameter

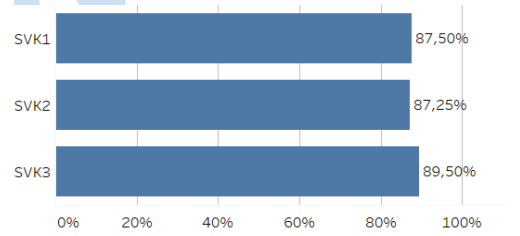

Fig. 14. Percentage of compliance score of each variable

Based on the results taken from test scenarios, subjects meet excellent categories in parameters 2, 4, 5, 6, 7, 8, 10, 11, and 12 and good categories in parameters 1 and 3. However, the percentage difference in parameters 1 and 3 is only 1% to reach the outstanding category. In Figure 13, each parameter has a score above 80%, with an average score scale of 4.4. In figure 14, the percentage of the subject's compliance level score for variable 1 is 87.5%, variable 2 is 87.25%, and variable 3 is 89.5%. All variables are included in the outstanding category. These results indicate that the

subjects have a very high level of compliance with international law in armed conflict.

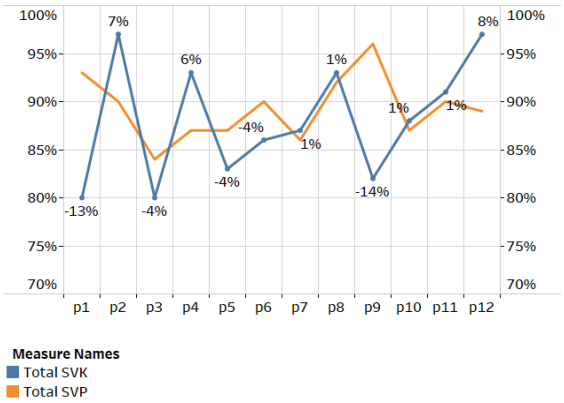

Fig. 15. Score comparison

The graph in Figure 15 and the results in Table 5 show the relevance between the knowledge level and subject compliance. From these graphs and tables, it can be concluded that the level of knowledge in parameters one and 9 are not more relevant to its level of compliance than the level of knowledge in parameters 2, 4, and 8 are still relevant to its level of compliance. The level of knowledge in parameters 3, 5, 6, 7, 8, 10, and 11 is very relevant to its level of compliance. The subject's level of compliance in parameters 1, 3, 5, 6, and 9 moves in a negative direction from its level of knowledge, while the subject's level of compliance in parameters 2, 4, 7, 8, 10, 11, and 12 moves in a positive direction from its level of knowledge.

TABLE V. RELEVANCE SCORE

Variable	Params	Difference Percentage	Relevance value category	Difference Bearing
V1	P1	13%	Irrelevant	Negative
	P2	7%	Relevant	Positive
	P3	4%	Strongly Relevant	Negative
	P4	6%	Relevant	Positive
V2	P5	4%	Strongly Relevant	Negative
	P6	4%	Strongly Relevant	Negative
	P7	1%	Strongly Relevant	Positive
	P8	1%	Strongly Relevant	Positive
V3	P9	14%	Irrelevant	Negative
	P10	1%	Strongly Relevant	Positive
	P11	1%	Strongly Relevant	Positive
	P12	8%	Relevant	Positive

C. *Analysis Result*

The test results show that respondents have an outstanding level of compliance with international humanitarian law, and most parameters have an outstanding level of compliance. This Discussion emphasizes the results of parameters with irrelevant criteria in Table 5. The results of the comparison between the level of knowledge and the level of compliance show that the level of knowledge of players in parameters 1 and 9 does not reflect its level of compliance.

The irrelevance of the respondent's level of compliance with the level of knowledge in parameter 1 is because the respondent tends to violate international humanitarian law by killing civilians. In contrast, previously, the respondent strongly agreed that civilians must be protected in the conflict zone so that the difference in knowledge and compliance moves negatively.

The irrelevance of the respondent's level of compliance with the level of knowledge in parameter 9 is because the respondent tends not to use equipment with protective symbols when acting as a combat medic in conflict. In contrast, previously, the respondent strongly agrees that medical personnel must use equipment with protective symbols that can be seen by the parties involved in the conflict so that the direction of differences in the level of knowledge and obedience moves in the negative direction.

For other parameters, respondents' knowledge level also reflects their level of compliance. It can be said to be relevant or very relevant so that the direction of difference does not have significant meaning.

IV. CONCLUSIONS

The application of the scenario-based framework method in developing scenarios for the video game ARMA 3 has successfully created scenarios that can measure the level of a player's compliance with international law in armed conflict.

From the analysis results, the subject has a very high level of knowledge and compliance with international law in armed conflict, with an average percentage level of knowledge and compliance level above 80%. Most parameters have a percentage difference below 5%, so the subject's level of knowledge is very relevant and influences the level of compliance as a whole. However, from the overall results, there are two exciting parameters, parameter 1 (variable 1) and parameter 9 (variable 3).

Both of these parameters result in subject knowledge that is irrelevant to their knowledge and moves in a negative direction. The value of parameter 1 is irrelevant because the subject has difficulty distinguishing between military personnel and civilians when engaging in armed contact, where the armed contact situation forces the subject to act quickly so that the subject does not have time to distinguish between military personnel and civilians. Then the value in parameter 9 is irrelevant because the subject does not

know in detail the form of equipment and vehicles that are mandatory and allowed to be used for combat medical personnel where combat medic personnel are medical personnel who are included in military organizations so that the forms of equipment and vehicles used are different from medical personnel civil that is known to most of the subjects.

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