Critical Analysis on Identifying the Effect of Military Training Simulations on Confidence Level of Soldiers

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Abstract— Simulations and games grow very rapidly and dynamically with technologies evolving every day. Technologies of military simulation are continuously evaluated and upgraded since it is a key factor for military trainings, analysis, planning, etc. The training simulations had been used to train soldiers for a long time period, but systematic analysis haven't been made to identify if the military simulations have been able to achieve increasing the confidence level of soldiers,. There have been many researches on military training simulations time to time around the world. Mainly defence research centres had done researches to identify the areas to improve in order to upgrade the quality of training. These have been used to train soldiers' way back in the World War II. In the advancement of technology these have become more and more advance and effective on achieving their goals. DARPA (Defence Advance Research Program Agency) and the US Army research institute were the major two researchers on this domain.

This paper presents a research that was conducted to identify whether military training simulations make an effect on the confidence level of the soldiers when they are battling.

The objective of this research was achieved through evaluating the existing background of military simulations against the confidence level of soldiers, investigating how military training is done in terms of simulations, evaluating how simulation based training are effective for soldiers, identifying the factors that affect the confidence level of soldier and introducing a model to evaluate the confidence level of soldiers.

According to the conceptual model used, actual experience, experience of others, self-efficacy, mission readiness, persuasion and emotional arousal were identified as factors affecting the confidence level of a soldier. Based on the collected data, the conceptual model which was proposed to measure the confidence level of soldiers could be justified to acceptable level.

Keywords— military training, simulations, soldiers, confidence level

I. INTRODUCTION

This research is aimed to measure the effectiveness of military training simulators by gauging the confidence level of soldiers who are trained using those. When it comes to training simulators, especially military, they are purchased by a specific community. They invest and acquire advanced technology for military training. Countries like USA, UK, France, Australia, etc. uses simulations as a supplement for military training. Government organizations that are involved in military training use these simulators. Sadly, any of the Sri Lankan organizations are not using such technology for military training.

Military training simulations are commonly known as war games in general. These are basically like a video or a computer game which simulates warfare in which the real world scenarios/operations are imitated. The realistic imitations are used as learning tools for soldiers before they are put to the actual battlefields. Most of the simulations are equipped with physical add-ons like weapons, military vehicles, air crafts, etc. In addition to audio and video outputs are included to endorse the interactive, as shown in Fig 1 and Fig 2.

Figure 1. Simulator projected to a larger area

Figure 2. Armoured vehicle plugged in to training simulator

In the military training simulation industry there are many products, and I have selected VBS2 (Virtual Battle Space 2) for the research. VBS2 is one of the widely used military training simulation software developed by Bohemia Interactive Simulations which is an Australian based company <http://products.bisimulations.com/products/vbs2/overview>.

II. AIM AND OBJECTIVES

The literature review reveals that a knowledge gap exists. The researcher's effort is to fill the gap as possible through the outcomes of this research.

A. Research Question
Do military training simulations effect on confidence level of soldiers?
B. Objectives
Main objective is investigating the effectiveness of military training simulations on confidence level of soldiers.

Sub objectives

  Evaluate the existing background of military simulations and confidence level of soldiers
  Investigate how military training is done in terms of simulations
  Evaluate how simulation based training is effective for soldiers

  Identify the factors that affect the confidence level of soldier
  Introduce a model to evaluate the confidence level of soldiers

C. Limitations
The main limitation of this research is to collecting data required for the analysis. Since the military training simulations are used by a limited number of countries, collecting data is difficult. Also due to many security issues, special permission is required to gather required data. A major limitation is that training simulations are is not used in Sri Lankan military. Due to these limitations gathering date was time consuming because of the distance and communication barriers.

III. LITERATURE REVIEW

The term modelling and simulation, refers to the use of simulators, stimulators, prototypes, models and also emulators over time in order to generate data as a base for technical and managerial decision making.

"War Game is a simulation game in which participants seek to achieve a specified military objective given pre-established resources and constraints; for example, a simulation in which participants make battlefield decisions and a computer determines the results of those decisions" (Page and Smith, 1998). Looking back into the early use of military training simulations, in 1811 a Prussian game called Krieg spiel was used by the Prussians in the Franco-Prussian war which was the first military training simulator.

After that period of time, some of the main US political military simulations which were used in the industry since the World War II were Strategic Air War (STRAW), SAFE and Cold War (COW).

Bruce W. Knerr of the U. S. Army research institute for the behavioural and social sciences researched about "Immersive Simulation Training for the Dismounted Soldier" in February 2007. The study has found out there are some drawbacks where it will limit the effectiveness of the training if the simulator is inefficient to perform that particular training sequence or activity. Virtual training simulations have a number of advantages compared to the live training simulation for dismounted soldier training. Virtual training simulation requires

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very less physical space compared to a live training simulation. Moreover actual military training equipments are not required for virtual simulation unlike the live training simulation. Above researcher had also recognized some disadvantages of virtual simulations compared to using live simulation for dismounted soldier trainings. Some disadvantages are trainee soldiers not considering virtual training simulations truly since they appear like video games and experimenting actions that are inappropriate in real world battlefields. But virtual immersive simulations provide a great chance for small unit leaders and unit members to exercise in a virtual environment of realistic simulated operations and enhance their cognitive and decision making skills that ultimately will foster adaptability and the competence to respond in rapidly changing situations.

Military training simulations are been used by many military training school and centres to train soldiers. Using training simulations is a very cost effective and advanced way when it comes to training soldiers. The cost of military training simulations are much lesser than the cost of operating the vehicles and weapons for live training. For instance the cost of using simulations to train laser guided precision weapons and high-tech air crafts is lesser than the live training using that weapons and aircrafts.

Susannah J. Whitney, Justin J. T. Fidock and Nicole Ferguson (2012) stated that "Training is an important way of addressing the threat posed by IED (Improvised Explosive Devices). In order to respond to the adaptive techniques used by insurgents, Coalition counter-IED training also needs to be flexible and adaptive in order to best prepare military personnel to detect and respond to explosive hazards. One way the USA and other countries have addressed this training challenge is through the use of simulation-based training. It is perceived to be a safe, cost-effective means of providing a wide range of customizable and repeatable training opportunities. Consequently, the use of simulation as a complement to existing forms of training is increasing in the military. An aspect of simulation that is growing in popularity as a training method is desktop-based simulation. This includes commercial off the shelf computer games originally designed for entertainment purposes, which have been re-purposed as training products, as well as products specifically designed for training. Compared to larger-scale simulations, desktop

based simulations are cheaper. In addition, they are perceived to generate higher levels of trainee engagement and motivation, especially among younger trainees." "It is vital that simulation provides effective training; otherwise there is a risk that trainees will not learn the necessary skills. In addition, if simulation-based training is ineffective compared to traditional forms of training, the potential cost benefits of its use are negated. The challenges of designing, conducting, and assessing simulation-based training are considered by human systems integration practitioners to be a human factors issue, alongside more conventional human factors areas such as human factors engineering and ergonomics. While definitions of 'effectiveness' vary, a common framework for evaluating training effectiveness is Kirkpatrick's model. This contains four levels,

- Trainee reaction,
- Learning during training,
- Improved performance following training,
- Improved organizational outcomes following training.

This model is useful for assessing the effectiveness of training, as it acknowledges the need to look beyond trainee evaluations or learning during training, and consider in addition the extent to which there is transfer of training.

Following training, the experimental group's attitudes towards simulation were significantly more positive, and participants' self-ratings of performance significantly improved, but this did not translate into improved knowledge or better performance in the live activity.

This was developed to complement existing methods of counter-IED training, such as Power Point slide presentations, static displays, and field exercises using inert IEDs. Only a small amount of research has examined simulation based training for explosive hazard detection, either for vehicle crews or dismounted combatants". The researchers perceived that the addition of Virtual Battle Space (VBS) training provided greater levels of immersion, realism, and variety of training scenarios in comparison to existing training methods. A control group completed conventional training comprising "sandbox" training and rehearsals using a static vehicle. Training outcomes were measured through

knowledge tests, surveys, and a live activity, with baseline measures taken prior to training". Susannah J. Whitney, Justin J. T. Fidock and Nicole Ferguson (2012) describes the study, which aimed to compare the effectiveness of simulation-based training conducting using VBS2, and traditional training conducted through ROC drill, for vehicle crews in the Australian Army, many high level organizations like the U.S. Army Research Institute for the Behavioural and Social Sciences (ARI) and Institute for Defence Analyses (IDA), etc. Where such studies have been conducted, there is a tendency to use the lower levels of the Kirkpatrick model such as trainee ratings or performance during training, as indicators, rather than the higher elements such as performance and organizational improvements after training. The results of such studies are generally consistent with other studies of military simulation-based training, in terms of both the way in which effectiveness was evaluated, and the study findings.

According to Ivan Oswalt, (1993), there are many characteristics by which a simulation or a game can be judged, including affordability, accessibility, data availability and database construction, efficiency, fidelity, resolution or level of detail, manpower requirements, modifiability and maintainability, portability, reliability, resulting degree improvement, standardized, user friendliness, validity, verification, validation and accreditation (VV&A) and verisimilitude.

In this research I consider the confidence level of soldiers who had used military training simulations for training. There have been many studies on measuring confidence of humans and they had identified the factors on achieving it. Some of the factors according to Jonathan (2013), external feedback, speech, self-talk, self-esteem, past results, external feedback and expectation.

According to the literature review which I have identified that the confidence level of a soldier can be vary due to these factors; experience of other team mates or soldiers, the self-efficacy of one self, mission readiness of a soldier, actual experience in combat, social persuasion and emotional arousal. A summary of the conceptual or theoretical model was is shown in Fig 3.

IV. DATA AND METHODS

A. *Data collection*
Structured interviews and questionnaires were used to collect required data for the research. Table 1 shows how each of the questions is mapped to the conceptual model.

B. *Data Analysis Techniques*
The research questionnaire was created using Google forms and the responses were collected through the form itself. All the responses were copied into a spreadsheet and the summary of that data set was taken into consideration for data analysis. Responses for each of the question was deeply analysed and mapped to the conceptual model's variables, then they indicated how they affect the confidence level of a soldier. According to the 12 responses to the questionnaire which has been given to the selected persons the data analysis was carried out.
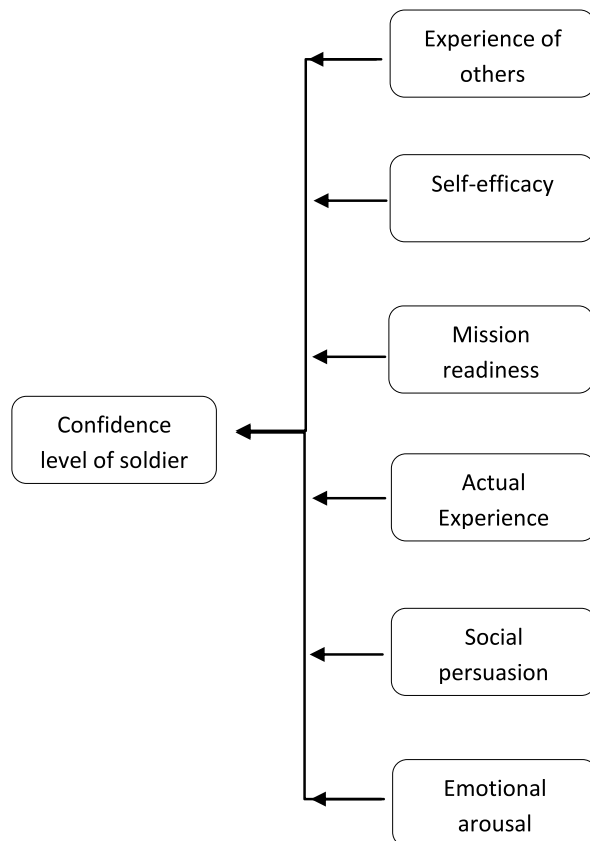

Figure 3 – Conceptual model

Table 1. Mapping questionnaire to conceptual model

Variable	Questions
Actual Experience	7. Did the primary weapon used in combat in simulator training, look and feel same as in the real world training? 8. Does the simulator allow you to manoeuver the weapon in a realistic manner? 9. Does the other equipment like the watch, binoculars, compass, radio, etc. fully functional according to the military specs (MilSpecs)? 13. How well does the simulator allow the trainee to make decisions and carry out alternatives if the initial strategy did not work out properly? 14. Was your previous simulator training session a success? 15. How realistic the simulator create unexpected/sudden scenarios during training sessions?
Experience of others	5. Were your teammates successful in simulation training sessions/missions? 6. Were your teammates confident after training that they could actually carry out a similar mission in the real world successfully? 16. Does the simulator allow trainees to work as a team?
Self-efficacy	1. How adequate was the quality of the realism of the stimulation (resolution, graphics, sound) for you to execute the mission? 10. How confident are you on performing predefined combat tactics after simulator training? 12. How easily can you recognize an enemy troop in the simulator? 17. How confidently are you following instructions in simulator training?
Mission readiness	11. How well aware are you about military procedures in a mission after simulator training? 13. How well does the simulator allow the trainee to make decisions and carry out alternatives if the initial strategy did not work out properly? 18. How effective is the communication within the group while in a mission or training session in the simulator? 2. How adequate was the details in the map to you to execute your mission?
Social persuasion	19. How successful do you think that the training simulators are when it comes to military training? 17. How confidently are you following instructions in simulator training?
Emotional arousal	3. How useful do you think the simulation was in providing an opportunity for the team to improve on skills to execute a mission? 4. How useful do you think this simulation will be for improving your abilities in MOUT (Military Operations on/in Urban/Urbanized Terrain)? 19. How successful do you think that the training simulators are when it comes to military training? 20. How realistic does the simulator, simulates the actual battlefield visually and audibly?

V. RESULTS

While conducting the literature, it was identified that the training simulations had been used by armies in order to train their soldiers even during the periods of world wars.

The research was conducted referring many military training simulators which are currently used by defence organizations and institutes around the globe. Amongst them Virtual Battle Space 2 (VBS2) is the widely used military training simulation software developed by Bohemia Interactive Simulations which is an Australian based company. As a result of the advancements of VBS2, many organizations like the US Army, Unites Stated Marine Corps (USMC), United Kingdom Ministry of Defence (UKMOD), Australian Army, etc. The VBS2 was selected as the military training simulation software in order to carry on with the research furthermore. Since VBS2 is widely used, the research was able to narrow down the scope, because the trainee soldiers from different organisations provided different opinions and feedback about training simulation.

Considering the first two sub objectives which were mentioned as "To evaluate the existing background of military simulations and confidence level of soldiers" and "Investigate how military training is done in terms of simulations", the following conclusion was made, mostly simulations are used in the context of instructor plus trainee where the instructor commanding the trainee soldiers what to do in simulation and the soldiers performing that task in simulation that is projected to a 270° or 360° view. This way of conducting training provides the trainee soldiers a more realistic feeling than a computer screen or a single projected screen which allow limited view and limited head and eye

movements. This realistic view helps the soldiers to gain better experience and as a result feel more confident which will assist them in real combats. The weapons, vehicles, are plugged-in to the simulator with separate application program interfaces (APIs) so that the trainees also get to use those them and engage in interactive training. Apart from that, the instructors have the capability to design training scenarios in the simulator addressing special areas of training, giving special care to the strengths and weaknesses of each trainee soldier. The above is a brief description on how the military training is done in term of simulations and how it affects the confidence of soldiers.

The forth and the fifth sub objectives of the research are "To identify the factors that effect to confidence level of soldier" and "To introduce a model to evaluate the confidence level of soldiers". A conceptual model which was introduced earlier was derived for confidence level by going through various studies and related literature which has been published over the internet. According to the conceptual model for increasing confidence, the below mentioned factors were initially identified.

- Actual experience
- Experiences of others
- Self-efficacy
- Mission readiness
- Emotional arousal
- Social persuasion

The selected population for collecting data was volunteers who have experienced military training simulations while undergoing tactical training. The selected population was using VBS2 as the military training simulation software which was mentioned above. After analysing the feedbacks which were collected from the questionnaire, it is clear that military training simulations increases the confidence level of the soldiers in the selected population up to a certain level.

The sub objective "To evaluate how simulation based training are effective for soldiers" interlinks with the previous sub objective because what is expected from the training simulation is to make the trainees confident of what they do. The boosted confidence of soldiers help them to perform better in real life combat field therefore the simulators have met its purpose, which means simulators are

successful and effective. Apart from that, when analysing the collected data, it is clear that the simulation based trainings are successful for training soldiers up to a satisfactory level. However the outcome varies on which the simulation software they are using, the hardware which they use, the type of mission or tactical procedures which they train on, etc.

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