

7.1 Leveraging Gaming Technology to Deliver Effective Training

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The best way to engage a soldier is to present them with training content consistent with their learning preference. Blended Interactive Multimedia Instruction (IMI) can be used to teach soldiers what they need to do, how to do each step, and utilize a COTS game engine to actually practice the skills learned. Blended IMI provides an enjoyable experience for the soldier, thereby increasing retention rates and motivation while decreasing the time to subject mastery. And now mobile devices have emerged as an exciting new platform, literally placing the training into the soldier's hands. In this paper, we will discuss how we leveraged commercial game engine technology, tightly integrated with the Blended IMI, to train soldiers on both laptops and mobile devices. We will provide a recent case study of how this training is being utilized, benefits and student/instructor feedback.

1.0 INTRODUCTION

Motivating soldiers to want to learn can be a difficult proposition. Even today, the majority of training is delivered by a classroom-based, instructor-led curriculum. Classroom-based courses typically result in one dimensional training, offering minimal opportunities to engage the soldier [6]. Even for simple training, one-dimensional curriculums usually consist of a long list of PowerPoint slides. Soldiers have a name for this type of training, "Death by PowerPoint." Blended Interactive Multimedia Instruction (IMI) solutions, incorporating different types of media and various levels of interaction, provide an engaging alternative to traditional classroom training. Blended IMI solutions have the ability to motivate soldiers who require repetitive training for collective, individual, and team performance tasks. This helps entice soldiers to learn tasks which could otherwise be considered tedious or boring [6]. Similarly, deployed soldiers can be engaged to remain proficient on individual and crew oriented tasks when supplied with engrossing tactical training applications on a handheld device. Handheld applications have the potential to be a powerful contributor in the process of ensuring that soldiers retain fundamental skills necessary for successful combat operations.

2.0 OPPORTUNITY

Have you ever watched a teenager with a new video game? They do not read any instructions; they simply load the disk into their game console and start to play. Youths learn without instructors. They learn through experience and both positive and negative feedback and consequences. Gaming technologies have the added advantage of letting the "player" be in control. First-person shooter games have been around for decades, and this new generation of soldier, "Generation X-Box," wants to participate in their training. They are more comfortable with a video game than sitting in a classroom viewing a PowerPoint slide deck or reading a technical manual.

With upwards of 70,000 new soldiers enlisting in the Army each year [9], it is imperative that every opportunity be taken to maximize access to training [3]. With continuing operational deployments, ready access to individual soldier tasks/collective training (i.e. crew drills) are equally important. Blended IMI allows for improvements in the quality of instruction in addition to increasing the efficiency of creating, deploying, and managing the instruction. With the ability to cover the widest array of material, blended IMI solutions can be completely web-deliverable. Blended IMI can offer the highest quality educational experience to

the greatest number of students. Transferring this training to tactical applications on a soldier's handheld device means better trained soldiers fully prepared for combat.

3.0 PROOF OF THE PROBLEM

Digitized course material (e.g. PDF files, PowerPoint slides, Word Documents) has been in use for decades. However, these are merely digitized versions of the existing course material which adds little to the effectiveness of the instruction. A blended approach utilizing multiple IMI levels and types, extracts value from these materials beyond what traditional classroom instruction can accomplish [5]. The most significant benefits of blended IMI solutions stem from their ability to transform the roles of instructors and students. This transformation allows for a reduction in the amount of class time needed, a decrease in the need for travel, and a positive return of investment for training dollars.

4.0 THE SOLUTION: A BLENDED IMI CURRICULUM

The use of a blended IMI curriculum provides benefits to four key areas of the modern educational process: student interactions, instructor interactions, accessibility and transportability, and return on investment.

4.1 Student Interaction

The best way to reach and engage a soldier is to present them with content consistent with their learning preference. In general, most people can be characterized as learning more effectively from one of three types of presentation: aural, visual, and physical kinesthetic. Auditory learners are more engaged by information presented in an aural format. Visual learners benefit the most from ocular content such as video and

text. Physical kinesthetic learners respond better to information disseminated during physical activity [2]. Blended solutions can provide simultaneous delivery of audio, visual, and physical kinesthetic content delivered on a single platform. An example of this is a video accompanied by voiceover, coupled with a basic game-based simulation exercise designed to allow the student to apply the knowledge transferred from watching the video.

Advances in the technology used to create today's multimedia instruction allow all of these formats to be seamlessly blended together to provide a consistent experience for the student. The result is an efficiently delivered package that has content catering to each style of learning. A significant benefit of blended IMI is the reduction in repetitive material that covers the same topics in different ways in order to engage different learning preferences. This reduces the time needed to train, freeing up time for additional courses or practical application exercises [7].

Blended IMI can provide a more enjoyable experience for the soldier, thereby increasing retention rates and motivation while decreasing the time to subject mastery [6]. Practical exercises can be reproduced through constructive games [10] that allow a warfighter to engage in training without fear of failure or poor performance. Without any performance anxiety the soldier is better able to utilize the training for the acquisition of knowledge and skills. These constructive games can be timed or objectively scored to provide feedback for the warfighter and a means of competition through which soldiers will challenge one another. Competition is an extremely effective motivator that is not only free, but entertaining. Training can now become something that soldiers are interested in doing on their own time.

Blended IMI empowers the warfighter to take a more prominent role in their own education by providing them the ability to

perform self remediation. Questions answered incorrectly can be linked to the area in the instructional content that contains the correct answer. This same principle can be applied to activities and constructive games, giving the soldiers the option to return to the instruction to review the procedure again before continuing their activity.

4.2 Instructor Interaction

The student is only half of the learning equation. The experience and insight of instructors cannot be replaced and is a valuable part of the learning process. Instructors can provide not only context to the learning materials, but also impart valuable real world experience. Moving to a blended curriculum transforms the role of the instructor to one in which they can be much more effective.

In the past, instructors had to spend a great deal of time doing little more than providing an audible version of instructional texts. This problem can be addressed by using blended curricula that utilizes a mix of media types. Creative and interesting take home and web-deliverable applications take the place of traditional homework, which usually consisted of reading printed materials. These enhanced pre-course or in-course homework assignments increase the amount of knowledge that students enter class with. Therefore, the instructor can spend their time in class answering questions, discussing advanced concepts, or relaying valuable personal experience [7].

Having students better prepared is not the only benefit to instructors that a blended IMI curriculum can bring. Through the use of IMI, instructors now have the ability to use a dashboard-like display to monitor the progress of all students in real-time. This can be used for instructional intervention when the instructor notices that a student is having issues with a particular concept or step of a process. Instructors can now act to improve critical decision making skills or

respond to infrequent, yet important, questions and scenarios. For example, if the entire class is running a basic constructive game of a certain maintenance procedure, only one of the students may have enacted the exact set of circumstances that would result in a rare safety issue. The instructor could stop the class and bring everyone's attention to that student's scenario to teach directly to this point. An instructor also has the ability to focus on individual remediation without interrupting the rest of the class.

5.0 ACCESSIBILITY AND TRANSPORTABILITY

Full-featured, blended IMI curricula can be created to meet the minimum system requirements for home computers as set forth by TRADOC's Army Training Support Center's Education and Training Support Directorate [1]. Not only will Army school houses be able to run this content, but most students will be able to access and run these courses from their residences or barracks, at home or abroad. The ability to train anywhere, anytime, on almost every computer made available to students is one of the most important benefits to using blended IMI. Being able to include this training as a tactical application on the soldier's handheld device means he can take effective training material with him wherever he is assigned or whatever the mission.

With a blended IMI curriculum, web-deliverable content allows for updates to training materials to be rapidly deployed. The modular nature of most blended training solutions also allows for course designers to upload content. This can provide additional context or relevance to soldiers, further increasing engagement and retention [4]. Required changes to course content can also be made without involving outside developers.

Mobile devices are emerging as an exciting new platform for the delivery of training.

Many warfighters already have a mobile device of some sort and are familiar with installing and using applications developed for their mobile devices. Training created for mobile devices can be used as a supplement to existing PC-based training or for sustainment purposes once a student has completed a course. It is important to make sure that continuity is maintained between mobile and PC based versions. This ensures that students are presented with a consistent interface and presentation style. The importance of maintaining consistency when updating content or moving to new platforms cannot be understated. Consistency between the versions also maintains a minimal learning curve for the student. Any confusion caused by a lack of consistency will be a detriment to the soldier's attitude towards the instruction.

Blended IMI curricula afford the opportunity for soldiers to continue learning and developing skills outside the classroom through the use of interactive leave behind materials. These materials are developed in conjunction with the blended IMI used in class so that the student can apply knowledge, practice skills, and deepen their understanding of key concepts [4]. Mobile versions of these leave behind materials allow students to use them for additional training or reference anywhere they are at any time. By literally placing the training into the soldier's hands enormous gains in the warfighter's initiative to train can be realized.

6.0 RETURN ON INVESTMENT

The replacement of any piece of an IT infrastructure can be expensive, time consuming, and disruptive to normal operations. A blended IMI solution should be designed with existing equipment in mind. The key lies in using the appropriate technologies to create multimedia presentations in order to ensure their

compatibility with the widest range of computer hardware possible.

The web-deliverable nature of the content also means that, in cases where appropriate, classroom instruction can be distributed to multiple locations. This results in a decrease in travel and travel-related costs as well as an increase in the number of soldiers that a single instructor can manage in a class. The reduction in travel not only means a direct cost savings but also that soldiers will be required to spend less time away from their families.

The logistical price tag associated with training on any weapons system can be staggering. Examples of the overhead associated with these systems include storage, fuel, maintenance, and transportation costs. Blended IMI and handheld applications lower these costs by reducing to total number of systems required for actual "hands-on" training. Soldiers can practice anytime, anywhere, without needing the actual equipment. They can access instructors/subject matter experts anywhere in the world to get questions answered.

7.0 THE SOLUTION

An effective blended IMI solution encompasses the entire spectrum of student centered instruction from all four levels of IMI to the production of each individual multimedia component. Each course needs to be evaluated for the purposes of isolating individual teaching points, around which student centered interaction can occur. Instructor or SME (subject matter expert) input also needs to be incorporated to enhance the relevancy of developed IMI content. The result is IMI developed with instructors that can function independently or as a supplement to in class training.

Utilizing tools that allow for rapid development, and Commercial off-the-shelf

(COTS) software, the time and cost associated with course creation are reduced significantly. Effective blended IMI solutions should be designed to function on a wide array of hardware, resulting in a dramatic reduction in costs because of the ability to use existing computers and network infrastructure [1]. These solutions should empower Soldiers to access developed courseware from their home PC, laptop or hand-held device.

The next generation of training solutions should leverage commercial game engine technology, tightly integrated with the Blended IMI developed to teach the associated tactical training skills. The Blended IMI portion uses a “crawl – walk – run” methodology to tell the soldier what they need to do, show them how to do each step, and then utilizes the game engine to allow them to perform the skills learned. Blended IMI is used to show the soldier “what right looks like,” and how to perform each step. During this portion of the training, learning checks are introduced in the form of multiple choice quiz questions. If a soldier gets a question wrong they have the opportunity to link back to the section of the training to review. All aspects of the training are tracked and recorded. Every step will be date/time coded, and every choice (correct or incorrect) is logged to aid in the After Action Review (AAR) process. With this innovative approach, it’s easy to see who completed the training, skipped through sections of the training, or got specific questions wrong. If used for New Equipment Training, an instructor can use this AAR data to assess the class as a whole, or to “zero in” on individuals who need more attention. Soldiers who demonstrate higher levels of proficiency in the Blended IMI training and during game play can be “graduated” out onto the live equipment sooner, while the rest of the class continues to refresh via the Blended IMI.



Figure 2. Screenshot of Handheld Gaming Solution



Figure 1. Screenshot of PC-based Blended IMI Solution

The gaming portion of the training can be timed, and should mirror the performance standard that a soldier is expected to achieve in order to demonstrate proficiency in executing the given tasks. The game can be developed such that multiple soldiers can work together in a cooperative manner, much as they do in a real combat situation. The game portion of the solution should emulate the various roles associated with a given set of tasks, and should allow the soldier to pick their associated role.

As the soldier works through the various levels in the game, he or she should be able to suspend the game play and review the appropriate training video on what is

supposed to be done at that specific step. The soldier can then click on a button to return to the game, and pick up where they left off.

In order to improve the accessibility and sustainability of the training, a portable version of the game should be developed. The mobile version of the game should mirror the lock step sequencing of the pc-based game. A mobile version of the pc-based game allows a soldier to take the game with them, refresh their knowledge where ever they go, whenever they want.

8.0 PROOF OF THE SOLUTION: 3-6 ADA

My company, in conjunction with Raytheon, developed a solution for the 3-6 Air Defense Artillery School to create a prototype training application for the March Order and Emplace Crew Drill. The intent of the solution is to supplement training for the 3-6 ADA schoolhouse. Currently, the 3-6 Air Defense Artillery schoolhouse is faced with the challenge of having to train soldiers on various aspects of the Patriot Launch Station platform, but in some cases they have a physical shortage of equipment. Another issue facing the schoolhouse is once they get soldiers on the physical equipment, only two soldiers can participate in a crew drill at any one time, leaving the remaining soldiers to wait and observe their classmates. Finally, the schoolhouse was also seeking an alternative to “death by PowerPoint” for their Advanced Individual Training (AIT).

This blended IMI solution, complete with an interactive game, was developed to address the needs of the 3-6 ADA schoolhouse. The game, called “Launcher Dogs: March Order & Emplace,” has been developed for both PC and mobile access. Four classes of 14-Tangos have participated in the initial pilot of the Blended IMI solution and played the associated “game,” as have their instructors. This solution has been selected

to be part of the Phase 1 of Connecting Soldiers to Digital Applications (CSDA) pilot. The audience for this pilot will initially be limited to soldiers undergoing 14-T AIT training at Fort Sill. The game is being used as part of the training and sustainment initiatives for the 3-6 ADA schoolhouse. The game is being made available within the schoolhouse barracks, classrooms, and via the Apple iPhone mobile platform.

Utilizing Blended IMI training and the “Launcher Dogs: March Order & Emplace” game, AIT will require less time and resources to teach the Crew Drill, while simultaneously improving learning, training proficiency, interest and long term retention of skills: even in the absence of tactical equipment (Experiential Learning). It is anticipated that through these training efforts, the 3-6 ADA will:

- Decrease the time to learn a crew drill by 50%
- Reduce instructor contact hours by 50%
- Improve training proficiency by 25%
- Decrease caution and safety violations by 25%
- Decrease equipment damage due to new operator fault by 30%
- Significantly increase interest and training motivation
- Significantly improve retention enabling certification at Soldier’s first unit
- Decrease maintenance costs from inexperienced use of tactical equipment

During actual tests of the training, soldiers repeated the game in an attempt to “better” their own time in comparison to their battle buddy. The results of this repetition directly translated to an improvement in performance and proficiency when the soldiers transitioned to the live equipment. Figures 3 and 4 depict the effectiveness of the training from both the student’s and the instructor’s perspectives.

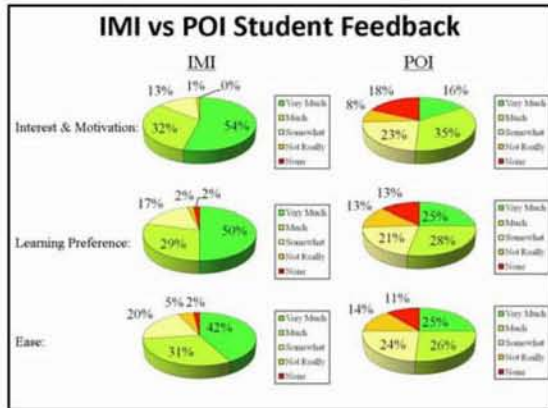


Figure 3. Student Feedback on IMI Effectiveness

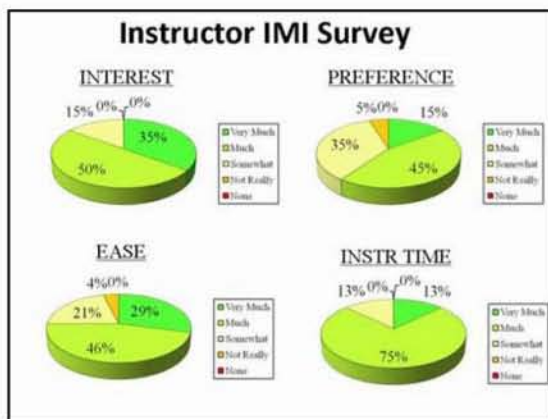


Figure 4. Instructor Feedback on the Effectiveness of Blended IMI

9.0 CONCLUSION

According to Dr. Roger Smith, CTO of PEO STRI, "Time-on-task is an important part of learning. The more time you spend rehearsing, exploring options, and studying outcomes, the better you will become at a skill. Games can add to that by encouraging soldiers to spend more time learning a skill" [9].

Games integrated into blended IMI solutions offer benefits to every facet of tactical training. One such benefit is an increase in training material quality resulting in soldiers

who are more engaged. This increased level of engagement results in higher retention levels and shorter time to subject mastery. Because of IMI's web-deliverable nature, soldiers can continue to gain these benefits while deployed. It is recognized that blended IMI solutions can also be leveraged to ensure all students are prepared before the first day of a course. However, sustainment materials can keep information fresh in a soldier's mind or be used as a reference after training has been completed. Instructors also benefit from the introduction of a blended IMI curriculum. With more prepared students they can focus their time on advanced concepts and relaying real world experience. Solutions can be produced that allow the instructors to update content for increased relevancy and accuracy. Both Games and blended IMI solutions can be designed for existing computer hardware and handheld systems in order to minimize the impact of adoption. All these benefits add up to cost and time savings to the DoD, as well as increased educational quality and accessibility for the warfighter.

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Outline/Agenda

- Introduction
- Opportunity
- Proof of the Problem
- Blended IMI
- Accessibility and Transportability
- Return on Investment
- Case Study: 3-6 ADA
- Conclusion
- Questions

Introduction

- Motivating soldiers to want to learn can be a difficult.
- Classroom-based courses offer minimal opportunities to engage the soldier
- Blended IMI solutions can motivate soldiers
 - Repetitive training for:
 - Collective
 - Individual
 - Team performance tasks

Opportunity

- Have you ever watched a teenager with a new video game?
- Gaming technologies let the “player” be in control.
- Upwards of 70,000 new soldiers enlist in the Army each year
- Blended IMI solutions can be completely web-deliverable

Proof of the Problem

- Digitized course material have been in use for decades
- “DEATH BY POWERPOINT”
- Adds little to the effectiveness of the instruction
- Limited interaction
- Not the way today’s soldier wants to learn!

Blended IMI

- A mix of media types
- Transforms the roles of instructors and students.
- Extracts value beyond traditional classroom instruction
- Provides benefits to four key areas:
 - Student interactions
 - Instructor interactions
 - Accessibility and transportability
 - Return on investment

Student interactions

- Present content consistent with their learning preference
- Three types of presentation:
 - Aural
 - Visual
 - Physical kinesthetic
- Blended IMI empowers the warfighter to take a more prominent role in their own education.

Instructor interactions

- Students better prepared
- Instructors can spend more time:
 - Answering questions
 - Discussing advanced concepts
 - Relaying valuable personal experience
- Monitor student progress in real-time
 - Instructional intervention
 - Focus on individual remediation

Accessibility & Transportability

- The ability to train anywhere, anytime, on almost every computer
- Updates to training materials can be rapidly deployed
- Mobile devices are emerging as an exciting new platform for the delivery of training
Avoid wordiness
 - Important for training continuity between mobile and PC based versions be maintained

Return on Investment

- Blended IMI solution should be designed with existing equipment in mind
- Reduction in total hours of training
- Reduction in total number of instructors
- Decreases in travel and travel-related costs
- Lower logistical costs by reducing to total number of systems required for actual “hands-on” training

Case Study: 3-6 ADA



A blended solution incorporating all 4 levels of IMI with an After Action Review at the completion of each module.



Two Man Crew Drill Prototype

- Reference Material
 - Videos of Two Man Crew Drills provided by Raytheon
 - ARTEP-44-635-Drill Documentation
- Crawl – Walk – Run
 - Conforms to ABCS Style Guide for PEO C3T
 - Mirrors ARTEP-44-635-Drill manual
 - Provides after-action review
 - Simulation utilized to engage student

Two Man Crew Drill Prototype

Challenges

- Limited access to SME
- Limited reference material
- Prototypes designed around materials provided
- Limited access to funding

Achievements

- Over 2 hours of IMI
 - Video
 - Flash
 - 3D Models and Character animation
 - Interactive
 - Link-back to video for refresher
 - After-action Review
- Framework from which additional modules can be developed/deployed quickly and cost-effectively

Two Man Crew Drill Prototype

Fort Bliss 12 March 2009

- Raytheon Montana St. facility
- 4 NCO's from 3-6 ADA
- Intent is to review IMI training, and to determine
- if of sufficient fidelity and accuracy to present to
- student test group.



Achievements

- Received "Go this station" on our IMI training from Instructors
- NCO's provided useful feedback and criticisms.
 - Expressed a uniform belief that what we have is an extremely valuable step that they believe soldiers will gravitate to.

Two Man Crew Drill Prototype

Fort Bliss 13 March 2009

- Raytheon Montana St. facility
- 12 Soldiers from 3-6 ADA
 - No prior “hands on” experience with the Patriot Launch Station hardware.
 - Morning Session
 - 8 Soldiers to be put through our IMI instruction
 - 4 Soldiers to attend AIT conference training
 - Afternoon Session
 - Take soldiers out on equipment in Abernathy Park
 - IMI soldiers on 1st Launch Station
 - AIT Conference soldiers on 2nd Launch Station
 - Have soldiers demonstrate what they learned

Two Man Crew Drill Prototype

Fort Bliss 13 March 2009

Results

- IMI test group took to the Computer-based training “like ducks to water”
 - Needed minimal instruction
 - Wanted to run the training portions repeatedly
 - Competition amongst soldiers to get the “Best Time”
- Soldiers provided useful feedback and criticisms.
 - Enjoyed the IMI Training
 - Felt they actually learned something
- At Abernathy Park
 - IMI test group was able to tell their instructors what steps they needed to perform
 - Control Group needed to be told by their instructors what steps to perform

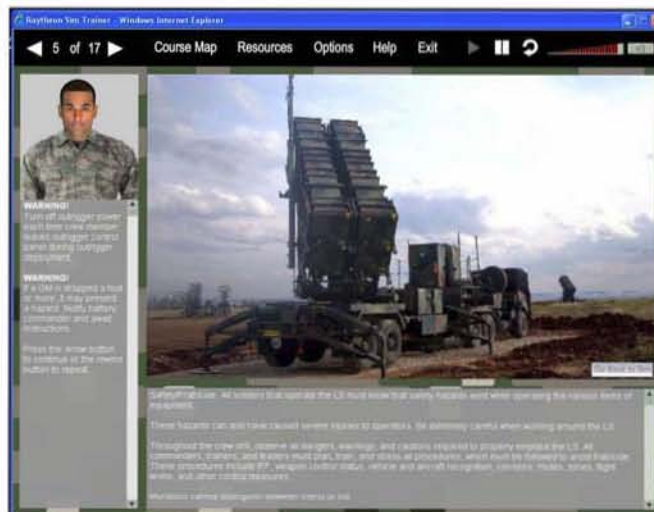


Two Man Crew Drill Prototype

Data Points:

- 75% soldiers completed Sim "mission".
 - 75% soldiers were able to complete the Sim mission on their 3rd attempt.
 - 25% soldiers completed training multiple times.
- 75% soldiers scored 75% or higher on the initial assessment.
- 100% soldiers showed improvements in time and assessment scores.

Basic IMI Screen



Interactive Game



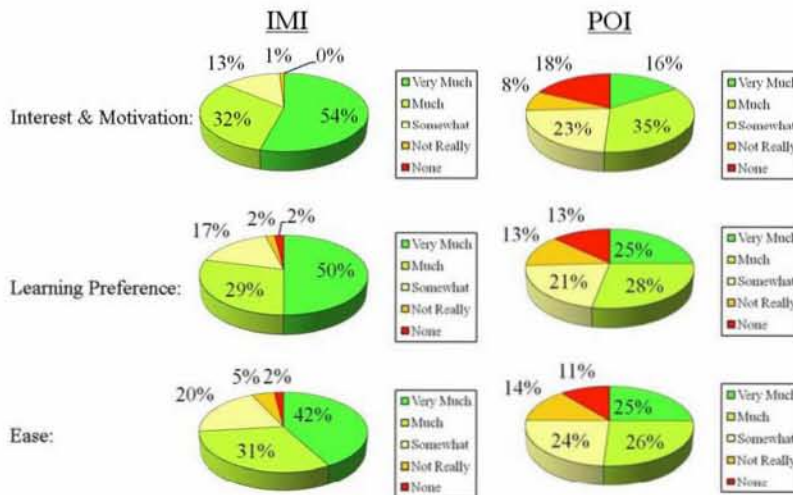
Incorrect Selection



Video Link-Back for Remediation



IMI vs POI Student Feedback



Expected Results

- Decrease the time to learn a crew drill by 50%
- Reduce instructor contact hours by 50%
- Improve training proficiency by 25%
- Decrease caution and safety violations by 25%
- Decrease equipment damage due to new operator fault by 30%
- Significantly increase interest and training motivation
- Significantly improve retention enabling certification at Soldier's first unit
- Decrease maintenance costs from inexperienced use of tactical equipment

Conclusion

- The more time you spend rehearsing, exploring options, and studying outcomes, the better you will become at a skill.
- Games & Blended IMI allows soldiers to continue learning and developing skills outside the classroom
- Increased engagement = higher retention levels + shorter time to subject mastery.
- Need to design for existing computer & handhelds to minimize adoption impact

Questions/Comments

