U.S. Army Research Institute
for the Behavioral and Social Sciences

Research Report 1939

Training Aids for Basic Combat Skills: A Procedure for Training-Aid Development

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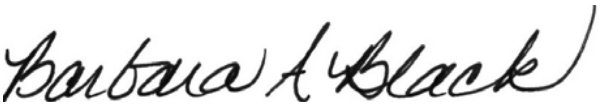

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14. ABSTRACT *(Maximum 200 words)*: There is a need to augment existing Army training approaches to address the differential rates and stages of learning evidenced among Soldiers. One way to easily modify existing training approaches is to make adjunct training aids available to trainers for use when appropriate. The fact that basic combat skills represent a heterogeneous skill set and are trained to Soldiers with large variability in skills and knowledge suggests that training aids may have a significant impact when used to train basic skills. This report describes a training-aid development process and provides a brief summary of training aids produced: a set of 200-meter zero targets, two aids to assist in the marksmanship zero process, material to reinforce and practice grid-coordinate skill, and a video capture and playback system. An assessment was conducted for each prototype training aid to determine its training value and to gain feedback for possible revisions. Each training aid contributed to enhanced Soldier performance. Details on the design, development, and assessment for each of the prototypes are provided in separate reports.

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TRAINING AIDS FOR BASIC COMBAT SKILLS: A PROCEDURE FOR TRAINING-AID DEVELOPMENT

EXECUTIVE SUMMARY

Research Requirement:

As an all volunteer force, the U. S. Army receives personnel with myriad backgrounds, experiences, and capabilities. In Initial Entry Training (IET), Soldiers are grouped into training units so Drill Sergeants (DSs) can train them on dozens of basic combat skills. Due to the low DS-to-trainee ratio and other challenges, trainees are often left on their own to determine if the skill is learned. The overarching goal of the current project was to develop a set of training aids that could be used by Soldiers to improve basic combat skill proficiency. The specific goals for designing and developing new IET training aids were to determine the greatest needs for new training aids for combat skills, to determine the most effective type of training aids to train these needs, to develop prototype training aids that meet the stated criteria, to assess the training effectiveness of the prototype training aids, and to document the process of developing training aids for basic combat skills.

Procedure:

After soliciting suggestions for potential training aids from approximately 150 IET trainers and reviewing recent research on IET skill performance, researchers followed a five-phase process to design, develop, utilize, assess, and revise prototype training aids. Training aids included a set of 200-meter zero targets, two aids to assist in the marksmanship zero process, material to reinforce and practice the map reading skill of plotting grid coordinates, and a video capture and playback system that could be used to provide immediate performance feedback to Soldiers.

Findings:

The five-phase training-aid development process proved to be useful. A relatively low-cost and easily used set of training aids was developed that could augment and remediate training outcomes across a Soldier population that varied in initial levels of ability on a given skill. The training aids developed for the current project used a combination of hands-on practice and background information to provide training material that would benefit individuals across multiple skill levels. Even though following the training-aid development process yielded effective products, some improvements to the process were noted.

Utilization and Dissemination of Findings:

Products stemming from the current training-aid development have been provided to selected IET units. Details on assessment of the training aids are provided in separate reports. Copies of the training aids for reproduction are available from the ARI-Fort Benning Research Unit.

TRAINING AIDS FOR BASIC COMBAT SKILLS: A PROCEDURE FOR TRAINING-AID DEVELOPMENT

CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

Training Aids for Basic Combat Skills: A Procedure for Training-Aid Development

Introduction

Training aids can be defined as objects or apparatuses that facilitate the learning objectives of training. Training aids differ from *training devices* in that a training device helps simulate the training task whereas a training aid supplements the training environment. Likewise, a training aid differs from a *job aid* because a job aid facilitates the execution of a task whereas a training aid facilitates the *learning* of a task. For the most part, training aids serve as memory joggers, advanced organizers, part-task trainers, remedial information, and examples of "the right way." Examples of training aids are prevalent in the military including flashcards for vehicle and aircraft identification, films and videos demonstrating various tasks, and computer programs to present decision-making scenarios. It is important to note that most training aids were designed to be used by trainees, but training aids may also be used by *trainers*. That is, some training aids help trainers make decisions about how to execute training given a certain set of circumstances or provide trainers with alternate approaches to training.

Historically, the ability to match training to Soldiers with different military and educational backgrounds and with heterogeneous skills and knowledge has been difficult to accomplish with existing training approaches. As a consequence, there is a need to incorporate training methods to address the differential rates of Soldier learning into existing training approaches. One way to easily modify existing training approaches is to make adjunct training aids available to trainers for use when appropriate. For example, Drill Sergeants (DSs) could provide combat-life-saver (CLS) flashcards to Soldiers who have difficulty understanding life-saving principles.

The fact that Initial Entry Training (IET) trains Soldiers from across the spectrum of military occupational specialties (MOSs), that the vast majority of IET Soldiers have no military background, and that IET Soldiers have different educational experiences suggests that there should be large variability in the skills and knowledge among IET Soldiers. For example, differences among IET Soldiers in marksmanship are likely due, in part, to differences in experience with weapons prior to IET. Likewise, learning skills and rates of learning will vary among IET Soldiers. Finally, basic combat skills are a heterogeneous skill set. As a result, training aids may have a significant impact when used in IET. In fact, the premise of the current project was that DSs can use training aids to alleviate some impacts of mixed-skilled populations in IET.

Training Challenges in IET

As an all volunteer force, the U. S. Army receives personnel with myriad backgrounds, experiences, and capabilities. As a consequence, incoming recruits are extremely diverse in both mental and physical abilities and range from some who lack high school diplomas to others with advanced academic degrees and from some who cannot pass basic physical aptitude tests to others who have played professional sports. This variety of individuals is grouped into training

units so DSs can transform them into Soldiers. A key aspect of the transformation is training this diverse mix of trainees on dozens of basic-combat skills[1].

Much of the skill training conducted during IET begins with a classroom presentation where a single DS might present information to more than 200 trainees. These sessions are often followed by some form of practical exercise. However, due to the low DS-to-trainee ratio and the host of requirements levied on DSs, these exercises frequently do not allow trainee performance to be assessed. In many instances, a trainee is left on his own to determine if he believes he has learned the skill, and many trainees do not ask questions even if they do not understand. Because the majority of skill training does not include a formal test to measure Soldier proficiency, there is no assurance that each Soldier acquires a given skill (Cobb, James, Graves & Wampler, 2009; Dyer, Wampler, James, Leibrecht, & Beal, 2007).

While Noncommissioned Officers attend school prior to being assigned as DSs, they frequently do not possess the requisite skills to be high-quality trainers (Beal, Dyer, James, Wampler & Johnson, 2008). DSs typically rely on lecturing trainees with information direct from standard training packages and do not adjust the training presentation to the audience. DSs may lack the expertise, the time, or the desire to modify training materials or approaches. Most likely, it is the case that DSs are not versed in tailoring their implementation of training methods, especially in the context of relevant learning theories. Because of factors such as throughput and time constraints, there may be little opportunity for alternative training techniques based on pre-training level of proficiency or experience of the learners. In fact, training techniques are seldom altered to better suit the task or training audience (for examples see, Dyer, Fober, Wampler, Blankenbeckler, Dlubac, & Centric, 2000; Leibrecht, Wampler, Goodwin, & Dyer, 2007; Wampler, Dyer, Livingston, Blankenbeckler, & Dlubac, 2006). Training programs, even for IET, might be improved if trainers accommodate requirement-specific training goals, student populations with varying characteristics, and diverse training environments. Using knowledge and training aids to tailor some aspects of training to individual needs may help Soldiers retain some skills (Arthur, Bennett, Stanush, & McNelly, 1998) and improve overall Soldier readiness.

Technical Objectives

The overarching goal of the current project was to develop a set of training aids that could be used by IET companies to assist Soldiers in improving their skill proficiency. The specific goals for designing and developing new IET training aids were as follows:

- To empirically determine the greatest needs for new training aids for combat skills,
- To determine the most effective type of training aids to train these needs,
- To develop prototype training aids that meet the stated criteria,
- To assess the training effectiveness of the prototype training aids, and
- To document the process of developing training aids for basic combat skills.

[1] According to the Soldier's Manual of Common Tasks (Department of the Army [DA], 2006) , there are 172 Warrior Skill Level 1 tasks. However, due to resource constraints some of these tasks are not trained in IET.

The final goal may sound superfluous. However, it was important to document the process used to develop the training aids because there is a paucity of research specifically outlining the methods for developing effective training aids especially in military contexts. Thus, it was first necessary to conceptualize the most efficient ways to design training aids in order to develop useful products. The current report documents a process for designing and developing training aids for basic combat skills. The report was only intended to document the process and to describe the products developed from the process. More careful analysis of the effectiveness of the training aids was provided in subsequent documentation (see Bink, Dlubac, Cage, & Wampler, 2011; Wampler, Bink, & Cage, 2011; Wampler, Dlubac, & Bink, 2011).

A Conceptual Approach to Training-Aid Development

Enhancing learning through the use of aids is a constant in training and education. Researchers in fields as varied as disability education, business, firefighting, vocal performance, sports, neuropsychological rehabilitation, and military education and training have all addressed the benefit of training aids (Achten & Jeukendrup, 2003; Carter & Carter, 1978; Kizakevich, 2002; Lasky, 1998; Rose, Brooks, & Attree, 2002; Sangiorgi, Manfredi, & Bruscaglioni, 2005; Taylor & Berry, 1998). Concepts embedded in the training-aid literature from across these various fields can be used to produce a rather consistent and systematic method of developing training aids. In particular, five major component phases of training-aid development emerged from the literature: Design, Development, Utilization, Assessment, and Revision. It is important to note that while the names of these phases might imply training aid completion, each component phase contains principles for training-aid development. In other words, a training aid is not fully developed until each phase has been applied to the aid. Additionally, these phases are completed sequentially, and it would be misguided, if not impossible, to execute these component phases in random order.

Prior to describing the specifics of each training-aid development phase, some preliminary distinctions are important. The phases that were most difficult to parse, and are many times easily confused, were the Design and Development phases. The Design phase refers to the preliminary plans regarding the purpose and function of the aid, whereas the Development phase refers to the application of Design principles to the practicality of the training environment and resources available for the training aid (Design, 2010). One way to easily distinguish the Design phase and the Development phase is the involvement of preparation vice participation. In other words, Design involves preparing the aspects of the aid that will drive its use, whereas Development involves participating in the construction of the aid and planning the practical aspects that might influence that construction.

Following Design and Development, Utilization involves the use (physical or mental) of the training aid. Next, Assessment involves the empirical and practical review of the phases that precede it. Principles in the Assessment phase call for the evaluation of whether the aid was effectively utilized in its current design to meet the goals for which it was developed. Finally, Revision involves using the evaluation results to create a more effective and efficient training aid.

Design phase. The training-aid Design phase addresses three considerations: the purpose, training analysis, and instructional design. In beginning to design a training aid, it is important to have a clearly defined purpose that includes both general notions of goals for the training aid, and more specific and concrete functions of the training aid. In developing aids for Field Artillery training, Horrocks, Fotheringham, and Bowlus (1956) proposed a general outline for the purpose of all training-aid design. The authors suggested that a training aid should generally increase training effectiveness, reduce training time, decrease skill loss, and decrease costs. Though maintaining this exact outline is not essential, what is important is to develop general guidelines to support training-aid development. Additionally, a specific purpose is necessary to determine which type of "training" is to be aided (Lumsdaine, 1960). That is, choosing a specific purpose involves deciding what type of mental skill or physical skill (or a combination of skills) is to be served by the training aid. Additionally, training aids can be used to provide background information about a concept, to explain relations among concepts, to practice task procedures, or to enhance decision making ability (Lumsdaine, 1960).

Once there is a clearly defined purpose, it is important to move into analysis of the task or the skills to be trained. A variety of task-analysis techniques exist (for a review see Schraagen, Chipman, & Shalin, 2000) including approaches specifically developed to provide curriculum elements for training (e.g., Shute, Torreano, & Willis, 2000). The goal for task analysis in training-aid development is to gain a comprehensive understanding of the skills required for the training task. In general, any training task can be divided into prerequisite skills and advanced skills. A training aid must tap prerequisite skills as these skills are necessary for basic understanding of the task. Advanced skills are those that are essential to meet any performance criterion and are specific, objective, and measurable (Horrocks et al., 1956; Lumsdaine, 1960). The developer should identify which components of the advanced skills lead to mastery of the training task. For instance, in restructuring the heart rate monitor for use as an aid in sport training, developers concluded that advanced skills for which the monitor should train were the ability to maintain increased intensity for longer duration over increasingly frequent training periods (Achten & Jeukendrup, 2003). The identification of advanced skills allows developers to structure aids that are difficult enough to challenge the learner (Lumsdaine) and to determine the types of training materials that benefit learners at different levels (e.g., Kalyuga, Chandler, & Sweller, 1999).

Once the task is identified for which a training aid will be used, some consideration of how the task will be trained is needed. That is, a process of instructional design needs to be applied to the training task. In general, instructional design involves incorporating basic learning principles with a delivery modality appropriate to the task to be trained. The goal of instructional design, at this point, is not to produce a training aid, but rather, the goal is to prescribe the efficient conditions of learning for the given training task (Lumsdaine, 1960). There are at least four basic learning principles that a training aid can address. A training aid should increase motivation for the task, provide a relation to existing knowledge for the task skills, provide immediate feedback on performance, and provide the opportunity for repetitive practice of the task (ref. Ericsson, Krampe, & Tesch-Romer, 1993; Lumsdaine). One or more of these learning principles should guide how the training aid is used. In addition to these learning principles, some consideration should be given to whether the training aid will address the whole task or only part of the task. There is considerable evidence that part-task training is both effective (e.g.,

Goettl & Shute, 1996) and efficient (Lumsdaine), but a training aid may be needed for the whole task. Also, decisions should be made whether the training aid is to be individually used or used in a group. All of the decisions about the best application of learning principles, whole-vs-part task training, and how the aid is to be used will guide the ultimate form of the training aid.

Development phase. Whereas the Design phase focuses on the conceptual principles that should govern the development of a training aid, the Development phase is focused on the practical application of the conceptual principles given the resources and environment in which the aid will be utilized. The Development phase is concerned with the functional characteristics of the aid and with the utility of the aid, which includes the resources available for development, and the limitations that inevitably exist in any training environment. It is in the Development phase that a prototype of the training aid is produced.

The functional characteristics of a training aid include the material that will be presented to the trainee and the modality of presentation (Horrocks et al., 1956). These functional characteristics yield different types of training aids including graphic aids (e.g. charts, slides, etc.), enhanced practice components (e.g. enhanced targets.), simulators (e.g. part-mission, full-scale equipment, etc), or reference booklets (see Evans & Osborne, 1988; Sticha, Gibbons & Singer, 1993).

Functional characteristics also include the interaction required between the trainee and the training aid. That is, if responses are to be made by trainees using the training aid, one must determine how the responses are to be made and, if necessary, to be recorded. A final consideration for the functional characteristic of a training aid is the environment in which it is to be used. For example, training aids used in basic combat training should be portable and weather resistant in order to withstand the field-training environment.

The utility of the aid includes addressing how the aid should be applied in training. This aspect of the Development phase is greatly influenced by the principles established in the Design phase, and includes considerations of time-limits for use of aids, and of using the training aid to maximize retention (Carter & Carter, 1978). Finally, a consideration of the resources available to develop the aid must be made. It is advantageous to use a cost-benefit analysis to determine the benefit of using aids that are more expensive and closer to the task requirement versus a low-cost substitute (Lasky, 1998; Lumsdaine, 1960). After the major development issues have been decided, it is important to assess the limitations of the developed aid with regard to the design factors that cannot be compromised and those factors that must be compromised (Horrocks et al., 1956).

Utilization phase. Once the prototype aid has been developed, it is important to pilot the use of the aid to assess whether the aid is utilized as intended and whether other ways in which the aid is utilized in the training environment are beneficial to training. The first consideration of the Utilization phase is to identify the utilization techniques. It is important to consider which techniques are naturally employed in the use of the training aid in addition to the intended techniques. Another consideration of the Utilization phase is to ensure broad exposure to the training aid and reinforcement for training aid use (Carter & Carter, 1978). These considerations will allow an accurate assessment of the training aid's effectiveness. Finally, informal feedback

can be obtained from trainees regarding the use of the training aid (Lumsdaine, 1960). Informal feedback allows adjustment of utilization procedures to fit trainees' needs.

Assessment phase. The Assessment phase is one of the most important activities in the development process in that assessment serves to define the final training aid product. Assessment includes both empirical and practical assessment of the aid. Without both components of the assessment process, the aid is at-risk of being ineffectual in the training environment. The empirical assessment process consists of validating the benefit of the training aid to an individual's knowledge as well as validating the transfer of skill obtained from the training aid to the real-world skill (Lumsdaine, 1960; Rose et al., 2002). The developer should look for measurable differences in knowledge before and after training aid use (Carter & Carter, 1978). For instance, after implementing a training aid for singers, Sangiorgi, Manfredi, and Bruscaglioni (2005) assessed whether singers had improved as expected, and were all within one standard deviation of the "desired voice". In addition to examining changes in individual knowledge, the training aid developer should also identify whether the benefit transfers to outcomes in real-world applications (McMillan, Bunning, & Pring, 2000; Rose et al.).

Once the empirical assessment demonstrates the learning outcomes of training-aid use, it is vital to complete an "ecological" assessment. The ecological assessment is meant to move beyond the experimental efficacy of the training aid to assess trainers' and trainees' perceptions of usefulness (Lumsdaine, 1960; Rose et al., 2002). The ecological assessment should assess the capability and the motivation for training aid use. Both capability and motivation will be significant determinants of whether the aid is implemented as expected in the training environment. On the one hand, capability is a question of assessing the degree to which trainees across varying levels of knowledge are capable of using the aid (Rose et al.). On the other hand, motivation is a question of the degree to which trainees are motivated to use the aid (Rose et al.).

Revision phase. The final phase of the training-aid development process is Revision. This phase consists of modifying the aid based on necessary changes identified in the Assessment phase (or other phases) as well as outlining new recommendations for the trainer and future aid developers. Researchers should be mindful that modifications to aids should better approximate necessary conditions for learning and that recommendations should include those to improve the development of aids meant to train similar tasks (Bakker, 1968; Horrocks et al., 1956; Lumsdaine, 1960). Finally, it is important to keep in mind that following the revision stage, the developer should repeat the utilization and assessment stages until the aid is satisfactory and the developer is left with no further revisions.

Method

In the current research effort, the five phases of training-aid development were leveraged to produce aids for basic-combat skills. The primary design principles for these new training aids were that the aids should (a) address tasks with which many Soldiers have difficulty mastering, (b) address tasks that are critical to basic combat training, (c) be easily used in the field, and (d) be beneficial to Soldiers across multiple levels of ability. Furthermore, the training aids were designed to allow Soldiers as much hands-on and self-guided practice as possible.

From these design principles, training-aid development was executed in four discrete activities. First, input was sought from DSs and training leaders in basic combat training (BCT) companies and in Infantry one station unit training (OSUT) companies. This input developed a list of possible training aids. Next, the possible training aids were analyzed according to the design principles and to the degree of practicality in order to choose prototype aids. Third, a set of prototype aids was given to training companies to utilize and assessments of the aids were conducted. Finally, the aids were revised into final forms and produced for distribution. It is important to note that the focus of the present report is to thoroughly document the Design, Development, and Utilization phases for each training aid. The assessment of the training aids is detailed in other reports (see Bink et al., 2011; Wampler, Bink, & Cage, 2011; Wampler, Dlubac, & Bink, 2011).

Idea Generation for Training Aids

In order to inform the Development process, a series of brainstorming sessions were conducted to gather ideas for new training aids. The primary brainstorming technique was to solicit suggestions from the DSs and leaders who were responsible for training new Soldiers. In a series of interviews and small group discussions (2 to 7 participants per group) researchers solicited input from approximately 150 DSs and training company leaders. Participants represented more than 25 different training companies including both BCT and OSUT. They comprised multiple specialties with varied background experience and included trainers for mixed-gender courses.

Each interview and discussion group began with a researcher providing a brief explanation of the project purpose. The researcher provided some ideas about potential use of training aids to initiate thoughts without influencing participant suggestions. The discussion generally followed a series of questions that attempted to elicit specific ideas from the participants (see Appendix B for the questions used). To ensure interviewees considered the potential for training aids for all basic training skills, researchers provided participants a summary list of major blocks of training included in BCT (Basic Combat Training Center of Excellence, 2008). Appendix A lists the training blocks used.

When participants were asked to suggest potential training aids, they were instructed to avoid perceived limitations and restrictions. Therefore, suggestions did not consider the cost, feasibility, or other factors (e.g. storage space, quantity required in order to be useful) that would impact pursuing these items. Also, some items were suggested by a single person and other participants disagreed with the suggestion, while some items received some consensus and

support from other participants. In some cases participants suggested a wider distribution of existing training aids and materials (e.g., realistic mannequins for practicing CLS tasks, paintball guns or Simunitions to increase training realism, improvised explosive device kits, and roll-over vehicle trainers). Suggested modifications to existing training aids were considered, but suggestions about merely expanding the distribution of currently available aids were not included in further analysis. Appendix C provides a comprehensive listing of training aids suggested by the participants.

In addition to soliciting input from trainers, results were examined from recent ARI projects to identify difficult training tasks (Cobb et al., 2009; Dyer, Tucker, Wampler & Blankenbeckler, 2009; Dyer, et al., 2010; Wampler, James, Leibrecht, & Beal, 2007). The intent was to determine training subjects that might benefit from the use of a training aid. This examination also included a review of existing Army training aids (DA, n.d.; DA, 2009). Finally, various training technologies being examined by other ARI offices were considered. The intent was to capitalize on on-going research that might yield beneficial ideas for training aids.

Selection and Development of Prototype Training Aids

There were several criteria for selecting the specific types of training aids to be developed. First, the training aids should address important basic-combat skills. Second, the training aids should address tasks with which IET Soldiers have difficulty. Third, the training aids should be compact and portable enough to be used in field environments but could also be used in the barracks or a classroom. Finally, the training aids should address the need to tailor training to the background and proficiencies of Soldiers.

Input from trainers yielded more than 100 potential ideas for training aids that did not include suggestions for a wider distribution of existing training aids. In an attempt to select the aids for further development, researchers compiled a list of selection criteria that might assist in identifying potential training aids that met the design principles. Table 1 provides the major criteria and the associated point values[2]. Because point values were subjective and not all criteria could be equally applied (e.g., ideas suggested in later sessions could not be considered by earlier participants), the rating process was intended only to provide an indication of which potential training aids might be more beneficial for consideration. While this rating process provided some relative indication of differences between the suggested training aids, the resulting values were not used in the final selection of training aids to pursue. In fact, some training aids with a low point value continued to be considered as candidates because of other practical considerations such as low cost, potential impact to critical IET tasks, etc.

[2] Discreet "point values" were assigned with the specific purpose of providing a clear discrimination of the overall contribution to training between the various training aid suggestions. The assigned point values do not represent the "worth" of any particular idea or criteria.

Table 1
Criteria for Evaluating Value of Potential Training Aids.

	Point Value		
Criteria	**1**	**5**	**10**
Extent of users	Not used by Soldier	1 item per platoon	Every Soldier
Criticality of combat skill	Nice to know	Save or take a life	Need to know
Projected usage	Up to 4 hours	5 to 10 hours	> 10 hours
# DS requests	< 10	11 to 20	> 20
Supports tailored training	Fast & slow learners	All Soldiers	Peer training
Soldier proficiency	No change	Some increase	Increase understanding

Given the large number of suggested training aids to be considered (see Appendix C), a means to refine the list to a smaller number was necessary. Using a panel of seven personnel, the Policy Delphi process (Linstone & Turoff, 1975) was semi-formally employed. The panel consisted of experts in training research and experts in basic-combat training. The panel was used because feedback and recommendations from a structured group of experts would yield a more meaningful and well-rounded outcome than those from unstructured groups or individuals. All panel members received the complete list of suggested training aids. In the first round of discussion, each person was asked to select the 20 training aids recommended for further consideration. Even with the large number of suggested training aids it is worth noting that each panel member selected only 10 to 15 items. The list of recommended training aids was posted for all panel members to view and common recommendations were clearly identified. Panel members discussed their rationale for recommending the items that differed from other panel members. In the next round of the selection process, panel members varied their range of recommendations and a general consensus identified 11 training aids for further exploration.

Subsequent to the Policy Delphi session, details on available training aids including information on what might already exist either in the military system or from commercial sources were gathered. Results from this exploration were shared with the Policy Delphi panel members and another session was conducted to further reduce the number of training aids to be considered. In a third round of the Policy Delphi process, panel members identified seven training aids for further consideration.

The final selection process involved the application of two factors. First, items that would be extremely costly were ruled out. One example was the possibility of a life-like functioning mannequin to apply actual CLS based on simulated medical conditions. Due to the anticipated cost of such a training aid, the likelihood of making this item available to support training basic combat skills was deemed to be remote. The second factor considered was the application of technologies that could potentially improve training. Because BCT/OSUT units generally have limited technologies available, the intent was to see if existing items could be used to assist in training basic-combat skills.

Considering the all factors and feedback received from basic-combat skills trainers, the list of seven training aids was reduced to four. The final training aids chosen for prototype development were:

- A target set that assists obtaining a 200-meter zero on rifles used in BCT/OSUT,
- Aids to be used by individual Soldiers to enhance their basic marksmanship skills,
- Aids that refresh map-reading skills in plotting grid coordinates,
- A means to provide immediate visual performance feedback to Soldiers.

Because each prototype training aid had unique intended purposes, each of the training aids was produced with different design principles and slightly different development processes. The specific details of the development process for each prototype training aid are provided in later sections of this report.

Utilization and Assessment of the Prototype Training Aids

While the assessment of each training aid followed a similar process, each was somewhat different. The following provides a general description of the process that was common across the training aids. A separate assessment plan was developed for each set of training aids. Each plan consisted of two major areas. First, a means to measure the "potential value" of the prototype aids was devised. This measurement was intended to be objective and was generally based on the possible contribution of the training aid to increasing overall Soldier performance. For example, the contribution of the targets and marksmanship training aids was centered on measuring marksmanship training performance and rifle qualification performance. The second area of the assessment plan involved soliciting feedback from users on how the training aid might be modified to increase its potential value. This area of assessment included the material content of the training aid, the design and display of the information, and the construction of the training aid including size, shape, and durability.

Once the assessment plan was developed, researchers coordinated with IET unit leaders to identify and select the company or companies to receive and assess the various training aids. The major selection criterion was that the companies had to be conducting training in the near future that could possibly benefit from the use of the training aid being assessed. For example, in the case of the map reading training aids, researchers requested a unit that was about to receive its initial map reading training class so the training aids could be provided immediately following the class.

For all training aids except map reading, DSs required some train-up in order to fully understand how to use the training aid as it was intended. For example, the training aids used to provide immediate feedback to Soldiers on their performance included a camera and projector, and train-up for DSs involved the operation of the equipment as well as providing some suggestions as to when and how the training aid might be useful. Generally, the train-up was conducted and the actual training aids were delivered to the companies just prior to or in conjunction with the block of training to be supported by the training aids.

The companies were allowed to retain and to use the training aids for varying periods of time depending on the block of training being supported. The targets and materials to assist with improving marksmanship were provided to the company at the beginning of its basic rifle

marksmanship (BRM) block of training. The company retained and used the training aids at various times throughout the BRM training periods, which generally lasted about three weeks. The assessment ended when the company conducted its final BRM session when all Soldiers attempted to qualify with their rifles. The map-reading materials were provided to the company when they received their initial map-reading training class and the company retained the training aids for about four weeks. These training aids could be used at any opportunity during this period and whenever Soldiers had the time. The video-feedback equipment was provided to DSs at different points in the training cycle and for varying periods of time. Some companies used the equipment for an entire training cycle, about 11 weeks, while other companies used the equipment for just a single training event or for a few days in the middle of the training cycle.

During the training-aid assessment period, some interaction with the companies was used. In the case of the marksmanship training aids, researchers gathered intermediate firing performance data. For the video-feedback equipment, researchers gathered weekly input from DSs throughout the training cycle rather than waiting several weeks and expecting DSs to recall details of when and how the equipment was used.

At the end of an assessment period, final data concerning the potential impact on training performance was captured, and the Soldiers and other personnel within the company who used the training aids were also surveyed. The survey generally addressed the amount of time Soldiers spent using the training aids as well as any suggestions for improvement. Following analysis of survey and performance data, various actions were taken as the Revision phase. In some cases, the training aids were modified and then provided to a different company for assessment. In other instances, the training aids remained basically unchanged, but were provided to a different company, in different quantities, or for different periods of time for assessment.

Details on the actual assessment and analysis for each of the training aids are provided in separate reports. See Bink, et al. (2011) for prototype targets and zeroing training aids. See Wampler, Bink, & Cage (2011) for map reading training aids. See Wampler, Dlubac, & Bink (2011) for the training aid components to provide immediate performance feedback to Soldiers.

Products of the Research

Each of the following sections provides a brief explanation of the process used to produce the prototype training aids. Each section also provides a general description of the final training aid with supporting rationale for the design. Finally, a brief description of the assessment outcomes and revisions to each training aid is given.

Set of 200-meter Zero Targets

The Army's marksmanship doctrinal publication, Field Manual (FM) 3-22.9 (DA, 2008), provides information for zeroing rifle sights at 300 m. Zeroing is the process of adjusting a weapon's sight so that the point-of-aim corresponds to the point-of-impact of the round. Targets provided on firing ranges are designed for obtaining a 300 m zero on the rifle sights. However, an emerging Army philosophy is that Soldiers should use a 200 m zero (Currey, 2008). For

example, the Army's Asymmetric Warfare Group developed the Combat Applications Training Course, which included having Soldiers zero their rifles to 200m. The stated advantage of a 200 m zero is that the point-of-impact of the bullet is within three inches of the point-of-aim from the rifle out to about 250 m. With a 300 m zero, the point-of-impact of the bullet is about seven inches above the point-of-aim at 200 m (M4 carbine), so Soldiers would need to aim low in order to hit center mass of mid-range targets (e.g., at about 170 m). Some training organizations are moving toward adopting the 200 m zero as a standard. Although various techniques are being used by trainers to assist in obtaining a 200 m zero (Dyer, et al., 2010), the Army has not yet developed standardized targets for obtaining a 200 m zero.

Using an iterative Development process of design, review, and revise, and in conjunction with marksmanship trainers, a set of prototype targets that could be used to obtain a 200 m zero was designed based on existing zero targets. The set of six targets included separate targets for the M16 rifle and M4 carbine and were intended for use during different marksmanship training periods to obtain and verify the weapon zero at 25 m, 100 m, and 200 m. Each target included clearly identifiable point-of-aim and point-of-impact locations. The point-of-aim location for each target was a four minute-of-angle (MOA) white circle. In addition, the targets were gridded with MOA, and each target included a table that provided sight adjustments for different rifle and sight combinations based on MOA. The 25 m target was printed on 8.5" x 11' cardstock. Both the 100 m and 200 m targets were printed on 22" X 36" heavy-weight paper. Each target is shown in Figure 1.

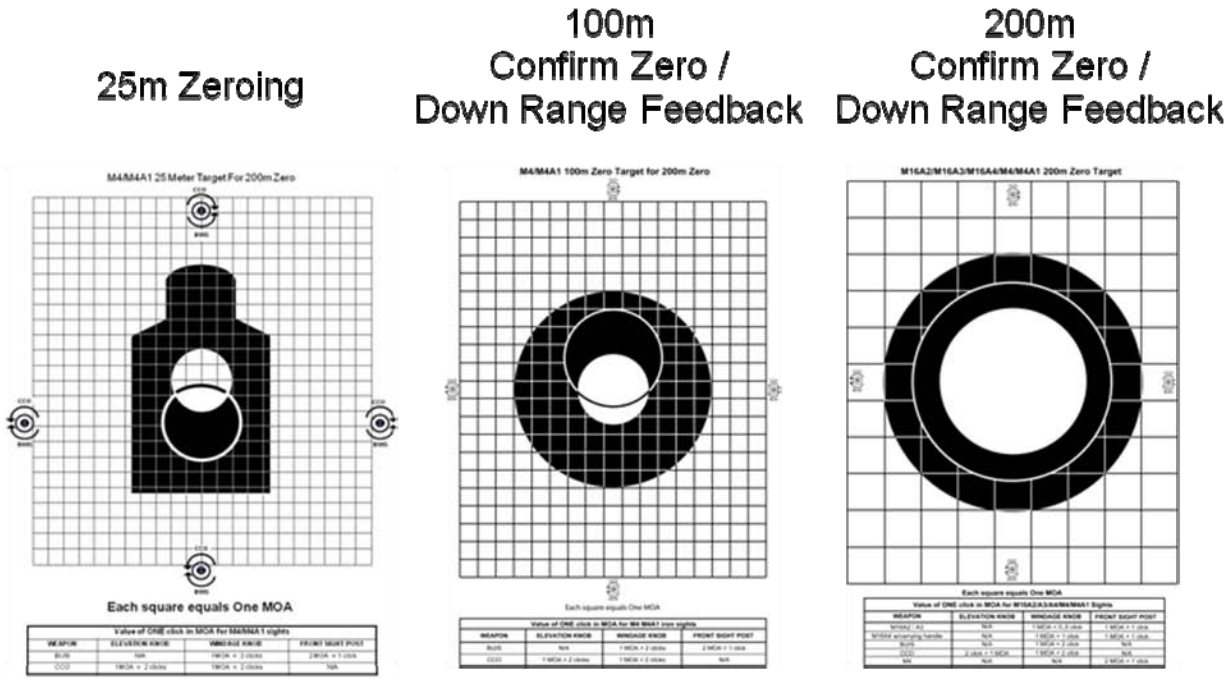


Figure 1. Prototype targets to attain a 200-meter zero with M4 carbine. The targets are not presented to scale.

The prototype targets were provided to training companies to use during the appropriate BRM training events. For less-experienced Soldiers and DSs, point-of-impact location and sight-adjustment information on the targets eliminated the need for estimating where bullets should impact. More-experienced Soldiers can use the same target information to determine sight adjustments and to assist other Soldiers in adjusting sights. While MOA is explained to new Soldiers early in marksmanship training, having this information immediately available on the target allows trainers to better assist weaker Soldiers with understanding the concept.

The prototype targets were assessed with an Infantry OSUT company. Half of the company used the prototype targets during grouping, zeroing, and confirm-zero weapons training periods. The other half of the company used standard Army targets, which were designed for a 300m zero but were modified by the DSs to train a 200m zero. Details on the prototype-target design, rationale for its features, and results of assessment of the prototype targets are available in Bink et al. (2011). While the use of the targets did not increase the record qualification scores of the Soldiers, the use of the targets reduced the number of rounds required to confirm zero and provided a positive relation among training events (i.e., zero, confirm zero, and record qualification). The targets also made it easier for DSs to train the Soldiers. The only revision to the targets after assessment was to produce a version of the confirm-zero targets (i.e., 100m and 200m) with concentric rings within the point of impact. These rings can be used to further refine marksmanship performance by "scoring" shot groups.

Marksmanship Zero Training Aids

One of the primary BCT/OSUT graduation requirements is that all Soldiers must shoot a qualifying score with their rifle. As noted in prior research, a significant contributor to being able to shoot a qualifying score is to have the rifle properly zeroed (Taylor, Dyer & Osborne, 1986). Soldiers with an improperly zeroed rifle will not be able to hit the intended point even if all firing fundamentals are correctly performed. While Soldiers receive instruction on how to zero the rifle, it was noted that the quality and level of instruction varied significantly among training units (Cobb, Graves, James, Dlubac & Wampler, 2010; Dyer et al., 2010; Cobb et al., 2009). The result is that Soldiers have difficulty learning and retaining the ability to properly zero their rifle, which impedes their ability to qualify with their rifle. The approach to assisting Soldiers in zeroing their rifles included two different components: applying correct firing fundamentals and understanding the process of zeroing.

The first consideration was to ensure Soldiers were applying correct firing fundamentals. In order to maximize the outcome of the bullet striking the intended point-of-impact the Soldier must properly align the sights with the target and then maintain the rifle pointing at the correct location while squeezing the trigger. While individual Soldiers can self-assess their firing fundamentals, the Army recognizes that other Soldiers serving as "peer coaches" can be a valuable assist in this process (DA, 2008). The doctrinal publication includes information on the duties and benefits of the peer coach. In addition, the Army developed a basic rifle marksmanship (BRM) Coaches Checklist which is Graphic Training Aid (GTA) 07-01-043. While the GTA might be helpful to more experienced trainers, it is lengthy and could be confusing to Soldiers just learning to fire during the BRM periods. As stated in FM 3-22.9, a problem with peer coaching exists when "the new Soldier does not have adequate guidance, a

'blind leading the blind' situation may result, leading to negative training and safety violations" (DA, 2008, p 4-12).

As a result, one of the zeroing training aids was a simplified "coaches card" shown in Figure 2 and Figure 3. The small coaches card presented information contained in FM 3-22.9 (DA, 2008), the existing GTA 07-01-043, and input provided by IET marksmanship trainers. The card was designed as a tailored product. That is, new Soldiers who are just learning firing fundamentals can use the card to remind themselves of proper firing procedures. The content and format of the card were designed in a simple and concise layout and used basic terminology. Likewise, the card is a quick reference guide for more experienced Soldiers. All Soldiers should be able to use the card to assist other Soldiers during the firing process. The cards were printed on laminated 3" X 5" sheets in order to be carried in a Soldier's cargo pocket.

Figure 2. Coaches Card – Side 1.

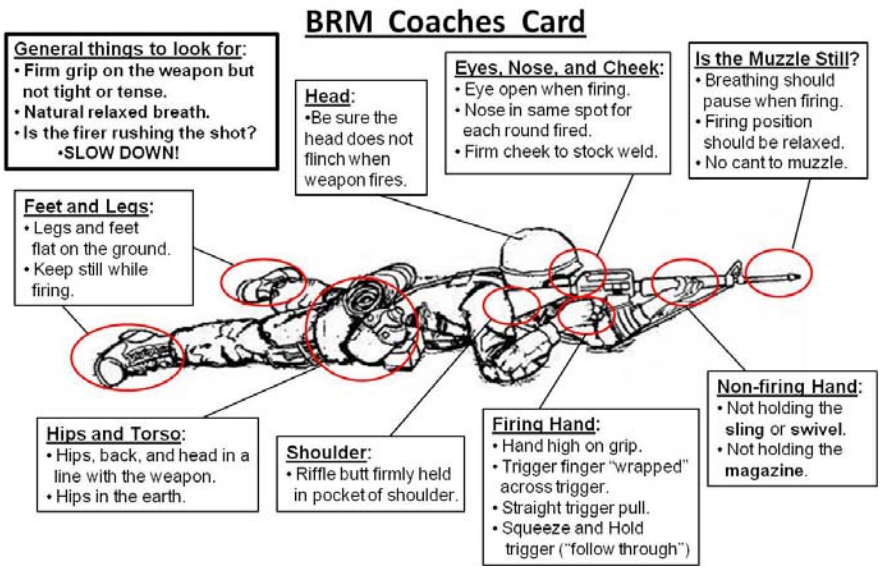


Figure 3. Coaches Card – Side 2.

All Soldiers in the companies using the prototype 200 m zero targets also received an early version of the coaches cards. Soldiers reviewed the cards prior to weapon grouping and zeroing and were instructed to refer to the cards while buddy-coaching during this training period. Anecdotal feedback indicated the cards were beneficial. Subsequent informal assessment provided input to revise the coaches card. Details on the coaches card design, rationale for its features, and results of feedback are available in Bink et al. (2010). In general, the revisions to the coaches cards were minor except to include a graphic of the Soldier in prone firing position. The final version of the coaches cards are presented in Figures 2 and 3.

The second consideration to assist Soldiers in zeroing their rifle was to ensure they understood how to properly adjust the rifle sights in order to move the strike of the bullet to the desired point-of-impact. A key factor in qualifying with the rifle is that the sights must be properly adjusted to the correct point-of-impact (Taylor, Dyer & Osborne, 1986). Current Army zero targets provide cues and guidelines to assist Soldiers in adjusting sights. However, the information is general in nature and targets do not provide any examples of assessing shot groups and determining sight adjustments.

In order to better aid the understanding of the zeroing process, the second component of the zeroing training aids was a set of sight-adjustment flashcards that allowed Soldiers to practice determining sight adjustments. The front of the flashcard portrayed the zero-target with an array of bullet holes representing a single shot group. Soldiers can assess the shot group and use the information on the target to determine how the rifle sight should be adjusted to move the point-of-impact of the rounds to the desired location on the target. The reverse of the flashcard provided an explanation of the correct sight adjustment. A sample of the flashcards is shown in Figure 4.

The sight-adjustment flashcards can be used by trainers to assist Soldiers in understanding how to determine sight adjustments. Soldiers having difficulty with the task can

use the cards alone to practice their assessment skills. Detailed drawing and explanations on the reverse of each card can help the less-skilled Soldiers in understanding how to assess the shot group and what sight adjustment is necessary. More-skilled Soldiers can use the cards to work with less-skilled Soldiers because the shot groups are provided along with the correct sight adjustments and supporting explanation.

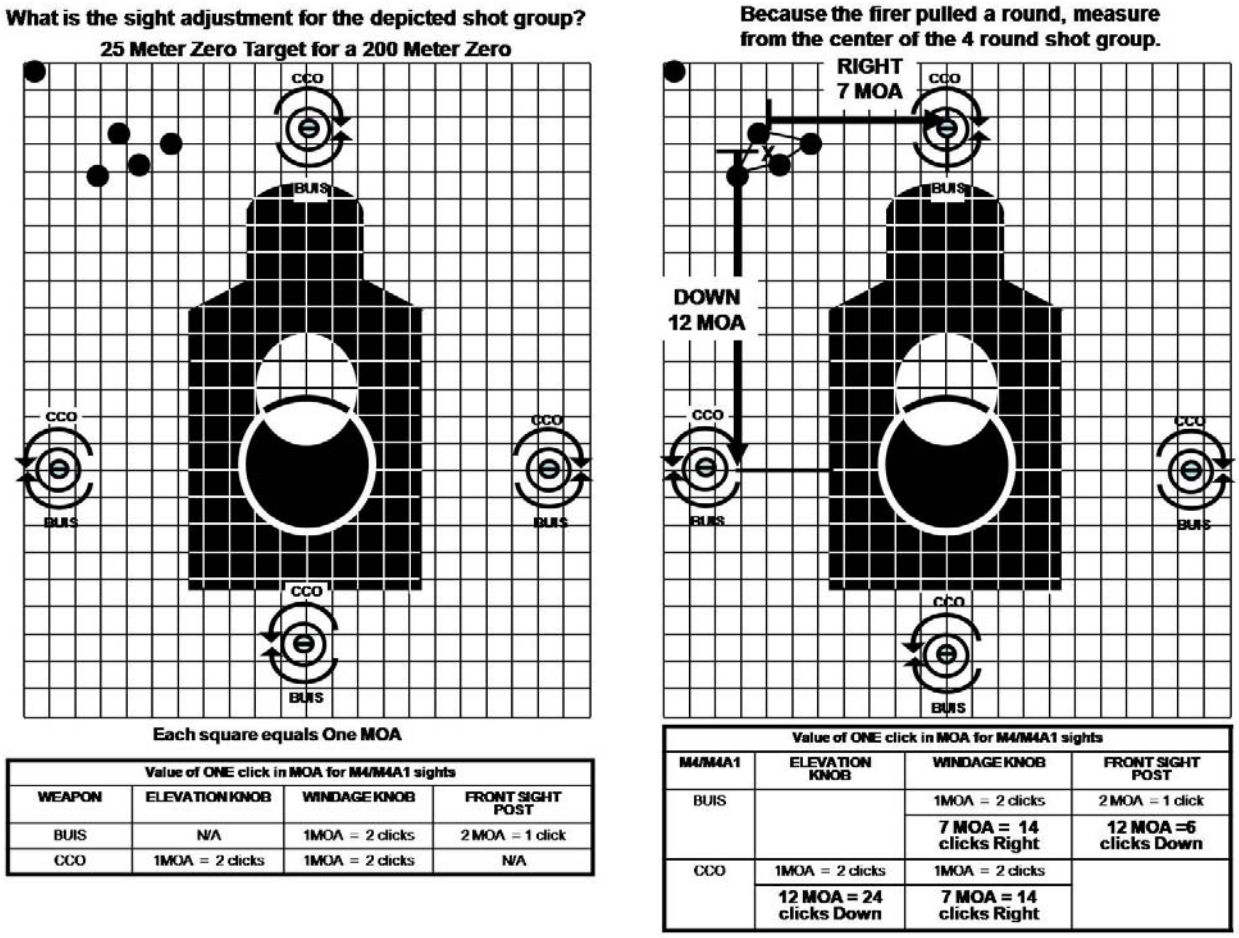


Figure 4. Sample sight-adjustment flashcard

Because the flashcards were designed to be used with the 200 m zero targets, the same companies that used the prototype targets received the sight-adjustment flashcards for utilization and assessment. Four sets of flashcards were distributed to each platoon, and the Soldiers circulated the flashcards within each platoon. Soldiers worked in buddy teams to review the flashcards during "down time" such as guard duty, fire watch, waiting to participate in a training event, etc. The flashcards were available to the Soldiers for about two weeks prior to grouping and zeroing their weapons. Details on the flashcard design, rationale for its features, and on potential training impact are available in Bink et al. (2011). In general, DSs and Soldiers who used the training aids understood the benefit of using such a training aid and were positive about the impact the training aid could have on marksmanship performance. No revisions were made to the cards themselves. However, additional cards were developed and added to the final version

of the packet. A total of 20 sight-adjustment flashcards comprised the final version of the training aid.

Grid-Coordinate Training Aids

In Cobb et al. (2009), a skill retention assessment of 10 tasks trained in IET was conducted. The assessment included a test of initial proficiency shortly after the skill was trained and a retest near the end of IET. The task that showed the lowest level of proficiency was determining the grid coordinate for a point on a military map with less than 10% of Soldiers attaining the required skill level at both the initial test and retest. To address this training difficulty, a training aid was developed that would allow Soldiers to study and learn how to plot a grid coordinate on a map and also provide a means for Soldiers to determine if they had learned the task.

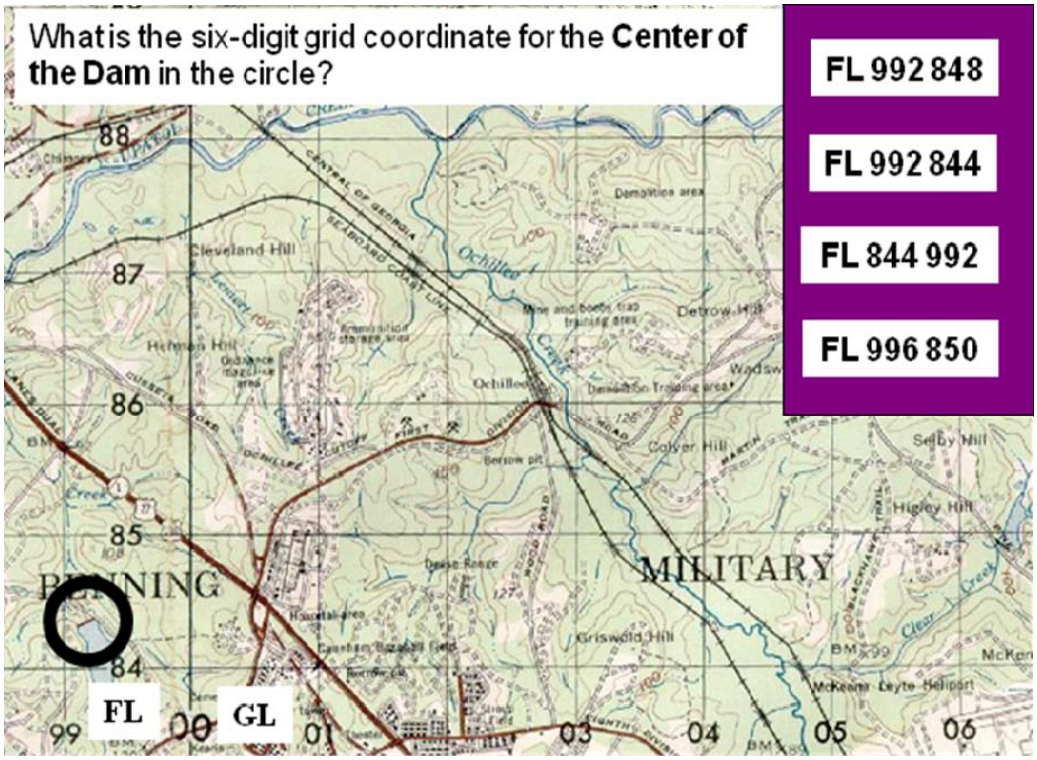
Land-navigation training material being used by IET units was examined to identify what was types of aids were currently available. This material varied from a standard training support package to various sets of PowerPoint slides developed and assembled by IET units. During interviews and group discussions, DSs provided links to web sites they accessed to gain additional training materials.[3] Some web sites included map-reading training materials. In addition, map reading training material previously developed by ARI was also reviewed (e.g., Dyer, et al., 2000). This training material was developed for users with limited map-reading skills similar to IET Soldiers. These sources also provided input for the content and format of the training aids being developed.

Initially, two distinct training aids were developed. Each aid was developed according to separate training procedures. Each of these training procedures should support the learning by a specific level of Soldier ability (Hammond & Gibbons, 2001; Hess & Holloway, 1983). One training aid was produced that allowed Soldiers to practice working with grid coordinates. This "hands-on" practice augmented training on the procedural requirements of determining grid coordinates. Practicing procedures is particularly useful in developing skills in novices (Applebee & Langer, 1983; Ericsson, et al., 1993; Palincsar, 1986). The second training aid provided background information. The information presented in this aid was intended to supplement the information provided in classroom training. Doing so should help provide knowledge to "scaffold" the learning process (e.g., Hmelo-Silver, Duncan, & Chinn, 2007; Puntambekar & Hübscher, 2005) and should be useful to learners with an initial grasp of the task.

The training materials for both grid-coordinate training aids were based on previous ARI remedial training packages (ARI, 2003). The "hands-on practice" training aid was composed of a set of 26 flashcards that tests one's ability to plot grid coordinates on a military map. The front side of each card presented a section of a military map. A problem was also presented that required Soldiers, for example, to determine the grid coordinate for a designated location on the map or to determine what is located at a designated grid coordinate. The reverse side of each card provided the solution along with some possible explanation as to what error might have

[3] Some of the web sites suggested by DSs include: www.550cord.com, www.squadleader.com, and www.armytoolbag.com

been made. A sample card is provided at Figure 5. The booklet of flashcards consisted of 5.5" X 8" laminated sheets printed in color and bound by a plastic spiral ring. The booklets were designed to fit in a Soldier's cargo pocket.



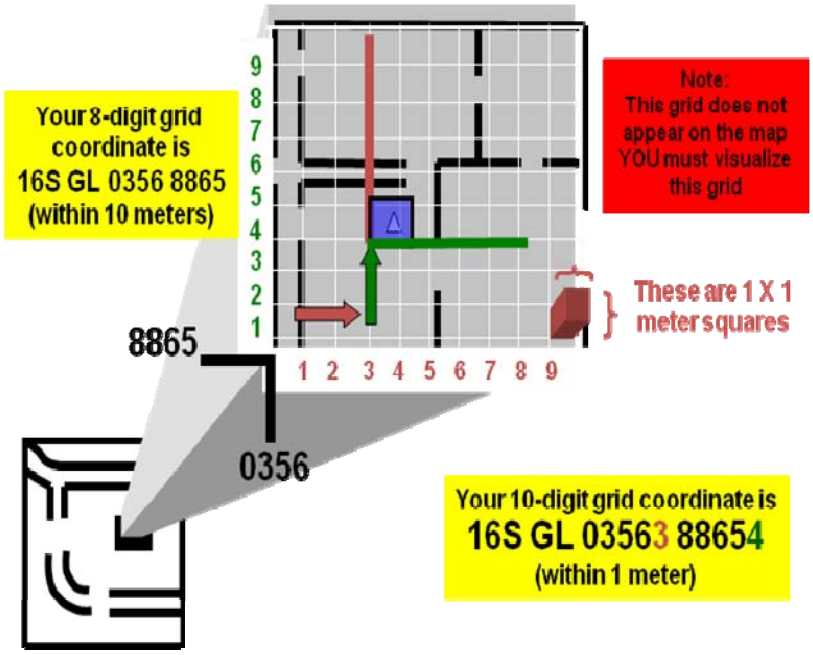
Reverse Side of Card

FL 992 848 Incorrect - You're off by 400 meters on the last digit.
FL 992 844 Correct
FL 844 992 Incorrect - You must read a grid coordinate right then up.
FL 996 850 Incorrect - You're off by 400 meters on the first digit and off by 600 meters on the last digit.

Figure 5. Sample card from "hands-on practice" training aid.

The other grid-coordinate training aid provided conceptual information to Soldiers. The "background information" training aid consisted of a 19-page training booklet that explained the principles of map grid coordinates, the relation of map displays to actual terrain, and how to determine grid coordinates on a military map. Each page presented a graphic with key learning points and supporting text that provided detailed information. A sample page is shown in Figure 6. The booklet was designed so that a new learner could grasp the major concept and then read how to determine grid coordinates on a map. The training-aid graphics provided the step-by-step process of plotting a grid coordinate. The written explanations were in easy-to-understand wording so that all Soldiers would be able to study the material on their own. Because the complete step-by-step process was fully explained, more advanced Soldiers and DSs should be able to use the training packet to assist Soldiers who might have difficulty learning the task. The graphics provided trainers a ready-made means to visually show the Soldier what to do and how

to do it. Again, this training aid was produced on 5.5” X 8” laminated sheets printed in color and bound into a booklet that could fit in a Soldier’s cargo pocket.



These 1 meter squares are also read to the right and then up. Remember to stop on the line <u>before</u> reaching your location inside the range building. The ten digit grid coordinate for your location inside the range building would be 16S GL 03563 88654.

Figure 6. Sample card from “background information” training aid.

The grid-coordinate training aids were assessed with two Infantry OSUT companies. In each company, one platoon received the hands-on practice training aid, one platoon received the background-information training aid, one platoon received both training aids, one platoon did not have access to any training aids during the assessment. Four copies of a given training-aid were provided to a platoon. The Soldiers circulated the training aids within a squad, and the Soldiers used the flashcards either alone or in buddy teams. The training aids were supplied to the Soldiers after an initial grid-coordinate test that was given after the scheduled map-reading training. Soldiers utilized the cards for about four weeks and were again given a grid-coordinate test.

The assessment results indicated that training aids increased retention of grid-coordinate skills. Furthermore, the results indicated that the background-information training aid did indeed benefit Soldiers who had an initial grasp of reading grid coordinates and that the hands-on practice training aid was beneficial to Soldiers who initially had difficulty with reading grid coordinates. As a result, the two training-aid materials were combined into a single training aid that could be distributed to all Soldiers. The combined training aid first presented background

information followed by hands-on practice. Details on the development and assessment of the grid-coordinate training aid are available in Wampler, Bink, & Cage (2011).

Video Capture and Feedback Training Aids

The final product of the present research was intended to explore the potential use of available video technology to equip DSs with the ability to provide immediate visual feedback to Soldiers on their performance. The idea was to provide a video capture and playback capability that could be used by DSs in field environments for easy use during a multitude of training events. Thus, the training aid in this case was not the actual tool but, rather, method to utilize the tool in IET training.

The VIO Point-of-view 1.5 camera was the central component in this training aid. The battery-powered system has multiple adapters available that allowed users to mount the camera to a Soldier's helmet or other parts of his field equipment. The camera could also be used in the hand-held mode. Specifications of the camera are available at the manufacturer's website (http://www.vio-pov.com/) and in a separate report (Wampler, Dlubac, & Bink, 2011) detailing the assessment of the video capability as a training aid. The camera was equipped with a small built-in viewing screen, approximately 2" x 1.5". While this was adequate for a few Soldiers to view simultaneously, it limited the DSs' ability to show the video. To augment the capability of showing a video to a larger group, researchers provided an Aiptek PocketCinema V10, a small, light weight, battery-powered projector. Detailed specifications for the projector are available at the manufacturer's website (http://www.aiptek.com/) and in a separate report (Wampler, Bink, & Dlubac, 2010). The camera could be connected directly to the projector so file transfer was not always necessary. The projector image was scalable up to 42 inches and could be displayed on a variety of surfaces, even in a field environment.

Utilizing a video system as a training aid was intended to provide the DS flexibility in providing performance feedback. If desired, experienced DSs could arrange, conduct, and record a training task, prior to the training event. The video could then be shown to Soldiers as an example of how the task should be performed. Even examples of poor performance could be recorded and used to assist Soldiers in recognizing errors in performance. More experienced DSs could conduct and record the event which would allow lesser trained DSs to avail themselves of the knowledge and experience of more highly capable DSs in that task area. Cameras could also be used during a training event to record actual Soldier performance. The video could then be shown to the Soldiers immediately following task execution. This would allow more experienced DSs to provide an on-the-spot assessment and provide feedback to the Soldier while the event was very fresh in his mind. Lesser experienced DSs could also record Soldier performance then allow more experienced DSs to provide the performance assessment feedback to the Soldier. More experienced DSs could also use the video to assist with Soldier peer-learning. The DSs could play the video for a group of Soldiers to observe. The more experienced Soldiers could reinforce their own skill by critiquing other Soldier performance and the less experienced Soldier could still learn from his errors.

Various methods were employed to assess the potential value of the video capture and playback capability as a training aid for DSs. Details on the assessment are available in

Wampler, Dlubac, & Bink (2011). Basically, cameras and projectors were provided to a training company along with suggestions for when and how the system might be beneficial in enhancing Soldier training in basic combat skills. The DSs were encouraged to use the camera and projector as much as possible throughout the entire training cycle and to explore different training events and situations that might benefit from the video capture and playback opportunities. Weekly discussions with DSs and an end-of-training-cycle survey yielded insights as to which collective training events and situations might benefit more than individual events from the technology. For example, recording a single Soldier performing a task required one-on-one interaction with a DS and the camera in order to provide recording and feedback. Also, some of the intricate details of the task performance, such as Soldier blinking or jerking when firing a rifle, were difficult to capture and view with the recording. The DSs suggested that capturing small unit collective task performance, such as buddy team or squad drills, provided higher payoff because the DS could observe a larger group and could simultaneously provide feedback to more Soldiers. Also, larger group tasks were not as focused on minute, split-second details as was the case with weapons firing.

Using the feedback from this initial exploration, a more in-depth exploration of the collective-training usage was conducted. Five training companies each received the cameras and projectors for between one and five days during various collective-training events. Daily feedback from DSs captured lessons-learned, which were shared with companies who used the systems on subsequent days. Conclusions from this usage indicated that the components were easy to use, even in a field environment. The most useful situation for using the video capture was while conducting operations in an urban environment. The DS could capture a small team of Soldiers performing various tasks and provide immediate feedback so each Soldier could see his error and make corrections before continuing with further training practice. Additionally, DSs used the projector to present training material to Soldiers that explained and showed how to execute a collective task prior to practicing the event in a field environment.

After considering feedback from the initial two explorations, it was determined that additional assessment with a different unit for an entire training cycle would be beneficial. A BCT company received the cameras and projectors along with suggestions for the most beneficial use of the cameras. Again, the DSs were encouraged to use the camera and projector as much as possible throughout the entire training cycle, and weekly discussions with DSs yielded insights as to which training events and situations might benefit most from the technology. Results were similar to the first exploration. The components were easy to use, but the pace of the training events and lack of time to conduct one-on-one assessments with each Soldier generally meant the technology was not very useful for individual training events. At the end of the training cycle the unit kept the camera and projector equipment to produce training materials for future training events. More information on the assessment is available in Wampler, Bink & Dlubac (2010).

Discussion

The overarching goal of the present research was to develop training aids for basic combat skills that (a) address tasks with which many Soldiers have difficulty mastering, (b) address tasks that are critical to basic combat training, (c) be easily used in the field, and (d) be

beneficial to Soldiers across multiple levels of ability. In order to do so, a five-phase training-aid development process was employed. This development process proved to be useful in producing training aids for basic combat skills that fulfilled the research objectives. Most importantly, a relatively low-cost and easily used set of training aids were developed that could augment and remediate training outcomes across a Soldier population that varied in initial levels of ability on a given skill. In other words, the goal of producing a set of training aids that could benefit all trainees, and not just those who require remediation, was achieved.

The goal of developing a training aid that was effective across the ranges of Soldiers' abilities may seem like a trivial or an obvious outcome. However, most training is developed to assure the "average" individual can meet a given standard. Likewise, most training aids are developed with a focus on the task rather than on the characteristics of the trainee (Sticha, et al., 1993). By using a "one size fits all" approach to training aid design, it is not likely that all trainees will benefit from using training aids (see, Duffy & Hoffman, 1999; Snow 1992). In fact, providing training material that some trainees do not understand while at the same time does not challenge other trainees is likely to inhibit learning (Tomlinson & Kalbfleisch, 1998). Thus, being able to construct training aids that can benefit performance *across* skill levels represents a significant advancement for training-aid design.

In general, the training aids developed for the current project used a combination of hands-on practice and background information to provide training material that would benefit individuals across multiple skill levels. Providing opportunities to practice basic procedural tasks contributes to the learning of new skills, especially when the trainee has no experience with the skill or has difficulty learning a given skill (e.g., Corno, 2008). In contrast, providing additional information about *why* certain tasks are done helps develop skill expertise in individuals with a grasp of the basic procedural tasks (e.g., Ericsson, et al., 1993; Larkin, McDermott, Simon, & Simon, 1980). The grid-coordinate flashcards were specifically designed to leverage both procedural training and background information. Likewise, the sight-adjustment flashcards provided both background information and the opportunity to practice sight-adjustment skills. Even the weapon-zeroing targets included background information (i.e., MOA grids and sight-adjustment information).

Providing immediate feedback on performance is an important learning mechanism regardless of trainee's skill level (Ericsson, et al., 1993). Thus, all the developed training aids provided feedback. The coaches cards and video-capture-and-playback system were designed for the specific purpose of facilitating feedback on Soldier performance. In addition, the grid-coordinate flashcards and sight-adjustment flashcards were designed to give immediate feedback to Soldiers (i.e., providing answers for each flash-card problem). Because the training aids were designed to benefit Soldiers across a range of skill, the training aids will be increasingly useful in training basic combat skills as IET moves to more towards a deliberate learning model that emphasizes critical thinking (Wilcox & Wickman, 2010).

Even though following the training-aid development process yielded effective products, some improvements to the process were noted. First, a more structured approach to gathering suggestions for training aids could potentially provide a more useful return. For example, using focused samples of DSs or trainers with specific expertise instead of a broad sample of DSs or

using a widely-disseminated survey may provide more targeted suggestions for potential training aids. Next, a more iterative and inclusive process could be used to select training aids to be developed. For example, the COMPASS $^{(sm)}$ (MacMillan, Entin, Morley, & Bennett, In press) method utilizes partially-overlapping sub-sets of an expert panel to develop knowledge consensus.

Products stemming from the current training-aid development have been provided to selected IET units at Fort Benning, GA. The 200m-zero targets are currently being made available to all training battalions within the 198th Infantry Brigade (Infantry OSUT). The video-capture-and-feedback system was also used in an extended training development initiative within a BCT training battalion at Fort Benning. These units will continue to use the products and could form the foundation for future research concerning the benefit of these products or other related training aids. Copies of the individual training aids for reproduction may be available from the ARI-Fort Benning Research Unit.

References

Applebee, A.N., & Langer, J.A. (1983). Instructional scaffolding: Reading and writing as natural language activities. *Language Arts, 60,* 168 – 175.

Army Research Institute. (2003). *Land Warrior prerequisite skills training,* v 1.0 (CD-ROM). Ft. Benning, GA: Infantry Forces Research Unit.

Arthur, W., Bennett, W., Stanush, P. L., & McNelly, T. L. (1998). Factors that influence skill decay and retention: A quantitative review and analysis. *Human Performance, 11,* 57 – 101.

Achten, J., & Jeukendrup, A. (2003). Heart Rate Monitoring: Applications and Limitations. *Sports Medicine, 33,* 517-538.

Bakker, H. (1968). A simple decision game as a training aid for NGO officers. *International Associations,* 759.

Basic Combat Training Center of Excellence. (2008, March 06). *Program of instruction for basic combat training*. Ft. Jackson, SC: Author.

Beal, S. A., Dyer, J. L., James, D. R., Wampler, R. L., & Johnson, V. (2008). *Assessment of drill sergeant candidates' experience and training with warrior tasks and battle drills* (ARI Study Report 2008-07). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (DTIC No AD- B347388).

Bink, M. L., Dlubac, M. D., Cage, E. A., & Wampler, R. L. (2010). *Training aids for basic combat skills: Obtaining a 200 m zero with M16 rifle and M4 carbine.* (ARI Research Report 1947). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Carter, R., & Carter, S. (1978). Modules can prove helpful as a training aid. *Training & Development Journal, 32(2),* 52.

Cobb, M. G., Graves, T. R., James, D. R., Dlubac, M.D. & Wampler, R. L. (2010). *Marksmanship Skill retention in basic combat training (BCT): An initial assessment of integrating asymmetric warfare group training techniques within a 10-week BCT* (ARI Research Report 1920). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (DTIC No AD- A516970).

Cobb, M. G., James, D. R., Graves, T. R., & Wampler, R. L. (2009). *Warrior task skill retention assessment* (ARI Study Report 2009-03). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (DTIC No AD- B353611).

Corno, L. (2008). On teaching adaptively. *Educational Psychologist, 43,* 161 – 173.

Currey, Craig J. (2008). Outcomes-based training: What's next? *Initial Entry Training Journal, 1-3.* Fort Jackson, SC: Directorate of Basic Combat Training.

Department of the Army. (n.d.). Graphic Training Aids available through Army Knowledge On Line. Retrieved March 14, 2009 from https://atiam.train.army.mil/soldierPortal/appmanager/soldier/start?_nfpb=true&_pageLabel=homepage

Department of the Army. (2008). *Rifle marksmanship M16-/M4-series weapons* (FM 3-22.9). Washington DC: Author.

Department of the Army. (2006). *Soldier's manual of common tasks: Warrior skills level 1* (STP 21-1-SMCT). Washington, DC: Author.

Department of the Army (2009). *Training: U.S. Army Training and Doctrine Command training devices for Armywide use.* (TRADOC Pamphlet 350-9). Fort Monroe, VA: Author.

Design. 2010. In Merriam-Webster Online Dictionary. Retrieved March 5, 2010, from http://www.merriam-webster.com/dictionary/hacker.

Duffy, G. G., & Hoffman, J. V. (1999). In pursuit of an illusion: The flawed search for a perfect method. *The Reading Teacher, 53*, 10 – 16.

Dyer, J. L., Fober, G. W., Wampler, R., Blankenbeckler, N., Dlubac, M., & Centric, J. (2000). *Observations and assessments of Land Warrior training* (Special report to PM-LW). Ft. Benning, GA: U. S. Army Research Institute for the Behavioral and Social Sciences, Infantry Forces Research Unit.

Dyer, J.L., Schaefer, P.S., Bink, M.L., James, D.R., Wampler, R.L., Dlubac, M.D. (2010). *Soldier performance on a new marksmanship course of fire*. (ARI Research Report 1924). Arlington, VA: US Army Research Institute for the Behavioral and Social Sciences. (DTIC No AD-A523973).

Dyer, J. L., Tucker, J. S., Wampler, R. L., & Blankenbeckler, P. N. (2009). *Investigation of the ten-week basic combat training pilot program (FY 2008)* (ARI Study Report 2009-01. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (DTIC No AD-B350050).

Ericsson, K. A., Krampe, R. T., & Tesch-Romer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*, 363 – 406.

Evans, K.L., & Osborne, A.D. (1988). *The development and implementation of basic advanced, and unit M16A1 rifle marksmanship training programs.* (ARI Research Report No. 1491). Alexandria, VA: U.S. Army Research Institute. (DTIC No AD-A204659).

Goettl, B. P., & Shute, V. J. (1996). Analysis of part-task training using the backward-transfer technique. *Journal of Experimental Psychology: Applied, 2*, 227 – 249.

Horrocks, J.E., Fotheringham, W., & Bowlus, D. (1956). *Study of the present status if training aids and services in the Army Field Artillery program.* (Technical Report-

NAVTRADEVCEN 495-8-1). Columbus, OH: Ohio State University Research Foundation. (DTIC No AD-0642596).

Hammond, J., & Gibbons, P. (2001). What is scaffolding? In J. Hammond (Ed.), *Scaffolding: Teaching and learning in language and literacy education* (pp. 1-14). Newton, NSW: Primary English Teaching Association.

Hess, R. D., & Holloway, S. D. (1983). Family and school as educational institutions. *Review of Child Development Research*. Chicago: University of Chicago Press.

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). *Educational Psychologist, 42,* 99–107.

Kalyuga, S., Chandler, P., & Sweller, J. (1999). Managing split-attention and redundancy in multimedia instruction. *Applied Cognitive Psychology, 13*, 351.

Kizakevich, P.N. (2002). *Development of a self aid / buddy aid simulation-based training program. (Final Report)*. Fort Detrick, MD: U.S. Army Medical Research and Material Command. (DTIC No AD-A411434).

Larkin, J., McDermott, J., Simon, D. P., & Simon, H. A. (1980). Expert and novice performance in solving physics problems. *Science, 208*, 1335 – 1342.

Lasky, R. (1998). Saving our own: Designing a firefighter survival training aid. *Fire Engineering, 151(5),* 10.

Leibrecht, B. C., Wampler, R. L., Goodwin, G. A., & Dyer, J. L. (2007). *Techniques and practices in the training of digital operator skills* (ARI Research Report 1878). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (DTIC No AD-A474556).

Linstone, H.A., & Turoff, M. (Eds.) (1975). *The Delphi method: Techniques and applications.* Glenview, IL: Addison-Wesley.

Lumsdaine, A. (1960). Design of training aids and devices. In J.D. Folley (Ed.), *Human factors methods for system design* (pp. 217-290). Washington, D.C.: Office of Naval Research.

Palincsar, A. S. (1986). The role of dialogue in providing scaffolded instruction. *Educational Psychologist, 21*, 73-98.

Puntambekar, S., & Hübscher, R. (2005). Tools for scaffolding students in a complex learning environment: What have we gained and what have we missed? *Educational Psychologist, 40*, 1–12.

MacMillan, J., Entin, E. B., Morley, R., & Bennett, W. (In press). Measuring team performance in complex dynamic environments: The SPOTLITE method. *Military Psychology*.

McMillan, L., Bunning, K., & Pring, T. (2000). The development and evaluation of a deaf awareness training course for support staff. *Journal of Applied Research in Intellectual Disabilities, 13,* 283-291.

Rose, F., Brooks, B., & Attree, E. (2002). An exploratory investigation into the usability and usefulness of training people with learning disabilities in a virtual environment. *Disability & Rehabilitation, 24,* 627-633.

Sangiorgi, T., Manfredi, C., & Bruscaglioni, P. (2005). Objective analysis of the singing voice as a training aid. *Logopedics Phoniatrics Vocology, 30,* 136-146.

Schraagen, J. M., Chipman, S. F., & Shalin, V. L. (Eds.) (2000). *Cognitive task analysis.* Mahwah, NJ: Erlbaum.

Shute, V. J., Torreano, L. A., & Willis, R. E. (2000). DNA: Providing the blueprint for instruction. In J. M. Schraagen, S. F. Chipman, & V. L. Shalin (Eds.) *Cognitive task analysis*. Mahwah, NJ: Erlbaum.

Snow, R. E. (1992). Aptitude theory: Yesterday, today, and tomorrow. *Educational Psychologist, 27 (1),* 5-32.

Sticha, P.J., Gibbons, S., & Singer, M.J. (1993). *Development of a concept formulation process aid for analyzing training requirements and developing training devices.* (ARI Research Report 1637). Alexandria, VA: U.S. Army Research Institute, (DTIC No AD-A263579).

Taylor, C.J., Dyer, F. N., & Osborne, A.D. (1986). *Effects of rifle zero and size of shot group on marksmanship scores* (ARI Research Note 86-15). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (DTIC No AD-A164 659).

Taylor, R., & Berry, R. (1998). The use of a computer game to rehabilitate sensorimotor functional deficits following a subarachnoid haemorrhage. *Neuropsychological Rehabilitation, 8,* 113-122.

Tomlinson, C.A., & Kalbfleisch, M.L. (1998). Teach me, teach my brain: A call for differentiated classrooms. *Educational Leadership, 56,* 52-55.

Wampler, R. L., Bink, M. L., & Cage, E. A. (2010). *Training aids for basic combat skills: Developing map-reading skills*. (ARI Research Report 1941). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Wampler, R. L., Dlubac, M. D., & Bink, M. L. (2010). *Training Aids for Basic Combat Skills: A Video Feedback System*. (ARI Research Report 1945). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Wampler, R. L., Dyer, J. L., Livingston, S. C., Blankenbeckler, P. N., & Dlubac, M. D. (2006). *Training lessons learned and confirmed from military training research* (ARI Research Report 1850). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (DTIC No AD-A446697).

Wampler, R. L., James, D. R., Leibrecht, B. C. & Beal, S. A. (2007). *Assessment of the new basic combat training program of instruction* (ARI Study Report 2007-06). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (DTIC No AD-B331403).

Wilcox, D., & Wickman, R. (2010). Smart training. *Initial Military Training Journal, July*, 2 – 9.

Acronyms

ARI	Army Research Institute
BCT	Basic Combat Training
BRM	Basic Rifle Marksmanship
CCO	Close Combat Optic
CLS	Combat Lifesaver
DA	Department of the Army
DS	Drill Sergeant
FM	Field Manual
GTA	Graphic Training Aid
IET	Initial Entry Training
MOA	Minute of Angle
MOS	Military Occupational Specialty
OSUT	One-station Unit Training

APPENDIX A

BASIC COMBAT TRAINING BLOCKS OF TRAINING

Basic Combat Training Blocks of Training Subject

Soldierization

Drill and Ceremonies

Basic Rifle Marksmanship

Advanced Rifle Marksmanship

U.S. Weapons Training

Basic Tactical Training

Tactics

Situational Training Exercises (STX)

Field Training Exercises (FTX)

Move Under Direct Fire

Land Navigation

Military Communications

Medical Tasks

Mine and Countermine Operations

Chemical, Biological, Radiological, Nuclear (CBRN) Defense

Physical and Mental Health

Rifle Bayonet Training

Administrative Support Time

APPENDIX B

TRAINING-AID INTERVIEW / DISCUSSION GROUP QUESTIONS

The purpose of this interview is to solicit ideas for training aids to assist you, the DS, with training Soldiers daily. Also consider training aids for yourself that the Soldiers may never see. We've already received some suggestions which we will share with you, as we ask our questions.

Keep in mind that these training aids could be used at several different times. Soldiers could use them during or after a period of instruction. You might use them for concurrent training, or even as advance training, or as refresher training. Soldiers might use them as study material during fire guard, or in preparation for unit testing. Drill Sergeants might use them to assist with assessing Soldier performance (such as the 4-cm circle to assess the tightness of a shot group), or to assist with teaching (instructor note cards). What about to help you with cadence calling, or to assist platoon guides with their duties? Keep in mind that these aids might help a new DS, especially if used as a refresher before a training event.

Hopefully this has sparked some ideas - - So let's go through some questions.

1. What does your platoon normally do better than the other platoons? (BRM, PT, FTX, etc.)

2. **Why** does your platoon do better than the other platoons? (What is your secret)? Do you have any special tool, device, or technique that you use? Some type of training aid you rely on?

3. What tasks / skills do you have a difficult time training? Why is this hard?
Is there something that could make it easier for you to train? Easier for Soldiers to learn?

4. What do you do to bring the "slow learners" along or catch them up with the "fast learners"? (buddy teams – extra training – motivation) Do you have some special charts, handouts, training material that you've found to be helpful?

5. What type of training aid or device might help the "other DS" (in your unit or other units) conduct their training, to bring them up to your level? Is there some skill / task area where other DS routinely come to you for assistance? What do you provide them to assist them?

6. When you teach collective tasks to the Soldiers what is the most difficult – thing – task – idea - for the Soldier to grasp? What device or aid would better enable you to explain it to them?

7. What device or aid could the Soldiers have / use to help them better understand the collective training (or to refresh their skills as they move to follow-on blocks of training)?

8. Would a 3D terrain model of your training areas help you teach terrain features / map reading / brief road marches / FTXs etc.? If so, should this model be portable for use in the field? What about just providing various blocks / pieces that could be configured, as you wish?
9. Urban operations is a critical collective task. Would a 3D building, without the roof, possibly with scaled toy Soldiers, assist you in training urban operations and room clearing?

10. Are there any other particular types of training aids or devices that could assist you in becoming a better DS and providing better training to your Soldiers?

11. What training aids do you use now, and how do you use them, do they need to be improved?

12. Do you know of another unit or DS that might have a good idea that we should talk to?

13. What type of training item would help you to make your platoon even better? Is there a training aid you use that could be modified – improved - created? How? What do you need it to do? What skills / tasks would it assist you in training?

Of your ideas, what are your top three "I have to have these" (indicate their top three choices)

Contact information:_____

How much longer will you be a DS? _____

When we have some prototype training aids developed, would you be willing to test them while training your Soldiers? _____

Thanks for your ideas and time.

APPENDIX C

IDEAS FOR POTENTIAL TRAINING AIDS

When participants were asked to suggest potential training aids, they were instructed to avoid perceived limitations and restrictions. Therefore, the following items are merely a compilation of suggestions without regard to cost, feasibility, or other factors (e.g. storage space, quantity required in order to be useful) that would need to be considered prior to pursuing these items. Also, some items were suggested by a single person and other participants disagreed with the suggestion, while some items received some consensus and support from other participants.

The following suggestions are grouped by major task training categories. The categories and items within the categories are *not* listed in any specific sequence; no priority or emphasis of participant support should be implied by the listing sequence. The following list does not include any indication of the degree of consensus or support.

It should also be recognized that many participants suggested a wider distribution of some training aids and materials that currently exist. Some examples include but are not limited to: realistic mannequins that allow practicing various combat lifesaver tasks; computers and projectors for every platoon; paintball guns or simunitions to increase training realism; engagement skills trainer (EST) 2000, LMTS (Laser Marksmanship Training System) and MACS (Multipurpose Arcade Combat Simulator) for marksmanship practice; combatives mats; improvised explosive device (IED) kits; and roll-over vehicle trainers. Training items already in existence are *not* included in the following list.

Items in Overlapping Training Categories

Large mockups: Large mockups of various pieces of equipment that have moving parts comparable to the actual equipment item; the mock-ups would not be fully functional. These mock-ups would be built to scale and would be large enough that the knobs, dials, etc. (e.g., windage and elevation adjustments) could be seen from a distance by a group of Soldiers. Items of equipment included the Close Combat Optic (CCO), the backup iron sight (BUIS), the front sight post on the rifle, PAQ-4, PEQ-2, PAQ-15, PVS-14, magnetic compass, and various radios that the Soldier might encounter in a unit.

3D videos (NOT mock-ups): Videos and electronic files that show various items of equipment, how to operate it, show it from different perspectives, etc. Some do NOT want large mock-ups of any devices or equipment. Units typically do not have adequate storage space and they believe the mock-ups would not be readily available for training when needed. Electronic files of the videos can be easily stored and used whenever desired, even by multiple users simultaneously.

Action / reaction situations: A variety of “what do you do now Soldier” type videos that present different real-world situations that Soldiers will confront while in the Army. These situations could be anything from encounters with Soldiers in the barracks experiencing different problems or dilemmas to actual simulated combat situations. The situations should be scenario-based and provide enough information that would cause the Soldier to respond in some way. Based on the Soldier response, the device would provide feedback on the consequences of the decision/action. The situations could be an “escalation of force” where

the situation changes based on the responses. These could be computer-based allowing individual Soldiers to respond independently or interactive videos for group sessions that could be facilitated by a leader.

Standardized Powerpoint instructional material: Various websites (e.g., www.550cord.com, www.squadleader.com, www.armytoolbag.com) contain instructional material for a variety of BCT skills. The material is developed in different formats that are downloadable and useable on a computer. The material is consistent with the tasks contained in the BCT training support packages. They would like this type of training material developed and provided for the classroom training tasks (they did not specify which classes). (Note: It was pointed out that some of these materials are "for sale", not freely available.)

Digital Training Labs: A group of computers available for each platoon that allow Soldiers to conduct self-study for all or most of the BCT classes in the platoon area, at night. Computers should be able to access and play Powerpoint material, interactive GTAs, videos, IMI, etc.

Rifle Marksmanship

Mini Range Facility: A wireless, remote-controlled array of targets that could be assembled and placed within a short distance (e.g. within 50 meters), both indoors and outside. The target arrays could be used to simulate a qualification firing range with scaled targets replicating 50 to 300 meter targets. Similar to "mouse trap" ranges where targets are raised by pulling strings.

Improved Weaponeer: Modify the system so it accurately replicates weapon recoil and allows a variety of shooting scenarios. Include functionality so the CCO can be used with the system. Make a system available to every platoon.

Improved MACS: Modify the system so it accurately replicates weapon recoil. Per DS claims, the MACS system must be fired on a level plane. Firing from the floor does not allow Soldiers to practice the kneeling or barricade positions. Therefore, provide a table or platform that allows the MAC to be used from various firing positions. The system should also be modified to include the ability to shoot the Combat Familiarization Firing scenario which includes such features as displaying multiple targets simultaneously, induces weapon malfunctions, and targets "bob" when hit and some require multiple hits to acquire a target kill.

Improved LMTS: Modify the system so it accurately replicates weapon recoil. Provide an operator's manual that concisely shows and explains how to setup and operate the LMTS so Soldiers can more quickly and easily use the system.

M4 carbine posters: General information on system operation and capabilities that can be displayed on walls throughout troop area.

Range mockup: A generic range facility mock-up that displays common areas (e.g. range tower, firing line and positions, bleachers). The various major pieces and components within the

display could be movable so the configuration could be changed to replicate specific range facilities. The mock-up would be used for cadre briefings and to train Soldiers on range procedures.

Riddle device: Similar to the device that already exist, but one that can be used with the BUIS.

Improved "shadow boxes": Constructed from material that is more durable than plywood to reduce damage and destruction during transport and use.

Large front and rear sights for M16/M4: In addition to just being a mock-up, as described above, these should be fitted with a laser to demonstrate the sight adjustment process and the impact of adjusting the sights in different directions. This would be used prior to Soldiers' firing on a zero range.

Magnetic target with magnetic "bullet holes": This should be the representation of a zero target that allows a DS to place the "bullet holes" at various locations and in different patterns on the target. This would be used to teach Soldiers minute of angle and sight adjustments.

M4 disassembly video: They currently have a video that shows and explains M4 disassembly. The video shows 3D aspects of M4 and the weapon rotates/spins so various angles can be seen as the weapon is disassembled. However, the current video provides disassembly down to a level beyond what the individual Soldier should accomplish. The video could be modified to show only the disassembly steps that a Soldier should perform.

Improved EST (Engagement Skills Trainer) weapon: Current weapon in EST is heavier than real M16/M4. Modify the weapon to replicate the real weapon.

Front sight post adjuster: A device that can be used with either the M16 or M4 that allows for easy adjustment of the front sight post. The device should be durable.

Rifle Qualification "Nintendo game": Per some DSs, a Nintendo-type device that allows a Soldier to practice shooting record qualification already exists and is located in the museum at Fort Leonard Wood. They would like to have a simple device that would allow Soldiers to practice shooting, using their own weapon, anywhere, anytime.

Realistic targets on rifle range: Today's battlefield targets frequently wear civilian clothes, not a green uniform like is replicated on most targets on current ranges. They would like targets that represent real world targets that Soldiers will likely see and need to engage.

Video of shooters: Provide a means for a DS to video a Soldier while on the firing line and then playback the video so the Soldier can actually see what he is doing wrong.

Magazine that induces malfunctions: The magazine should not only include dummy rounds for misfire, but also cause double feeds or other types of malfunctions.

Modify “Zero” ranges: Provide a system that allows targets to be brought to the firing line without Soldiers being required to walk the 25 meters (similar to target retrieval systems used in indoor ranges). This allows each lane to operate more independently and quickly so more Soldiers can be trained more quickly. Also, provide some protection over the targets so they do not get wet during inclement weather (wet targets do not allow marking shot groups).

Land Navigation

Map reading: A pocket size handout that summarizes all of the key training included in the classroom instruction.

3D terrain model of Tenino map sheet (or at least a portion of the map sheet): Terrain model needs to be durable to withstand handling and transport. It should be large enough for at least 20-30 Soldiers to see simultaneously during classroom training. Since some units at one installation use a different map sheet than Tenino for training, a similar 3D terrain model for that map sheet could also be developed.

Dagger training: A Powerpoint slideshow to train “how to use” the Dagger system. Also, a pocket-sized card that summarizes key operating information for the Dagger which Soldiers can carry with them during land navigation exercises.

Map reading interactive testing: Provide computer-based scenario questions that allow a trainer to test Soldiers on various map reading skills. This should be interactive and evaluate the array of map reading skills (i.e. grid coordinates, marginal map data, etc).

Large functional protractor: Suggestion includes creating a large protractor that is attached to something like a butcher board easel. The protractor should be attached to “slides” that allow the protractor to be moved vertically and horizontally. The butcher board should display a section of a map sheet that allows practicing plotting different grid coordinates.

First Aid / Combat Lifesaver (CLS)

Dummy extremities (arms and legs) for breaking bones: These should be similar to dummy arms used for IV training, but these devices should allow Soldiers to experience actually breaking a bone in a person’s body (i.e. the amount of force required, the sound, where the bones are typically the weakest, etc).

IV arm: A cheap and simple device that allows Soldiers to practice inserting a needle for a simulated IV. This could be pressurized so the Soldier receives visual feedback from blood backflow when the needle is properly inserted in the vein. Also needs to replicate the texture of actual skin and veins, as well as have the vein that moves within the arm to replicate the actual difficulty of inserting a needle in a vein.

Mannequins or functioning arms and moulage kits: They would like to have “functional” mannequins so Soldiers can practice the full scope of CLS skills. If not full mannequins, then at least provide materials that can be used by Soldiers to practice inserting an IV and applying

tourniquets. Mannequins should provide some realism, such as a timing device that tracks elapsed time and then induces additional complications if appropriate treatment is not completed within required time. Mannequins should be able to be quickly and easily "programmed or set-up" to represent a variety of injuries or medical conditions.

Medical tasks videos: While many different videos and training materials exist, most are "out-dated" and do not present the most current techniques that Soldiers should use. Provide materials that match what Soldiers should really do to treat various injuries they would encounter. For example, in combat, the primary means of stopping bleeding is to cover the wound and immediately apply a tourniquet then evacuate the Soldier. Soldiers typically do not go through graduated-application of pressure dressings before a tourniquet. The rationale is that casualties are evacuated quickly (within 2 hours) so the tourniquet rapidly stops bleeding and will be removed at the medical facility before any permanent damage can be done to the extremity.

IMI modules for the various CLS skills: These should be provided for all CLS classes and be suitable for a DS to use when presenting training to a platoon or company size group. Should include interactive exercises and questions that require Soldiers to respond and react.

Drill & Ceremony (D&C)

D&C gauntlet: Provide reconfigurable materials that can be easily assembled to form hallways, corners, etc. that can be used so Soldiers are forced to practice drill & ceremony commands in restricted spaces.

D&C demonstrations: Video or 3D IMI material that demonstrates all the various D&C commands being properly executed. Demonstrations should include both individual and unit movements. Material should show close-ups as well as overall views, where appropriate. Trainer should be able to pause the demonstrations, to easily rewind, to replay, to run in slow motion, etc.

Tactical Training
FTX (Field Training Exercise) / STX (Squad Training Exercise)

Battle Drill hand book: A pocket-sized booklet that briefly and succinctly displays and explains the proper execution of battle drills trained in BCT. This would be similar to the Ranger Handbook or FM 7-8, but should be much slimmer in content.

Formation and order of movement (FOM) board: A display board that depicts various small unit (squad and platoon) movement formations, including all unit members and sectors of fire. The board could also display doctrinal techniques for executing small unit battle drills. Displays could include a patrol base with sectors of fire and minimum priorities of work, as well as unit procedures for long and short halts. Various display options were suggested from having all of this information permanently drawn on the board or providing magnetic symbols and objects that the trainer could use to create any display.

3D terrain model of local training areas: Units typically use the same Forward Operating Base (FOB) and surrounding training area for their FTXs. They would like a terrain model of the operating area that depicts all of the major features (e.g. creeks, streambeds, trails). They would also like to have a variety of small scale objects and devices that can be placed in the terrain model to represent objectives, unit movement routes, potential enemy locations, etc. The terrain model needs to be durable, all-weather, and large enough for briefing platoon-size groups of Soldiers at the FOB. The terrain model would remain at the FOB. (Note: Some groups were adamant that NO terrain models were needed. They should learn to make field expedient terrain models, just as they will be required to do in real-world situations.)

Mobile configurable building: This would be sections of walls and doors made from durable wood that could be quickly and easily assembled to form "buildings" with different sizes and shapes for rooms and halls. The vertical structures would need some sort of stand to hold them erect. The intent is to allow Soldiers to rapidly assemble a building in any available location then easily redesigned the building within minutes causing Soldiers to adjust to different building and room configurations. This would allow units to train urban operations (UO) in virtually any location, on short notice, and with varying building designs.

FTX "kit": A kit that includes uniforms (e.g., Iraqi Army, Police, Insurgents, Civilian), signs (e.g., town names, directional arrows, names common bivouac locations such as latrine and entry point), moulage kit, rubber weapons (e.g., AK-47, RPG), prayer call audio tapes, etc. The kit could include a variety of other items and materials that are frequently used to support and enhance the realism of an FTX.

Video of unit correctly executing battle drills: A series of videos or 3D IMI material that demonstrates the correct way for a small unit to executer battle drills. Demonstrations should include both individual and unit movements. Material should show overall unit view as well as close-ups, where appropriate. Trainer should be able to show the material at a normal battle drill execution speed, to pause the demonstrations, to easily rewind, to replay, to run in slow motion, etc.

HMMWV (high mobility multipurpose wheeled vehicle) turret trainer: This would be an actual size mock-up of the HMMWV turret space. The mock-up should replicate the general turret configuration with sufficient movable components to represent the actual vehicle turret. It is not necessary for all components to be fully functional. These mock-ups should be located in the company training area for easy training access, as well as at the FOB for refresher training during FTX/STX.

Realistic Opposing force (OPFOR) weapons: Functioning OPFOR weapons or at least a pneumatic firing device that replicates the sound of OPFOR weapons. These weapons should replicate the sound and firing characteristics of the various OPFOR weapons so Soldiers can learn to distinguish between friendly and enemy fire and respond appropriately.

Simulated enemy that fires back at Soldiers: Provide some type of device that will actually shoot back at Soldiers during STX/FTX and while on shooting ranges. The device should represent various enemy weapons. The device should be able to actually engage the Soldiers so the

Soldiers know that they have been shot/hit. The device should be able to engage a Soldier after the designated period of time or when a Soldier remains exposed.

Training hand grenade: A replica of various hand grenades that are the actual size and weight of actual hand grenades. These grenades should explode like the real grenades and dispense a powder-like substance the same distance as the grenade shrapnel so that casualties can be assessed appropriately.

Paint ball-type items: In addition to having paint ball rifles for force-on-force, they would like to have booby traps and hand grenades that function like paint balls to dispense a visual indication of engagement and to inflict simulated casualties. These devices should be the actual shape, size, and weight of real items.

Road signs (changeable): Some material that allows leaders to rapidly make a road sign and hang it from trees/bushes/buildings/etc. along a route. The signs should provide multiple hanging or mounting options that can be used in different areas or situations. The basic sign should be about 1ft x 1ft in size, should be all-weather, and should allow leaders to write on the material to change names (e.g., something like an alcohol pen that is not water soluble, but no magnets or stick-ons that could get lost/misplaced). These signs could also be used during an FTX/FTX to designate locations for Soldiers who are executing various lane training exercises.

Night Vision Goggle (NVG) "simulator": Something as simple as a toilet paper roll with green cellophane over the end so the Soldier can look through the tube and experience the sensation of viewing through an NVG. The item should provide limited field-of-view and depth perception, as well as dimmer light, just as the actual NVG devices. It would be good if the item "resembled" the actual NVGs (e.g., size, weight, shape) and could be worn by Soldiers so they can actually walk around with the simulated device. It does not need to be a fully functional device. However, it would need to be designed so Soldiers can wear it with their own glasses so no focus is necessary. It should draw sufficient light from the sun so it can used during the day and degrade the light enough so it still represents the typical night darkness conditions.

Convoy "react to contact" virtual simulator: Provide some device that allows Soldiers to learn and practice responding to contact while traveling in a vehicle. The device should represent a variety of vehicle types (e.g., Stryker, HMMWV) and different contact situations (e.g., IED, traffic accident).

Role players for STX and FTX events: Depending on the training event, the role players would be diverse nationalities, speak different languages, etc. These role players would be interjected at key points in certain field training events (e.g., checkpoint operations, responding to various situations) to increase realism.

Soldier Visualization Station (SVS): The Dismounted Battle Lab at Fort Benning, Georgia includes a virtual environment that allows a group of Soldiers to interact in tactical operations in various terrain areas. Soldiers can see others, OPFOR can be live or virtual, battlefield

conditions can be altered to change the situation, and engagement effects are tracked. Scenarios can be recorded and used afterwards to critique performance and conduct an AAR. The request was to have this capability made available for use by BCT.

Roll-over vehicle simulator: A device that represents different vehicles and varied roll-over conditions. This would allow Soldiers to practice procedures for responding to and exiting a vehicle that rolls over.

Night Infiltration Course (more realistic): Current ranges are too artificial. Need to introduce more battlefield sounds, have craters from explosions, include bloody body parts and wounded personnel, scatter car hulks and other debris throughout the area, etc.

Public address system in FOB: The audio system should be capable of broadcasting a variety of media (e.g., audio files, sounds, live verbal). Sounds should be audible throughout the FOB. The system could be used to play realistic battlefield sounds, to simulate "call to prayer", to inform Soldiers of critical information, etc.

Communication

Actual radios used in units / theater: While trainers would like to have the actual radios being used in units and operational theaters to use during their training, they would be partially satisfied with videos or PowerPoint training material so they can show Soldiers what the actual radios look like and how to use them. Included in these training materials, they would like to have "functional" face plates so Soldiers can actually enter code fills, turn knobs, push buttons, etc. as they would be required with an actual radio. (Note: A DS stated that the units in Vicenza have an interactive-type 3D video that shows how to use the various radios.)

NBC (Nuclear, Biological, Chemical)

NBC video: While videos and training material exists for a variety of NBC topics, most are vastly outdated. Training materials need to be updated to reflect the equipment that is currently available and in use in the theaters of operation.

NBC protective mask "timer" device: The intent is to have a timer device that can be attached to the NBC protective mask. The timer begins when the mask is removed from its carrier and would provide some alert to the Soldier and DS when the specified donning time (9 or 16 seconds) has expired. This alert could be an audible sound, or some visible indicator such as the eye lens being covered.

Realistic gas chamber: Something like an obstacle course that Soldiers must negotiate, including crawling through a hole in a wall, climbing over a barricade, etc. At some point in the course gas would be encountered which would force the Soldier to don a mask and continue with the mission.

Urban Operations

3D terrain model of Urban Operation training site: Installations have sites that are typically used to train urban operations skills. Trainers would like scaled 3D terrain models that depict buildings, roads, etc. They would like to have available objects that could be moved within the model to represent vehicles, debris, obstacles, damaged buildings, etc. They would also like the buildings to have removable roofs to allow viewing inside structures. Finally, they would like scaled Soldiers so that formation movement down streets, selection of supporting fire positions, and team movement for room clearing could be taught.

Building "floor plans": While schematics that depict building locations within an urban training area might be available floor plans for each of the buildings are not. They would like to have building floor plans to assist when training Soldiers on building entry and clearing, to use for coordinating allocation of training space, and to facilitate planning for force-on-force training events.

Computerized target discrimination device: A portable target system that could be easily moved and emplaced in various locations throughout a training site. The system could be programmed to randomly present targets that require the Soldier to make rapid Fire / No Fire decisions.

Pre-fabricated and replaceable door frames for urban operations facility: Negotiating doorways is critical in urban operations (e.g., must consider which side of door is hinged, whether the door opens into or out of the room, force required to move door). According to DS, some urban operations facilities do not have any doors. Doors should be provided in urban operations training sites. In addition, doors frequently are damaged during training. Therefore, should provide pre-built door frames with doors that can be quickly and easily replaced by the training unit.

Pugil / Bayonet Training

Bayonet with retractable blade: Instead of an "always-extended blade bayonet", provide a bayonet with a retractable blade for use on the Bayonet Assault Course (instead of puncturing a target, the blade would retract upon impact. This could reduce Soldier accidental injuries when they are moving around the training area, but still provide some degree of realism when negotiating the course.

Pugil "scoring devices": Provide protective gear that is equipped with sensors to track and assess the location of a hit and amount of force. This could be something like the equipment used in fencing. A device should record the performance.

Pugil equipment: Need better equipment to protect Soldiers during pugil training; current equipment is old, very worn, and does not provide adequate protection from injury. Some units usually resort to having Soldiers wear their body armor to provide better protection. They also suggested having plastic or hard rubber rifles to use for pugil training in lieu of the sticks with pads on the ends in order to increase the training realism.

Bayonet Assault Course targets: Provide realistic targets that will actually fight back. At a minimum the targets should provide some resistance or threat to the attacking Soldier.

Physical Training

Combatives: A video currently exists that shows how to perform each of the Level I combatives actions and moves. Some would like to provide this video, as is, to all DS. Others would like the video modified to eliminate some of the training information because it goes beyond the level of training Soldiers receive in BCT (the DS concern is that Soldiers might attempt to perform actions and moves on the video that are beyond their level of training).

Push-up grading device: Grading push-ups for the Army Physical Fitness Test (APFT) is very subjective; a grading device would eliminate or reduce the subjectivity. The device would need to be used with all sizes and shapes of Soldiers in a field situation. The device would need to measure that the Soldier went down far enough to cause upper arms to be parallel to the ground and that the Soldier returned to the full upward position with elbows properly locked. They prefer something like a laser system that measures proper performance of each repetition and also counts number of correct repetitions.

Administrative

Checklists for "duty platoon" responsibilities: For most training events or blocks of training a platoon is designated as the "duty platoon". This platoon is responsible to ensure all necessary support items are acquired and available at the training site. The platoon also supplies the personnel to provide on-site support during the training event (e.g., loading ammunition magazines). They want a "duty platoon" checklist that details all of the various support items and requirements for each training event or block of training.

Instructional "note cards": According to some DSs, the Drill Sergeant School has developed and provides condensed booklets (note cards) that provide a summary of selected blocks of training. These instructor note cards would have class material to assist the DS with instructing the classes. They would like note cards such as these for every block of training, such as: IED, Medical Evacuation (MEDEVAC), reporting (e.g., SALUTE / SALT, NBC 1), battle drills, etc.

Web site for reference material: Establish and maintain a web site that provides easy access for DS to various training materials, training aids/devices and the most current lessons learned and suggestions for presenting various classes. They suggested that the DSS could possibly maintain the web site.

Soldier uniform models: One option is to provide life-sized mannequins that are wearing the various uniforms. This allows DSs to show Soldiers how to assemble and wear the uniforms without having to wear the uniform themselves. Another option would be to provide large pictures or posters that show "heroes and zeroes" (i.e. Soldiers who are wearing the uniforms

correctly and incorrectly). Need to include both male and female examples with the different uniforms.

Personal Hygiene training material: Should be an interactive multimedia instructional (IMI) module that is scenario-based. The scenarios should include both the cantonment and field environments. The IMI module would present different situations and varying conditions for a Soldier to address or correct. If proper actions are not accomplished, the Soldier should experience appropriate consequences.

Motivational video: Produce a 30-min video that shows how a "civilian" enters BCT and transitions through the various classes and phases of BCT to become a Soldier. Ideally, the video would follow a typical recruit from arrival at a reception station through to graduation, highlighting and explaining the myriad events that would be encountered throughout BCT.

Cross-reference guide for training aids: This guide would identify which training aids and devices are available for each block of training in BCT with a short explanation of how the items could be used. (Note: Several DSs stated that this information already exists in the appropriate field and equipment manuals; they believe this information should be documented in the training support packages [TSPs] for each of the classes or blocks of training. They suggested there is no need for a consolidated guide, but rather just keep the TSPs current with appropriate training aids/devices.) Some DSs stated that the installation Training Aids Support Center (TASC) would fabricate specific items if a unit requested them. The TASC would assign an installation tracking number. These items would not be available at other installations, and therefore, would most likely not be included in the standard TSPs developed at a central location.

Radios (non-tactical): These radios would be used by DSs and Soldiers to facilitate more effective communication when Soldiers are spread over an area, such as across a firing range, when on guard duty in the barracks, etc.

"Electronic board" for classes: Replace the old wooden "sandwich board" with something like a "neon sign" or video monitor that can be used to quickly enter/change trainers' name and class. Cardboard name cards and class titles are time-consuming to make and wear out easily, especially in bad weather.