

Bloody Serious Gaming – Experiences with Job Oriented Training

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ABSTRACT

A long needed educational paradigm shift is steadily finding its way into the Dutch military organization, namely that of Job Oriented Training [1,2]. When training the JOT way, from day one, military students are confronted with increasingly complex real 'job' challenges to be solved in virtual environments. Along that road, we do not take prisoners; mistake means virtual death. Neither do we supply theory in advance: theoretical insights are acquired while solving realistic issues. Frequent and thorough reflection makes the insights stick.

Military personnel enjoy being challenged and thrive on it. This is one of the main observations of four years of JOT within the field of serious gaming. We make them learn the hard way. They say 'it is pretty cool'.

In this paper, we will explain the effects of JOT on learning and performance as we observed it in the various Dutch military schools that have adopted this way of training. While implementing JOT, we gathered quite some lessons learned. Additionally, we measured the development of crucial aspects of learning and performance during JOT curricula.

Our experiences indicate that JOT may be a very effective approach to challenge soldiers to become professionals, to take responsibility for their performance and to be flexible when their mission and environment change. The effectiveness of JOT is promising for present military education, the road to implementation, however, is challenging.

ABOUT THE AUTHORS

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Maj Clemens Roos graduated the Royal Military Academy in 1995 and presently is staff officer in the newly founded Army Simulation Centre. Coming from the operational Air Assault Infantry he got involved in Serious Games 3 years ago. From his new position he will continue with the implementation of Serious Games and Job Oriented Training in the Royal Netherlands Army.

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May 8th 2008, the following exercise in urban operations takes place at the Maneuver Training Centre (OTCMan) of the Royal Netherlands Army (RNLA). NCO students are being trained, using Virtual Battle Space 2 (VBS2) while being immersed in Job Oriented Training.

Mission

A standard infantry squad is clearing a house on the north-east part of a street in the village of Sango. One insurgent has been detected on the second floor and is taken out after prolonged shooting. Two squad members are wounded and one is killed. The third floor has yet to be cleared and the situation is chaotic. There is hectic communication between the platoon leader and squad leader about the possibility of either withdrawing the troops or calling for reinforcements. Suddenly, one of the squad members detects an insurgent on the third floor. The man is looking out of the window and has his back towards the troops. The squad member shouts to his commander asking for direction, and still the insurgent does not turn. The commander replies 'shoot him' and the insurgent is taken out. The house is cleared soon after.



Reflection

During the team-reflection phase, this event receives a lot of attention and scrutiny. The squad members, including the acting commander, soon come to a consensus that they should not have opened fire on the insurgent according to their Rules of Engagement (RoE). According to these rules, they should have tried to take him captive. Despite this guidance, most squad members indicate they would have given the same order to take out the insurgent. Quite some discussion then ensues about the rationale for a commander to give such an order under these circumstances, as well as the potential consequences of this action. The students will continue to challenge the validity of the RoEs.



Expert view

As discussions come to a close, the urban operations expert acknowledges their conclusions and explains the validity and applicability of the RoE to the May 8th JOT exercise by detailing the consequences of violations.



INTRODUCTION

In the 8th May VBS2 exercise, a group of 8 aspirant sergeants are being trained in infantry tactics, command, and control. This scenario demonstrated the main aspects of Job Oriented Training (JOT) using serious gaming.

Gaming based on JOT indeed is bloody serious. From day one, students are confronted with a series of realistic scenarios that gradually increase in complexity. There is no part-task training, from the very beginning the students perform the integral tasks; i.e. they analyze the current situation, they create a tactical plan and control the execution of that plan. The scenarios provide distinct and confronting feedback, thus making clear whether the tactics applied were effective or not. The scenarios are designed to elicit tactical mistakes to trigger discussion among the students, allowing them to understand the practical application of a specific tactic.

As peers, the members of the squad reflect upon the experiences encountered, resulting in a common understanding of the areas where their performance needs improvement. Following this approach, an expert presents his view on both their performance and their reflections, relating their findings to the bigger picture for tactics and C2. Students have not completed tactics training prior to the exercise, as they are expected to discover the essential tactical principles themselves during the JOT exercises.

This paper describes the principles of Job Oriented Training (JOT) along with the lessons learned that were gathered during 4 years of practical implementation within 8 different curricula. In addition, this paper correlates the findings to the effects on learning and performance.

SERIOUS GAMING WITHIN THE RNI ARMY

The OTCMan started with the use of serious gaming at the Cavalry school (Steel Beasts) six years ago and at the Infantry school (VBS) 3 years ago, with a primary focus on tactics, command, and control education. About 4 years ago, the initial founders of JOT [1,2] initiated the development of a social constructivist approach to serious gaming. As a foundation for this approach, the students are provided with the experiences to help them construct tactical knowledge and C2 skills themselves rather than going through formal instruction.

This approach has evolved substantially over the years and only recently reached a mature state, upon which we will report in this paper. Before going into the principles, we will start by detailing the underlying motivation for this approach.



Figure 1. VBS2 is used to teach infantry tactics

Motivation for JOT

‘Our complex and fast changing world calls for professional experts’ [1]. Military personnel are not trained to simply reproduce knowledge, perform standard procedures or solve standard problems. The application of tactical measures must be tailored to best suit the specific mission to be accomplished in a military environment. As a result, training for tactical events should focus on delivering professionals who can act in ever changing and unpredictable situations.

The flexibility needed to handle these unpredictable situations presents itself clearly in situational decision making. Formal classroom teaching of tactical theory is not sufficient to acquire this type of competency. In order to understand the most important aspects of creating and ensuring successful execution of a tactical plan, one must undergo the real thing. For example, an issue such as following RoE may seem easy when taught in the classroom. However, real world application of the RoE entails split second decision making in a hectic and unclear situation. Such situational decision making is difficult and frequently leads to errors.

More than 15 years of research on situational decision making (e.g. by Klein [3,4]) reveals that such decision making can only be mastered by repeating the task as many times as possible in a controlled yet relevant reality, combined with intensive reflection upon one’s own performance. Hence, we need to present students with a vast series of tactically challenging situations,

which they will only be able to solve when they thoroughly analyze each new situation, prepare tactical plans, and execute missions based on those plans, over and over again. We need to make them learn the hard way.

The next section describes the principles of JOT.

JOB ORIENTED TRAINING –PRINCIPLES

JOT entails seven assumptions about the nature of optimal learning. Below, these assumptions will be described in conjunction with the lessons learned of four years of experimentation with these principles.

Practice precedes theory

JOT is a constructivist approach to training (see e.g. [5]). Hence, a main assumption of JOT is that students must be actively engaged in their proficiency in order to construct tactical knowledge and skills by themselves. It is doubted that teaching tactics and requiring students to do as instructed will result in a real competency. Competency in existing effect-based military organizations requires that commanders come up with a proper tactical solution for each and every new situation. Therefore, from the very beginning of their education, students are made to think about tactics. The missions encountered will be so challenging that the student will make mistakes. As part of the reflection process, they are required to reflect upon acceptability of outcomes and come up with performance issues to be improved in the next run.

Given the constructivist approach in JOT, no theory is provided in advance of the gaming sessions. From day one, the students perform the fully integrated task in a relevant reality, i.e. 'the job'. The basic idea is to practice the job first and allow the student to get sensitive to the theory essential to that job. For many years, there has been a conviction that students first need to have a solid theoretical base before they can start with the practice oriented training. Quite some evidence suggests the contrary (see e.g. [6,7]). Practical experience makes people receptive for theory, not the other way around.

Lessons learned: Students thrive on being challenged to do it all themselves. After some initial hesitation, the students are generally found to enjoy being offered the responsibility for their own learning. When offered a challenging environment, learning seems to come naturally, as detailed in the Effects section of this

paper. Also, after some initial resistance, the students perceive it as natural to reflect after each mission as part of the normal routine without being told to do so. We have found syndicate members reflecting in various odd locations, including sitting in the grass, on the stairs, and in smoking corners while fervently discussing the latest mission issues. Ultimately, when they present their findings to the domain experts, it can be observed that generally about 80% of the relevant tactical issues of the previous mission are already being addressed by the syndicates themselves.



Figure 2. Reflection

Learning needs to be active

Students have to be actively engaged in learning. Previously, tactical instruction was oriented largely toward conveying theory by means of formal instruction. Too often, long series of Power point presentations had to be endured. One may question the long term effects of such instruction. In formal instruction, the instructor is active and the student is passive. Particularly for young people, this passivity goes against their nature and is therefore counterproductive. The theory does not sink in [8].

Lessons learned: While actively engaged on a mission, students don't mind the extra hours. Our students voiced no objections to the issuance of orders to the next acting commander past 10 p.m. for missions that would start the following day at 7:40 am. The students in the 8th May course actually said in their evaluation that this was pretty cool. Their positive attitude towards learning was reflected in their performance, which was evidently above standards, as confirmed by their instructors..

Integrated task training

As stated in the introduction, studies on complex decision making by Klein [3,4] reveal that decision

making is best learned by actually making these complex decisions as many times as possible in a relevant reality. Application of this concept is the basis for the decision to not start with part-task training, and to start from the very beginning with the complete and integrated task. Throughout the progression of the training, the complexity of the environment in which the decision making takes place is controlled. The tasks gradually increase in complexity while performance requirements increase. See section 'curriculum design' for an example of such progression.

Relevant reality

Learning needs to take place within a so called 'relevant reality'. The students need to become aware of the aspects that are important for performing their job. Consequently, in serious gaming, the game environment has to provide the cues essential to tactical decision making. This certainly does not imply the requirement for a 100% fidelity environment.

Lessons learned: Students frequently criticize the 3D environments of VBS2 and Steel Beasts Pro. According to them, these environments are not state of the art. Students feel that commercial entertainment games have better 3D graphics or incorporate specific additional aspects into the simulation model. However the criticism as to the limited field of view in games such as VBS2 is legitimate.

Yet, the limited fidelity of the games currently used in the RNLA schools appears to have no significant effect on the learning outcomes. Fidelity studies like those reported in [9,10] provide evidence that, when aiming at tactics, relatively low physical fidelity still yields good learning results. For instance, in training for urban operations, a high fidelity visualization of civilians is not required. The fidelity required in this situation is a visualization depicting whether the civilians are walking casually or running, as the latter provides cues suggesting a critical situation. Similarly, an infantry training environment requires that some elements of a real-life mission are present – such as lighting conditions, presence of enemy patrols and proper equipment for the infantry squad. However, creating a fully geo-specific terrain is not required.¹

The main requirement for creating a relevant reality is predicated on the ability of the environment to provide a sufficient functional fidelity [10]. In other words, the cues for decision making are required, but there is no need for a high fidelity visualization of the overall environment.

¹For mission rehearsal, though, geo-specific cueing in the terrain is essential.

As it turns out, so-called 'military off the shelf' games provide an adequate environment for about 90% of the tactical tasks targeted in the RNLA's courses. These games, although not necessarily ideal, provide an adequate environment for tactical decision making.

The fact that full physical fidelity is not needed, saves much money: 'off the shelf' games usually cost one tenth of the production costs of a game approaching full fidelity. The final 10% fidelity takes about 90% of the total investment [11].

The relevant reality goes beyond the virtual environment. Creating a setting that corresponds with operational reality is one of the responsibilities of the instructor. The instructor plays the role of higher commander by providing realistic briefings and providing mission orders and new information during the execution of a mission.

Challenge

As previously mentioned, a fundamental assumption underlying our work is that learning the hard way provides the fastest track to proficiency.

Consequently, a JOT curriculum should provide an increasingly complex series of authentic cases. Those cases should be sufficiently challenging. Educational psychology states [6] that only by challenging people are they able to construct and apply effective strategies. Underestimating students is a major threat to development [5].

Lessons learned: Initially, we made the mistake of developing scenarios that were not sufficiently challenging for our students. For example, these missions had approaches that were too long and did not enforce the training objective. While working through these scenarios, students got bored and started laughing and chatting during missions. These students lost their concentration and reverted to an entertainment gaming mode. The moment we offered more complex missions, the students responded by increasing their focus on the tasks at hand and working harder. The increased complexity evidently, through increased focus of the students, resulted in a more enjoyable training experience.

Cooperative learning

An essential aspect of JOT is the grouping of students in small teams or syndicates. By having the students work together during the process of tactical analysis and planning, they are forced to verbalize their thoughts and be clear about the motivations for their decisions.

Lessons learned: During the execution phase, quantities of personnel in the various syndicates congregate to a complete organic unit. This arrangement lends itself well to reproduce the operational setting of real missions. As a result of the interactions between the students, they will face the problems related to communication and disobedience. They will share the same experiences during the missions, thereby facilitating the discussions in the reflection phase.

When training platoon commanders, we use a smaller syndicate size of 2 or 3 in the analysis and planning phase. The majority of the commanders' work lies in the analysis and planning phase. This smaller team arrangement allows each syndicate member to participate more actively in the training mission, similar to the quantity of effort required in a real mission. These small syndicates then present their tactical plan to the other syndicates. Varying views on the approach result in active debate about the best solutions and the rationale behind those solutions.

Reflective learning

The experiences acquired need to be conceptualized and solidified. After each scenario, students therefore engage in a self-reflection process. Reflection is found to be an essential part of the learning process [12,13]. Reflection relates experiences to general concepts and allows the students to identify potential areas where their performance could improve. This process integrates domain knowledge and the successful strategies to apply this knowledge, which are typical competencies of an expert.

Lessons learned: The search for an adequate form for self-reflection took some time. Students are not accustomed to engaging in reflection on their own without turning to their instructors for guidance and suggestions. In addition, the instructors felt naturally inclined to provide unsolicited assistance. For the students to fully engage in the reflection, instructors had to stay clear of the group interaction and accept that the first few reflections might not be brilliant. The student in the role of acting commander was given the responsibility for the reflection. The reflection of the students improved when we gave those students five general standard questions addressing the overall outcome of the mission, the care for safety, the appropriateness of the chosen tactics, the areas where performance was acceptable, and performance aspects that needed improvement.

THE PROCESS

Four years of experience with Serious Gaming based on Job Oriented Training resulted in a core process which has put the JOT principles into practice. This is a three-step process, described by the acronym EAGR (Experiment with Assignment, Game and Reflect).

Currently, JOT has been applied using different simulated environments in several training programs across multiple ranks. All of these existing implementations differ slightly. Below we will detail the process for NCO training.

Experiment with Assignment In the first stage, the acting commander and his assistant will receive orders from their commanding officer, who is role-played by the domain expert. They are provided with materials such as a 2D map and a virtual 3D representation of the geographical environment. They may experiment in this 3D environment in order to prepare their mission.

Game In the second stage of the process, the acting commander will start by briefing his squad. The students execute their mission plan in the virtual environment based on the mission plan and will have to be steered during the execution of the mission. The acting commander will therefore practice command and control while he experiences the quality of his own preparation.

Reflect In the third and final stage of the process the students will – as peers – collectively reflect upon their performance. The key to the success of this reflection lies in the discussion that emerges. Only when the students have finished reflecting will the domain expert give his expert opinion on both the performance and the reflection of the students. As part of the domain expert's analysis, he indicates strengths and weaknesses to the solutions provided by the students, relates events to real-life experiences, and provides the appropriate military terminology for those aspects discovered by the students.

The instructor must ensure that his opinion is not presented in a dogmatic way. If the complete process is conducted properly, the expert opinion will be void of authority and based on merit.

The role of the instructor

In JOT, the instructor is much more of a coach than he is a teacher in the traditional sense of the word. His main objective is to guide the students through their experiences and guard the quality of the learning process in the classes.

As essential part of the JOT process, the instructor should not impart wisdom to his students. The instructor primarily guards the process, role-plays commanding officer and acts as a domain expert. In addition, the instructor controls the opposing forces. Interventions on the process level are needed when discussions drift off-topic or if they become emotionally loaded.

As commanding officer, the instructor will give orders and can request information from the students. As the domain expert, the instructor will be a source of background information for the students without guiding the students in their quest for the optimal solution. It is crucial for the instructor to understand that students are supposed to make mistakes. The instructor must never prevent mistakes from being made; instead he should let the students discover which solutions work by themselves.

Lessons learned: Our experiences indicate that one of the problems new instructors encounter when starting with JOT is that they are too eager to provide the student with tactical knowledge on how to solve tactical issues. The instructor should always be as reluctant as possible to provide solutions to the problems the students encounter. In particular at the beginning of the course, students need to become accustomed to the initiative they are required to take. They are frequently found to be reluctant to experiment within the virtual environment and might not be very proactive in discussions and reflections. At these moments, the instructor should take a step back and try to remain passive – after a while the students will become more active and will appreciate the new way of JOT Training.

Finally, JOT does challenge military hierarchy. The students will bring forward very challenging questions and will not accept “because I say so” as an adequate answer. The instructor should engage in these discussions and will be confronted with unexpected questions. The instructor should respond to this level of questioning by using clear arguments and feedback from the simulated environment to help the students gain insight into the fundamental workings of their job without providing the solutions to their problems. For the instructor to be effective within the JOT process, he must be a self-confident and experienced domain expert.

PREPARATION

Curriculum design

One principle of JOT prescribes that the training scenarios should always contain realistic problems, in which the integral task of the professional has to be performed. As indicated earlier, the curriculum should therefore not progress from the training of parts tasks towards complete tasks, but should increase the inherent complexity of the missions. For instance, when focusing on tactics for reconnaissance, students are provided with a series of missions that start off relatively easy. Earlier missions force them to come up with a tactic that is very similar to the default reconnaissance tactic. When the students do not properly analyze the terrain beforehand, they will fail to gain a good overview of the enemy territory. Subsequent missions will contain more complexity and, while standard tactics might still apply, more optimal solutions are possible. One of the scenarios, for instance, places the object to be observed on the flank of a mountain. In this scenario, standard tactics apply but are relatively unsafe considering the presence of civilians and enemy patrols. However, a good over-watch position can be taken from higher up the mountain, which will allow the students to easily observe the target. Later missions may introduce new factors to be taken into account such as aspects of urban surroundings, opponents who act irregularly, increased time constraints and radio silence.

The idea behind this progression of scenarios is that each new scenario should make students think about local circumstances, the terrain, and the presence of the enemy. The students should never apply standard tactics without thoroughly thinking through all relevant factors and threats that each unique scenario can present.

EFFECTS

Does JOT result in better learning? Both instructors and students claim that their learning experiences improved as a result of JOT. For example, during the evaluation of the May 8th course, initially, one of the sergeants claimed that infantry tactics could not be taught with a computer game, but should be learned in the field. Immediately, the other sergeants reacted, disagreeing fiercely and asserting that they had definitely learned a great deal from the game-based JOT course with respect to situational decision making and command and control. In addition, most of the students insisted they thoroughly enjoyed the course.

Although anecdotal evidence is generally positive, experimental results had previously not been gathered. In order to validate our experiences an exploratory data collection effort has been initiated and is currently ongoing. Preliminary results indicate that learning performance trends are in line with expectations and that social learning takes place.

Measuring instrument

A first step in validating JOT effectiveness was the development of a performance based instrument for measuring student learning results. Initial measurements with the instrument resulted in good reliability scores (with Pearson's r varying between 0.7 and 0.9), also validity of the instrument was found to be satisfactory (for more detail on both, see [14]). The aspects of performance considered are three 'tactical' dimensions (analysis of the situation, tactical planning and situational decision making) and one general leadership dimension.

Social learning

The initial measurements indicated that social learning takes place. For example, in an NCO course, as squad leadership rotates through the group, a student's performance typically picks up where the previous student left off. This situation could only occur if the other students, while acting as subordinates, learn from actively participating in the scenario and reflecting on the applied tactics and C2. This situation could occur only if the other students, while acting as subordinates, learn from actively participating in the scenario and reflecting on the tactics applied and the C2, as opposed to individual learning, where only the student in the role of squad leader learns. Further exploratory research was set up in order to investigate this hypothesis. Up to now, a total of three courses has been used to measure the performance curves of the students. These measurements have been conducted at infantry training sessions.

Figure 3 shows the average performance of the acting commanders in three successive courses (A, B and C). As the role rotates through the group within a single course, the figures along the horizontal axis depict the four successive measured runs. Along the vertical axis the average scores of the different squad leaders are shown on a scale from 1 to 4, with a 4 indicating 'optimal performance'. Besides the three courses measured, also an average (the blue line) of all three courses is displayed. For a more detailed comparison, including per dimension scores, see [15]. Apparently, with two exceptions in run 3, new acting commanders seem to have learned from the previous commander's .

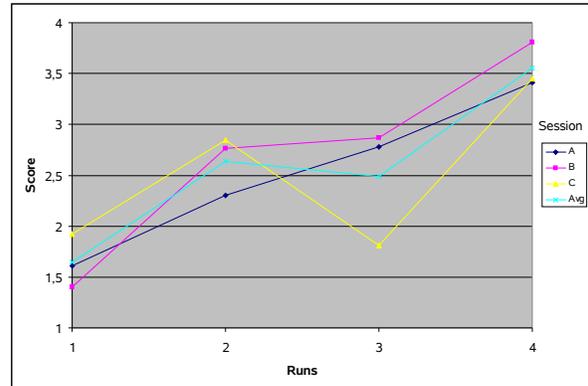


Figure 3 Average performance of the acting commanders.

Effectiveness

Besides this social learning effect, these measurements also indicated that the overall trend within courses is of students starting out poor (with a score around 1.5 out of 4) on all dimensions, while over time the performances improve dramatically. After two and a half days of completely immersed training, the NCOs managed to perform close to optimal (average end score is 3.5), even with the latter scenarios being far more complex than the initial ones.

In order to validate these indications, a pre-post quasi-experimental design will have to be used. Such experimentation with comparison groups to control for methodology influence on game-based learning is planned.

Transfer

A crucial question now is: does performance acquired in JOT training transfer to the real situation? When practicing in the field, initial perception is that no training value has transferred. Coming from a virtual game-based environment, we see students act as if they were doing a live exercise for the first time. Their performance is substandard and they generally do not take things seriously. This issue seems to be a result of classical transition problems. After one or two runs, the students discover that what they learned in the game can be applied in the field. After this realization kicks in, performance rises rapidly and quickly reaches a level similar to that achieved in the game.

Course duration reduction

The first course that was fully based on JOT has now run for three years. Along with the decision to transform the course into a JOT course, the duration was reduced from nine to six months. The first batches of students that enrolled in the new curriculum have been followed intensively.

When their commanders were asked about their performances in the field, they generally stated that these students performed at least as good as, and usually better than the students who were trained traditionally, despite the substantial reduction of course duration.

RANGE OF APPLICATION

JOT has been implemented in a variety of courses in the Dutch defense organization. Originally, JOT was implemented in the tactical air defense course for platoon commanders, as it was believed that the principles would be most effective when applied to the training of tactical decision-making. By now, JOT has been successfully applied over a range of courses, varying both across branches and in rank:



Figure 4. The tactical air defense game

- Tactical air defense, both squad and platoon commanders.
An in-house game for air defense is used to make these courses possible (see Figure 4). The game allows students to make a tactical plan on air defense and to deploy stinger teams in a virtual 2D and 3D environment. The stinger models are realistic, immediately showing the sight diagrams and thus the strengths and weaknesses of the employment. The 3D environment can be used to analyze the terrain as well as to simulate a real-time enemy aircraft attack to show the effects of the tactical decisions.
- Infantry tactics, both squad and platoon commanders.
Virtual BattleSpace (VBS) has been the main tool applied for infantry tactics. VBS2 allows execution of infantry scenarios, including urban, night and combined operations. Various terrains can be used and many models for military equipment are available. The real-time editor is used to insert confronting events, enhancing the

learning value of this serious game in a JOT training environment.

- Cavalry (armored) tactics for both squad and platoon commanders.
The game used in these trainings is Steel Beasts Pro, which is conceptually similar to VBS, but simulates mechanized operations.
- Tactical picture compilation for junior sailors:
For this course, JOT is employed on a game simulating radar and tactical plots developed in-house. The goal in this course is to grasp the procedures for radar contact identification. Our tool allows the student to utilize a simulated radar screen and communication tools to distinguish enemy and non-enemy activity.

Target group Initial implementation of the JOT courses targeted officer-level courses, since we initially assumed that students in higher ranks would be better equipped to handle the freedom afforded and emphasis on one's own responsibility that JOT provides. However, we have found that students of a lower rank also benefit from being trained with a JOT approach. We tested the air defense course with NCOs and observed that, similar to the officers, they discovered all tactical ground rules.

We experimented with junior soldiers acting as squad commanders. After a week of intensive gaming they actually could act as squad commanders, both in the game and in the field. This result was a surprise to both the junior soldiers and the JOT implementation team. We experimented with junior sailors who were required to learn the proper procedure for picture compilation, again with positive effects.

Inasmuch as these lower ranking students have had negative experiences with the classic instructor-based learning environment during high school, they have thrived on the practical student-oriented surroundings of Job Oriented Training. By encouraging the students to stay active during classes and by making the students take responsibility for their actions during their assignments, they become accustomed to adopting a professional attitude. Even though the decisions made during JOT instruction are not significant for their current job, they learn and understand the value of their job and position in the organization and as a result become motivated to look for optimal solutions and keep performing tasks at their very best.

Task type There was a discovery regarding the different types of tasks similar to what we found for the various target groups. Initially, we believed JOT would primarily be effective for tasks in dynamic environments and unpredictable situations, where there is no single best solution. Yet, we discovered that JOT

works as well for learning operational tasks and procedures. When no theory is presented, students have to think and be active to be able to solve the problems they are facing. As a result, the solutions found by a group can almost always be generalized directly into the standard procedures that are applicable to the task at hand. Learning procedures in this manner will ensure that students grasp the concept: they should understand the rationale behind the concept and not just remember how they were supposed to 'follow the rules'. The diversity in task type is shown in the examples listed above.

EMBEDDING INTO THE ORGANIZATION

The effectiveness of JOT is promising for present-day military training. The road to broader implementation across the military organization, however, remains a challenging one. The changes needed for the implementation of JOT remain confronting and a real attitude shift is demanded of both the instructor and his organizational surroundings. Most courses remain focused on the role of the instructor, instead of focusing on the student. This results in instructors who try to actively transfer knowledge to passive students.

The first necessary step to part with this tradition is to ensure that the instructors are comfortable not being in control over how students tackle the problems they are facing. For JOT to work, it is necessary that the students are allowed to experiment and make mistakes, while the instructors allow this to happen on a non-interference basis. Instructors must learn how to stimulate the learning process when a student needs assistance, without providing the solution to the challenges at hand. Instead, the instructor should monitor the overall process and act as coach and domain expert.

The second step will be overcoming skepticism. Instructors usually start off with a considerable amount of skepticism towards the effectiveness of JOT and the results that can be achieved by its application. They will question the ability of the students to meet the training goals by experimenting with the assignment in a simulated environment without previous instruction of the theory. Some instructors have questioned whether or not the students are able to reflect on their own learning process. Instructional manuals and documentation on design and implementation of JOT courses will not take away these reservations. In order to overcome this skepticism, instructors themselves will have to experience that JOT works. This understanding can be provided to the instructors by

giving demonstrations, or by allowing them to experience JOT themselves.

CONCLUSION

After four years of experimentation with the application of a variety of different forms of Job Oriented Training (JOT), it can be observed that the long needed educational paradigm shift is beginning to find its way through the Dutch defense organization. Moving away from classical instructor-oriented approaches, Job Oriented Training provides the framework to design effective student-oriented courses using simulated environments such as 'military off the shelf' games or custom military simulations.

JOT was developed bottom-up by military instructors and educational technologists of TNO². Since the initial developments in 2005, the implementation of JOT has progressed within the RNL forces. Several courses across several areas have been redesigned according to JOT-principles.

A main observation is that when applying the principles of JOT, students will start adopting a professional attitude towards their job. This originates from a shift of focus to responsibility and result-oriented leadership. From the very beginning of their military education, the students are permitted to solve real problems in virtual environments without prior instruction of theory. Immersion of a student in his or her proficiency in its integral entirety while using a controlled virtual environment creates a realistic but clear picture of their future job. We have observed that students are motivated to find workable solutions to immediate problems they encounter while performing their job, while searching for overall solutions to overcome the challenge. This approach results in the active discovery of the theory and procedures that underlie the job, and encourages the students to reach a deeper level of understanding. The first trial results indicate that performance measurements show a strong inclining learning curve and that social learning seems to occur.

JOT has been implemented across a variety of domains and across several ranks, showing that it is not only effective in officers training. However, further embedding of JOT in training programs within the Dutch defense organization will require determination and ongoing research into areas such as the analysis of

² Defense branch of the Netherlands organization for applied scientific research.

strengths and weaknesses of particular simulated environments, the training of new instructors, and the design of new curricula.

Both the RNL Navy and Army are in the process of converting more courses to JOT. Also, the educational policy board of the Navy considers adopting JOT as a policy measure to increase the effectiveness of their training programs. We believe that this transition will make students enjoy learning more and simultaneously become better professionals.

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