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THESIS

USING WEB-BASED INTERACTIVE MULTIMEDIA TO SUPPLEMENT TRADITIONAL TEACHING METHODS: A PILOT PROGRAM FOR MEDICAL TRAINING OF NON-MEDICAL PERSONNEL

by

Gregg W. Gellman

March 2005

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This thesis proposes that it is possible to create an adjunct to traditional instructor-led training that will reduce training time and costs and at the same time improve performance using commercial off-the-shelf (COTS) software. Motivated by the lessons learned following the attack on the USS Cole on October 12, 2000 in which 17 sailors were killed and 42 were wounded, we created a simulator using readily available software in minimal time with zero funding and tested it against small sample sizes of eventual recipients of the training. The simulator, as part of a blended learning solution, was shown to be as effective as traditional instructor-based learning but was conceived at a fraction of the cost and with a significant reduction in total training time. Both of these factors are increasingly being valued in today's reality of increased operational tempo and reduced resources.

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ABSTRACT

This thesis proposes that it is possible to create an adjunct to traditional instructor-led training that will reduce training time and costs and at the same time improve performance using commercial off-the-shelf (COTS) software. Motivated by the lessons learned following the attack on the USS Cole on October 12, 2000 in which 17 sailors were killed and 42 were wounded, we created a simulator using readily available software in minimal time with zero funding and tested it against small sample sizes of eventual recipients of the training. The simulator, as part of a blended learning solution, was shown to be as effective as traditional instructor-based learning but was conceived at a fraction of the cost and with a significant reduction in total training time. Both of these factors are increasingly being valued in today's reality of increased operational tempo and reduced resources.

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EXECUTIVE SUMMARY

> After the 12 October 2000 attack on the USS Cole (DDG-67), in which 17 sailors were killed and 42 were wounded, the U.S. Navy received a costly education in medical readiness. We must ensure these lessons are heard and acted on for the sake of all those who go in harm's way. (Hayashi 2002)

This passage is taken from the July 2002 *Proceedings* article titled "Attack on the Cole: Medical Lessons Learned," which recommended requiring every sailor and officer not already extensively trained in first aid to undergo a full day of first-aid training, with emphasis on the "Gitmo Eight". The "Gitmo Eight" (treating Extremity fractures, Abdominal evisceration, Electrical shock, Amputation, Smoke inhalation, Sucking chest wound, Jaw fracture, and Burns) takes its name from medical treatment drills evaluated when refresher training was conducted for Atlantic Fleet ships at Guantanamo Bay, Cuba. The *Proceedings* article recommends requiring the training, but the training is already required of every shipboard sailor (COMNAVSURFLANT 6000). Training to address these injuries also is required of all Soldiers and Marines.

After the explosion on the Cole ripped a 20-foot-by-40-foot hole in her port side, crewmembers immediately administered self and buddy-aid to one another as the crew's three medical personnel, including one striker, were overwhelmed by the large number of casualties. The incident response system worked as it was intended, as the Gitmo Eight training ensures that every sailor can handle the basic medical emergencies. Sailors provided immediate care until their injured shipmates could be seen by medical personnel or even the ship's stretcher-bearers. Stretcher-bearers, also non-medical personnel, receive additional training to handle the treatment and transport of casualties in certain events and complement ship's medical crew in emergencies.

While 17 sailors perished in the Cole attack, it could have been worse. Had these topics not been mandated as annual training on every deployable platform, the Cole's personal toll might have been considerably greater. Crewmembers agree that the quick actions taken by ordinary sailors helped to save most of the lives of the 42 who were injured. The quick actions were a direct result of the important skills the crewmembers had learned when they reported aboard and kept current through annual training. While all of the injured did not have classic "Gitmo 8" wounds, the skills learned within the modules encompass the basic first aid skills needed to treat a range of commonly seen injuries such as the control of bleeding, basic bandaging and splinting of limbs.

Information gleaned from unclassified sources and such as award submissions from Iraq and the attack on the Cole show that the medical training that our soldiers and sailors received is effective. A majority of the training currently received is via instructor-led training (ILT) and remains this way due to the fact that ships and deployable forces do not have sufficient resources to provide each member a true 100% e-learning experience that the Navy is pushing through Navy Knowledge Online (NKO).

ILT, especially with competent and engaging instructors, is an optimal experience, and it is not the intention of this thesis to completely replace this kind of training. However, ILT for the mandatory medical topics requires that the entire crew submit to the minimum 8 hours of instruction per year and with the busy operational tempo that today's units face medical training is often given low priority in the ship's schedule. This is where a "blended learning" strategy can be introduced to great benefit. A blended learning solution is one where traditional ILT is combined with a technology-based solution such as a simulator or computerized testing.

This thesis proposes an adjunct solution to supplement current training methods with the use of existing COTS software. The presumed benefits of this solution are reduced costs realized in crew and trainer time and improved

accountability for personal training completion. This adjunct solution can not only supplement the way in which information is distributed and improve the matter in which feedback is collected and processed as well.

A product that would meet the immediate needs of the force and enable quick and cost-effective growth at the same time was researched with the requirement that the system had to be compatible with the current networks that exist on surface ships, submarines, shore commands and for the troops deployed without an IT network to attach to. Also considered was a program that could be taken home by service members, providing active duty personnel 24-hour access and increasing the scope to reservists who may not have continuous access to military computer assets.

Macromedia Flash, as an accepted and installed part of the Navy and Marine Corps Intranet, was chosen as the software and "Sucking Chest Wound" as the sample lesson to be used for this adjunct training. "Sucking Chest Wound" (SCW) was chosen from the eight as the instruction of choice because it had a fair amount of material to convey and is somewhat complex. Treatment of this type of wound requires a fair number of steps, but the ordered presentation was a comfortable match to the presentation method. The construction of a blended learning system for the pilot program began with a review of the fundamentals of adult learning.

Instructional System Design (ISD), a process for developing instruction, recognizes three integral factors: learner, instructor and materials. A simple and well-respected model for developing training, ADDIE (Kruse and Driscoll), was chosen for this thesis and addresses the three factors mentioned. ADDIE (Analyze, Design, Develop, Implement, and Evaluate) is a simple model for developing any kind of training. When standardizing training across multiple services, a straightforward approach is preferable and ADDIE helps all those involved in the design process to share a common vision, understand all the phases and the level of detail can be altered to match the size and complexity of the task and the experience of the team.

This thesis examines the technical background behind learning theory and instructional methods. A comparison of current COTS software used in medical training and the presentation of information is discussed in the context of evaluation for use in a medical simulation. The design process of a learning system is reviewed and a general description of the steps necessary to build the proof-of-concept is presented. The proof-of-concept is designed in relation to the features required to conduct the training and compared to the existing software solutions providing similar training. Lastly, a discussion of what this simulator offers to the military in general and as a part of a new blended learning process is presented and supported in part by simple testing results. The final conclusions and recommendations lead to possible follow-on projects in the growing realm of web-based instructional media and blended learning solutions.

I. OVERVIEW

A. THESIS STATEMENT

This thesis proposes that it is possible to create an adjunct to traditional instructor-led training that will reduce training time and costs and at the same time improve performance using commercial off-the-shelf (COTS) software.

B. MOTIVATION

> After the 12 October 2000 attack on the USS Cole (DDG-67), in which 17 sailors were killed and 42 were wounded, the U.S. Navy received a costly education in medical readiness. We must ensure these lessons are heard and acted on for the sake of all those who go in harm's way. (Hayashi 2002)

So begins the article from the July 2002 *Proceedings* titled "Attack on the Cole: Medical Lessons Learned." In the article the first recommendation made is to require every sailor and officer not already extensively trained in first aid to undergo a full day of first-aid training, with emphasis on the "Gitmo Eight".

1. The "Gitmo Eight"

The "Gitmo Eight" (treating Extremity fractures, Abdominal evisceration, Electrical shock, Amputation, Smoke inhalation, Sucking chest wound, Jaw fracture, and Burns) takes its name from medical treatment drills evaluated when refresher training was conducted for Atlantic Fleet ships at Guantanamo Bay, Cuba. In 1995, the training became regional but the drills still are referred to as Gitmo wounds. The *Proceedings* article recommends requiring the training, but the training is already required of every shipboard sailor (COMNAVSURFLANT 6000). Training to address these injuries also is required of all Soldiers and Marines.

2. Training in Action

After the explosion on the Cole ripped a 20-foot-by-40-foot hole in her port side, crewmembers immediately began to administer self and buddy-aid to one

another as the crew's three medical personnel, including one striker, were too busy to handle the large number of casualties. However, this is the way the incident response system is intended to work. The Gitmo Eight ensure that every sailor can handle the basic emergencies that are commonly encountered and provide immediate care until that injured shipmate can be taken to medical personnel by the ship's stretcher-bearers. The stretcher-bearers are also non-medical personnel who receive additional training to handle the treatment and transport of casualties in certain events.

These topics are mandated as annual training on every deployable platform. The Cole's command policy had mandated a full day of first-aid training during indoctrination for each new crewmember. The rate of turnover for this and most ships was one-third of its crew per year.

3. Results

While 17 sailors perished in the Cole attack, it could have been worse. Crewmembers agree that the quick actions taken by ordinary sailors helped to save most of the lives of the 42 who were injured as ship's medical staff were overwhelmed almost immediately. The quick actions were a direct result of the important skills the crewmembers had learned when they reported aboard and kept current through annual training. While all of the injured did not have classic "Gitmo 8" wounds, the skills learned within the modules encompass the basic first aid skills necessary to treat a range of injuries such as controlling bleeding, bandaging and splinting.

C. APPROACH

The Cole attack and information gleaned from unclassified sources such as award submissions from Iraq show that the medical training that our soldiers and sailors received is effective. During my time with the fleet, the majority of training received was via instructor-led training (ILT) and remains this way. This is way it has always been done, and due to the fact that ships and deployable forces do not have sufficient resources to provide each member with a computer

terminal, nor the bandwidth necessary to stream content from a central server and it would be operational infeasible to provide these services to have a true 100% e-learning experience that the Navy is pushing. ILT, especially with competent and engaging instructors, is an optimal experience. It is not my intention to completely replace this kind of training.

Instructor-led training for the mandatory medical topics requires that the entire crew submit to the minimum 8 hours of instruction per year. All too often this is the only time that this type of training takes place and there is no method in place for refreshing or supplementing that knowledge if one desired. With the busy operational tempo that today's units face, it would be difficult to increase the amount of time crewmembers spend in training. In some cases the minimum time requirement has been actually shortened as medical training is often given low priority in the ship's schedule. This is where a "blended learning" strategy can be introduced. A blended learning solution is one where traditional ILT is combined with a technology-based solution such as a simulator or computerized testing.

My goal is to create an adjunct solution to supplement current training methods with the use of existing COTS software. The presumed benefits of this solution are reduced costs realized in crew and trainer time and improved accountability for personal training completion.

Currently the Navy tracks completion on paper or computer rosters, but doesn't gather performance data or any metrics describing problems in the training. An adjunct solution can both supplement the way in which information is distributed and improve the matter in which feedback is collected and processed.

In deciding which software package to use, I looked for a product that would meet the immediate needs of the force and enable quick and cost-effective growth at the same time. In other words, I intended to add new material without reinventing the entire program. Also, the system had to be compatible with the current networks that exist on surface ships, submarines, shore commands and for the troops deployed without an IT network to attach to. Lastly, I looked at a

program that could be taken home by service members, providing active duty personnel 24-hour access and increasing the scope to reservists who may not have continuous access to military computer assets.

Based on these considerations, I chose to use Macromedia Flash as the software and "Sucking Chest Wound" as the lesson to be used for adjunct training. Flash allows for parts of the simulation to be inserted or deleted dynamically (See Chapter V.) It also has cross-platform abilities, so both Apple and PC users can take the material home or on the road. Furthermore, Flash does not require massive amounts of processor speed or a graphics card.

"Sucking Chest Wound" (SCW) was chosen from the eight as the instruction of choice because it had a fair amount of material to convey and is somewhat complex. Treatment of this type of wound requires a fair number of steps, but the ordered presentation was a comfortable match to the presentation method. In terms of difficulty of treatment required, number of steps to follow, and extent of equipment usage, SCW was in the middle of the eight wounds.

D. THESIS ORGANIZATION

Chapter II provides the technical background upon which this thesis is proposed. Chapter III then provides an in-depth analysis of current COTS software concerning medical training software and presentation software to be used for the proof-of-concept discussed in the next chapters. In Chapter IV a view into the design process is presented as a general description of steps necessary to build the proof-of-concept. Chapter V describes the features required and compares the existing software solutions providing similar training. Finally, Chapter VI provides a discussion of what I think this simulator offers to the military in general and as a part of a new blended learning process. It also gives simple testing results, final conclusions, recommendations, and possible follow-on projects.

II. BACKGROUND

A. GUIDELINES TO ADULT LEARNING

Building a blended learning system for the pilot program must begin with a review of the fundamentals of adult learning. Since the target audience (Navy ship crewmembers) is known, we can concentrate on specific criteria and research from the beginning. The following criteria are detailed in most literature, but are best explained in *Web Based Training, 2nd Edition* by Margaret Driscoll and are summarized in this section.

1. Uniqueness of Adult Learners

Adult learners differ from younger learners because they have already gathered vast life and work experiences. As a result adult learners have different motivators, mostly based on responses to problems and changes. Many authors agree that there are certain characteristics of adult learners. They:

- Have real-life experiences.
- Prefer problem-centered learning.
- Are continuous learners.
- Have varied learning styles.
- Have responsibilities beyond the training situation.
- Expect learning to be meaningful.
- Prefer to manage their own learning.

2. Adults Need Structure

An effective program should provide enough structure to limit learner control to a certain extent. Learners must be free to start and stop the media as they wish, return to certain spots (bookmark), replay complex audio or video segments, and review previous material. Advanced learners must also be given

the opportunity to study lessons in an order of their choosing and eliminate practice and assessment segments.

3. Meaningful Feedback Improves Performance

Feedback is used to develop the learner's ability, helping him or her to eventually correct errors without prompts. Clever animation, constructive prompts, and encouraging audio can all be used to get the positive feedback to the learner. Good feedback can turn wrong answers into educational experiences without giving the right answer outright, and feedback on right answers can be extended and expanded.

4. Assessments Test What Has Been Taught

All too often we teach the steps for getting to the goal without stressing the "why" that binds the steps together. What ends up getting taught is a script. The tests should determine whether the stated objectives have been met, not whether students can follow directions.

5. Mastery Through Adequate Practice

"Practice makes perfect." There must be adequate practice for students to provide fluency and master content. Determining the proper ratio of exercises to text will require formative evaluations to determine what level of practice is going to need to be delivered.

6. Actively Engage the Learner

Learners need to get more than just correct or incorrect responses. Also, there is no formula for how much interactivity there needs to be to accomplish the task and engage the learner. The proper degree of interaction needs to be continuously updated throughout the alpha phase of evaluation. Along with this evaluation and while the program is still in its formative stage, other factors also

need to be manipulated to increase engagement. These include the level of difficulty and the number of practices.

7. Use Multimedia Meaningfully

Just because our computing power allows us to stream DVD quality movies does not mean that we need to use that in every lesson. Choosing the correct media at the correct time can be a difficult task. The choice should be driven by the performance and content stated in the objectives and we should avoid choosing the latest and greatest technologies just because it is available. Many recipients of the training may not be able to take advantage of the most modern technology due to outdated equipment, limited bandwidth and network security restrictions.

8. Create a Safe and Respectful Environment

Learners want to have an environment where they feel valued as individuals. They need to feel comfortable to participate. This includes areas that we may not consider at first, such as online forums, exercises and feedback loops.

9. Nurture Self-Directed Learning

Helping learners to develop and apply skills for managing and assessing their own learning will encourage them to assume responsibility for continuing their education.

B. FRUSTRATIONS FACING ADULT LEARNERS

1. Technical Problems

Training programs that are available 24 hours a day need to function 24 hours a day. Even during working hours it is frustrating to have to make a series of phone calls to resolve hardware and software issues.

2. Inadequate Feedback

In traditional classrooms, students can use the performance of others and the nonverbal gestures and facial instructions of the instructor to gauge their own performances. This immediate feedback is not always available in computer-based learning. Examples of this feedback being delayed or missing include instructors not responding to emails promptly or at all and/or ignoring chat rooms.

3. Overwhelming E-Mail and Threaded Discussions

At the opposite end of the spectrum, students can be flooded with email including changes, updates, discussions that take irrelevant off-topic turns, or topics that are too lengthy. Frustration may set in when the student feels overwhelmed and fails to keep up.

4. Lack of Navigation Skills and Metacognitive Skills

Learners may feel frustrated if they don't have access to the mental models and cognitive skills assumed by the developers. Some of the most common problems are confusion over use of search engines, a lack of ability to follow hyperlinks, and the inability to navigate pop-up windows.

5. Ambiguous Instructions

Without visual clues, the learner is often unable to understand the directions and may require additional clarifications. This need is further confounded by a lack of immediate feedback from the instructor.

6. Domination by One Group of Learner

Just like real life, computer learning can have a good or bad sense of community. Frustration comes when one group or person dominates the forum.

7. Physical Fatigue

Lessons should be presented in small units to avoid fatigue from long hours in front of the computer. Eyestrain, back and neck fatigue, and physical tiring can result from reading long documents online or from sitting for extended periods.

C. INSTRUCTIONAL SYSTEM DESIGN

Instructional System Design (ISD) is a process for developing instruction (Driscoll, 2002). This approach recognizes three integral factors: learner, instructor and materials. There are plenty of existing models out there and each one provides step-by-step processes for developing training. Unfortunately many of these models are too complex to implement with developers who lack prior training and development background. A simple and well-respected model, ADDIE (Kruse and Driscoll), was chosen for this thesis.

D. ADDIE

ADDIE stands for Analyze, Design, Develop, Implement, and Evaluate and is a simple model for developing any kind of training (Driscoll 2002). When standardizing training across multiple services, a straightforward approach is preferable. ADDIE also helps all those involved in the design process to share a common vision and understand that all the phases.

Each phase of ADDIE is divided into subtasks. As a generic model, ADDIE can be shaped to conform to the material you wish to present. Also, the level of detail can be altered to match the size and complexity of the task and the experience of the team.

1. Analyze

Initially there are three areas that need to be analyzed: audience, task, and the environment. These three analyses can be conducted in parallel. The audience portion looks at what members of the target audience already know

and need to know, and their abilities to work with the system being discussed. The task is defined by the skill or knowledge to be taught and the conditions under which it should be taught. Lastly, the environment deals with the actual physical limitations of the system on which the training will be deployed. This last part is especially challenging since the plan is to be able not only to deploy this program on military networks, but also to run it on individual laptops and home computers.

2. Design

Design is primarily the paper-and-pencil step. Here, the subtasks consist of specifying objectives, determining prerequisite skills, and creating a detailed outline of the presentation, practice and assessment activities.

3. Develop

In this phase, the information presentation, practice, and assessment blueprints are created. This step can either rely on paper copies or begin to be programmed into the computer. At this point development occurs with the use of slides, audio and graphics to be implemented and combined into the final presentation.

4. Implement and Evaluate

While shown in the ADDIE model as two distinct steps, Implement and Evaluate are actually an intertwined, and quite often complex, process during which evaluation occurs as a continuous process. Each step should determine whether the analysis is still accurate, the design is appropriate, and the development is consistent with the program's goals and objectives. (Driscoll 2002)

During this phase, particular attention is paid to the implementation of the pilot program and how it is evaluated against real learners. Only after corrections

are made to a satisfactory level can the program be implemented to the entire organization. More discussion of the final process will follow in later chapters.

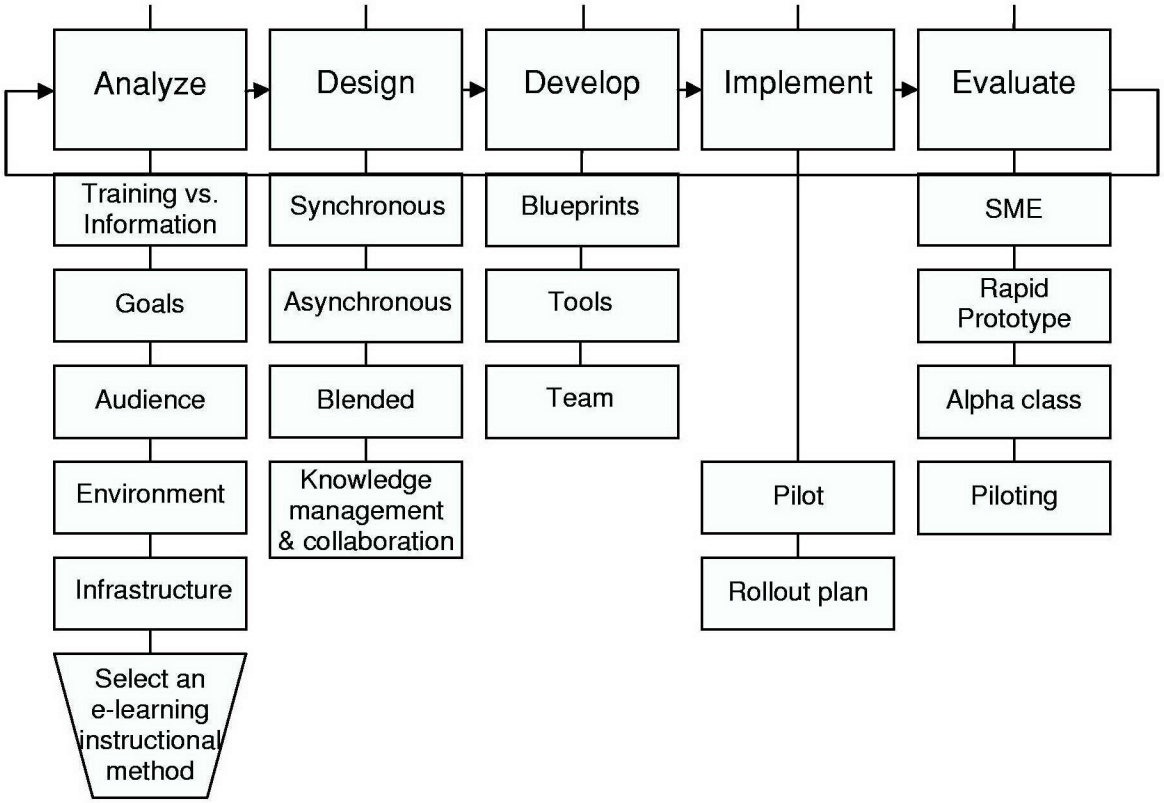


Figure 1. The ADDIE Model (Driscoll 2002)

E. SUCKING CHEST WOUND

"Sucking Chest Wound," or "Open Chest Wound," is a condition that exists when some traumatic action introduces a hole into the thoracic cavity. This hole allows air to enter into the chest and fill the normally vacant space between the chest wall and the lungs. The inrushing air then compresses the lung and does not allow it to expand properly. As a result, breathing becomes increasingly difficult and will eventually stop due to the lungs' inability to expand

Rapid intervention is required in such an emergency, and more often than not, the first person to respond to the scene will be a non-medical person. To use

examples from the fleet, consider two scenarios: an explosion on an Amphibious Assault Ship (LHD) and an engagement with a Marine Unit.

On an LHD, there are approximately 1,200 crewmembers. Of those, there are 16 corpsmen and 2 physicians located in the medical department. In the event of an emergency, medical personnel respond and can be anywhere on the ship in less than two minutes. This approach works as long as the emergency is an isolated incident or the scene is safe for medical personnel to respond. However, according to procedure, medical personnel do not leave Battle Dressing Stations during General Quarters or Mass Casualty Incidents, so Medical Resources can be accounted for and centralized. This situation leaves non-medically trained shipmates to care for one another.

On the battlefield there are three squads in a platoon. A squad is then usually comprised of 11 Marines and one corpsman. If a Marine is shot, the closest man to him might not be the corpsman. Instead, the victim may be pinned down in a remote location inaccessible to a corpsman, and it is up to the victim's buddy to save his life.

In both of these situations, it is crucial that a buddy or shipmate be trained in basic first aid skills so that immediate action can be taken until proper medical care is available. There is no argument that the basic skills are an important part of the annual training requirement. However, the information should also be available for review throughout the year in a format that is friendly and engaging. Here is where a simulator can assist in making information available and user-friendly.

One of the advantages to reforming an already existent training regimen is that the initial work has already been done and standardized across the services.

The material used was excerpted from the Army Combat Lifesaver Program (CLP), which mirrors the Navy's program. The teaching content of the CLP was taken verbatim and placed directly into the simulator text boxes, and the quiz uses the exact questions asked in the CLP. Furthermore, the skills testing portion was evaluated against the Army's Go/No Go criteria. The same

criteria exist in the Navy Shipboard training, but to keep a standard document for all testing levels I used the Army document.

F. DOMAINS OF LEARNING

Rarely does an instructional goal relate only to one type of learning. Most skills, such as reassembling a piece of equipment, require two or more domains. While this example requires mostly psychomotor skills, there is also a cognitive aspect in knowing where things go and why. Developing the best delivery method requires knowledge of the available learning domains.

1. Psychomotor Domain in Learning

Not necessarily best suited for computer simulation training, psychomotor skills require repeated practice and feedback for mastery. Psychomotor skills used for placing a bandage, for example, require face-to-face tutorial sessions that provide opportunities for practice, coaching, and feedback.

2. Cognitive Domain in Learning

Cognitive instruction is best suited for computer-based training because it communicates to learners via language, text, numbers and symbols. Learning in the cognitive domain includes such intellectual skills as memorizing terms and concepts, problem solving, applying rules, distinguishing among items, analyzing data, and evaluating information.

3. Attitudinal Domain in Learning

The teaching of new attitudes builds on what learners already know, both directly and indirectly. Without direct methods such as face-to-face mentoring this domain is also not well-suited for computer-based learning as its sole source. Direct methods such as praise, rewards, and recognition and indirect methods such as role modeling and leading by example are needed and require a combination of teaching methods.

4. Can You Teach an Old Dog Psychomotor Skills?

Can you teach psychomotor skills by way of a computer? Judging by the countless books that teach you to improve your golf swing, tennis serves, and even cooking, there seems to be some belief that text-based technology can impart psychomotor skills (Jentsch & Bowers, 1998). Unfortunately there is little research available to support such claims of efficacy in teaching psychomotor skills.

There are methods such as Merritt's Component Display Theory (1994) that prescribe optimal methods for fast, effective, and efficient skills and knowledge transfer. The motivation for using optimal methods is straightforward. Effective methods remove unnecessary obstacles and reduce learner frustration. Therefore, these methods should be faster and yield greater skills transfer. (Driscoll 2002)

G. INSTRUCTOR-LED TRAINING

This incorporates the traditional method of instruction: teacher-led. There will always be a place for instructor-led training as centuries of human history show the power of people coming together to learn. Instructor-led training is effective because:

- The enthusiasm of the facilitator for the content is contagious and encourages learning.
- People prefer to learn in a social situation.
- There is accountability in a classroom that is missing in e-learning.
- Learning occurs casually and indirectly when individuals interact.
- Instructor-led sessions remove people from their daily work responsibilities so participants can focus on learning. There is no such protection when using e-learning methods.

- The questions and comments of class members help raise and address important issues, and make it comfortable for others to talk.
- The pattern of learning in a group environment is established in almost everyone's school experience and connects with our past learning.
- The facilitator speeds the process of knowledge acquisition.
- Classroom experiences provide opportunities for learners to practice and rehearse skills and to receive feedback from others.

H. E-LEARNING

E-learning Internet has been described as,

> ...a field of using technology to deliver learning and training programs. Typically used to describe media such as CD-ROM, Internet, Intranet, wireless and mobile learning.... Took a while for the right term to come about, circa 1995 it was all called "Internet based Training", then "Web-based Training" (to clarify that delivery could be on the Inter- or Intra-net), then "Online Learning" and finally e-learning, adopting the in vogue use of "e-" during the dot com boom. The "e-" breakthrough enabled the industry to raise hundreds of millions from venture capitalists who would invest in any industry that started with this magic letter. (http://e-learningguru.com/gloss.htm)

E-learning is heralded by some as an invention with greater impact than Gutenberg's printing press, while others dismiss it as a passing fad. The Department of Defense has also financed large amounts on Web-based training and little to show from it. Vast repositories of training topics exist on NETg and SkillSoft, but for the most part these are unknown to the service members. SkillSoft and NETg are subscription services that the Department of Defense subscribes to, offering free courses in many subjects including computer languages and programs, foreign languages and management lessons. In discussions with various officers and enlisted personnel that I have taught in

several subjects, I asked them how often they took any classes on Navy Knowledge Online (http://wwwa.nko.navy.mil), the Navy's online training site, that they were not mandated to take. Just about all stated they did not even know that the classes existed. I personally learned about the classes from reading message traffic, but most sailors and soldiers do not have access to daily message traffic and it seems leadership does not adequately pass on the information. This is a purely informal survey, but I was unable to obtain specific costs and user statistics for either program for this thesis.

The advantages of e-learning include:

- Huge cost savings can result from cutting travel expenses of both trainer and trainee and time away from job.
- Efficiency comes from ability of designers to remove all extraneous information and activity from the learning process.
- Many people learn more efficiently using technology.
- Investments in instructional design result in highly efficient programs.
- The use of varied learning methods results in highly engaging programs.
- Huge cost savings come from people not needing to leave their work, travel long distances, stay in hotels, and eat out.
- People progress at a unique pace and doesn't hold back others or become bored by a slower pace. Learners can repeat parts of a program that aren't clear to them.
- People can complete learning at times that work best for their schedules.
- Many people learn more efficiently on their own rather than in groups.

- In some content areas, results comparable to those of instructor-led training have been achieved in 40 – 60 percent less time.
- E-learning seems especially appropriate for transfer of information and cognitive understanding.
- Complex performance skills can also be learned efficiently with technology-enhanced learning such as flight simulators.

(Taylor 2002) (Galagan, 2001) (Horton 2000)

Skeptics argue that nothing can change as fast as the explosive growth predictions for e-learning suggest; the way people learn simply will not undergo such a rapid upheaval. Customized e-learning is limited to date and consists of what may be described as "learner tracking." That involves creating a syllabus and guiding learners in a way that reflects their base knowledge and rate of progress. Some of these e-learning systems use inference engines -- intelligent agents that record learner activity and use that information to provide future signposts.

I. SIMULATORS

Simulators try to replicate essential characteristics of the real world that are necessary to produce learning and transfer. A variety of simulators have been designed for specific training purposes, including skills development, decision-making, and problem solving. Simulators have several elements that set them apart from e-learning:

- Built-in extraordinary realism
- Highly interactive experience
- Opportunity for learners to make safe mistakes and get immediate feedback
- The capability of learners to achieve unconscious competence by repeated practice

1. Reasons for Using Training Simulators

An early study by Salvendy and Pilitis (1980) investigated simulator use in teaching medical students suturing techniques needed in surgical procedures. The traditional method consisted of a lecture-slide presentation and videotape describing the technique. Included in the instructions were the materials related to the general geometry of the suture path, descriptions of the instruments and their functions and general guidelines. The student used these instructions while practicing on pig's feet until the instructor determined that the student was performing the task appropriately.

The simulator created as an alternative to this procedure was called the "Inwound procedure simulator." The simulator consists of simulated tissue mounted on a mannequin arm and wired to monitor entry and exit points and wound path geometry, or exact path a bullet takes, against actions from an electrically activated needle holder. A feedback console consisting of 11 sets of amber and red lights gives visual and auditory cues that correspond to correct and incorrect motions. The number of errors, the time in the wound, and the number of cycles performed for each of the procedure phases are recorded individually on the monitoring console.

The research found that simulator training improved the performance of the medical students beyond the traditional training methods. Additionally, psycho-physiological measures of stress such as heart-rate variance and muscle tension were collected from the medical students. The data confirmed that students trained by simulation showed less stress when they were required to perform new suturing tasks.

The use of simulators for training technical skills has increased in the two decades since that study. Four specific reasons for this increase include the potential for controlled reproducibility of the work environment, safety considerations, learning considerations, and cost-effectiveness (Goldstein 2002).

2. Fidelity Issues

The benefit of work simulators is a function of the physical and psychological fidelity that designers attempt to incorporate in the simulation (Goldstein 2002). However, simulators that strive for full immersion are costly and can be quite large and demanding on resources. For this reason many simulators are part simulations which replicate a critical or difficult portion of the task without attempting to provide the complete experience or the entire scope of the job.

Regardless of the level of physical fidelity and cost, most researchers maintain that simulation efforts must have psychological fidelity as their chief objective in order to maximize the benefits of simulator training. Designing for psychological fidelity requires that the training task provide the trainee the opportunity to reproduce the behavioral processes that are necessary to perform the job. This means that instructional features must be incorporated into the training simulation that helps the trainees successfully meet the learning objectives for the course (Goldstein 2002).

A study by Jentsch and Bowers (1998) provided a summary of studies done on lower-fidelity flight simulators that shared more characteristics with video games than with actual work tasks. Their review of ten years of research found that participants rated the content validity quite high and agree that behaviors elicited by the scenarios in the simulations are important for on-the-job performance and training.

More studies need to be done to study the trade-off of physical fidelity, cost, and psychological fidelity later in training. While the task studied in this thesis does not require the fidelity of a flight simulator, the fidelity issues must be considered.

3. Simulator Design to Facilitate Training Transfer

Simulators exist solely for the purpose of facilitating training transfer and individuals use the simulator so they will perform better in a real-life situation. At

this time, however, few studies have been done to look at the connection between transfer of training and simulators.

J. BLENDED LEARNING

The above methodologies can coexist and even overlap. Characteristics of a blended solution include a completely integrated instructional design with consistent framework and nomenclature. This approach offers maximum flexibility and variety. It ensures that each method delivers its best, for example:

- E-learning delivers content and handles the learning management processes, process assessments, and feedback tools. It also delivers content and robust simulations that come from over the Web.
- Instructor-led sessions are used for content that requires touching people's emotions, practice and rehearsal, discussion of the challenges participants will face implementing what they've learned back on-the-job, and feedback among participants.

Organizations will encounter several challenges in incorporating blended learning solutions. One is that vendors tend to have internal competence in either instructor-led training or e-learning, but seldom both. Another hurdle is the huge front-end costs and moderately high delivery costs for the instructor-led parts. The up-front cost demands a large population of learner-supervisors, middle managers, sales staff, or customer service representatives to justify the investment.

When using a blended learning solution the content selected for delivery must be widely applicable, in contrast to highly specialized content related to a small aspect of one job. One focus is on reusable Web-based training modules, which can be purchased from any source or generated within an organization. The second focus in on synchronous, real-time lessons delivered by subject matter experts using visual and audio links that give learners the opportunity to ask questions via audio or email messaging.

The use of blended learning suggests that e-learning is most effective when it is a part of a considered strategy involving all aspects of learning, including classroom and on-the-job. Technology should be a means to an end, not an end in itself. Success will be achieved when the people desiring to present the learning material concentrate on the learners and do not get seduced by technology.

K. DIRECTION

After combing through the literature for the optimum approach, I looked for computer-based learning solutions that approximated those approaches. I looked at medical applications in the entertainment and gaming industry as well as some highly respected educational institutions and the military itself. I did not limit my search for medical training, but rather looked at applications that might have a medical component (such as the use of medical personnel as a character) and that could be converted into a learning environment.

There is a lot of material available at every level of complexity and fidelity. Originally the plan was to have a military contractor produce a simulator in a 3D environment using the Unreal Tournament engine. For reasons of time and money, the simulator was produced using COTS software that would require some learning but not a huge investment in programming time. After evaluating the options outlined in Chapter III, I chose Macromedia's Flash MX for the simulator design; this is also the basis for the existing "Sucking Chest Wound" training program.

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III. CURRENT TECHNOLOGY

A. INTRODUCTION

The purpose of this chapter is to evaluate the various software and some solutions that are available for use in the simulator. While the entire project could be written from the ground up, it would defeat one of the largest reasons for producing a blended learning environment. That reason is the return-on-investment (ROI). By repurposing an existing technology, one can avoid a great deal of up-front costs necessary to find a new solution. Using already successful software packages and then altering them to fit the needs of the topic make sense when resources are limited.

Another cost issue is the price of failure. If a project does not fulfill its goals it can easily be reconfigured quickly and cheaply for a better fit. Furthermore, if such a project is a complete failure, then the cost of failure will be low. When looking for a new system, it would be better to try out 10 systems each costing $100,000 and have at least one succeed than to put all efforts into one-million dollar failure.

B. SELECTION CRITERIA

The criteria that I chose primarily concern cost, ease of use, scalability, and accessibility. Traditionally it has been assumed that whatever the choice of software used, there will be a team to produce the product. The three-person minimum team is comprised of a team leader, artist, and programmer. While I believe this to be an optimal team size, it is not the minimum. A successful simulator can be designed with one person in a relatively short amount of time. This is adequate for a pilot test, but more work would be needed for a truly fleet-ready application.

I tried to look at software specifically aimed at providing emergency medical care. The simulator's target audience is not intended to be trained medical personnel, so I looked for applications that were visually appealing but

not overly complex when it comes to medical procedures and knowledge. As a medical provider and instructor, I was confident that I could properly evaluate the software for its medical accuracy as well as the interface that it interacts with the user.

1. Cost

In terms of selection criteria I looked at the direct cost of the software. This included the initial price paid, plus any licensing fees that may apply.

2. Ease of Use

Ease of use was determined by looking at the software's interface: what was required to initiate an action and follow the direction of the story/mission for game software. Since there was also the possibility that the software might have to be built from scratch, presentation software was evaluated. In the design software, however, it was the interface for entering and manipulating data that was evaluated.

3. Scalability

Scalability is specifically a measure of how the program can be changed from its initial state into what we need, or how easy it will be to improve our model once we find areas for improvement. Also, scalability is the measure of the software program's ability to allow items to be added in the future to incorporate more features.

4. Accessibility / System Requirements

Since one of the main ideas of this investigation was to make the simulator run across the different platforms in the fleet and in individual service members' homes, the desire was to minimize this requirement. It had to be engaging and make use of multimedia but not drain the computer's main and graphical processor.

C. COMMERCIALLY AVAILABLE MEDICAL SOFTWARE

The first category investigated for possible use as a simulator covers programs that already have medical aspects to them or are strictly produced as medical simulations.

1. "911 Paramedic"

"911 Paramedic" is a commercial release that chronicles the player's ascension from brand new Emergency Medical Technician to the level of Senior Paramedic. This product, produced by Legacy Interactive, is designed with Macromedia components and uses video clips superimposed over static backgrounds. The game follows the player from one patient scenario, or call, to the next, and the player is scored on their performance and efficiency in treating the patient.

The screen is divided into sections detailing equipment, the patient, and a personal data assistant (PDA) where treatments and patient information are listed and stored, as well as a place where hints are given. Through the PDA the participant asks questions and switches between different medical bags. When finished treating the patient, the user enters treatment information onto the patient report and then electronically signs the report to end the case.



Figure 2. "911 Paramedic" screenshot of cut scene. (http://www.legacyinteractive.com)

a. Pros

The game offers continual feedback from a virtual partner and constructive criticism from the supervisor after the call. Users also get feedback from the physician at the hospital when they succeed. The tool graphics are large and not confusing and the patient's injuries are designed to look realistic.

As a multimedia patient simulator, this program is quite well constructed and does hold one's attention between scenarios with cut scenes of station life and interactions with virtual co-workers. Also, each scene is blended together to create a "career" in EMS and altogether it creates overall continuity among the individual elements.

b. Cons

One problem with this program is its lack of teaching. The participant can ask for hints, but those provided are very basic, suggesting, for example, "Use glove on head" -- offering the next action but not giving any specific reason for the activity.

Actions performed on the patient require the user to click on the appropriate area. This requirement is often made complicated by poor mapping on the body, and body parts obstructing other parts.

The functionality of the game suggests that people playing this game would already be medically trained. In real life, all medical personnel are taught to conduct full physical exams from head-to-toe and document findings from there. This simulator allows the user to only treat the particular injury. This approach works when teaching one specific skill. However, when instructing students how to treat a patient with unknown injuries, it is illogical to penalize the student who looks for injuries and treats aggressively in "gray areas, as the program insists.

2. "Combat Medic: Special Ops"

Legacy Interactive created "Combat Medic," trying to capitalize on recent military operations around the globe and to highlight those elite units that are now getting significant press coverage for their current accomplishments in the War on Terrorism. In this game, the user assumes the role of a Special Forces medic who enters a combat zone and evacuates fallen teammates while fighting enemies who try kill the other teammates and the user.



Figure 3. "Combat Medic": Special Ops screenshot (http://www.gamespot.com)

a. Pros

This program has an engaging storyline that immerses the player into the assumed character. Again, as with "911 Paramedic", superiors provide constructive and appropriate feedback after the missions, when the user may encounter several patients, and is expected to perform triage, returning some to fighting and sending others to hospital units. As in real combat situations, action continues while the user treats a patient and simulates the dangerous environment that is the backdrop for practicing learned skills. The game's

designers keep the fighting to a simple point and click engagement so as to keep this as primarily a medical program and not a glorified "shooter".

b. Cons

Although this game presents teaching as its main purpose, it actually does not provide instruction in medical skills or triage. Its training missions are nothing but short scenarios that lead the user through the actions without explanation or guidance on when to return patients to duty and when to evacuate them. The gear is extensive and includes advanced medications and tools, but aside from a brief description in the manual, there are no instructions on their use or the dangers in using certain items.

Lastly, the patients are animated 3-D models that create two problems. First, it is hard to locate the exact point of the body to conduct treatment, often causing errors in choosing a part and wasting of supplies. Second, the system requirements are too great. The 3-D animations require a graphics card with 8 MB of memory -- not enough to run the animations without slowing down the machine.

3. "Delta Force: Black Hawk Down"

"Delta Force: BHD" is a first-person "shooter" game that recreates downtown Mogadishu in the game version of the best-selling book *Black Hawk Down*. The medic character is only available in the multiplayer version of the game; a player can choose to be a medical character and to revive other characters that have been killed in action.



Figure 4. "Delta Force: Black Hawk Down" promotional screenshot (http://www.gamespot.com)

a. Pros

The game is very popular and pretty easy to play. A mainstream commercial product with high-value visuals, this game would motivate crew members to complete the program.

b. Cons

As a medical simulator, "Delta Force: BHD" has no merit. Rather than administer medical treatment to other players, the user just runs over them and revives them as if by magic. The game in its current version requires a high degree of processor power along with a capable graphics card, and will slow most laptops to a crawl.

Commonly, players use the medic character for honor points because this character progresses in levels by reviving multiple players. As a

result, users often traded the role with other players to help pad their scores. The company currently has no plans to add more medical functionality to this game.

4. "America's Army: Operations"

"America's Army: Operations" is a first-person shooter game sponsored by the U.S. Army for use as a recruiting tool to show the various jobs and missions in the Army, with an emphasis on Special Forces. The game is only playable in multiplayer arenas, but contains many training classes that the player must complete offline in order to be allowed to participate in the different missions and to play certain characters with specialized equipment.



Figure 5. "America's Army: Operations" screenshots. Classroom (left) shows instructor giving traditional slide-based lecture. Field training (right) includes triaging patients and treating them in order of severity. (http://www.americasarmy.com)

a. Pros

Finely-produced training sessions mimic training conducted by the U.S. Army in medical and other training. The medical training, while lengthy, has the player sit in a simulated classroom and listen to instructors give a lecture while he watches a slide presentation on the screen in front. The first instructor is engaging, informative, and conveys some emotion, a trait that is often missing from computer-generated characters.

The lectures are based on the actual Army lesson plans and are presented with interesting graphics and pictures of patients with simulated wounds. Between lectures the user can wander the halls of the classroom facility and interact, sometimes humorously, with the staff inhabiting the halls. The allowed exploration maintains and encourages player interest.

After completing the lectures, the user is required to take a multiple-choice exam. Passing the exam grants the medical field badge and the chance to play the game as a medic. All training is required for advancement in the game, so skipping the medical training is not an option, as is the reality with actual military training.

"America's Army: Operations" is one of the few games that actually contains a time component for implementing medical skills. When the user treats his teammates, he must take time to treat them rather than fight back. In this case, the user is left vulnerable. Any delay in treatment to take care of another activity, such as firing at an enemy, forces the user to restart the treatment timer. This technique demonstrates how the capacity of a combat medic is not simply a "Tag, you're it!" action, but rather a time-consuming process with risks.

b. Cons

While the program's training is compelling, lectures tend to be unnecessarily lengthy. There is no book-marking feature to save the user's progress in the middle. Thus, the user may have to repeat portions of a lecture. Ending the lecture early necessitates a repeat of the entire scene from the beginning.

The system requirements for this game may preclude the fleet adopting this program for use in training. Intended as a commercial release, this game takes advantage of the latest graphics technologies and is designed to run on high-end equipment. With the latest graphics cards, this game can run smoothly. However, only a small fraction of military systems can accommodate

this program at close to normal speed and few service members, unless they were avid gamers, could run this on their home computers.

5. "Trauma One"

Produced by Mad Scientist Software, "Trauma One" is just one of many medical simulator/trainers available for medical personnel. "Trauma One" simulates the treatment of patients in an emergency room setting with all the equipment and staff of an ED available. The simulator consists of video images superimposed on a photograph of a stretcher in the ED. The user interacts with his staff by typing short commands into a command line. A list of usable vocabulary, along with tests and commands, is available in the help menu.

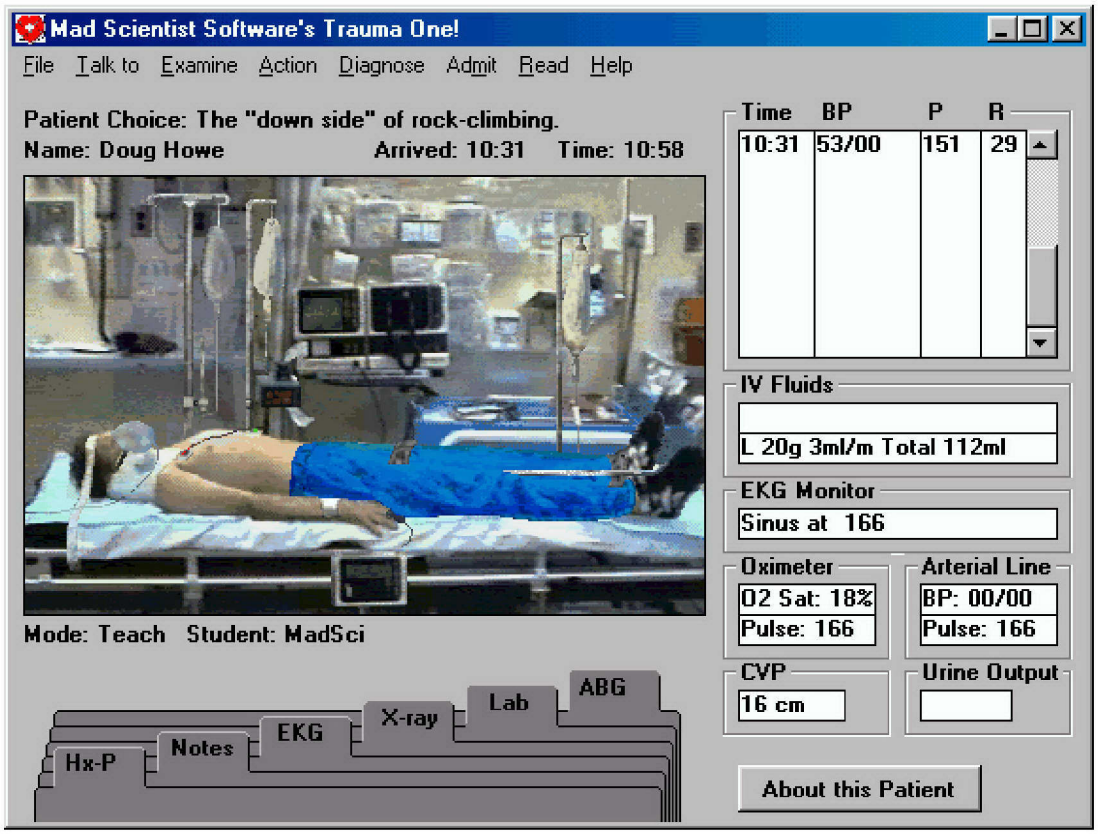


Figure 6. "Trauma One" screenshot (http://www.madsci.com)

a. Pros

"Trauma One" is effectively designed and follows a national curriculum for the injuries/illnesses that it simulates. There are a variety of patient encounters and in fact the same injuries exist in easy and increasingly more

difficult variants. The product presents the patient's chart in detail for the user. Also, the patient's vital signs are displayed and continually updated at intervals set by the medical personnel.

A portion of this program was used as a training aid in a paramedic program I was the lead instructor for in Seaside, California for the California EMS Academy with great success. The students participated in this training in 3-4 man groups while rotating through other real-life physical skills stations. Students collaborated on the case studies on a standard laptop and compared their final outcomes, given as a 1-100 score, against the other student groups. Several students also asked to use the program on their home computers to study for class exams and state certification.

b. Cons

"Trauma One" software, as it is set up right now, does not provide actual training in the treatment of injuries. Manuals that accompany the programs provide some explanations of the procedures and their uses. When using the online learning capacity, one can only ask for hints or see the algorithm being used. However, other smaller programs accompanying this program as part of a package teach various subjects and use animation, video, and sound in the modules.

While the simulator is quick to comment on your wrong actions, there is no feedback loop when the right actions are performed. It appears the player, rather than the student, is in charge of all progress. To convert this program for fleet training needs, improvements would be needed for continuous feedback of student performance and to retain interest. However, compared to the other programs evaluated, this is actually a very small concern with an otherwise excellent product.

6. "Biohazard"

Produced by the Comparative Media Studies (CMS) department at the Massachusetts Institute of Technology (MIT), this simulator casts you as a young medical professional in an urban hospital in 2050. You must use all available expertise and medical tools to find out who is sick, how they got infected, and what can be done to contain the impending epidemic. One's ability to progress through this case will not only save lives but will also help one's own career progression. Success in playing the game brings the user one step closer to becoming an acclaimed epidemiologist. First the simulator focuses on mainly local cases and helps the user hone medical and immunology skills. Through this journey as an epidemiologist, the user travels to crowded urban hospitals, dangerous sites of bioterrorism, and exotic jungle locations. The goal of the simulation is to use physiological knowledge and investigative skills to save patients' lives. (http://cms.mit.edu/games/education/Biohazard/Intro.htm)



Figure 7. "Biohazard" storyboard samples (http://cms.mit.edu/games/education/Biohazard/Intro.htm)

a. Pros

"Biohazard" has a good pedigree in the CMS department of MIT and its experienced personnel working on this project. "Biohazard's" look mirrors some commercial animation and the presence of storyboards shows a true concern with story and presentation.

According to the "Biohazard" learning Website:

> "Biohazard" is pedagogically informed, primarily, by Roger Schank's "Goal-Based Scenarios" (1994).Emphasizing the benefits of experiential learning, Schank is a leader in the field of artificial intelligence and multimedia-based interactive learning. Schank argues that people learn through making mistakes rather than by perfecting routines. Successful learning environments start not with what content is to be "mastered," but rather by immersing learners in authentic activities like those which experts in their fields actually do. This approach to learning by doing (which is often described as problem-based or case-based learning) is increasingly common in medical, business, and law schools. With "Biohazard", we are building on the design history of Goal-Based Scenarios while adding in the story interactivity and emotional draw of Role-Playing Games.
> (http://cms.mit.edu/games/education/Biohazard/Learning.htm)

b. Cons

Unfortunately this program is still in development and not slated for production anytime soon. While the Website boasts a first level walk-through, the link does not work. I was unable to learn if the project will proceed and requests to MIT were not answered.

D. PRESENTATION SOFTWARE

1. Microsoft FrontPage

Microsoft's Web design software is a what-you-see-is-what-you-get (WYSIWYG) HTML (hypertext markup language – the universal programming language behind all Web pages) editor to enable users to create Web pages and Websites easily and without much programming or graphical training. FrontPage supports the use of graphics and animations, and a fairly experienced designer,

could increase the degree of interactivity through higher level programming to supplement the built-in templates.

a. Pros

FrontPage has a short "ramp-up" time for the new user, and results can be seen immediately. Dozens of Websites and Microsoft support are available for the product. Using templates designed by other users and by Microsoft can shorten productivity time on certain projects.

b. Cons

Websites created in FrontPage are limited in their interactivity due to the use of standard templates and the user of FrontPage is generally a novice user posting their first site. Also, animations and user interactions are usually designed in other more capable languages, such as XML or Macromedia Flash. These more advanced tools require programming or graphics skills and have extensive learning curves.

In addition, Websites tend to be only as good as the server that is hosting them, and Websites can be unavailable at times. An excellent Website that is unavailable for use has no value. Also, deployed units and some homes may not have access at all times. Depending on the complexity of the site there might be large bandwidth needs that would burden participation.

2. Microsoft PowerPoint

Microsoft's presentation software allows users to rapidly create multimedia presentations to be replayed later individually or presented to large classes and audiences. The program required to create the presentations is available individually or with Microsoft Office Suites. It is universally known and is already used widely.

a. Pros

This program has a very small learning curve for users to create and share presentations. PowerPoint presentations can be created in a stand-alone form that does not require the use of the main program to view, reducing the cost of deploying the end product. As with all Microsoft products, there is a vast amount of documentation, Web sites, and media available online and in book format, all supporting the product.

b. Cons

PowerPoint offers little interactivity for the viewer other than clicking of active links. The completed presentation only presents material. Programming events requires knowledge of Visual Basic for Applications (VBA) and can be confusing for non-programmers to alter once deployed. Files are large once created with graphical elements and may prove difficult to share and deploy. There are no options to slice the content and load as needed.

3. Adobe GoLive

Adobe GoLive CS software is useful for designing Web sites and allows interaction though built-in Java-script and XHTML support. This program also offers WYSIWYG Web design, making the programming task easier.

a. Pros

Adobe GoLive has a Co-Authoring feature that allows beginners to easily revise and maintain authored sites. Interactivity is easy to create using the program, but again the student is limited to displaying content and following links.

Adobe's user and developer community is large and the company offers many ways to get help and learn about the product. Online support sites and third-party add-ons help with setting up any type of Website.

b. Cons

Designed primarily for Website designers, the program requires extensive training to get proficient. GoLive is not specifically designed for learning, so the functionality for creating feedback and testing only involves clicking links. As with FrontPage, access to the Internet is required to view finished product.

4. Adobe Atmosphere

Adobe Atmosphere is a completely integrated end-to-end solution for creating 3D interactive stage sets, delivering them over the Web, and allowing users to collaborate within them. The Atmosphere embedded multimedia type gives the Web or document designer the ability to present a rich variety of interactive content, including three-dimensional objects, directional sound, streaming audio and video, SWF animations, and physical behaviors, all within the context of a live theater performance.

Viewers of Atmosphere environments can move and interact freely within these spaces and collaborate. Arts, e-commerce, education, promotional, and entertainment Web sites document that authors, among others, "will find these dynamic, real-time "stages" a compelling way to engage their customers and provide experiences which enhance the information content and value of their work in ways not previously possible". (Quote from http://www.adobe.com)

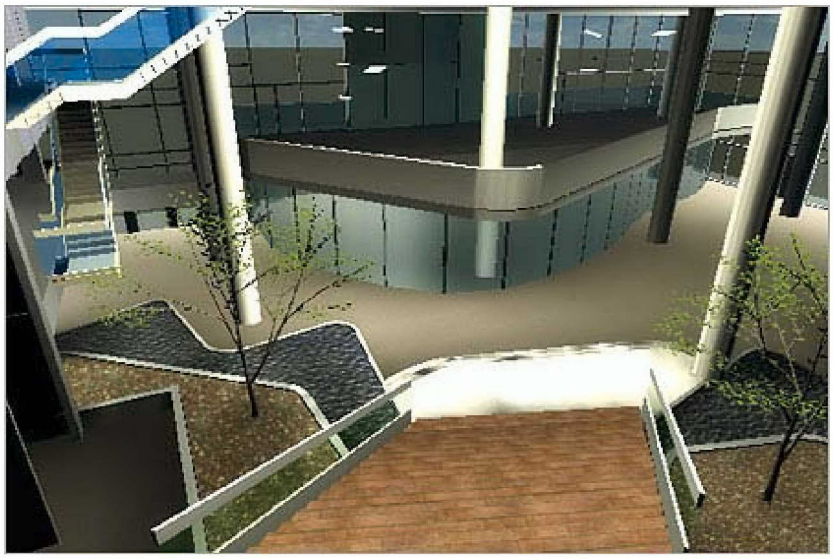


Figure 8. Adobe Atmosphere screenshot from Metropolis Magazine's rendition of global biotech firm Genzyme's new corporate headquarters. (http://www.metropolismag.com/html/content_0104/gen/index.html)

a. Pros

Atmosphere is a COTS program used to create an immersable 3-D environment. Atmosphere has the ability to interact and present content to a user and supports most multimedia formats and streaming technologies across PC and Mac platforms concurrently.

Classroom environments can be constructed in 3-D and users can interact with each other creating a virtual classroom. This program does not require the user have intense graphics training and programming skills; since most components are drag and drop, using the program is as easy as creating a slideshow.

b. Cons

To run the environment player, the user needs a powerful computer. I tried to run the environment on my laptop (1.9 GHz, 512 MB RAM) and was unsuccessful. My home computer (2.0 GHz, 1 GB RAM) was able to keep up, due entirely on the graphic card, but I don't know if most commands could run this software on current graphics cards that are delivered in the average computer.

This program also requires a separate computer to run the application server, so its ability as a stand-alone application is currently limited. Connectivity to that server is also required, so limitations on numbers of connections and amount of different physical areas trying to connect have to be considered.

5. Macromedia Director MX

In a manner similar to Adobe's GoLive, Director allows the user to create content-rich Websites. Director's WYSIWYG design allows users to create content and see what it will look like when deployed during the development process.

a. Pros

Director is easy to use and most of the programming is accomplished by using preprogrammed functions. As with Adobe, Macromedia can produce content for both PC and Mac platforms.

b. Cons

Director is primarily geared toward creating Websites and is not focused on individual content to be placed on the sites. As a result, one needs to produce the content first in Flash or another program, Fireworks. Because Director is a Macromedia product, any proficiency in Microsoft or Adobe products will not be a substantial help. However, any proficiency in Macromedia design products will help.

6. Macromedia Flash MX

Macromedia Flash allows the user to integrate video, text, audio, and graphics into rich and effective experiences with interactive learning and presentations, e-learning, and application user interfaces. "Flash is the world's most pervasive software platform, used by over one million professionals and

reaching more than 97% of Internet-enabled desktops worldwide, as well as a wide range of devices."
(http://www.macromedia.com/software/flash/productinfo/overview/).

a. Pros

Flash makes it easy to produce content and to set it in motion by using a timeline as its basis. The interface is structured well. Its layers and different frames make it easy to envision projects as they are created. Converting a storyboard to Flash content was easy.

As quoted above, Flash is already in place on many users' computers at the office and at home, so deploying the application would be easy and may not require additional installations. Anyone who has ever played an Internet game on a Website, or viewed motion picture Websites, should be set to run Flash animations.

In its most basic level, Flash uses preprogrammed chunks of code that reduce the amount of programming knowledge the user needs, but an expert mode allows a user great depth. Overall, the ease of programming allows a large amount of interaction to be inserted and used.

b. Cons

The documentation that comes with the program and is available through help menus is inadequate. In order to take advantage of everything offered in the program, one needs to purchase at least two different books from outside authors and possibly a third book for code samples. This library would ensure enough examples of applications to test, and explanations of buried functions.

A new user of this program may find that his or her applications can get bloated and take a long time to load over slower connections. However, good

planning and "chunking" of the application can ensure that the time a user spends downloading the lesson doesn't slow down learning.

Altogether, all of the programs needed to produce your own solutions can be purchased for less than $5,000, a figure that provides all of the tools needed minus the labor.

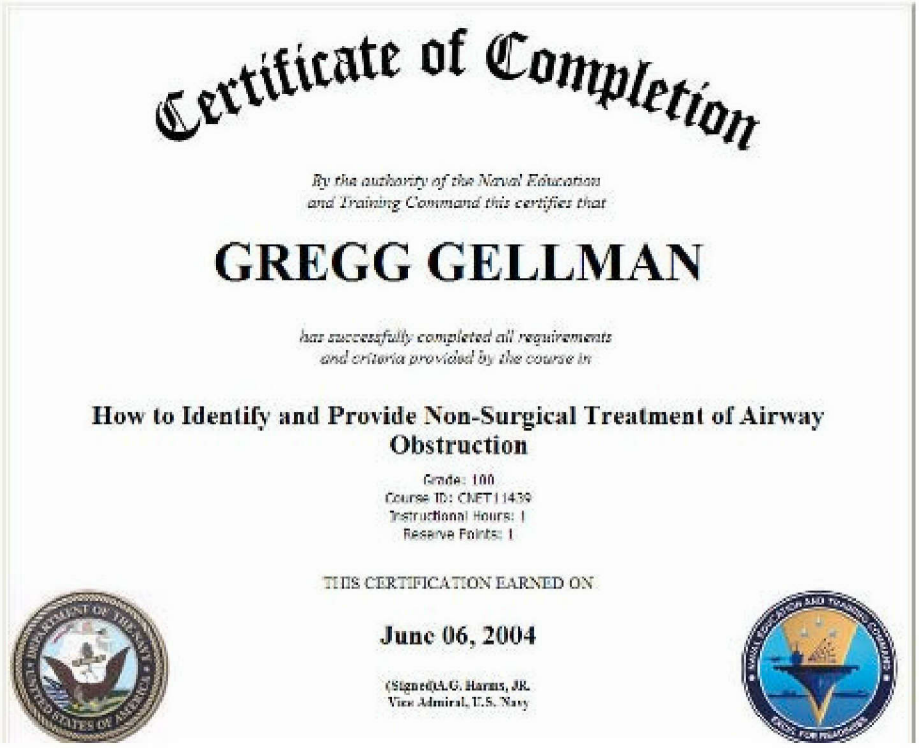
E. TRAINING SOLUTIONS ONLINE

1. Navy Learning

A Navy Website open to all members, active or reserve, Navy Learning has a variety of courses relating to all levels of navy careers. While this is not a medical library, there are medical classes. In particular I looked at the "How to Identify and Provide Non-Surgical Treatment of Airway Obstruction" module. This slide-based lesson shows users how to perform the necessary tasks of clearing an airway obstruction, and provides the basic knowledge for why this is important and what parts of the body are involved.

The lesson has a pre- and post-test with five lessons in between. Each lesson includes text slides with color graphics interspersed. On several slides there is a link for streaming video to demonstrate physical actions such as rolling patients onto their backs.

The course is tracked automatically and progress can be viewed at anytime. Upon completion, a course completion entry is entered into the user's online record and an accessible transcript. The user can print a full color-certificate and earn instructional hours as well.



Certificate of Completion

By the authority of the Naval Education and Training Command this certifies that

GREGG GELLMAN

has successfully completed all requirements and criteria provided by the course in

How to Identify and Provide Non-Surgical Treatment of Airway Obstruction

Grade: 100
Course ID: CNET 1439
Instructional Hours: 1
Reserve Points: 1

THIS CERTIFICATION EARNED ON

June 06, 2004

(Signed)A.G. Harms, JR.
Vice Admiral, U.S. Navy

Figure 9. Navy E-Learning certificate. (http://wwwa.nko.navy.mil)

a. Pros

Accessible in a central online location for all Navy members, Navy E-Learning provides a variety of courses in all fields of study, from computer languages to foreign languages, PQS requirements and medical treatments. Web-based learning requires little bandwidth and video stream only if requested by the user, allowing troops with limited bandwidth to participate but not choke resources. Also, any lesson can be saved to be finished at a later time if needed.

The presentations look well-produced and are in full color with large, visible graphics. Information is provided in bulleted, readable format.

b. Cons

This is an almost hidden benefit of the Navy. Unfortunately, this presentation method lacks any process for feedback. There are no places to ask questions about the material and get answers. These courses would benefit by

having an area to ask questions to a live person, or by being part of a larger class with an actual instructor.

In addition, the tests are poorly prepared and, in the course I reviewed, some of the questions could have more than one answer, although only one of the answers is marked correct. The one lecture that I saw included some repetitive material.

2. Uniformed Services University of the Health Sciences

While there are many Flash E-Learning examples available, I found the best to be authored by the military's medical school, in conjunction with Lippincott, Williams, and Wilkins (http://www.wmddemo.com/wmddemo/). They produced a Medical Response to Weapons of Mass Destruction patient simulator. The simulator places you in the role of emergency room doctor in a small-town hospital with some strangely ill visitors. The course contains lectures detailing the chemical, nuclear, and biological damage that one could expect, and features the treatment options one would be faced with. The simulator was built in Macromedia Flash.

After the lectures, the user completes patient scenarios where he or she gets the results of the physical exam of the patient and order tests and treatments based on the findings. A post-test of the material is also presented and required in order to qualify for completion credit. Results are displayed in comparison to peers who have also completed the course, along with costs incurred as a result of treatment.

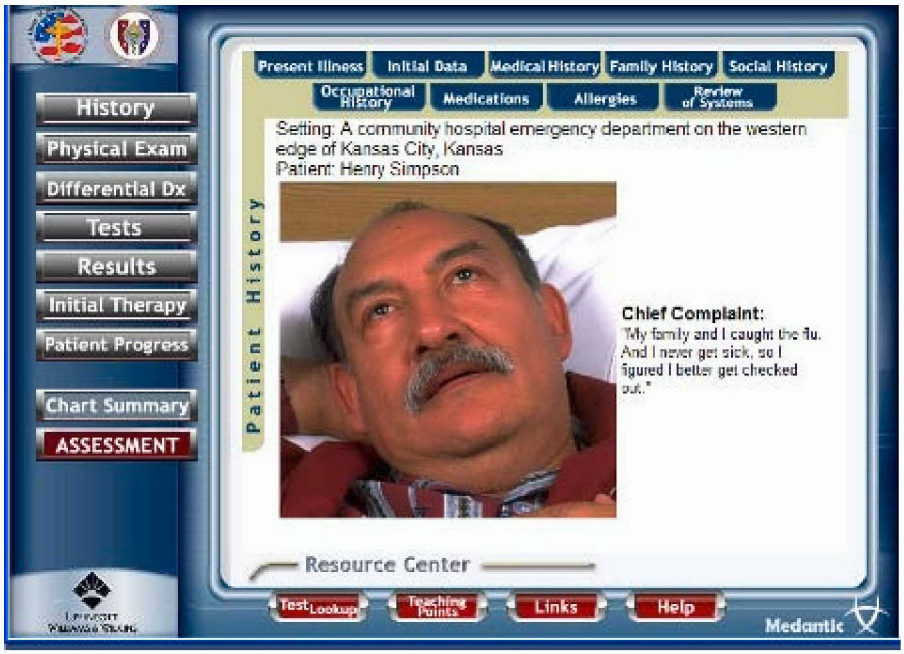


Figure 10. USUHS WMD patient simulator screenshot. (http://www.wmddemo.com/wmddemo/)

a. Pros

The program tracks progress and allows the user to pause the lesson and return later in the same spot. The user can also review what has already been accomplished, so there is no need to duplicate efforts. Viewing the average of the peers helps the user to measure him or her against other providers for comparison.

The inclusion of the cost issue was an interesting addition in a medical simulator. All too often in a simulator players are allowed to proceed unchecked in their actions and do what they would normally not do. This feature shows if the treatment worked or if the test was warranted and the cost of that action. Tests also had a time attached to them so that longer test results would cause a delay in patient care while waiting for results to return. In real life, this can sometimes be a fatal action.

b. Cons

I do not find much to fault in this simulator. I believe it is well-constructed and engaging. However, a blended learning experience could have been added in the form of an online exchange for people to share experiences, and possibly teaching materials such as interesting cases and photos. A link to an expert to ask questions to would have also been a welcome addition.

3. PS Magazine: *The Preventive Maintenance Monthly*

While not an E-learning tool in the strictest sense, I found PS Magazine to be one of the best-produced regularly available information tools in the military today. Produced by the USAMC Logistics Support Activity since at least 1990, this monthly "comic book" reminds Army personnel how to properly perform preventative maintenance (PM) on their equipment and where to find the right information on PM issues.

The publication uses a cast of familiar characters each month and even personifies some of the equipment in order to teach a few lessons from their viewpoint. Humor is interspersed with actual Army PM procedures to create a fun way to pass a lesson.

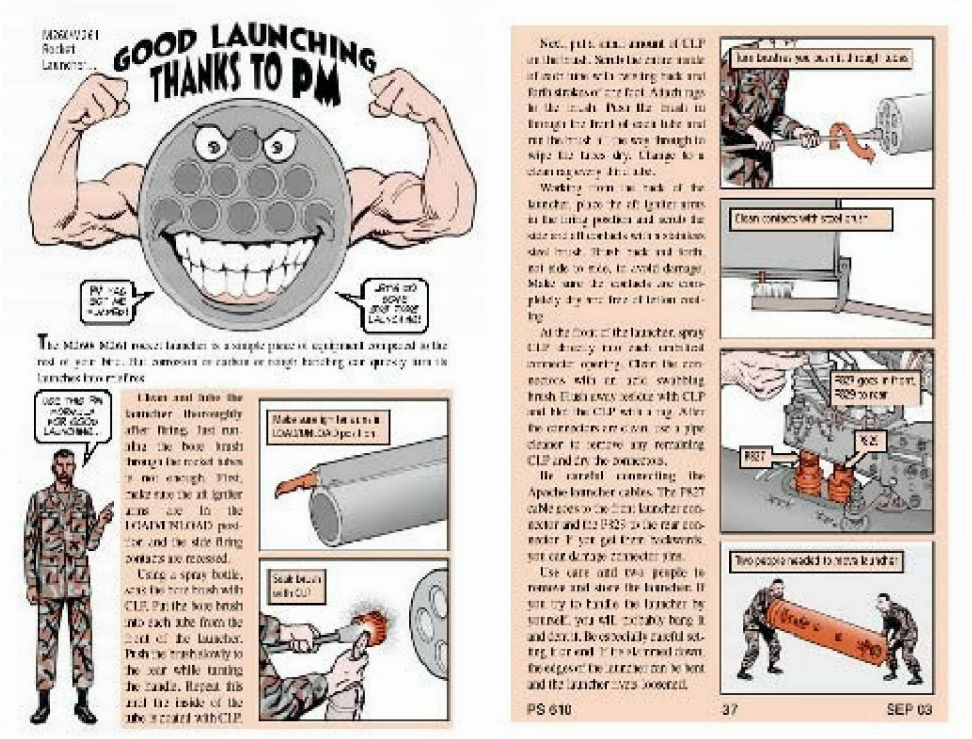


Figure 11. Cartoon Depiction of Preventive Maintenance Task (https://www.logsa.army.mil/psmag/psonline.cfm)

a. Pros

An entertaining style for teaching a boring subject helps to increase retention among the target audience. Using caricatures of people we know in our units, and using them to teach the lessons each month creates familiarity, encouraging readers to share the stories with each other.

b. Cons

No online version is currently available other than the PDF versions of the actual magazine. This is unfortunate because the cast of characters and the style would lend itself to conversion into a computer animation quite well. Limited distribution also limits the reach of its message.

F. SELECTION

As a result of reviewing these software packages and the available training, I decided to create my own solution using Macromedia Flash MX. While

it would have been preferable to alter an already existing project, there were many obstacles that had to be cleared to make that a possibility. There are some viable options in e-Learning out there, but each carries with it a variety of strength and weaknesses. For example, using the USUHS simulator for the tracking capabilities would have been preferred, but the cost and time involved in obtaining permissions did not fit into the allotted time for producing a thesis. In the next chapter, I will review the process I used to build the simulator from the ground up using the ADDIE model.



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IV. PROOF OF CONCEPT

This chapter outlines the steps used to design a simulator using the first three steps in the ADDIE model. Also listed are the steps preceding the physical creation of the final simulator used in the thesis. Any future simulators should follow similar steps as outlined in this chapter.

A. INTRODUCTION

As discussed in Chapter I, subject matter for the simulator was built around a "Sucking Chest Wound" scenario. The goal was to construct a module to be used as part of a blended learning solution, and for the module to contain all the information necessary for the students to review on their own time and without any gaps in the subject matter. The intent was that in properly performing our analysis, design, and development, our implementation and evaluation will have the best results.

B. STEPS IN SIMULATOR CREATION

1. Analyze

The three areas that initially need to be analyzed, according to our model, are the audience, the task and the environment. Each area was evaluated to form the basis of the simulator, and the results form the basic building blocks of the project.

a. Audience

It is crucial to know what the audience's abilities are in relation to the technology and skill set. Since we know our audience, and are not, say, launching a new product into a market area, we can take a very specific view of our population regarding what they already know, what they need to know, and their abilities to work with the system being discussed.

First, we know that due to annual required training, participants should have already had the training either during recruit training or at their previous commands. The simulator will contain all of the same material from those classes so that even those without any previous exposure to this scenario will get the complete set of information. What they need to know is outlined in the learning objectives from the military publications, the basis of this simulator.

It is important to establish the ability of the audience to work with the computer-based system. With the pervasiveness of technologies such as e-mail and the Internet into the workplace, it is a safe assumption that most service members can run the program from a desktop link or CD-ROM at home and then follow the simple navigation with push buttons. Later additions to the software could include items that are familiar to the target population, such as sign-in screens and message boards.

b. Task

The task, once decided upon, is broken down into the skills or knowledge areas to be taught and under what conditions. Our skills and knowledge in this simulator are chosen from proven material and adopted from the print form.. In this case, the task is divided into a computer-based portion and an instructor-led review and practical testing station.

c. Environment

In looking at the physical limitations of the system the training will deploy, we have an interesting problem. Like today's e-learning designers, we must keep in mind that this program may run on computers in service members' homes that range from top-of-the-line gaming machines to older laptops with limited memory. Furthermore we have to consider that some homes, or even remote commands, may not have high-speed Internet access, so network requirements have to be minimized. The hope of this project is to create an

application that can load easily over a 56K modem. If it needs to load other applications or players, they should load unobtrusively in small chunks.

2. Design

At this stage I took the syllabus and created a rough storyboard of how I envisioned the simulator to look and run. My final objective was that a user could successfully pass a multiple-choice quiz and make it through a simulation of the injuries without critical mistakes. The critical mistakes are listed in the program criteria from the military program, and are labeled as No Go actions. Having this list of criteria was a major benefit to converting an already existing program.

Sadly, the talent and expertise of the America's Army game project would not be available for full-time use. However, it remained a source of knowledge of graphics and design that proved invaluable. Without them the plan was about to change to a leaner and simpler product.

3. Develop

I had decided to proceed with the talents of myself as the artist, the animator, and the programmer. I had to start placing material into the chosen package, which was now Macromedia Flash, but I didn't have background in Flash. I quickly started to alter my plans and re-evaluate priorities versus what was possible considering my available resources. Chapter V provides a more detailed account of this process.



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V. IMPLEMENTATION

A. SUCKING CHEST WOUND SIMULATOR

Nine months was assumed to be ample time to produce and test the simulator and to deploy the simulator onto a fleet platform to test its efficacy. I had extensive experience with Adobe products, but mainly from a print background, producing static images and newsletters. Instead, I chose Flash, in part because of its ability to play on a large number of computers, but also to prove that I could produce this simulator on a platform I knew nothing about and have it work. This would show what could be possible even with limited funding and a realistic time frame.

1. Initial Concepts

The first design for the simulator had 3-D actors interacting in a 2-D environment. The patient would be static, and the user would simply employ a point-and-click interaction with tools and the patient. The pointer started as a disembodied hand and change as necessary.

When the simulator was meant to be deployed on a networked system, there was a plan to include a logon screen, allowing tracking of individuals and feedback on time on the system, frequency of mistakes, and other metrics that would have been helpful in the analysis of the product. This logon would also be tied to a score-board where individuals would track their performance against their peers. A forum idea was considered but scrapped due to network requirements.

The simulator would offer three distinct phases for the user to progress through. The phases would teach the skill in an interactive way, using a computer-based lecture, a video demonstration, and an animated practicum. The users could progress at their own rates and repeat each part as often as possible. Important steps would be illustrated with more detail to assure they were recognized as important, through the use of callouts.

The user would then progress to a practicum as in the first section, but unlike the learning example, the user would work independently. This performance would be graded according to the Go/No Go criteria, where instead of a generic Go or No Go, the user would receive a percent score based on correct actions performed. This trait would allow the users to gauge their performances against previous attempts, and see just how precise they were with the knowledge.

Lastly, the user would have to complete a multiple-choice quiz with a necessary minimum score. This score, combined with the previous practicum test score, would have to meet a predetermined level to qualify for successful completion of the topic. Upon completion, the user would be instructed to contact the responsible personnel, usually the medical division, to be tested on the actual physical skills performed on a live individual or a mannequin.

2. Equipment Used

Since the goal was to produce a simulation using COTS software that would be easy to maintain and update, it was important not to use any equipment that also was not COTS. All of the equipment was standard to any computer artist and animator and none of the equipment was purchased specifically for the thesis. All of this equipment, with the exception of the video camera, is property of the author and part of my daily routine.

a. Personal Computer

My computer is Homebuilt AMD® Athlon™ XP 2400 with 1 GHz of DDR memory and the operating system is Windows XP. The machine is connected to a dual monitor set-up with one 19" and one 21" and has video inputs for analog and digital feeds. Manipulation of graphics was eased due to the monitor size and setup. This situation also replicated a multiple member team which would have to deliver pieces to one another for a project.

b. Laptop Computer

My laptop is a Hewlett Packard Pavilion ze4560 with Mobile AMD® Athlon™ XP-M processor 2500+ with 512MB memory. All flash programming and assembly was performed on this machine. Some graphics work was done in this machine when a small amount of tweaking was needed. For the most part only Flash was used on this machine.

c. Hewlett Packard Officejet 6110 all-in-one

I used the HP for printing to a small degree, but primarily used it for its scanner functions when a document was not available electronically, or when artwork was brought in from hand drawings.

d. Wacom Intuos2 Platinum 4X6 Tablet

This digitizing input pen-based tablet was used for more control over graphics production. This tablet allows the user to manipulate a pen to produce artwork instead of having to struggle with a mouse.

e. Pentax Optio S 3.0 Megapixel Digital Camera

This small digital camera was used to take photos of the equipment to be used in the simulator. No special filters or lighting were used to take the photos. Photos were uploaded directly to the computer and used with a minimum of retouching. Its video recorder was used to capture items to be used in animations of blood.

f. Sony Digital Video Camera

This camera was used in the initial stages to produce a video of the skill being taught live. Digital video was recorded and uploaded via Firewire and edited digitally on the desktop computer.

g. Software Used

While Flash was the software used to create the final project, there was a variety of software packages used to manipulate graphics. This included creating images from scratch or making corrections to images imported digitally. The additional software used includes Adobe Photoshop 7.0, Adobe Illustrator 10.0, Adobe Dimensions 3.0, Adobe Premiere, and Adobe Acrobat 6.0. For cost savings, I am sure most of this work could be done in the Macromedia Suite of programs or through similar Microsoft programs, most of which are installed on government computers. However, all of these Adobe products are mine and I did not have to learn how to use them like I did Flash.

3. Learning Flash

While I was proficient in Adobe products and could have adopted one for use in this thesis, I thought Flash was a better fit. As discussed earlier, Flash had features that made it highly attractive for use across the multitude of potential users. Also, subsequent development would be cheaper and easier to learn without previous programming experience or a background in graphic arts.

I started by purchasing a few books with examples and similar attributes to what I was attempting. I went through the tutorials and modified them, all in an attempt to get comfortable with the interface and the features. I could then focus on adding content and getting the functionality I wanted.

B. FIRST ATTEMPTS

1. Beginnings

Using the outline provided in the Combat Lifesaver Course I proceeded to assemble the elements needed to insert into the simulator. The equipment used in the simulator was taken from the content list for shipboard gun-bags. Gun-bags are pre-positioned first aid kits on board every surface vessel in the Navy.

While the locations may change among the platforms, the contents are the same. This assures that sailors can always be confident despite the ship they are assigned or even visiting.

I took photos of each piece of equipment and then cropped them in Photoshop so they could be used as icons in the simulator. Each picture was converted into jpeg format to allow for maximum compression and to keep the overall size as small as possible. A second version of the picture was created, slightly smaller that the tool box image to be used on the simulated patient.

The patient was created with an existing image of a full body first aid mannequin and by tracing it with the Wacom tablet. The uniform and utilities were painted on in layers to allow it to be removed as needed throughout various instructional modules.

To simulate blood and bleeding, fake blood was recorded digitally, dripping and pooling onto white surfaces that would be removed later using Photoshop. For the SCW portion, bubbling, frothy blood was created using a technique employed in live medical simulations called moulage. By adding crushed Alka-Seltzer tablets to watered-down fake blood, a pinkish froth was created which closely simulated blood bubbling from the open chest wound. This information was also recorded digitally and the background removed.

The different modules were assembled individually using shared components and were linked by a title screen. The user could choose to go directly to the skill performance, written quiz, or different teaching modules.

2. Revisions

In the development phase, I was constantly adjusting the project based on many factors: readings that I continued to accumulate through class work; literature reviews and research; and input from testers who viewed the Flash modules as they were produced. I also continued to look at existing products. I

learned what I had originally intended, for the most part, was too much to include in a simple simulator. I was better off compressing the design to keep interest and not overload the student.

The first thing to eliminate was the video portion showing the skill being performed in a live environment. While the video looked realistic and professional, the amount of editing necessary was becoming a large burden and its value was questioned. I struggled with the decision to cut it, because it showed all the skills performed correctly in a way the computer animation could not duplicate. For example, I visualized how to animate tying a knot, and determined video was better for this task. Another important aspect that impacted my decision to cut the video was to eliminate the only portion of the exercise that the students could not control at their pace. Video also requires a lot of bandwidth to display at a size large enough for the skills demonstrations. Although I had to eliminate a significant piece of the program, I remained true to the intent of transportable training.

During subsequent revisions, I continued to look online for examples of medical simulators and training for inspiration. One particularly excellent Web site is run by the Center of Science and Industry (COSI) in Columbus, Ohio and is an educational tool to allow users to perform an interactive knee replacement surgery (http://www.edheads.org/activities/knee/). Having assisted with many knee-replacement surgeries as an Operating Room Technician, I found the animation to be very accurate in its depiction. It was not meant to teach physicians how to perform the surgery, but with a few additions it could be a great tool for prosthetic companies to demonstrate new products and surgical techniques to physicians.

Geared for children, the COSI "simulator" has a great deal of interactivity, and keeps the user engaged by having him "perform" the skills, such as reading the x-ray to determine what knee to operate and making the initial incision. Unlike my intention of multiple teaching methods, it provides one path through the steps of the surgery, imparting wisdom to the point where that information is relevant

and then quizzing the user at appropriate times. I was so impressed by this approach that I decided to make some more changes to the initial plans. In my new design, I interspersed the text within the simulator and allowed students to get the information at appropriate times through pop-up windows.



Figure 12. COSI Virtual Knee Simulator.
(http://www.edheads.org/activities/knee/)

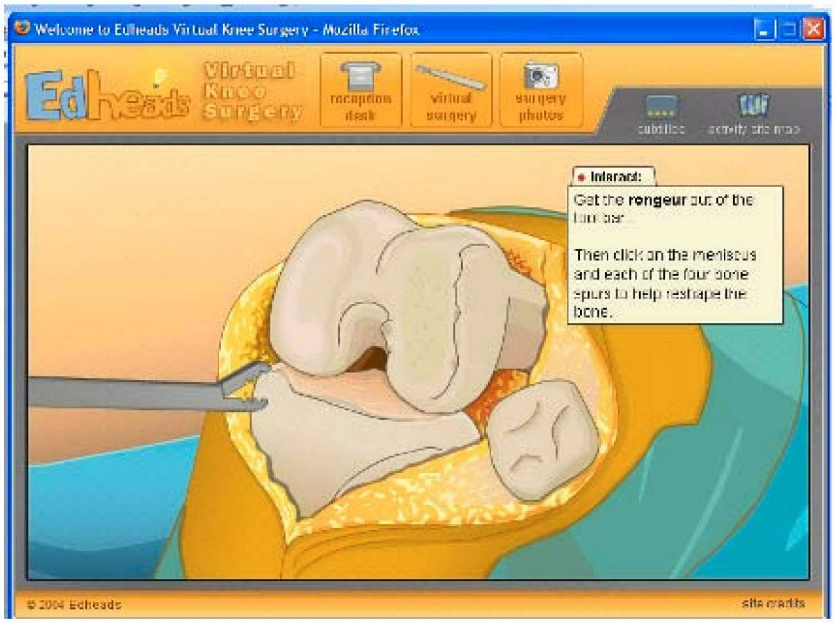


Figure 13. View of the exposed simulated knee.
(http://www.edheads.org/activities/knee/)



Figure 14. Photo gallery picture of similar view of above figure. (http://www.edheads.org/activities/knee/)

I used two test subjects to conduct a beta test of this new design in order to determine if this deserved to be the final design -- one with medical training and another without, and solicited their opinions in what I hoped was the final iteration. Up to this point, there were at least five different approaches and probably close to ten separate "final" releases. For the most part changes were cosmetic: spelling errors, poor feedback, and broken links. The testers were told to test the program by intentionally making errors and clicking on everything.

My testers suggested that the gory detail of the blood effects might not be appreciated by all users of the simulator. Recognizing that the audience was not medical personnel, I cut the blood effects so as not to disgust students and impede learning. The blood animation was replaced with a red squiggle. Interestingly, some of the subjects who tested the final version had difficulty with just the title "Sucking Chest Wound."

There was certainly a variety of problems that occurred throughout the initial design process but each error brought a new solution. The next chapter describes the deployment of the simulator and the design of the analysis.

VI. ANALYSIS

This chapter discusses the implementation and ongoing evaluation phases in the ADDIE model as it applies to this project. Included is a summary of the work done to this point, in particular a small sample study to gauge the effectiveness, transfer of training, and the benefits of this training. Finally, there is a discussion of further topics of study for future work.

A. EVALUATION DESIGN

In order to implement the blended training solution, I proposed it was crucial to measure whether or not the training in this form was valid. Because the skill being taught is a required part of annual medical training, it is important to ascertain the objectives are being met and learning is taking place. This method of learning involves the psychomotor and cognitive domains and moves partially into the affective domain, so our evaluation must measure these effects. To focus on these desired measures, we must make a distinction on the two types of data that are possible to measure – hard data and soft data.

1. Hard Data

Hard data are the primary measurements of improvement, presented in undisputed facts that are easily collected. In this investigation, the ideal hard data include return on investment (ROI), productivity, profitability, cost control, and quality control (Phillips, 1991). Specifically, hard data as measured in this project are training time, work stoppages, known costs such as equipment and possibly travel costs, and ultimately quality of the task. This last measure, if we are lucky, is only measured in training environments on simulated patients, but if needed in real life the measure of failure could be death.

2. Soft Data

Often hard, rational numbers are difficult to obtain, so we must look to soft data acquisition. Soft data concerns itself with measuring often intangible

measurements such as job satisfaction, work habits, corporate climate, and new skills. With this project, I looked at whether this type of training would improve attitudes to training, reduce absenteeism at sessions, and increase interest and confidence. These measures were evaluated through a post-training questionnaire and feedback.

B. PROJECT DESIGN

Since the simulator was designed to teach a skill used by every soldier, sailor, and Marine, the target audience would logically be pulled from these groups. Since the training was computer-based, I decided that a shipboard setting would be ideal because computer access is available to all crewmembers. The ships would have between about 300 and 3000 people to choose from, depending on the chosen platform. A Control Group Design was used for comparison between two groups: the experimental group and a control group. Since the medical training is required yearly and rosters are maintained by the medical division, it would be easy to see the training status of all participants and their specific training received.

The Control Group Design requires that data be gathered on both groups before and after the training session, and the comparison of the two groups at the outset reveal the impact of the program. The following diagram illustrates the process. The control group receives the current level of training.

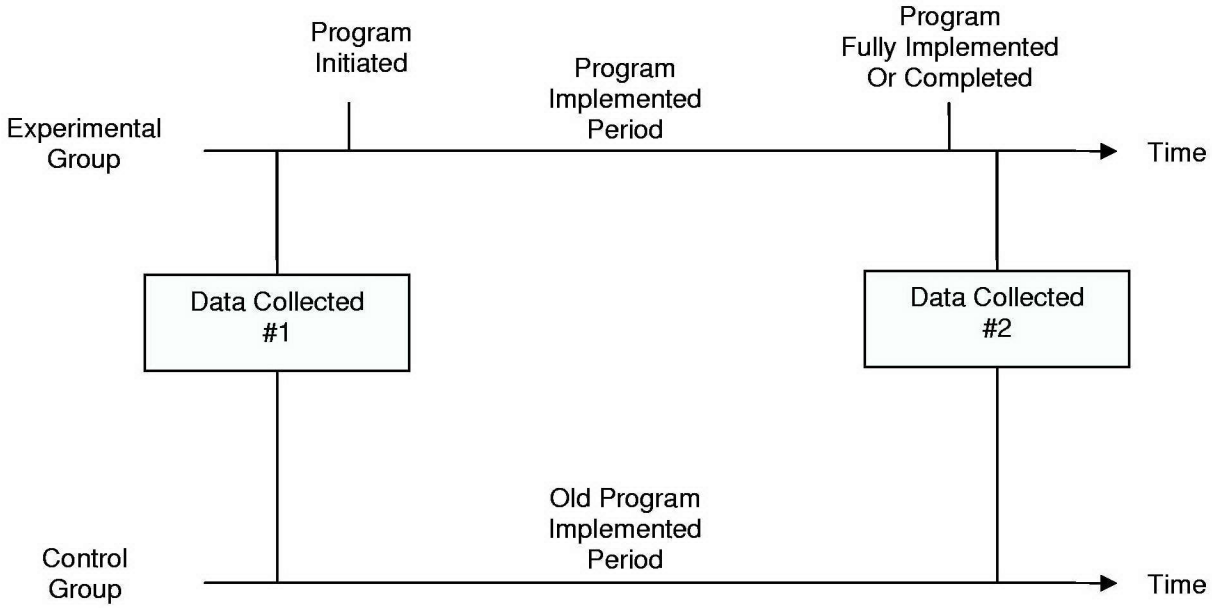


Figure 15. Control Group Design (Phillips, 1991)

Participants would be chosen at random from the crew, and placement into the control group versus the experimental group would be chosen randomly from the participants. The participants would come from across the ship and not be sorted by age, rank, or job. In real life, as witnessed on the USS Cole, this task may fall to anyone, anywhere.

The experimental group would be given access to the simulator for at least a week and be told to keep track how often it accessed it and for how long. The group would be tested after a brief review of the skills with both a practical and written quiz. The control group would attend a class similar to the ones they attend now: a one-hour session consisting of a lecture without accompanying media presentation, and a skills test and written quiz. The practicum and quiz for both groups would be identical in content and steps.

Unfortunately, due to the increased tempo of military operations at the current time, it was not possible to secure a platform for experiment. Ships contacted remarked that interrupting the training schedule for training they already received was not possible. There was also concern that the simulator might not work and the training would have to be repeated, costing more time. An

alternative was considered: use the military population in Monterey, consisting of Defense Language Institute (DLI) students and Naval Postgraduate School (NPS) students. In this alternative, a smaller number of participants would be possible.

C. DATA COLLECTION AND ANALYSIS

The experiment took place between two groups of students. The control group, composed of enlisted Navy personnel from DLI, was set to receive a one-hour class conducted in the same manner the class would be taught aboard a ship. Having taught and attended the class while deployed aboard USS WASP (LHD-1), I knew the class would be representative of the current teaching method.

The experimental group was given a CD-ROM with the simulator and told to run it. No explanation was given for use of the simulator, but students were told to follow the instructions within. They were told to record the number of times the simulator was accessed and for how long. The group was also informed that a final quiz and a practical skills test would be given.

1. Control Group

The control group consisted of 10 Navy enlisted personnel (N=10), each with less than 6 months in the Navy. The lecture was conducted in a single room with one lecturer and two skills evaluators. The lecture content was taken from the Combat Lifesaver text and was identical to the information contained in the simulator. No additional information was given during the lecture aside from the written material. A copy of the material is contained in Appendix C.

Several pieces of data were recorded from the group. The total time of the class was recorded from the beginning of the lecture to the last person to complete the skills. Next, scores from the written quiz, given to the class to complete while others were taking their skills examination, were recorded. The performance on the skills examination was recorded on the Go/No Go scale. A

failure of any of the critical criteria (Appendix C, page 127) was counted as a No Go for the skills examination and completion of the entire skill with no discrepancies was scored a Go. However, all students were given one prompt at any one critical step to help correct a potential wrong action or prompt the next step if needed. All prompts were recorded and failure to correct the action when prompted was recorded as a No Go.

Lastly, the group was given a questionnaire (Appendix D) and the scores were collected. The questions dealt with whether they had taken the training before and whether they liked the method of training presented. They were not informed of the simulator until after the testing was complete and the questionnaires were handed in. The results are listed in Appendix F.

2. Experimental Group

The experimental group consisted of 12 graduate students at NPS (N=12) consisting of 4 Navy, 1 Marine, and 2 Army officers and 5 GS civilians at similar levels. Two of the civilians were former Army service members; one was a Warrant Officer, and one a retired Senior Enlisted leader. They reviewed the CD-ROM with the Flash program and were given five days to run the simulator. At the end of the five days, the individuals were tested on the physical skills on the same Go/No Go criteria as the control group, also with the prompt option. They then completed the written multiple-choice quiz, which they had not seen before this point, with the same questions contained in the simulator quiz. A similar questionnaire (Appendix E) to the control group participants was given to the experimental group and their responses were recorded separately. The results are also listed in Appendix F.

3. Group Disparity

While it can be agreed that the control and experimental groups are very different (officer, or civilian equivalent, graduate students and newly enlisted sailors), I maintain that the level to which the material was written is still far below

both groups' educational levels, and the skill set is not exclusive to either group. The enlisted, while not graduate level students, are still recognized as high-level learners chosen for foreign language training. In the class there were students of Serbo-Croatian, Chinese, and Arabic. The only disparity I recognized was that the DLI students may not have the access to computers of an NPS student, because the only computer access DLI students have is in busy language labs and in the student center, also high traffic. The NPS students all had computers at home. Without exception this is where they reviewed the material.

4. Results

To summarize the data presented in Appendix F, it can be shown that the two groups performed similarly in all tasks. The control group, which attended traditional training, had one failure among 10 students, while the experimental group had one failure among 12 students. Also, the quiz scores are similar in both groups with no great deviation in score between the two groups. Unfortunately there were not enough subjects to draw any firm statistical conclusions.

Does this mean that the simulator cannot be proven to work? I think not. As I outline in the next few sections, the work done here is a valid basis for contemplating more blended learning solutions for current training and the data collected shows the training is effective and shows a transfer of training as evidenced by the quiz results and the practical performance.

D. SUMMARY OF WORK

Blended learning solutions are gaining popularity in organizations as a link between established trainer-led instruction and new e-learning technologies. The military must adapt to the fact that increased operational tempos and thinly stretched assets will ultimately impact the availability of structured training programs and ability to travel for training. The military must adapt new methods

to meet these challenges. By creating blended learning solutions, formal classroom training time can be reduced, and the knowledge can be imparted with equal effectiveness.

This project is designed to rethink traditional teaching techniques, which while not ineffective, are not entirely efficient. Productivity can be increased with less time away from work-centers. Reducing the amount of disposable materials used in training can control costs. We can reduce trainer workloads and both keep soldiers and sailors at their primary jobs longer or have them attend more training by shortening class times.

Consider a small ship, or unit, with approximately 400 members to illustrate this point. If each member needs to attend 8 hours annually for medical training (1 hour for each of the 8 battle wounds), this equals 3,200 man-hours per year. Medical instructors keep each one-hour lesson to 20 persons at time (due to space limitations and time constraints), so each wound requires 20 different classes, assuming no person misses the class. This means the 2-man medical department spends 160 hours, or 20 business days, teaching the 8 classes annually. This training takes everyone away from their work centers at a time when increased tempo requires constant attention to one's primary duties. This situation is more extreme on a LHD or LHA, whose crew size is close to 1,200 personnel, and on aircraft carriers where it can swell to 5,000.

The value of this simulator is recognized as returning at least 6 hours to each member, as they would only have to attend one 15 minute session on their own schedules, in order to take the written quiz and practical skills module. Another option includes bi-annual sessions of one hour for completing 4 modules. A 400-sailor ship would get a return of 2,400 man-hours and the medical department members would see 120 hours returned to them to provide more time for internal training or attend to tasks such as record maintenance. Additionally, personnel interested in more training would always have the ability to review the material any time, anywhere.

E. BENEFITS OF COTS SOFTWARE

I chose to COTS software because it was readily available, cheap, and easy to update, and there are many sources of information on its use. The total cost of the materials listed previously is as follows: (prices from Amazon.com as of June 1, 2004)

Personal Computer	$3,000.00
Laptop Computer	$1,500.00
Hewlett Packard Officejet 6110, all-in-one	$195.00
Wacom Intuos2 Platinum 4X6 Tablet	$257.00
Pentax Optio S 3.0 Megapixel Digital Camera	$319.00
Sony Digital Video Camera	$1,290.00
Macromedia Studio MX	$850.00
*Adobe Photoshop 7.0	$580.00
*Adobe Illustrator 10.0	$475.00
*Adobe Dimensions 3.0	$124.00
*Adobe Premiere	$665.00
Adobe Acrobat 6.0.	$250.00
#Total	$9,505.00

* denotes optional as the software functionality is contained in Studio MX, to a degree.

total cost excludes labor cost for at least three personnel working 100 hours apiece.

In creating the simulator, a total of approximately 300 - 400 hours went into the actual product. This included the readings necessary to learn the products. The time requirement would shorten as most modules would use the same basic format and images. Adding each of the next seven modules would be considerably quicker than the time required for the initial module.

More importantly, COTS software provided a route in production that eliminated the initial steps in creating a platform for delivery of the training. By using a software package that does not have a hefty licensing fee, limited development abilities, and burdensome system requirements, we can create training that can be deployed universally, updated on the fly, and created at lower costs.

F. CONCLUSIONS AND RECOMMENDATIONS

There is a strong case for the continued study of blended learning solutions. Blended learning solutions are intended to supplement traditional training techniques and relieve some of the training burden that besets every unit in the military. By using these solutions we can limit the amount of time spent on routine training, increasing productivity in other areas that might otherwise be ignored due to the high training demands. We also can save money by eliminating time that instructors and students need to attend classes off-site.

More importantly to the commanders who purchase such training systems, the cost of failure is reduced significantly, if not eliminated altogether. If a training system is purchased for $1,000,000 and doesn't show any improvement over traditional methods, then the funds are wasted with no return on investment. If we can produce 10 training systems each for less that $100,000 with the ability to change parts that don't work well almost as soon as they are deployed, we create a successful and dynamic training system. Even if some modules fail to perform, others should perform to expectations. In the end, we can learn from the successes and failures to build even better systems with even less financial outlay building on existing platforms.

G. FUTURE WORK

While my simulation achieved its desired outcome of providing a training experience similar to that of traditional methods, with a savings realized in man-

hours, substantial work still needs to be done before full-scale implementation is possible. I suggest future work that can be performed.

1. Improve the Simulator

Based on input from the participants, there are areas where the simulator can be improved. Parts can be expanded and items added to increase the learning experience. Adding the simulator to an online community, like Blackboard, in which students could get feedback from an instructor, might help with some of the more difficult concepts in other modules. Also, I would like to see a better interface with more interactivity designed to include actual shipboard and combat scenarios, as opposed to the static representations in the simulator.

2. Expand the Study

Either now or once the simulator is improved, it should be inserted into a ship's training schedule so as an option during the next training module. Data from an entire platform of 300-400 people should provide a definitive analysis and prove the effectiveness of a blended learning solution.

APPENDIX A. FINAL SIMULATOR PRODUCT

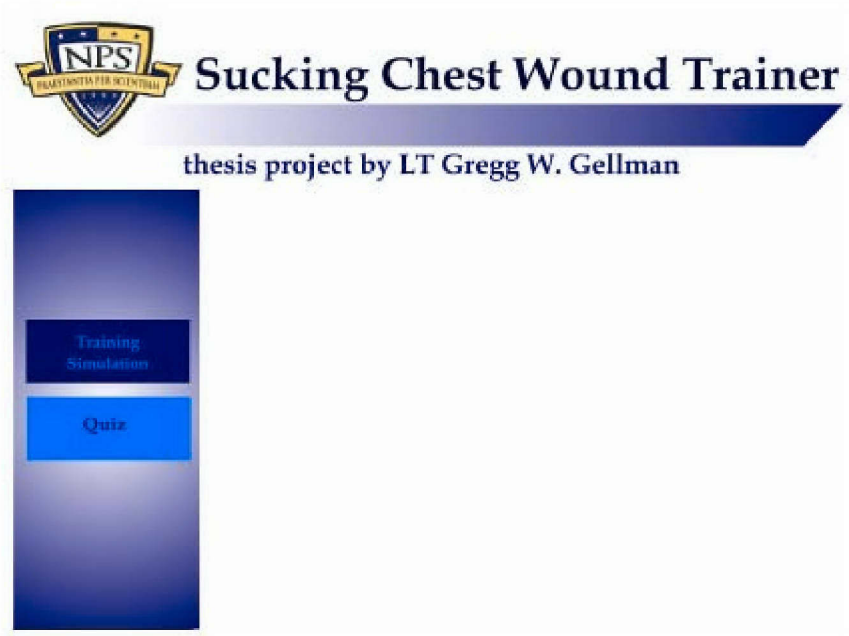


Figure 16. Title Screen

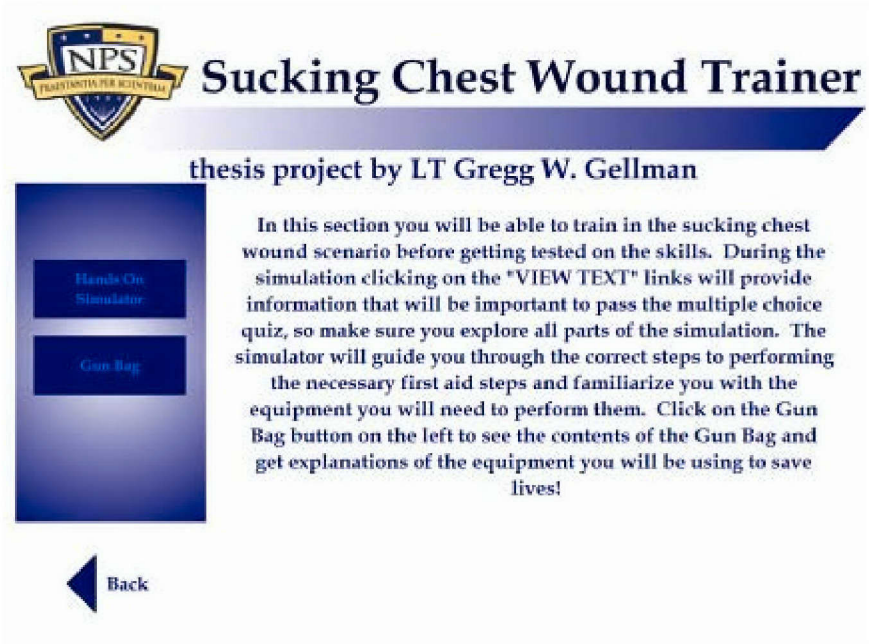


Figure 17. Introduction Screen

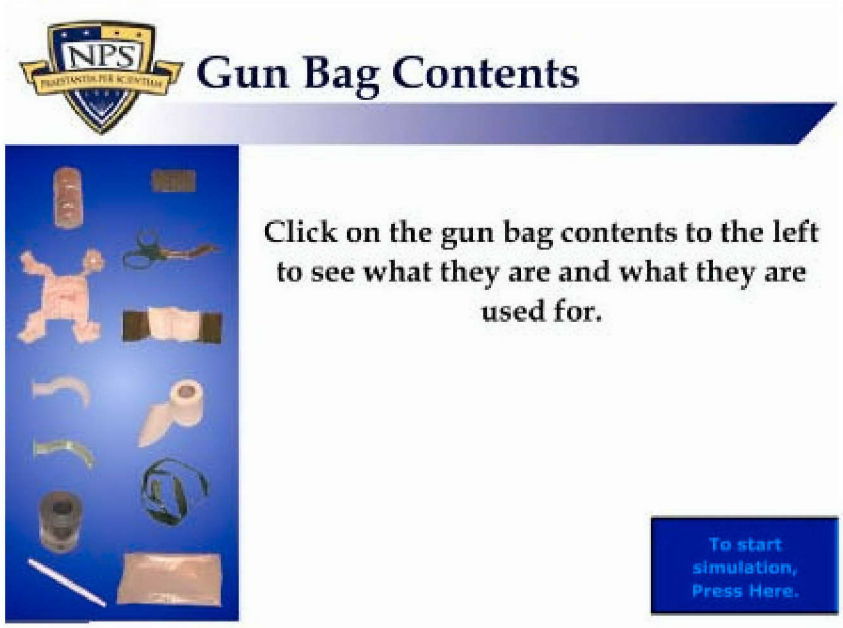


Figure 18. Gun Bag Contents Intro Screen



Figure 19. Elastic Bandage Definition



Figure 20. Large Field Dressing Definition

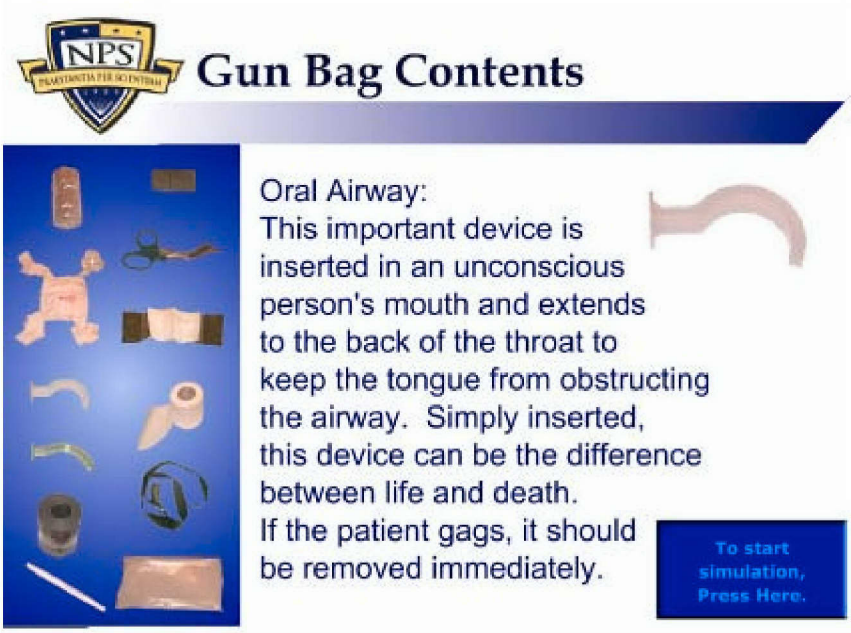


Figure 21. Oral Airway Definition

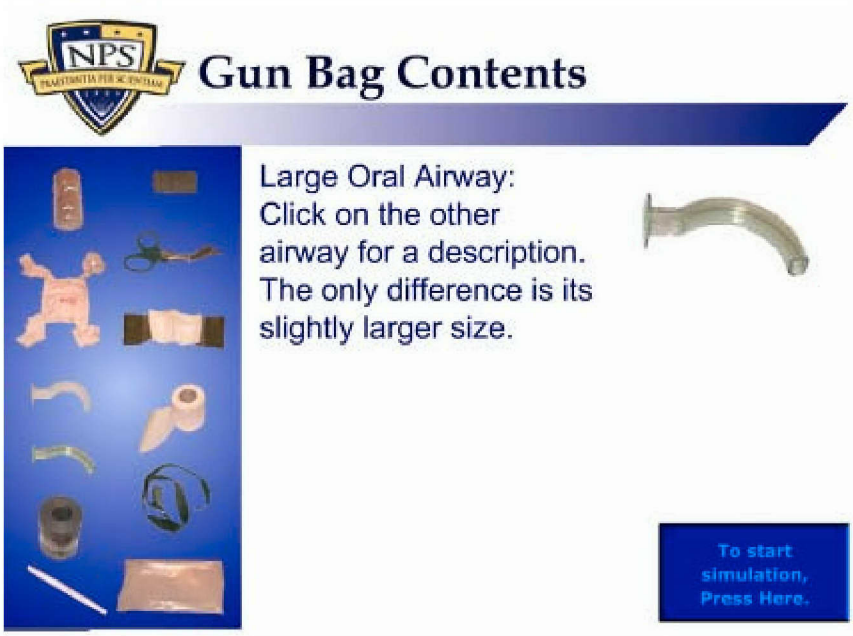


Figure 22. Large Oral Airway Definition



Figure 23. Universal Splint Definition



Figure 24. Surgical Marker Definition



Figure 25. Muslin Bandage Definition

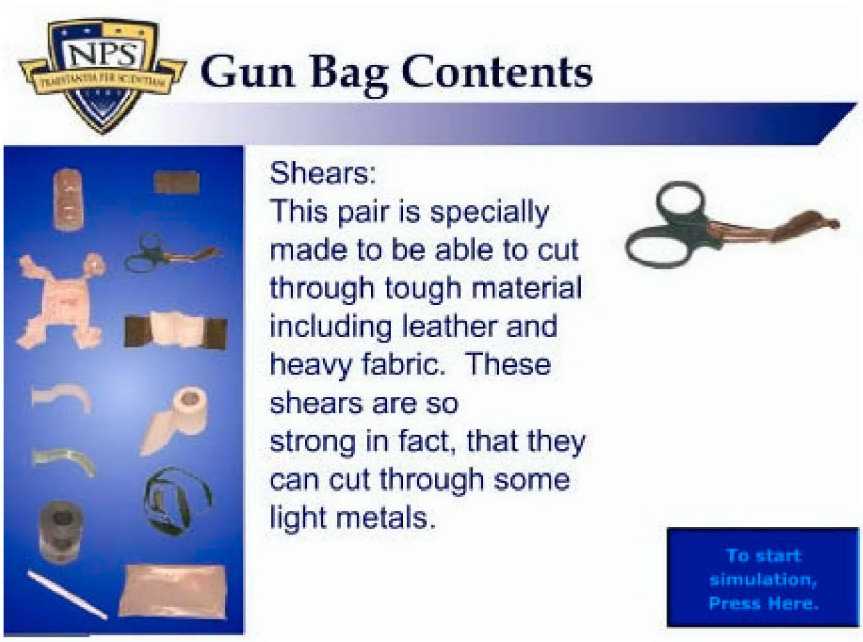


Figure 26. Shears Definition



Figure 27. Small Field Dressing Definition



Figure 28. 2-inch Tape Definition



Figure 29. Tourniquet Definition



Figure 30. Plastic Wrapper Definition



Figure 31. Training Simulator Start Screen

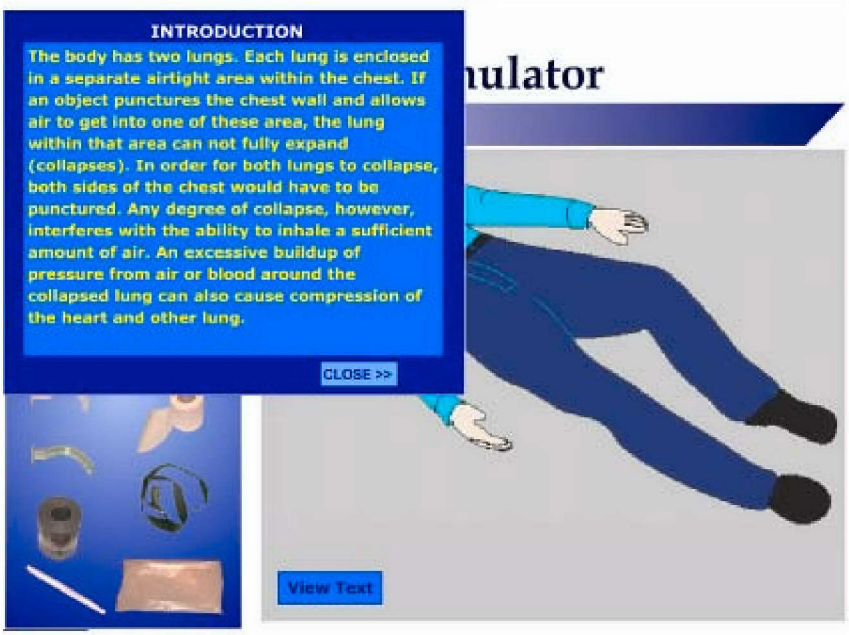


Figure 32. Introduction Text



Figure 33. Start Screen with Next Arrow



Figure 34. Signs and Symptoms Screen



Figure 35. Signs and Symptoms Text 1

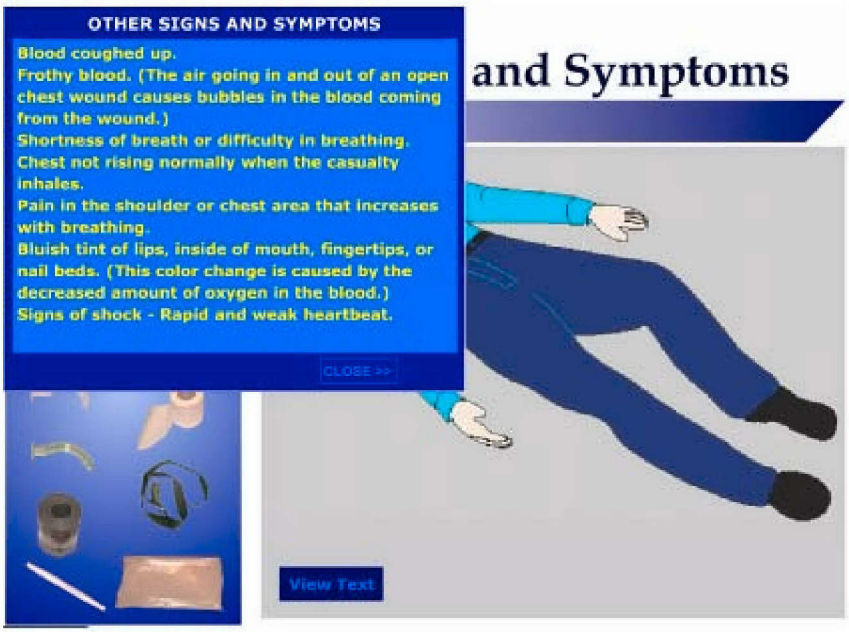


Figure 36. Signs and Symptoms Text 2



Figure 37. Signs and Symptoms with Next Arrow



Figure 38. Locate and Expose Wound Screen

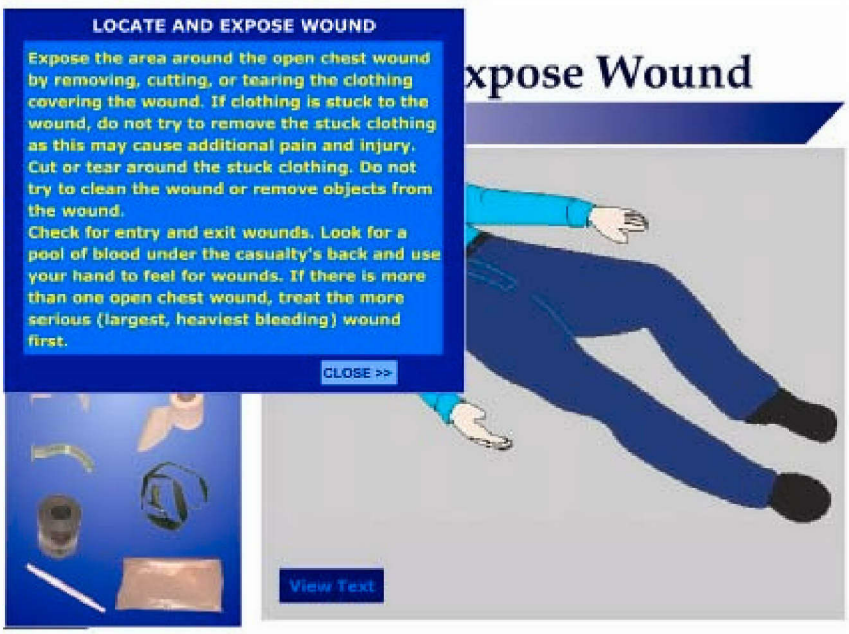


Figure 39. Locate and Expose Wound Text



Figure 40. Locate and Expose Wound - Shears Selection



Figure 41. Locate and Expose Wound – No Blouse



Figure 42. Locate and Expose Wound – No T-Shirt



Figure 43. Seal and Dress Open Wound Screen

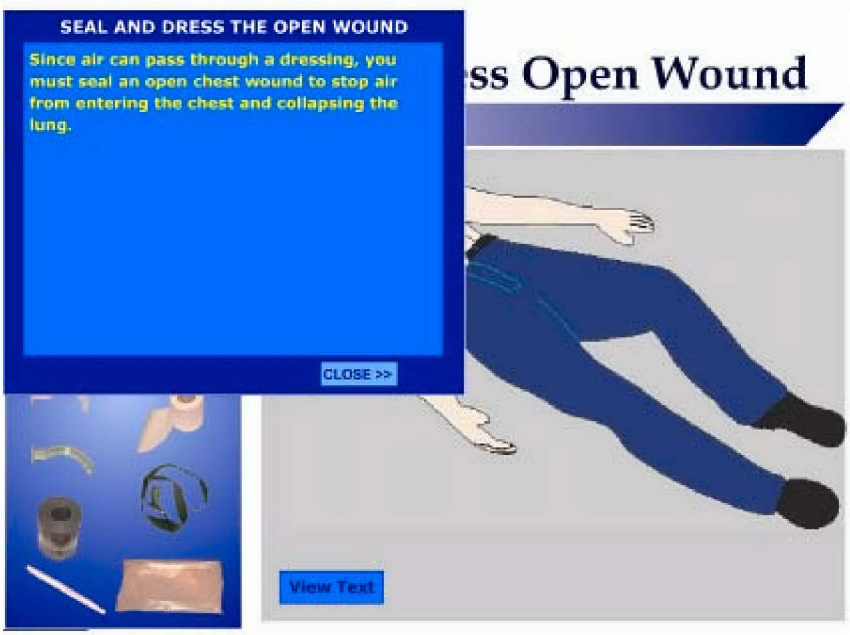


Figure 44. Seal and Dress Open Wound Text



Figure 45. Seal and Dress Open Wound with Next Arrow



Figure 46. Open Field Dressing Wrapper Screen



Figure 47. Open Field Dressing Wrapper Text



Figure 48. Open Field Dressing Wrapper Caution Text



Figure 49. Open Field Dressing Wrapper – Wrapper Selection



Figure 50. Have Casualty Exhale Screen

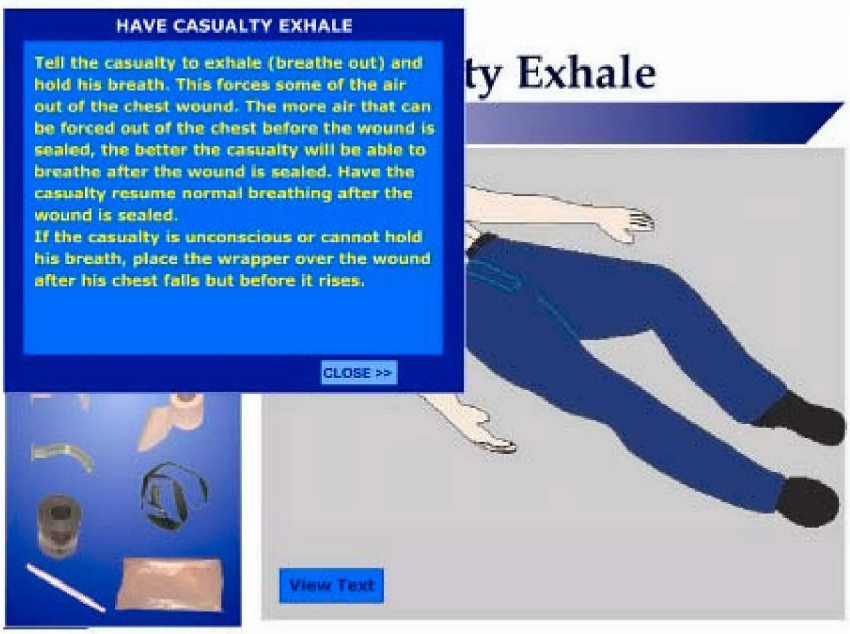


Figure 51. Have Casualty Exhale Text



Figure 52. Have Casualty Exhale with Next Arrow



Figure 53. Place Wrapper Over Wound Screen

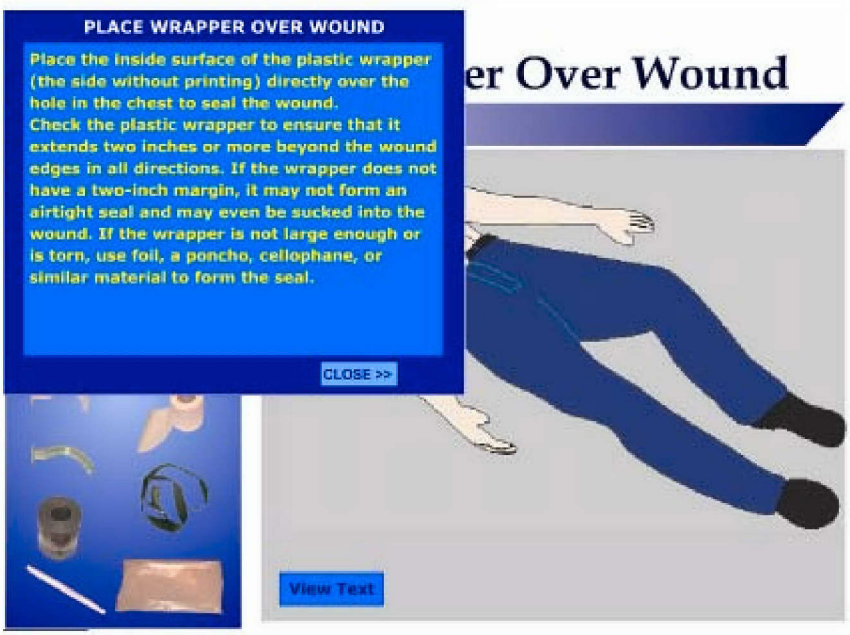


Figure 54. Place Wrapper Over Wound Text



Figure 55. Place Wrapper Over Wound – Place Wrapper



Figure 56. Tape Wrapper in Place Screen



Figure 57. Tape Wrapper in Place Text



Figure 58. Tape Wrapper in Place – Choose Tape



Figure 59. Apply Field Dressing Screen

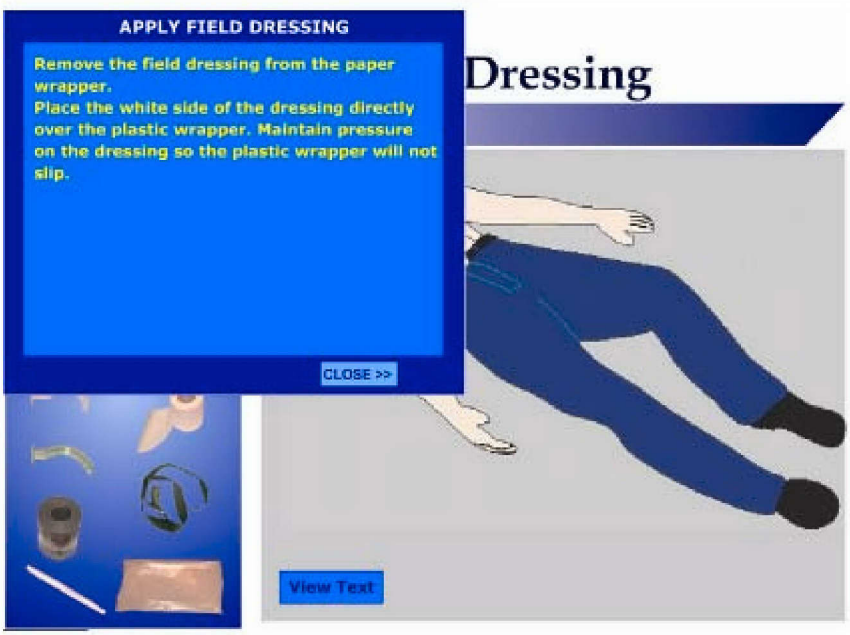


Figure 60. Apply Field Dressing Text



Figure 61. Apply Field Dressing Warning Text



Figure 62. Apply Field Dressing – Choose Field Dressing



Figure 63. Secure Dressing Screen

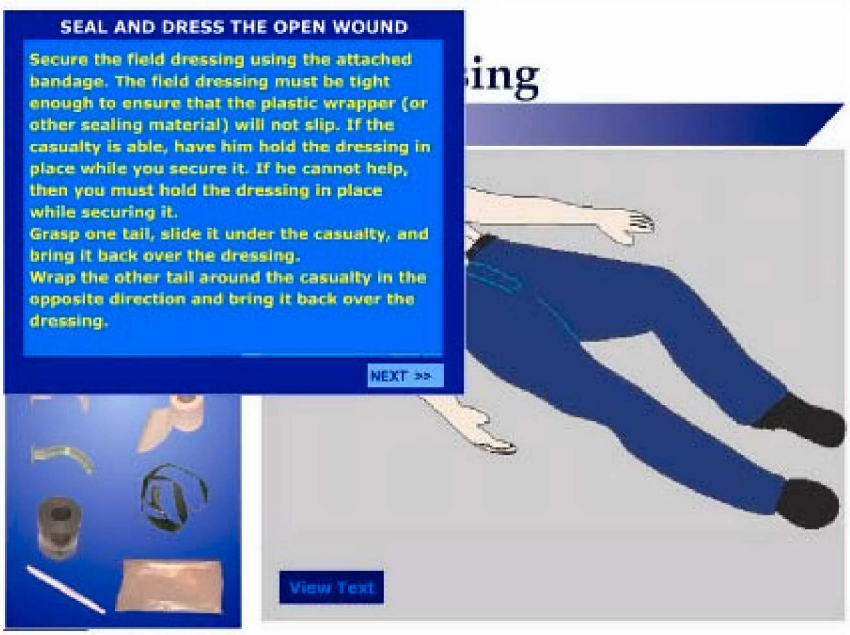


Figure 64. Secure Dressing Text 1

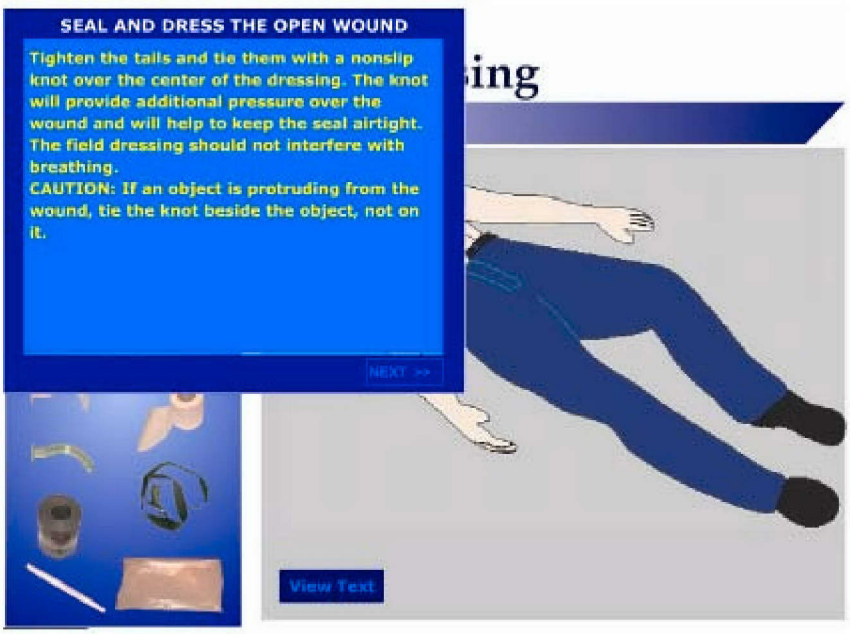


Figure 65. Secure Dressing Text 2

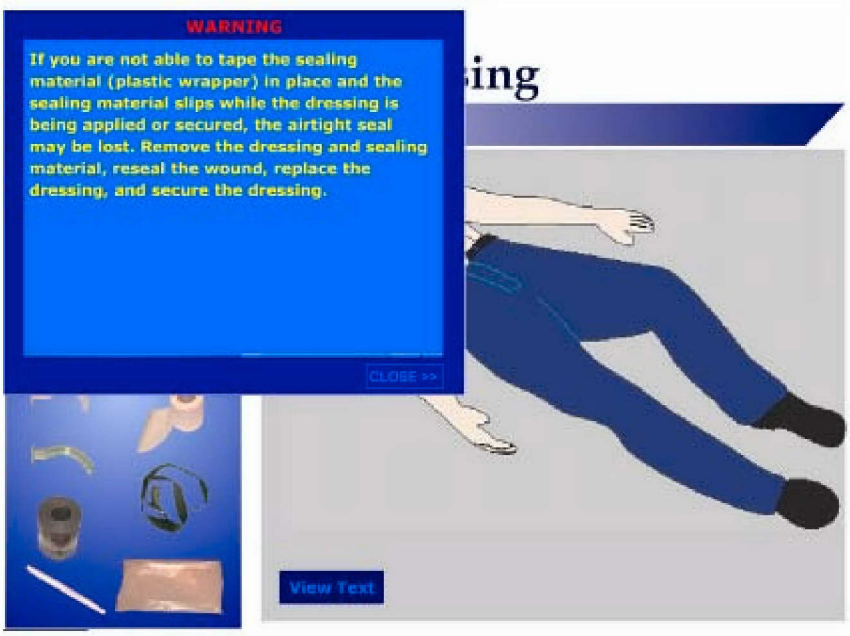


Figure 66. Secure Dressing Warning Text



Figure 67. Secure Dressing with Next Arrow



Figure 68. Seal and Dress Other Wounds Screen

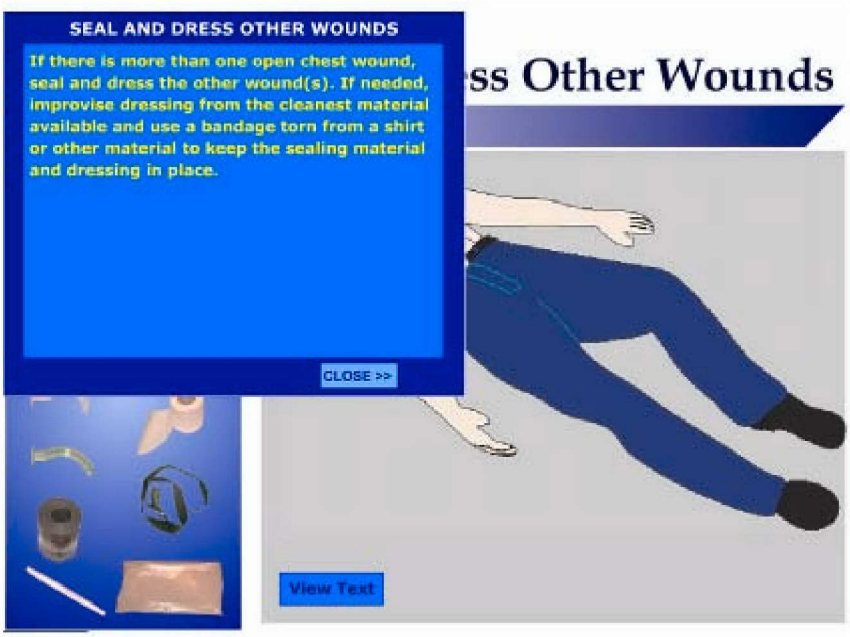


Figure 69. Seal and Dress Other Wounds Text



Figure 70. Seal and Dress Other Wounds with Next Arrow



Figure 71. Position Casualty Screen



Figure 72. Position Casualty Text



Figure 73. Position Casualty with Next Arrow



Figure 74. Monitor Casualty Screen



Figure 75. Monitor Casualty Text



Figure 76. Monitor Casualty Warning Text

Figure 77.



Figure 78. Monitor Casualty with Next Arrow



Figure 79. Simulator Complete Screen

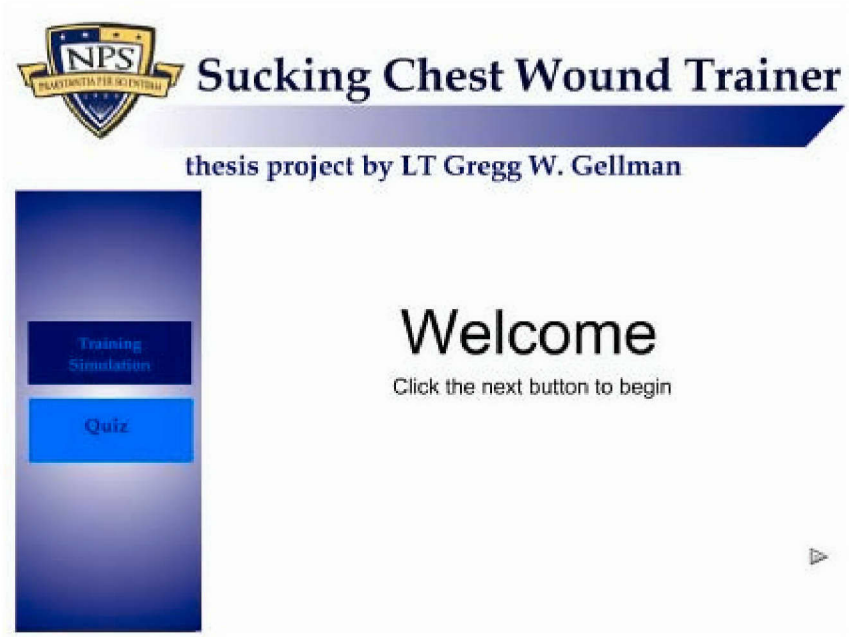


Figure 80. Quiz Welcome Screen

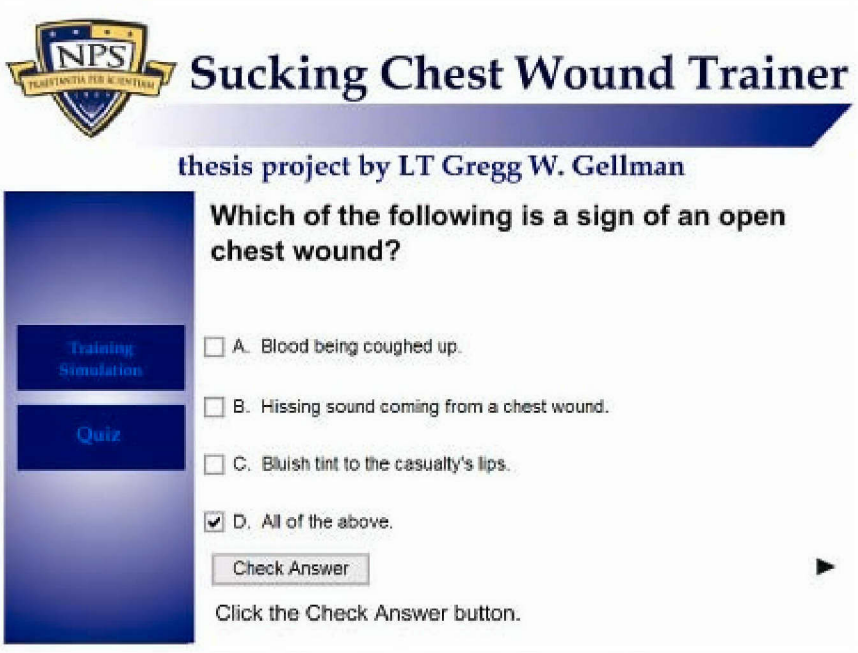


Figure 81. Quiz Question 1 with Correct Answer

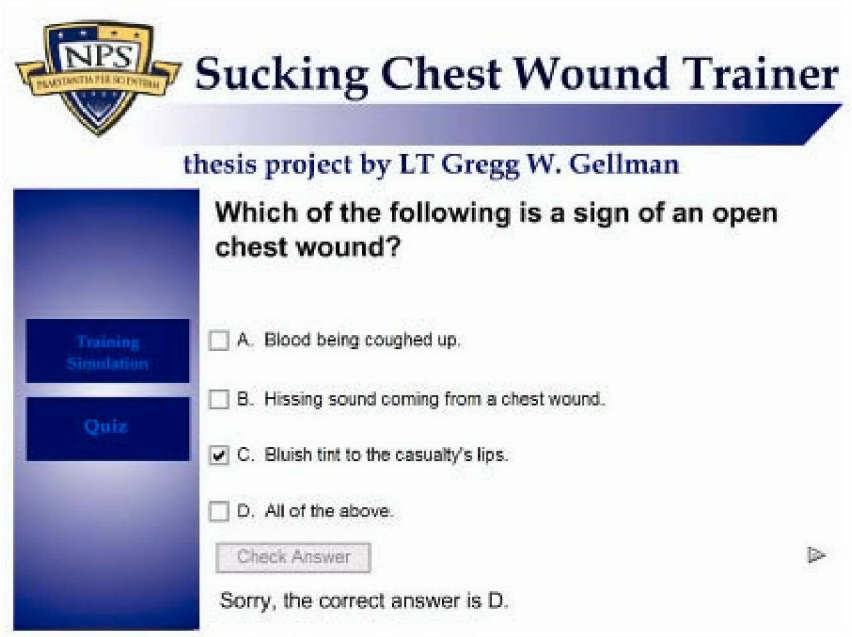


Figure 82. Quiz Question 2 with Correct Answer

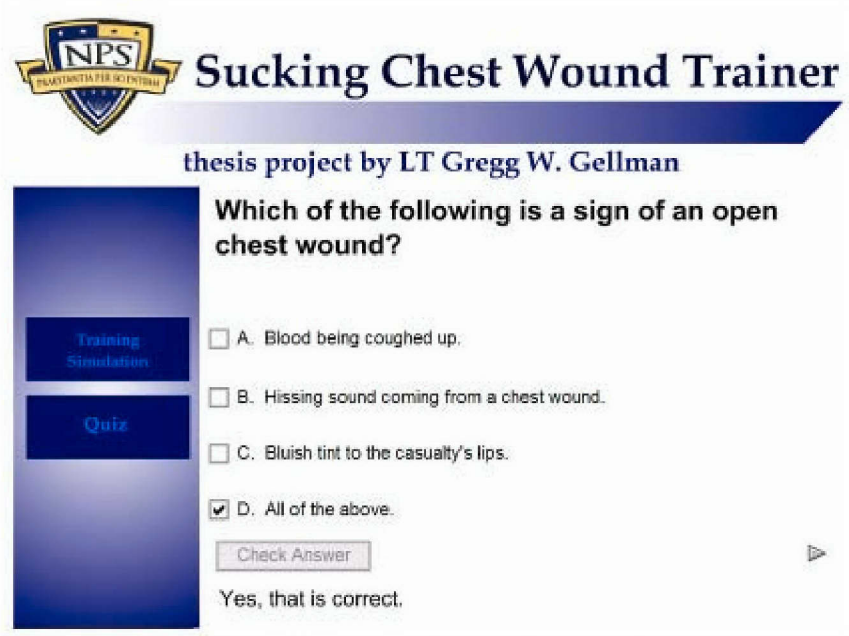


Figure 83. Quiz Question 3 with Correct Answer

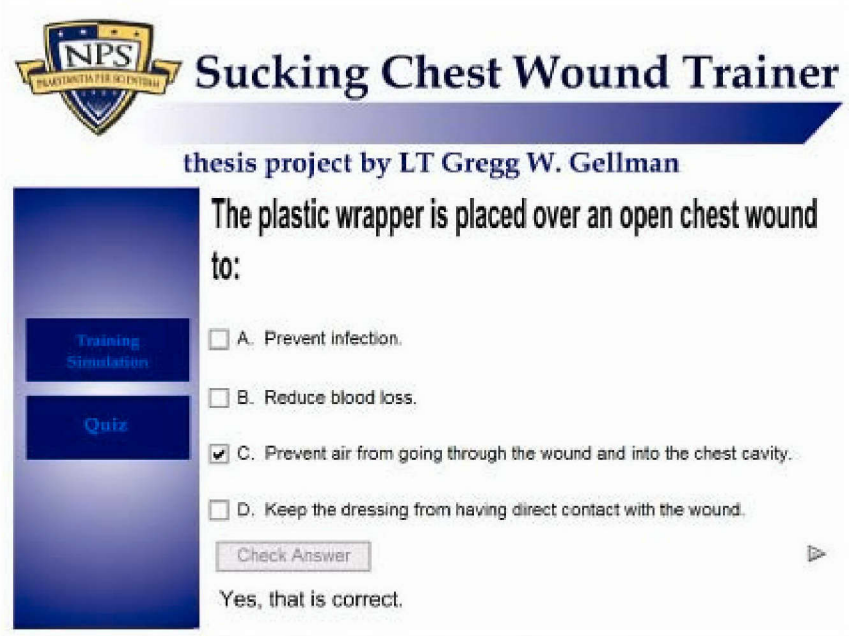


Figure 84. Quiz Question 4 with Correct Answer

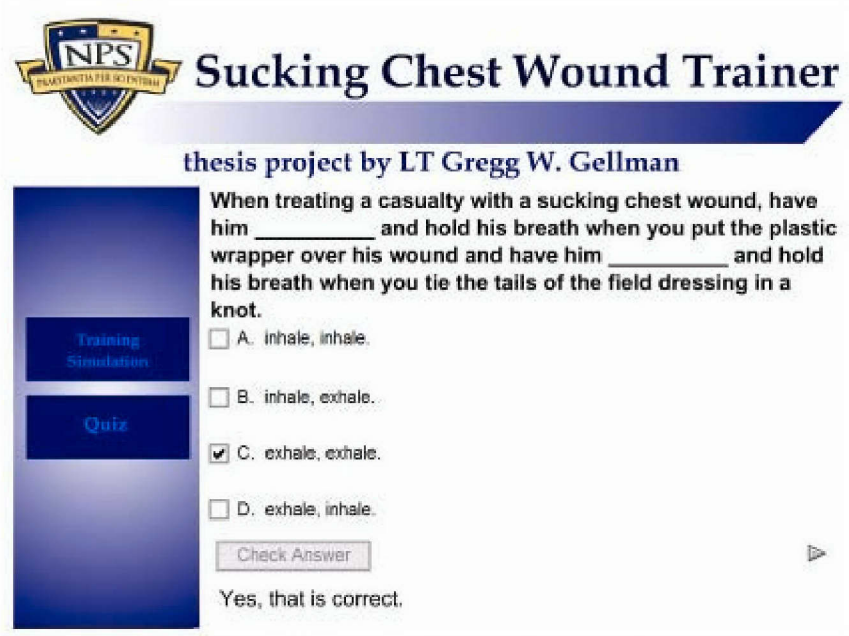


Figure 85. Quiz Question 5 with Correct Answer

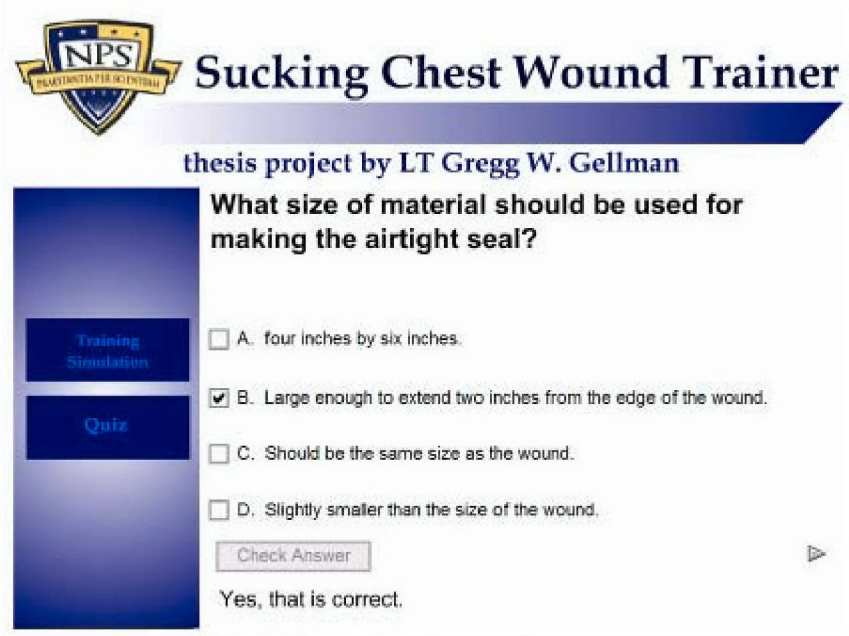


Figure 86. Quiz Question 6 with Correct Answer

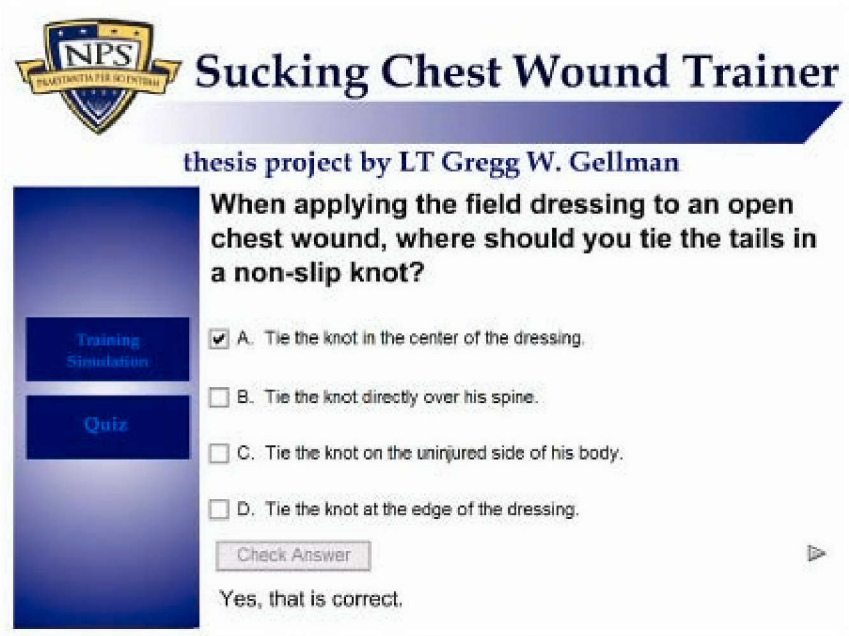


Figure 87. Quiz Question 7 with Correct Answer

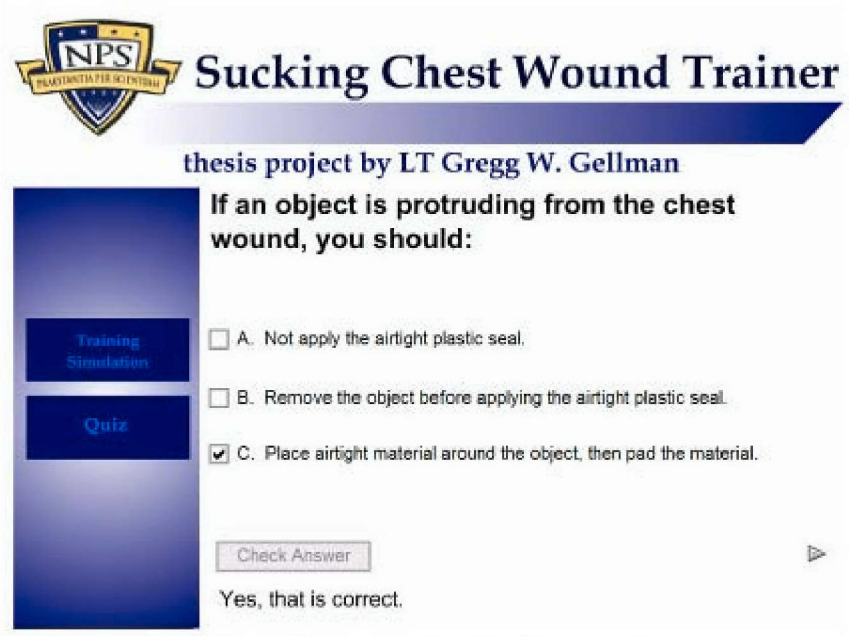


Figure 88. Quiz Question 8 with Correct Answer

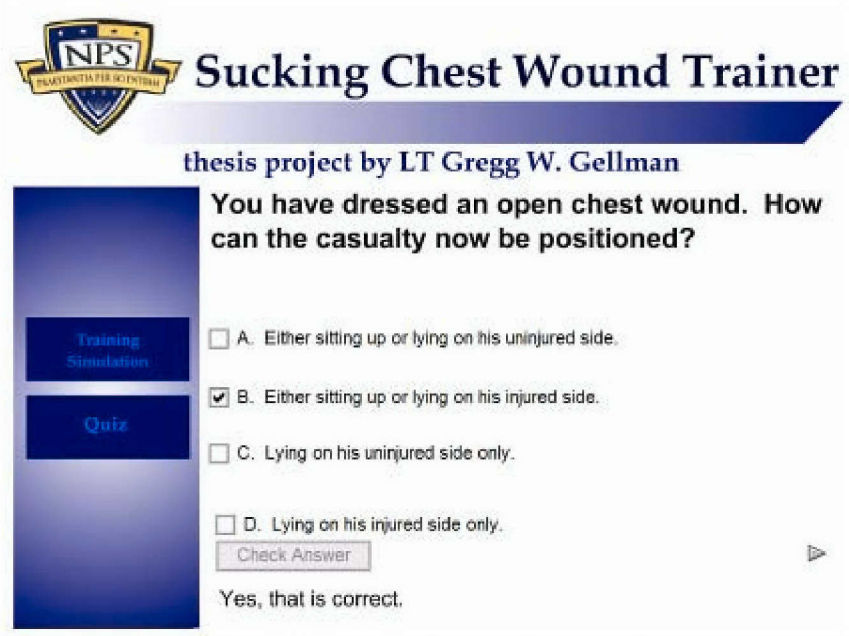


Figure 89. Quiz Question 9 with Correct Answer

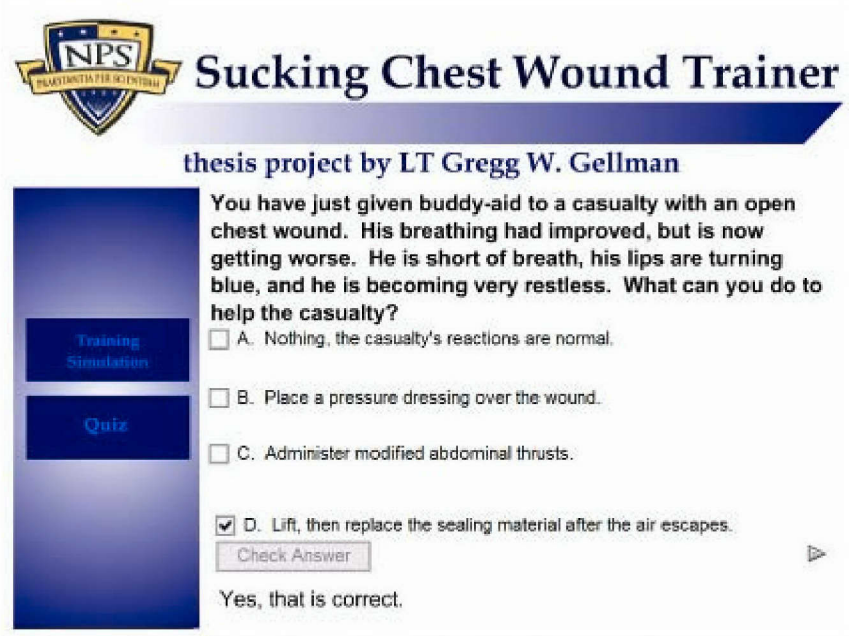


Figure 90. Quiz Question 10 with Correct Answer

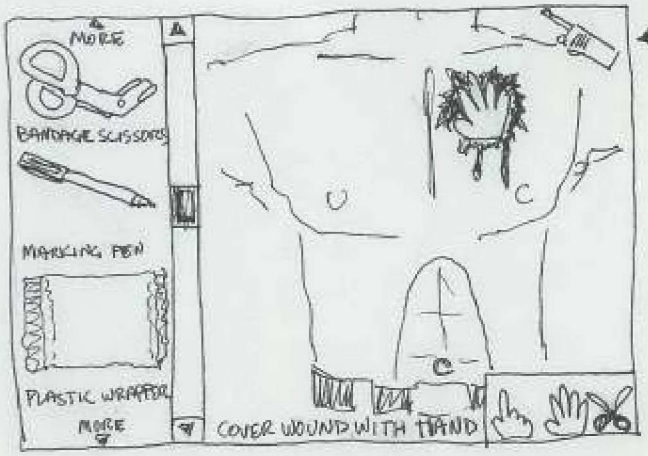
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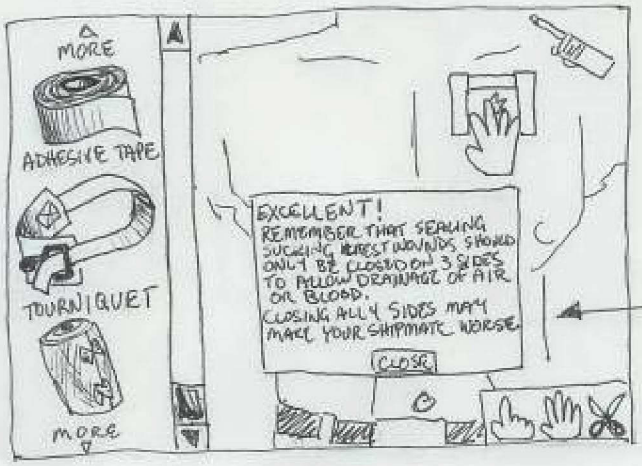
APPENDIX B. INITIAL CONCEPT STORYBOARDS

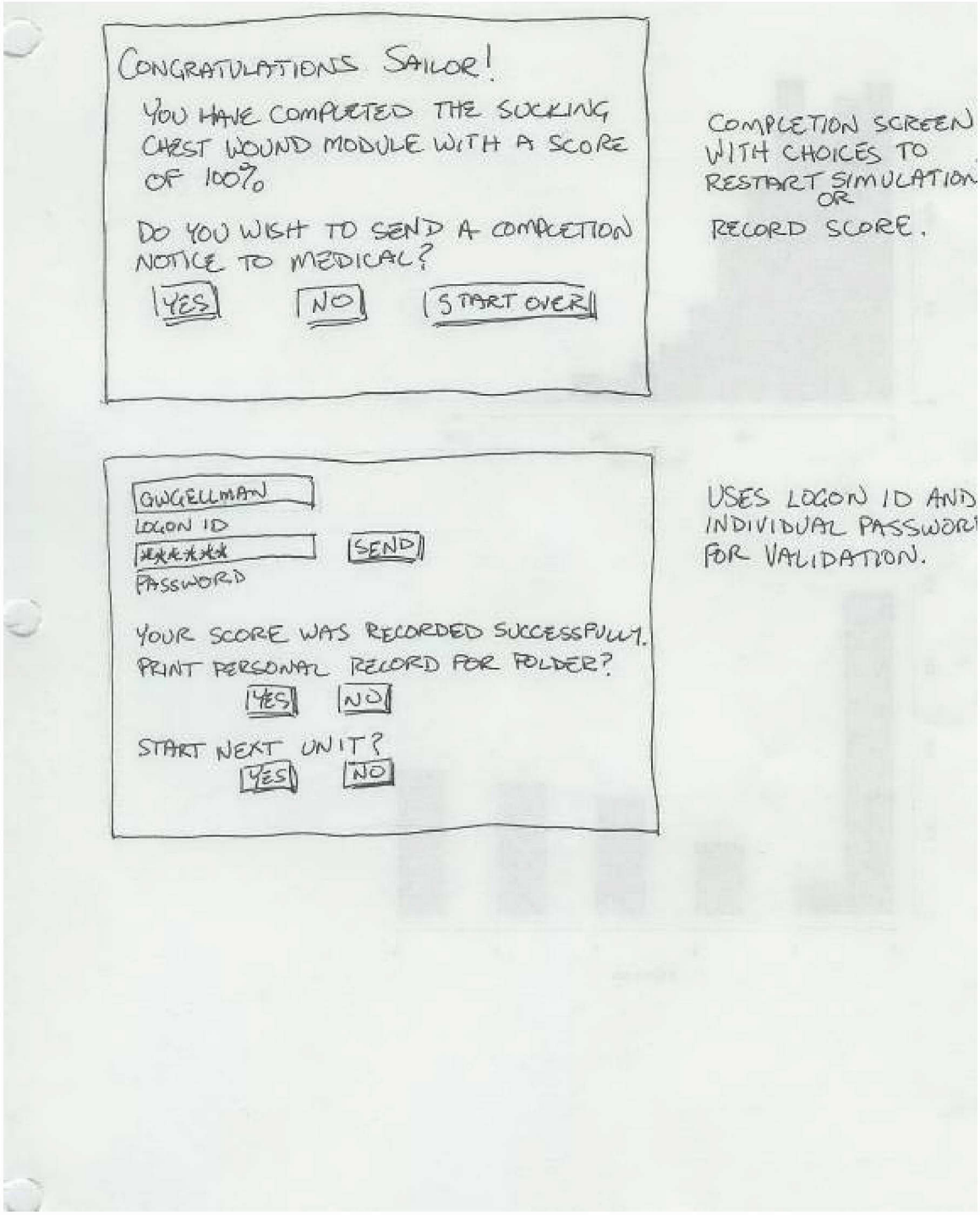
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PROPOSED SCREENS








CONGRATULATIONS SAILOR!
YOU HAVE COMPLETED THE SUCKING CHEST WOUND MODULE WITH A SCORE OF 100%
DO YOU WISH TO SEND A COMPLETION NOTICE TO MEDICAL?
YES
NO
START OVER
COMPLETION SCREEN WITH CHOICES TO RESTART SIMULATION OR RECORD SCORE.
GWGELLMAN
LOGON ID
******
PASSWORD
SEND
USES LOGON ID AND INDIVIDUAL PASSWORD FOR VALIDATION.
YOUR SCORE WAS RECORDED SUCCESSFULLY.
PRINT PERSONAL RECORD FOR FOLDER?
YES
NO
START NEXT UNIT?
YES
NO

APPENDIX C. COMBAT LIFESAVER COURSE MATERIALS

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LESSON 5

PERFORM FIRST AID FOR AN OPEN CHEST WOUND

TASK

Apply a dressing to a casualty with an open chest wound.

CONDITIONS

Given a simulated casualty with an open chest wound and needed supplies.

STANDARD

Score a GO on the performance checklist.

REFERENCES

STP 21-1-SMCT, Soldier's Manual of Common Tasks: Skill Level 1.
FM 21-11, First Aid for Soldiers.

5-1. INTRODUCTION

The body has two lungs. Each lung is enclosed in a separate airtight area within the chest. If an object punctures the chest wall and allows air to get into one of these area, the lung within that area can not fully expand (collapses). In order for both lungs to collapse, both sides of the chest would have to be punctured. Any degree of collapse, however, interferes with the ability to inhale a sufficient amount of air. An excessive buildup of pressure from air or blood around the collapsed lung can also cause compression of the heart and other lung.

5-2. CHECK FOR SIGNS AND SYMPTOMS OF AN OPEN CHEST WOUND

An open chest wound can be caused by the chest wall being penetrated by a bullet, knife blade, shrapnel, or other object. If you are not sure if the wound has penetrated the chest wall completely, treat the wound as though it were an open chest wound. Some of the signs and symptoms of an open chest wound are given below.

Sucking or hissing sounds coming from chest wound. (When a casualty with an open chest wound breathes, air goes in and out of the wound. This air sometimes causes a "sucking" sound. Because of this distinct sound, an open chest wound is often called a "sucking

chest wound.")

Blood coughed up.

Frothy blood. (The air going in and out of an open chest wound causes bubbles in the blood coming from the wound.)

Shortness of breath or difficulty in breathing.

Chest not rising normally when the casualty inhales.

Pain in the shoulder or chest area that increases with breathing.

Bluish tint of lips, inside of mouth, fingertips, or nail beds. (This color change is caused by the decreased amount of oxygen in the blood.)

Signs of shock - Rapid and weak heartbeat.

5-3. LOCATE AND EXPOSE OPEN CHEST WOUND

Expose the area around the open chest wound by removing, cutting, or tearing the clothing covering the wound. If clothing is stuck to the wound, do not try to remove the stuck clothing as this may cause additional pain and injury. Cut or tear around the stuck clothing. Do not try to clean the wound or remove objects from the wound.

Check for entry and exit wounds. Look for a pool of blood under the casualty's back and use your hand to feel for wounds. If there is more than one open chest wound, treat the more serious (largest, heaviest bleeding) wound first.

WARNING

If you are in a chemical environment, seal and dress the wound(s) without exposing the wound(s).

5-4. SEAL AND DRESS THE OPEN CHEST WOUND

Since air can pass through a dressing, you must seal an open chest wound to stop air from entering the chest and collapsing the lung.

a. Open Field Dressing Wrapper

Tear open one end of the plastic wrapper of a field dressing. Remove the inner packet (the

field dressing wrapped in paper) and put it aside. Continue to tear around the edges of the plastic wrapper until a flat surface is created. This plastic wrapper will be used to make an airtight seal which will keep air from entering the chest cavity through the wound. If there is both an entry wound and an exit wound, the plastic wrapper can be torn to make two seals if the wounds are not too large. The edges of the sealing material should extend at least two inches beyond the edges of the wound.

> **CAUTION:** Avoid touching the inside surface of the plastic wrapper. The inner surface will be applied directly to the wound and should be kept as free from contamination as possible.

b. Have Casualty Exhale

Tell the casualty to exhale (breathe out) and hold his breath. This forces some of the air out of the chest wound. The more air that can be forced out of the chest before the wound is sealed, the better the casualty will be able to breathe after the wound is sealed. Have the casualty resume normal breathing after the wound is sealed.

If the casualty is unconscious or cannot hold his breath, place the wrapper over the wound after his chest falls but before it rises.

c. Place Wrapper Over Wound

Place the inside surface of the plastic wrapper (the side without printing) directly over the hole in the chest to seal the wound.

Check the plastic wrapper to ensure that it extends two inches or more beyond the wound edges in all directions. If the wrapper does not have a two-inch margin, it may not form an airtight seal and may even be sucked into the wound. If the wrapper is not large enough or is torn, use foil, a poncho, cellophane, or similar material to form the seal.

d. Tape Wrapper in Place

Tape down three edges of the plastic, usually the top edge and two side edges. This creates a "flutter valve" effect. When the casualty inhales, the plastic is sucked against the wound and air cannot enter the wound. When the casualty exhales, air may be able to exit the wound through the untaped (bottom) edge of the plastic.

> **Caution:** If the securing material is not taped down, it must be held in place until the dressing is applied. If the casualty is able, he can hold the sealing material in place. Otherwise, you must keep the sealing material in place while preparing to dress the wound (see Figure 5-1B).

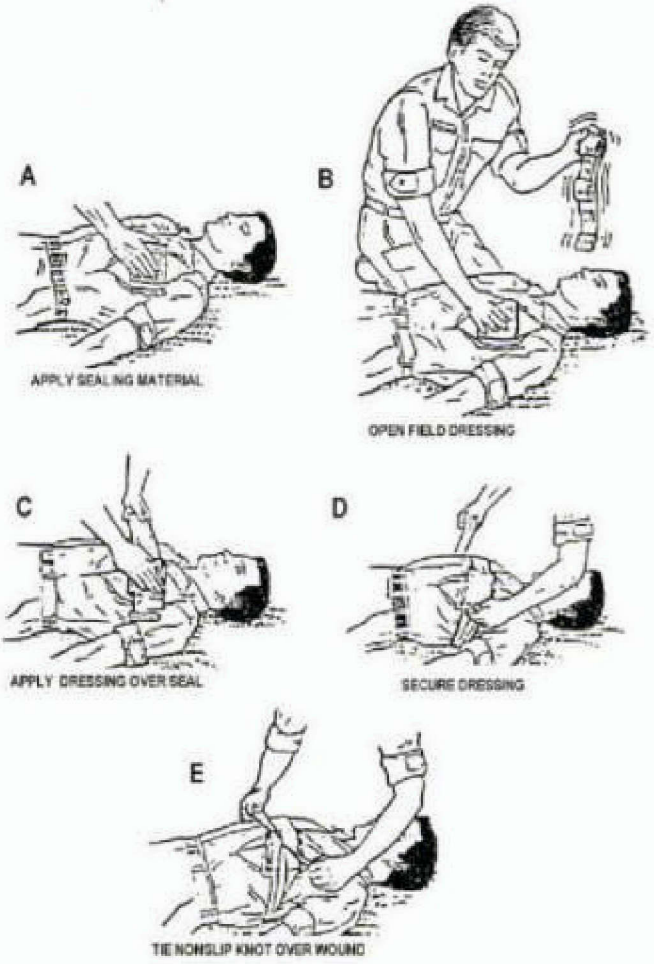


FIGURE 5-1. SEALING AND DRESSING AN OPEN CHEST WOUND

e. Apply Field Dressing

Remove the field dressing from the paper wrapper.

Place the white side of the dressing directly over the plastic wrapper. Maintain pressure on the dressing so the plastic wrapper will not slip.

WARNING

If an object is protruding from the chest wound, do not try to remove it. Place airtight material around the object to form as airtight a seal as possible. Stabilize the object by placing a bulky dressing made from the cleanest material available around the object. Apply improvised bandages to hold the sealing material and dressings in place. Do not wrap the bandages around the protruding object.

f. Secure Dressing

Secure the field dressing using the attached bandage. The field dressing must be tight enough to ensure that the plastic wrapper (or other sealing material) will not slip. If the casualty is able, have him hold the dressing in place while you secure it. If he cannot help, then you must hold the dressing in place while securing it.

Grasp one tail, slide it under the casualty, and bring it back over the dressing.

Wrap the other tail around the casualty in the opposite direction and bring it back over the dressing.

Tighten the tails and tie them with a nonslip knot over the center of the dressing. The knot will provide additional pressure over the wound and will help to keep the seal airtight. The field dressing should not interfere with breathing.

CAUTION: If an object is protruding from the wound, tie the knot beside the object, not on it.

WARNING

If you are not able to tape the sealing material (plastic wrapper) in place and the sealing material slips while the dressing is being applied or secured, the airtight seal may be lost. Remove the dressing and sealing material, reseal the wound, replace the dressing, and secure the dressing.

g. Seal and Dress Other Open Chest Wounds

If there is more than one open chest wound, seal and dress the other wound(s). If needed, improvise dressing from the cleanest material available and use a bandage torn from a shirt or other material to keep the sealing material and dressing in place.

5-5. POSITION A CASUALTY WITH AN OPEN CHEST WOUND

Position the casualty on his side with his injured side next to the ground. Pressure from contact with the ground acts somewhat like a splint to the injured side and helps to reduce pain. (Positioning the casualty on his uninjured side might cause a worsening of his condition.)

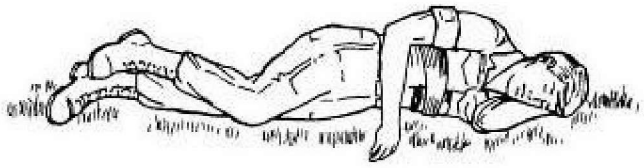


FIGURE 5-2. CASUALTY WITH DRESSED OPEN CHEST WOUND

The casualty may wish to sit up. If he can breathe easier when sitting up than lying on his side, allow him to sit up with his back leaning against a tree, wall, or other support. If he becomes tired, have him lie on his injured side again.

5-6. MONITOR A CASUALTY WITH AN OPEN CHEST WOUND

Seek medical help. If possible, send someone else after help while you stay with the casualty.

Monitor the casualty's breathing. Perform mouth-to-mouth resuscitation, if needed.

Treat for shock.

Evacuate the casualty as soon as practical.

WARNING

Air may still enter the chest cavity even if the wound is sealed and dressed. The air can cause a life-threatening condition called tension pneumothorax.

If the casualty's condition worsens (increased difficulty in breathing, shortness of breath, bluish tint to skin, etc.), lift the sealing material from the wound to let the air escape and then reseal the wound. Taping the plastic wrapper (flutter valve effect) helps to prevent tension pneumothorax.

If possible, practice applying an airtight seal and field dressing to a simulated casualty. Have another person score your performance using a performance checklist.

Continue with Exercises

Return to Table of Contents

PRACTICE EXERCISES: LESSON 5

INSTRUCTIONS: Answer exercises 1 through 8 by circling the letter of the response that best answers the question or best completes the sentence or by writing the missing term in the blank provided. After you have answered all of the exercises, check your answers against the "Practice Exercises Solutions". For each exercise answered incorrectly, reread the lesson material referenced.

1. Which of the following is a sign of an open chest wound?

   a. Blood being coughed up.
   b. Hissing sound coming from a chest wound.
   c. Bluish tint to the casualty's lips.
   d. All of the above.

2. The plastic wrapper is placed over an open chest wound to:

   a. Prevent infection.
   b. Reduce blood loss.
   c. Prevent air from going through the wound and into the chest cavity.
   d. Keep the dressing from having direct contact with the wound.

3. When treating a casualty with a sucking chest wound, have him_____ and hold his breath when you put the plastic wrapper over the wound and have him _____and hold his breath when you tie the tails of the field dressing in a knot.

4. What size of material should be used for making the airtight seal?

   a. Four inches by six inches.
   b. The distance between the edge of the sealing material and the edge of the wound should be two or more inches.
   c. The sealing material should be the same size as the wound.
   d. The sealing material should be slightly smaller than the size of the wound.

5. When applying the field dressing to an open chest wound, where should you tie the tails in a nonslip knot?

a. Tie the knot in the center of the dressing.
b. Tie the knot directly over his spine.
c. Tie the knot on the uninjured side of his body.
d. Tie the knot at the edge of the dressing.

6. If an object is protruding from the chest wound, you should:

a. Not apply the airtight plastic seal.
b. Remove the object before applying the airtight plastic seal.
c. Place airtight material around the object and cover the material with a bulky dressing.

7. You have dressed an open chest wound. How can the casualty now be positioned?

a. Either sitting up or lying on his uninjured side.
b. Either sitting up or lying on his injured side.
c. Lying on his uninjured side only.
d. Lying on his injured side only.

8. You have given buddy-aid to a casualty with an open chest wound. His breathing had improved, but is now getting worse. He is short of breath, his lips are turning blue, and he is becoming very restless. What can you do to help the casualty?

a. Nothing, the casualty's reactions are normal.
b. Place a pressure dressing over the wound.
c. Administer modified abdominal thrusts.
d. Lift the sealing material from the wound, let the air escape from the chest cavity, and then make the wound airtight again.

Check Your Answers on Next Page

IS0824 LESSON 5 Practice Exercise Solutions

1. d (para. 5-2)
2. c (para. 5-3)
3. exhale; exhale. (para. 5-4b)
4. b (para. 5-4c)
5. a (para. 5-4f)
6. c (para. 5-4e)
7. b (para 5-5)
8. d (para. 5-6)
9. See the checklist.

PERFORMANCE CHECKLIST

DRESS AN OPEN CHEST WOUND

Situation: You have evaluated a casualty and found only one serious wound, an open chest wound. You are not in a hazardous environment.

	GO	NO GO
Exposes wound.	_____	_____
Opens field dressing plastic wrapper to create a flat surface without touching the inside surface of the plastic wrapper.	_____	_____
Places inside surface of plastic wrapper over wound when casualty exhales.	_____	_____
Ensures that plastic wrapper extends at least 2 inches beyond the edges of the wound. (Obtains and applies other airtight material to seal wound, if needed.).	_____	_____
Tapes three sides of wrapper.	_____	_____
Applies white side of field dressing over plastic wrapper.	_____	_____
Secures dressing with bandage.	_____	_____
Ties tails in a nonslip knot over the center of the dressing.	_____	_____
Applies manual pressure over wound (5 to 10 minutes if practical).	_____	_____
Positions casualty on injured side or, if casualty desires, sitting up and leaning against a support.	_____	_____
Checks for tension pneumothorax. (If found, lifts seal, lets air escape, reseals wound, and secures seal.)	_____	_____

OVERALL EVALUATION (A no-go on any step gives an overall evaluation of no-go.)	GO _____	NO GO _____

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APPENDIX D. CONTROL GROUP QUESTIONNAIRE

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LIVE CLASS STUDENT #_____
SUCKING CHEST WOUND

1) Have you had this training before?
2) Was this class similar to other Navy training classes?
3) Did the instructor prepare you for the physical skills?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

4) Did the instructor prepare you for the written test?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

5) Will you review this material after today?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

6) Do you find this skill important?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

7) Do you prefer lectures to other alternative methods of learning?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

8) Would you like to limit the amount of lecture-based training you receive for required training?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

9) Would you use computer based training if offered?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

10) Please comment:

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APPENDIX E. EXPERIMENTAL GROUP QUESTIONNAIRE

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SIMULATOR STUDENT #_____
SUCKING CHEST WOUND

1) Have you had this training before? Yes No
2) Did you discuss your progress with others, including your instructor? Yes No
3) Was this class similar to other Navy training classes? Yes No
4) How many times did you access the simulator?

1-2	3-4	5-6	More than 7	Not at all

5) How many hours in total did you spend on the simulator?

0-.5	.5-1	1-1.5	1.5-2	2+

6) Did you find the method in which the material was presented engaging?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

7) Do you feel you were adequately prepared for the physical skills?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

8) Do you feel you were adequately prepared for the written test?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

9) Was the instructor review helpful?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

10) Do you find this skill important?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

11) Would you prefer this type of testing over lectures for annual training?

Very much so	Could have been better	Sort of	Could have been worse	Not at all

12) Will you review this material over the next year?

Definitely	Probably will	Sort of	Probably won't	Not at all

13) Please comment:

APPENDIX F. EXPERIMENT RESULTS

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Control Group Results

C9 ▼ fx No Resp

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	STUDENT	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	GO/NO	PROMPT	QUIZ	
2	0541	0	1	5	5	5	5	3	3	5	1	1	8	
3	0451	0	0	5	5	3	5	3	5	1	1	0	7	
4	9721	0	1	5	5	5	5	3	1	5	1	0	8	
5	1411	0	1	5	5	3	5	1	3	5	1	1	8	
6	3705	0	0	5	5	5	5	1	3	3	0	1	6	
7	5073	0	1	5	5	3	5	1	5	5	1	0	6	
8	6917	0	1	5	5	3	5	2	3	5	1	0	8	
9	0182	No Resp	No Resp	4	4	2	5	4	3	3	1	1	7	
10	8371	0	0	5	5	5	5	3	5	5	1	0	7	
11	3214	0	1	5	5	5	5	5	3	5	1	0	6	
12				4.90	4.90	3.90	5.00	2.60	3.40	4.20			7.10	N=10
13		0=NO	0=NO								0=NO	0=NO		

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Experimental Group Results

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	STUDENT	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	GO/NO	PROMPT	QUIZ	
2	6751	1	No Resp	No Resp	5	5	5	5	5	5	5	5	2	1	0	8	
3	9732	0	0	1	5	5	4	4	4	5	5	5	5	0	1	7	
4	9717	0	1	0	5	5	5	4	5	5	5	3	4	1	0	8	
5	9219	0	0	No Resp	5	5	5	3	5	5	5	5	4	1	0	8	
6	5366	1	No Resp	No Resp	5	5	3	3	5	3	4	5	1	1	0	8	
7	4113	0	0	1	5	5	5	5	5	5	5	5	4	1	0	8	
8	1915	1	0	1	5	5	4	4	5	4	5	5	2	1	0	8	
9	3415	1	0	1	5	4	4	4	5	5	5	5	2	1	0	8	
10	6991	1	1	1	5	5	5	5	5	4	3	5	4	1	0	8	
11	9105	0	No Resp	No Resp	5	5	5	4	5	5	5	5		1	0	7	
12	5682	0	No Resp	No Resp	5	5	4	4	4	5	5	5	1	1	0	8	
13	9309	0	0	1	4	4	4	3	5	5	5	5	1	1	0	8	
14					4.92	4.83	4.42	4.00	4.83	4.67	4.75	4.83	2.73			7.83	N=12
15		0=NO	0=NO											0=NO	0=NO		

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