OPTIMIZING THE MIX BETWEEN VIRTUAL AND LIVE MILITARY TRAINING

Task 4.2 –Final Project Report

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Introduction and Overview

This is the final report in the OPM contract, Optimizing the Mix Between Virtual and Live Military Training, concerning the issue of whether to train a task by live or virtual means. The final report focuses on the work completed in Task 4 (Applying Grouping Criteria); earlier reports documented work completed on the other tasks. However, to provide a practical context for the outcomes of Task 4, summarizing earlier work is necessary.

A synopsis of the work completed in Tasks 1 (Examine and Categorize Tasks) and 3 (Develop Criteria for Filtering Task Classes into Virtual and Live Training), performed by ICF International (ICFI) is provided here. It is important to note that Booz Allen Hamilton (BAH) worked separately on Tasks 2 (Roadmap of State-of-the-Art Virtual Training Capabilities[1]) and Task 5 (Identify any Gaps in Virtual Training Technologies or Live Training Capabilities[2]), which were part of the same Statement of Objectives that encompassed tasks performed by ICFI. Results of the studies performed by BAH were reported directly to the sponsor, the Office of the Secretary of Defense, Readiness and Training Strategy Directorate. Some degree of coordination was necessary between ICFI and BAH to complete project requirements. These activities were coordinated through meetings and planning reviews, but otherwise project work was pursued independently. Reported here is the ICFI work only.

Project Overview

The overall project concerned the development first of a model and then a decision algorithm based on the model for determining what military tasks can be taught virtually (both synchronous and asynchronous) and which tasks should only be taught in classroom or field environments (i.e., live). The decision algorithm was then fashioned into the L-V Decision Aid for the user community. The model and decision algorithm addresses both individual and collective tasks across the military Services and is designed to assist in making only a 'first-cut' determination. The goal was to develop a user-friendly system to aid military training developers in making decisions about training delivery methods, specifically live or virtual. The model is based on a variety of elements from established, peer-reviewed research, current

[1] The final report for this task was titled with the same name as the task and dated the final report for this activity dated December 15, 2010.
[2] The final report for this task was titled with the same name as the task and dated the final report for this activity dated February 1, 2012.

technology, and current military practices. Earlier work by ICFI on the completed Tasks 1 and 3 is summarized below, followed by previously unreported details on the outcome of Task 4. Throughout this final report, the term 'model' is also used in a generic sense, referring both to the decision algorithm and decision aid. Some details described in the earlier reports are included in the User's Guide section of this report in order to provide a complete framework.

TASK 1 – Examine and Categorize Tasks

The goal of Task 1 was to develop a set of criteria useful for categorizing military tasks, and further categorize a set of tasks based on these criteria. Four subtasks were involved in this activity that included developing an inventory of military tasks, creating a task sampling plan and sampling tasks from the task inventory database, identifying task class criteria and developing a classification model, and categorizing selected tasks based on class criteria. (The criteria focused on internal task characteristics and learning issues rather than external factors such as costs and safety. How these later factors can be brought to bear on a final decision is described later in this report.)

The first activity involved comprehensively identifying and then sampling military occupations across the four Services, represented by the unique military occupational codes (MOCs) used in their identification. Following this, the research team used the sampled list of MOCs to target collection of sets of military tasks linked to each selected MOC. The objective at this stage was to create an inventory of approximately several thousand military tasks (individual and collective tasks combined) that would serve as the basis for a database, from which a sub-set of tasks would be selected for categorization using ratings factors derived at a later stage of the project. Ultimately, the research team identified approximately 7,000 military tasks (including individual MOC-linked tasks, collective, and Service-required common tasks) from the four Services. The sampling strategy from sub-task 1.1.1 was used to identify candidate MOCs.

It is important to note that the original sampling methodology proposed the use of a stratified sampling strategy for tasks. The sampling strategy included the strata of enlisted, warrant officer, or commissioned officer and Service. The team sampled across military occupations and task lists using the strata described as randomly as possible, and also gave consideration to issues such as ensuing that highly populated MOCs were as representative to the actual military population as possible.

The next stage of Task 1 was to identify the categorization criteria for tasks required for use in the decision-making framework in Task 3. As a first step, to identify and develop the various factors and criteria, the research team performed an extensive review of the research and training practice literature. The goal of the review was to identify existing task classification schemes and associated methods, examples, and evidence that would help to frame the factors. This was performed both for individual tasks and collective tasks. Results were synthesized from various technical perspectives to generate a recommended set of criteria for integration into the decision-making framework. Details of this activity are provided in two reports: *Task 1.3 Task Categorization Criteria Report* (addressing the criteria for individual tasks), and *Task 1.5: Collective Task Categorization Criteria Report*, both previously delivered to the sponsor.

Following identification of recommended task categorization criteria, the research team then sampled the task database, identifying a sub-set of these tasks targeted for rating with the draft classification criteria. At the same time, the team reached out to members of the Services to collect the relevant task documentation that would provide the level of detail about the task needed in order to apply the rating factors recommended. It was critical that tasks used in the task categorization activity had the level of detail needed for the research team to effectively apply the categorization factors and make ratings.

Once tasks were collected, a multi-rater approach was used to apply the task rating criteria to the sample of tasks. All tasks were rated by several raters, and a consensus rating was then formed for each task. A total of 302 (200 individual tasks and 102 collective tasks) were rated. An important function of this sub-task was to 'test' the rating criteria through application of the classification criteria to military tasks. In some cases, this resulted in modifications to the criteria. Details on this activity, specific ratings for sample tasks, and details on modifications to classification criteria were provided in the combined report, *Task 1.4-Task Classification Results and Task 3 – Decision Making Framework Report*, previously reported and delivered to the sponsor.

TASK 3 – Develop Criteria for Filtering Task Classes into Virtual and Live Training

The next stage of the project involved the development of the task-classification model that integrated criteria that would generate the 'live/virtual' training decision determination. The first step involved identifying and reviewing existing task training decision-making models. The team performed a literature review in the academic and training practitioner literature and identified several existing models relevant to this purpose. In addition, the team collected available information on the strategies and methods used by the Services to make the determination of whether a task should be trained in a live or virtual environment. These sources of information, also informed by earlier work in the project were synthesized to develop a recommended classification model.

A significant part of the effort in developing the task-classification model and decision algorithm involved identifying cutoffs for the various rating factors that, when merged, would delineate a dichotomous 'live' or 'virtual' recommendation. Cutoffs for the rating factors were determined from data collected in previous tasks (e.g., literature reviews), feedback from stakeholders and subject matter experts (SMEs), existing military practices, and the knowledge and experience gained from earlier work, such as the results of task rating. In addition, key contributing information was gathered from the results the Booz Allen Hamilton work for Task 2 and 5 (described earlier). In particular, the Task 2 report provided relevant information on the current state of virtual training capabilities in the military and was of value in setting upper limits on the various rating factors in terms of gaps between what is currently available and what is on the horizon.

Once the classification model was developed, the team sought to validate the model. First, the team ran a selection of tasks through the model and decision algorithm and reviewed the 'live/virtual' classification results to examine whether the process was classifying tasks correctly. The research team then identified a small group of SMEs (i.e., military training experts and stakeholders), presented the model to them, and sought their feedback. The team also asked SMEs to rate several tasks they were familiar with using the draft model, and asked them to discuss their results with the team. Feedback received from SMEs was used to make additional adjustments to the model. Details on activities performed for this task was provided in earlier reports.

TASK 4 – Apply Grouping Criteria

For one subtask, the research team applied the draft classification model to the full sample of tasks, previously rated, and analyzed the outcome. The results were organized by task classes in accordance with previous work, and provided to the project sponsor. For example, for individual tasks, the Domain Factor included 38 percent of tasks as procedural, 34 percent cognitive, 25 percent psychomotor, and 4 percent affective. The list of final task categorizations for individual tasks is provided in Appendix A, and the final task categorizations for collective tasks is provided in Appendix B.

Another subtask involved a series of activities to mature the model, disseminate it to the broader population of stakeholders, and collect feedback from stakeholders to complete final updates. The general term 'validation' was used in the sense of user feedback and acceptance of the content and constructs rather than a formal test of criterion validity. The activities for maturing the model included:

- Conducting additional stakeholder meetings to gather reactions on the utility of the model and collect validation data; summarizing the results
- Disseminating the model through submission to targeted publications and presentation opportunities
- Revising the model and suggesting further extensions

Conducting Additional Stakeholder Meetings and Summarizing the Results

Following development of the initial classification model in Task 3, the research team then worked to collect feedback on the model and also validate its utility by engaging stakeholders from the military training community. Construct validity was the focus, rather than an empirical comparison between rating groups on a common set of tasks. Although the latter was done to a small extent, the scope of the project did not allow a full empirical test to be conducted. The team sought feedback from these stakeholders on the worthiness of the model for immediate use by planners and trainers: does it make sense, is it complete, can it be used, and is there value were the focus questions of this user validation process. Specifically, the team collected information on both operational and research/analysis points of view. To facilitate communication of the model to stakeholders and as part of the "disseminating the model' requirement, a draft User's Guide was developed, which provided a stand-alone and useable version of the model. The Guide includes specific instructions and documentation for stand-

alone use in rating a task. Feedback ultimately led to a revision of the User's Guide; its contents are presented later in this report.

During user validation, the draft version was distributed to stakeholders prior to meeting with them. The intention was to allow them to test application of the classification model to their own use, as well as speak to the utility of the User's Guide as a vehicle to disseminate the model's use. The User's Guide was also a step towards ultimately providing a vehicle for wider distribution of the model after a validation check.

Reports from Task 1, reference guides for the rating factors, and early versions of the User's Guide were presented to stakeholders. Meetings were conducted either in person or through an audio conference. Also, a presentation was made at a technical session at the I/ITSEC conference in Orlando, Florida, in December 2012 with a planned user's meeting immediately afterwards, however due to many conflicts and competing sessions, the user's meeting was attended only by representatives from the Marine Corps. Nonetheless, this initial meeting led to further demonstrations, briefings, and meetings with the Standards Division, Marine Ground Air Task Force Training Command, Quantico, Virginia. The I/ITSEC paper is contained in Appendix C.

The first stakeholder meeting was with the Director, MAGTF Training Simulations Division, Training and Education Command (TECOM), and several key members of the Division. The classification model was presented and feedback was requested. Key points that were raised and discussed by stakeholders at this meeting are provided below, as are comments and responses by the research team.

First, it was recommended by members of this stakeholder group that *Time,* particularly time-savings, should be a factor included in the model. The team agrees that this would be a useful factor in the decision-making scheme, although we do not believe that it should be included in the model itself. Our recommendation would be to include *Time* as a factor in a higher-order decision-framework.

The stakeholder group also indicated that one important need they have, that in their opinion the model could be adjusted to respond to, is determining whether virtual methods could be used for refresher or sustainment training. Our response is that, while the classification model

developed was not designed for this use (it focused on initial training), it could have utility if modified for determining if virtual training could be used in sustainment training. The team later developed a white paper to address this issue, which is summarized later in this final report. Another related issue voiced by the stakeholder group was their need for a decision-tool that would address the 'training mix' issue. In other words, a tool that would assist them in the 'part-task/whole-task' training determination (i.e., determining when part of a task could be trained virtually while other parts are trained live, and which are most appropriate for each training mode). The research team developed a second white paper providing information on how the classification model could be extended to address this issue as well, which is summarized later in this report.

The stakeholder group also made the observation that the target population for this tool should be those military personnel involved in developing training programs of instructions. The research team agrees completely that this is the target audience for primary use of the model. The group also addressed several other issues to include their recommendations to how results could be displayed, that care should be taken when referring to 'simulators' and 'simulations', and that for future stakeholder meetings the research team should target the institutional training schoolhouses. All of this information was useful for later interviews with additional stakeholders and valuable in developing final recommendations for the models use.

The second USMC stakeholder meeting for validation of the classification model was with the Deputy, Standards Division, USMC, TECOM. In addition to several individuals from the Standards Division, three officers from the Aviation Standards Division, and several officers from the Ground Standards Division joined the meeting. Following presentation of an initial briefing, the research team walked the group through the User's Guide that was developed after the first stakeholders meeting. A summary of key points from the discussion that followed are provided below.

The group expressed the opinion that *Cost* should be included in the model. Inclusion of a metric of training throughput as it relates to costs was recommended for consideration specifically. The research team agrees that *Cost* is an integral decision-making factor, and should be part of the overall decision-making process, although the team does not agree that it should be integrated into the classification model itself. One reason for this is that the model was specifically developed to exclude cost considerations at the direction of the sponsor who

was interested in the 'raw power' of training technology. The research team suggests that *Cost* should be addressed as part of a larger decision-making framework. Examples discussed at the meeting included ideas such as using the classification model as the first step in a multi-stage process where cost is addressed after the classification model provides the 'live-virtual' decision, or incorporating into some type of 'balanced scorecard' approach where multiple metrics are assessed alongside of the output of the classification model (i.e., concurrently), to achieve the final 'live-virtual' decision.

There was an additional consideration voiced as to who would make cost estimates, which could be beyond the expertise of an operator responsible for training. One opinion provided was that it may best be left to acquisition policy, using established cost-training effectiveness analysis. *Safety* was another factor that similarly was identified by the stakeholders for inclusion in the model. Again, the research team discussed this with the stakeholder group, and came to the conclusion that *Safety* could also be included in a higher-order decision framework similar to *Cost.*

There was also a discussion on how changes in technology and the capabilities of emerging technology should be addressed over time. Discussions among members of the SME group and research staff attending resulted in the conclusion that the model would need to be updated roughly every 3 to 5 years to adjust the cutoff criteria in order to make changes relevant to new technology. This period was deemed acceptable, particularly given that the 3 to 5 year timeframe fit well with USMC planning cycles. This discussion led to the issue of identifying the level of effort needed by groups using the model to maintain it, as well as identifying the most appropriate personnel that should be assigned to update the model. The consensus was that there should be two sets of personnel used to maintain the model. One group, comprised of individuals with the greatest knowledge of the technology and its capabilities, would be assigned to update the L-V cutoffs on a periodic basis. A second group, made up of task analysts and/or task content SMEs, should be assigned for any task rating activities using the model.

Referring to the User's Guide, the stakeholder group suggested that we provide an example of a commercial technology available to train the specific examples presented in the guide, such as a radar repair task. A commercial product was identified for the task in question, in line with the assumptions. The research team responded that this is a viable modification to the User's Guide, but cautions that it is important that the guide is not perceived as endorsing a particular

product. Therefore, if this strategy is followed, care would be needed to ensure that it is a training technology that is widely used and whose features are commonly known, and that there is sensitivity to any potential changes in functions and features of a technology over time, such as the commercial viability of the company providing the technology.

The research team then presented the current version of the User's Guide along with task rating worksheets. One member of the group presented two sample tasks, one individual and one collective, for ratings. Ratings were made by group consensus and radar charts were plotted immediately. The results were in agreement with pre-disposed expectations regarding live versus virtual.

The research team informed the stakeholder group that a pilot version of an automated tool for task rating (using the classification algorithm) was being developed. The team expressed a high degree of interest in acquiring this tool and the team agreed to provide the beta-test version of the tool to them as soon as it was complete.

Other additional topics discussed more briefly during the session included the issue of part-task training (similar to the previous stakeholder group), the importance of making a clear distinction between the terms 'simulator' and 'simulation' (particularly expressed from those attending the meeting from the aviation community), the issue of generating requirements vs. generating questions, the strategy of including depreciation factors into cost calculations, the issue of the importance of consideration of resource drivers, the potential for users to customize the decision aid, and the ongoing Government Accountability Office audit on simulators.

The research team also sought feedback from the Defense research community, with reviews of earlier drafts of the model and decision algorithm by experts from the Army Research Institute, the Naval Air Warfare Center Training Systems Division, the Naval Education and Training Command, and the Air Force Research Laboratory. The feedback was positive on the methodology and currency of the research considered in the articulation of the model. There were questions, however, on the lack of consideration regarding costs and safety, which were also voiced by feedback from the operational community. The research community also noted the difficulty of a single model for collective tasks, as the size of collectives varies which may affect the relative importance of certain factors, such as the teamwork training factor.

Disseminating the Model through Targeted Publications and Presentations

To disseminate the classification model and decision algorithm, and create awareness of the model's utility across a wide variety of stakeholder groups, the research team completed targeted submissions of articles to specific relevant publications and presentation venues such as training and simulation conferences. The team was successful in having their submission to the 2012 Interservice/Industry Training, Simulation, and Education Conference (IITSEC) accepted and published in the conference proceedings as previously mentioned. The research team also developed an article describing the classification model that was published in the June 2013 issue of *Military Training Technology*, a trade journal. The IITSEC paper is provided in Appendix C and the *Military Training Technology* article is provided in Appendix D.

As referred previously, a User's Guide was developed for multiple purposes, primarily to facilitate communication to prospective stakeholder groups as part of the validation process. Ultimately the goal of the User's Guide is to provide stakeholders with a freestanding and highly usable encapsulation of the decision algorithm, where stakeholders could apply the algorithm for their own use with the guide and relevant task descriptions. The target audience for the guide comprises training analysts or developers working in collaboration with subject matter experts, and the output from using the tools provided with the guide, the rating sheets or e-tool format, is intended to provide only a first-cut estimation on the live versus virtual question. The User's Guide specifies the principal rating factors, one set for individual and another set for collective tasks, questions to ask involving these factors (along with related response scales), and the output of the rating process rendered in radar chart form.

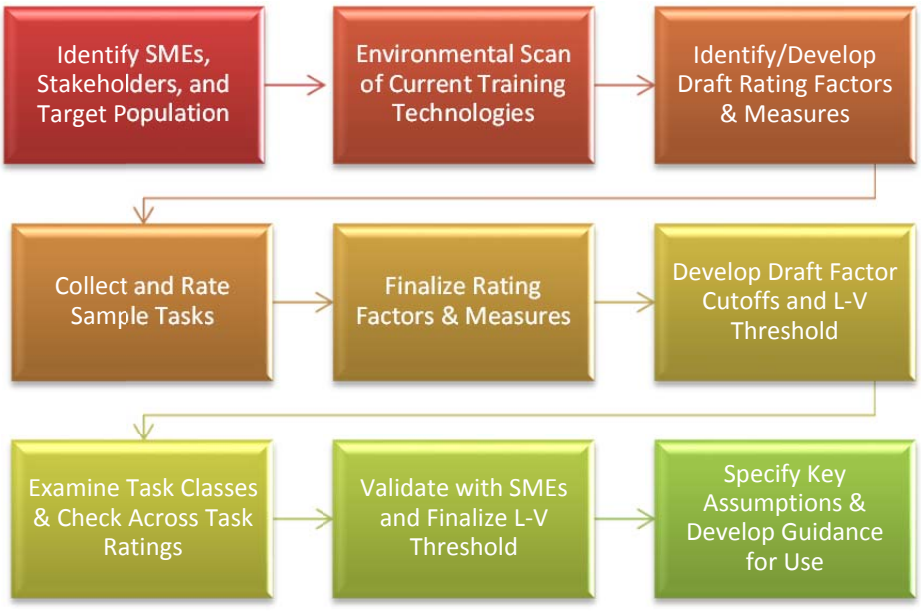
The guide is intended to be part of a more comprehensive front-end analysis, and it was specified that output from use of the guide should be weighed against resource constraints, safety factors, training logistics, and other considerations before making a final decision regarding instructional delivery for the stakeholder group.

The User's Guide

The *User's Guide* describes how to apply the Live-Virtual (L-V) Decision Aid. It is fully described in a separate report, including rating sheets, which was delivered to the sponsor. Much of the Aid has been re-purposed in this section of the final report. The guide includes information related to the automated version of the decision aid, called the 'e-Reporting Tool.' The intended user audience comprises training analysts or training developers working in collaboration with subject matter experts. The goal is to offer the training community a tool that informs whether virtual training is a viable alternative for training either individual or collective tasks. The decision informs training planners whether military tasks *can* (not necessarily *should*) be trained entirely through virtual methods.

The L-V Decision Aid is based on an integration of technical perspectives from leading practitioners and researchers in the training field, is described in more detail in reports provided earlier. Figure 1 shows the general process that was used in the development of the decision aid.

Figure 1. Development Process for the Live-Virtual Decision Aid

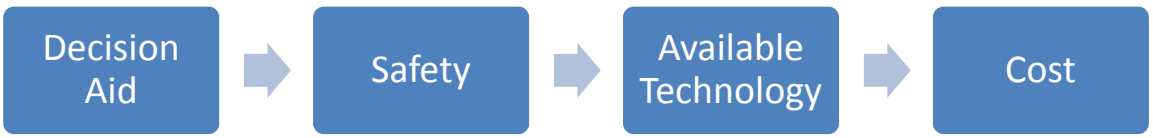


Background on the Decision Aid

The Services apply a comprehensive process that determines whether a problem may be resolved through a training solution, rather than through a new material acquisition, an upgrade to a current system, or a design change. This process spreads to the front end of the instructional systems design process where problem identification is performed, such as analyzing the job, identifying who must be trained, and selecting the tasks to train. The *Acquisition Guide Book*, for example, calls for the inclusion of 'the tools used to provide learning experiences' for training. The output of such a Front-End Analysis (FEA) usually offers options with different training potentials and cost estimates. Here is where the L-V Decision Aid can assist.

One component of the FEA is a media and technology analysis. Historically, the media analysis concerned identifying sensory stimulus requirements for each learning objective and matching each with the sensory stimulus features of media to identify a candidate training technologies, such as videodiscs or audio cassettes. Such media selection aids are somewhat outmoded now in light of the integrated nature of information and communications technologies. The L-V Decision Aid is an abbreviated form of this process that 'matches' task characteristics against a reference threshold of current training technology capabilities. Therefore, only task characteristics are accounted for by this decision aid, rather than additional factors such as cost and safety. Costs are not taken into consideration in this aid as there are Service-specific considerations and cost methodologies in place to guide the final decision. The intention of this aid is to serve as a starting point in the decision-making process. Figure 2 is a notional depiction of how the L-V decision aid can act as an input into the overall decision-making process that will include contextual factors that vary by Service.

Figure 2. Notional Decision-Making Process



The *User's Guide* specifies the principal rating factors, one set for individual and another set for collective tasks, the questions to ask involving these factors (along with related response scales), and the output of the rating process rendered in radar chart format. As part of a more

complete front-end analysis, this output must be weighed against resource constraints, occupational health and safety factors, training logistics, and other relevant factors in order to make a final decision regarding instructional delivery.

Applying the Decision Aid

The Decision Aid requires subject matter experts and training analysts/developers to form a consensus rating on four (individual) or seven (collective) task factors. At least one SME and one analyst are needed. The values from the factor ratings are plotted into a radar chart, forming a pattern that serves as a visual aid for interpretation. If the pattern falls inside the **L-V** box, the task is a good candidate to be trained by virtual delivery, if it falls outside the **L-V** box, the task should be trained through live delivery.

Assumptions

An overarching assumption of this aid was that all tasks can be trained through live training methods. We chose a simplified approach with a high, but imperfect, level of prediction rather than a complex approach that, while having greater refinement, burdens the user with many more factors and a complex set of rating rules. A separate assumption was that the virtual technology contemplated for training delivery was in use and commercially available, precluding those technologies in an R&D stage, in prototype form, or at a conceptual level as of 2011.

Within each the individual and collective aids, we propose thresholds for each factor that draw the line between virtual and live methods. The aids are sensitive to psychological factors established in the literature on individual and team training. The thresholds are also sensitive to the current state of proven, off-the-shelf training technology. The thresholds can be adjusted as new technologies become proven and stable.

It is important to note that task ratings using the two aids are designed for use in training for initial task acquisition, not for refresher or sustainment training.

Individual Task Factors

The four individual task factors are:

Domain Factor (categorical scale)

We recommend using the *domains* (cognitive, psychomotor, and affective) from Bloom's taxonomy with the added category of "procedural" that fits many military tasks. Although many

tasks can be described as a procedure, some include a dominant psychomotor or a critical cognitive component that overrides the routine nature of step-by-step execution that we count as procedural. In the scheme, then, the four categories are:

Rating of 1. Procedural routine step-by-step, limited cognitive complexity or psychomotor activity

Rating of 2. Cognitive knowledge and development of intellectual skills

Rating of 3. Psychomotor involving physical movement, motor skills, or perceptual & physical coordination

Rating of 4. Affective involving emotions, motivation, and attitudes

In reality, many tasks are combinations of domains, so select the highest level of the most dominant or critical domain exercised during task performance as your rating.

Interaction/Fidelity Factor (ordinal scale)

This factor identifies the degree that the completion of a task is dependent on interaction with data, people, or things. This factor is derived from functional job analysis as well as the interpersonal activities category of the position analysis questionnaire. We recommend using four levels for this factor:

Rating of 1. One-way interaction with data or things, low fidelity requirements

Rating of 2. Two-way interaction with data or things, moderate fidelity requirements

Rating of 3. Two-way interaction with people, moderate fidelity requirements

Rating of 4. Two-way interaction, high fidelity requirements

Learning Complexity Factor (ordinal scale)

This factor refers to the complexity of a task, and how difficult it is to retain related knowledge and skills. To determine learning complexity, we recommend using multiple considerations that can be integrated into a single complexity factor. Retention of knowledge/skill depends on the number of steps in a task, whether a job-aid or other memory aids are built in, whether the sequence of steps is fixed, internal cues and feedback, etc. Another consideration relates to the mental requirements from Bloom's taxonomy, particularly the complexity of any cognitive requirements, such as applying formulas. We call this factor *learning complexity.*

Rating of 1: Not complex at all

Rating of 2: Complex at times, but usually not complex

Rating of 3: Moderately complex throughout

Rating of 4: Varies between moderate and high complexity

Rating of 5: Consistently highly complex

Task Certainty or Feedback (ordinal scale)

Finally, *task certainty* is the extent to which a task has built in feedback, such that an individual knows when he/she has successfully completed the task without feedback from an instructor.

Rating of 1. Built in/synchronous

Rating of 2. Sometimes available/Sometimes delayed

Rating of 3. Never available or very delayed

ASSUMPTIONS SPECIFIC TO THE INDIVIDUAL DECISION AID

A. The aid assumes that tasks are trained to a level sufficient for proficiency, as recognized by the Service, using the training method selected;

B The aid does not account for a blended learning approach. Therefore, if a virtual method is selected, then the aid assumes that the entire task *can* be trained virtually, so blended learning falls into the live side of the dichotomy;

C. Tasks deemed appropriate for virtual *can* be wholly taught through virtual technology, with no live instructor input other than for administrative and technical procedures;

D. The final certification of task performance can occur either through virtual or live testing, depending on military Service regulations and preferences.

COLLECTIVE TASK FACTORS

There are four main factors for collective tasks, but one factor has four subcomponents.

Domain Factor (categorical scale)

This factor addresses the nature of the team in terms of what they need to accomplish for a specific task. There is no single, universally agreed on taxonomy of teams. For our purposes, we reduced the classifications to three categories, focusing on the outcomes of team performance in terms of a general input-process-output aid. The three categories and criteria are:

Rating of 1. Project/Development Category - Members of this team category are typically involved with planning, analysis of alternatives, and so forth. They likely need to

collaborate on project work. An “output” or product may be complex and unique, such as a mission analysis, a course of action, or a piece of software. This category could include software development teams, project teams, and planning groups.

Rating of 2. Action and Negotiation Category - Action and negotiation production teams are highly skilled specialists who must cooperate in brief activities and events. For our purposes, the main outcome is a decision or recommendation rather than a formal document. Examples of teams within this category include corporate boards and negotiating panels.

Rating of 3. Production and Service Category - Production and service teams work together in a physical environment where the use of equipment, the movement of assets, or the reactions to tangible conditions (e.g., terrain) influence performance. This category can include construction teams, assembly line work, or field activities of small military units.

Teamwork Training Factor (ordinal scale)

Collective tasks can engage more than the knowledge and skills of individuals, (such as teamwork, communication, and physical activities) and may depend on coordinated performance that is not necessarily trained at the individual level. The training of teamwork skills is distinguished from the training of individual skills. Prerequisite capabilities of individual members are essential for successful team training.

The categorization assumes that individuals are proficient on tasks performed in isolation, so teams rather than individuals are the basic unit of analysis. This factor concerns the development of roles and interaction patterns among members of the teams. It consolidates the supporting competencies that underlie successful performance of a mission essential competency such as situational awareness, multi-tasking, and internal teamwork. For our purposes, the aid simply recognizes teamwork training as a factor with three rating categories, indicated by degree to which collective task training emphasizes teamwork:

Rating of 1. Low

Rating of 2. Medium

Rating of 3. High

Synchronous Activity Factor (ordinal scale)

This factor concerns the degree to which teams are required to coordinate their actions in order to perform their collective task successfully. This factor involves knowing when, how and to whom to handoff tasks and accepting the handoff of tasks. We generalize the consideration of

a temporal dynamic in the collective categorization scheme as overall synchronous activity and the extent to which coordination and task dependencies are present are rated using three categories

Rating of 1. Low

Rating of 2. Medium

Rating of 3. High

Environmental Conditions Factor

This factor addresses issues that are relevant to instructional delivery, rather than to team processes and performance. These issues have not generally been included in taxonomies of team performance, but they are important for the purposes of the present study. The environmental factor includes four subcategories, the use of actual equipment versus using a virtual representation, need for special conditions in the environment, non-verbal factors such as the presence of cues that can be seen or otherwise sensed but not heard, and a multi-motoric factor. The four subfactors and ratings are:

Subfactor: Use of Actual Equipment (ordinal scale)

Rating of 1. Not needed

Rating of 2. Preferred

Rating of 3. Essential

Subfactor: Special Environment (ordinal scale)

The need to have certain environments for training, such as darkness, vibration, or background noise.

Rating of 1. Not needed

Rating of 2. Preferred

Rating of 3. Essential

Subfactor: Non-verbal (ordinal scale)

The presence of cues that can be seen or otherwise sensed but not heard, such as hand signals.

Rating of 1. None

Rating of 2. Occasional

Rating of 3. Frequent

Subfactor: Multi-motoric (ordinal scale)

The need for two or more team members to simultaneously engage strength or dexterity in performing an action, such as paddling a watercraft or installing concertina wire to form an obstacle.

Rating of 1. None

Rating of 2. Occasional

Rating of 3. Frequent

ASSUMPTIONS SPECIFIC TO THE COLLECTIVE DECISION AID

A. Individuals and subgroups are proficient in all prerequisite individual and subgroup tasks;

B. The aid assumes that tasks are trained to a level sufficient for collective proficiency, as recognized by the Service, using the training method selected (i.e., live or virtual);

C. The current aid does not account for a blended learning approach. Therefore, if a virtual method is selected, then the aid assumes that the entire task can be trained virtually, so blended learning techniques fall into the live side of this dichotomy;

D. When deemed acceptable for virtual training, the collective task is wholly taught through virtual technology, with no live instructor input other than a human-in-the-loop for administrative and technical procedures;

G. The virtual technology contemplated is currently in use and commercially available (not in an R&D stage, concept formation etc.);

G. The size of the collective, or group, is between 5 and 24. The recommendation from the decision aid may hold for larger or smaller groups, but with reduced certainty as to its validity.

THE RATING PROCESS

The following steps are needed to classify a task within the set of factors established for either an individual or team task.

1. Identify the Analysts and Experts – First, a training analyst familiar with technical areas such as the concepts from Bloom's taxonomy, cognitive task analysis, or simulation fidelity is needed. The familiarity could have been gained through formal education or job experience. Second, a subject matter expert familiar with the tasks to be rated is required, such as an instructor, a training designer, an NCO with field experience, an officer (depending on the tasks), a field exercise observer/controller, or human systems integrator. The SME must be knowledgeable enough to judge whether a task has been performed successfully.

2. Information on Tasks – A written description of the task, which clearly details the performance steps, task conditions, and performance standards, must be available for all raters during the rating process. This assures a uniform understanding of the task.
3. Developing a Consensus – A rating team comprised of a training analyst and a subject matter expert (Step 1) review the task information and decide on a rating for each factor on each task. It is important to develop a consensus rating on each factor, and essential to do so on the Domain Factors. In the case of disagreement on the other factors with ordinal scales, it is acceptable to take an average if the proposed ratings are off by one scale unit. For example, in the Learning Complexity Factor, the training analyst may judge the task to be 'not complex at all' (rating of 5) while the subject matter expert may judge the task to be 'complex at times, but usually not complex' (rating of 4), so an overall rating of 4.5 can be given. If the proposed ratings are off by more than one scale unit, an agreement must be reached. Generally, the SME should be provided a slightly greater influence on the rating. *Note on Special Cases: There are special circumstances in which the Live or Virtual recommendation can be determined without rating all the factors for a particular task. These circumstances are specified in the rating sheets.*
4. Use of Rating Sheets – The task title, the consensus ratings, and other administrative information (e.g., career field the task is associated with, the Service-, or DoD-specific numerical task designation number) is entered on each sheet. The sheets are maintained for documentation purposes.
5. Plotting to a Radar Chart – Prior to plotting ratings on a radar chart, it must be determined a) which of four charts should be used for individual task classification, or b) for collective task ratings whether plotting is necessary at all by answering several questions. When plotting on a radar chart, for each task rated, the values of each factor are entered as a dot onto the axis on the plotting chart and the adjacent dots are connected with a straight edge. The charts are maintained for documentation purposes, and to assist in communicating rating decisions to stakeholders.
6. Interpretation of Chart – If the plotted figure falls entirely inside the L-V box, the task is a candidate for virtual training. If it falls outside the L-V box, it should be trained through live training methods. If it bisects the box, there is not a clear answer; blended learning could be a viable solution.
7. Documenting the Results – For each task, the combined rating sheets and plotted chart document the rating effort. The separate ratings of the analyst and SME can also be kept, along with any discussion notes, for later reference.

RATING INDIVIDUAL TASKS

A template is provided in the complete User's Guide, provided to the sponsor, for rating and documenting ratings for individual tasks. This template can be used by individual raters, as well as for recording consensus ratings agreed on by multiple raters. Once consensus ratings have been agreed upon, ratings can be mapped to specific rating charts to identify the live/virtual training recommendation. Depending on which of the four Domain Factors was selected for a specific task, the User's Guide provides different charts and guidelines to interpret the results.

RATING COLLECTIVE TASKS

The Guide includes a template for rating and documenting ratings for collective tasks. This template can be used by individual raters, as well as for recording consensus ratings agreed on by multiple raters.

The next step, once consensus ratings have been determined for the task, is that the rating team should answer a series of questions with respect to the ratings to the ratings. These questions will determine if 'special' cutoffs' apply (immediately determining whether the task should be trained in a live environment) or if the ratings should be mapped to a radar chart to the general rating thresholds (i.e., comparing to the L-V box). The recommendation is to train the task in a **live** environment, if any of the following are true:

- Is the Domain rating 'Production/Service' (3)? If so, the recommendation is to train the task in a **live** environment.
- Is the rating for Multi-motoric Activity 'frequent' (3)? If so, the recommendation is to train the task in a **live** environment.
- Is the rating for Non-verbal Cues 'frequent' (3)? If so, then the recommendation is to train the task in a **live** environment.
- Is the rating for Special Environment 'essential' (3)? If so, then the recommendation is to train the task in a **live** environment.
- Is the rating for Actual Equipment 'essential' (3)? If so, then the recommendation is to train the task in a **live** environment.
- Is the rating for Teamwork Training 'high' (3)? If so, then the recommendation is to train the task in a **live** environment.
- Is the Domain rating 'Project/Development' (1)? If so, the recommendation is that the task <u>can</u> be trained in a **virtual** environment, with the exception that recommendations from any of the preceding questions take precedence (e.g., If the rating for Domain is

'Project/Development' and the rating for Teamwork Training is 'high, ' then the recommendation is **live**).

If all answers to the questions above are 'no,' then the task ratings should be mapped to the general collective rating radar chart to determine the live/virtual training recommendation

THE E-REPORTING DECISION-AID TOOL

In addition to the decision aid materials already presented, an electronic version, referred to as the e-Reporting Tool, is available for release to DoD organizations by making a request to any of the contacts listed at the end of this guide. The e-Reporting Tool uses the same methodology as the manual method presented previously while automating several steps when rating tasks and determining the training recommendations (i.e., live or virtual). Use of the e-Reporting Tool should allow a degree of efficiency in applying the decision aid, particularly when using the method for assessing large numbers of tasks.

The e-Reporting Tool is actually a suite of Microsoft Office files. It incorporates Word documents (i.e., a version of this User's Guide), PowerPoint presentations (to provide instructions and details on use of the tool as well as key background information on the method), and an Excel-based tool (that incorporates a VBA-script macro), which automates task classification and report generation.

Detailed instructions describing the tool and its use are included in the e-Reporting Tool package, which includes a Programmer's Guide, part of the User's Guide provided in a separate document. This provides more detailed information on the programming structure of the Excel-based macro so that those with a degree of programming skill (particularly in VBA Script) can alter and modify the program if needed. The Programmer's Guide is presented in Appendix E.

Revising the Model and Potential Extensions

Initial responses to the model, by military users (during the feedback and validation phase), were positive on the value of the classification model as part of a front-end analysis. Researchers critiquing the model suggested additional factors for inclusion, or proposed fine-tunings to the definitions and methodology. Several specific additional factors, described previous (e.g., *Cost, Time, Safety*) were regularly noted. The research team suggests, rather than making changes to the model itself, that a strategy of incorporating the output of the model into the decision-making process is the best approach. The additional factors of interest mentioned, for example, are not characteristics of a task but rather budgetary and operational factors outside the realm of learning, or 'trainability.'

In the course of presenting the Decision Aid and an accompanying Users Guide to the military training community; analysts, instructors, and department heads also suggested several additional directions for extending the model to areas not originally within the scope of the project plan, or considered by the development team. Two of those suggestions are outlined here; each was delivered in separate cover to the sponsor.

EXTENSION 1: PART TASK TRAINING.

For the L-V Decision Aid, users expressed an interest in being able to model a task such that training is divided as virtual for certain components of the task and live for others. Part task training refers to training or practice on specific components of a task prior to training/practice on the whole task. It compares to whole task training where the complete task is presented for training/practice as a single unit.

Background. Part task training has a firm foundation in the research literature dating to the early 1960s, in particular with aviator training on simulators and the relative value of high-fidelity versus low-fidelity training devices. It is distinct from the concept of blended learning, which segments a program of instruction, or curriculum, into live and virtual delivery methods. For example, blended learning may suggest that tasks A and B be trained by live methods and tasks C and D be trained through virtual methods. In contrast to part task training, the question is whether it is best to train certain components of task A through live instruction and other components of task A through virtual methods. Currently, an assumption of the L-V Decision Aid is that the *whole task* is trained one way or the other to the point of being tested for task

proficiency. The research has demonstrated that part task training is generally more effective than whole task training, but there are conditions and circumstances in which the opposite is true. Specifying when part-task training is more effective is not always straightforward. The general guidance is that the difficulty and organization of a task determines the optimum training method.

Factors for Use. There were several impetuses for the part task training concept as it pertains to the modern uses of training technology. For one, safety factors were a key driver for identifying which task components should be trained virtually with, obviously, the most dangerous tasks trained through technology during initial training. Another factor was costs, with high-cost task components (e.g., requiring expensive equipment, fuel, or other contingencies), being the candidates for part-task training through virtual methods. Interestingly, feedback from user groups also pointed to the safety and cost factors as shortcomings of the L-V Decision Aid independent of the part versus whole task training issue.

Issues and Procedures. An important assumption is that task components can be identified, separated, and independently trained. Essentially, part task training entails splitting a task into sub-tasks, training each to a criterion performance level, and then re-integrating performance across sub-tasks at the time of whole-task execution. Researchers have proposed various approaches and procedures, and three methods have gained popularity. One of these is *segmentation* ─ the process of teaching a trainee the final actions necessary in a task, reinforcing them, and then working backwards (adding the part of the task that preceded the previous one until the entire task is learned). A second method is called *fractionation*, in which a task is divided into its sub-tasks that are normally performed all together, such as decomposing a golf swing into the address, backswing etc. Each sub-task is trained individually before being recombined into the actual task. The third method is called *simplification*, in which certain requirements of the task are removed to make the task simpler (e.g., reducing the number of dials that need to be monitored) to simplify the task and make it easier to learn. Once this task is learned, the removed components are added back in until the task is complete.

Adjustments to Model. To accommodate the part task training approach, the assumptions of the model would require adjustment. Furthermore, analysis of part task training methods would need to determine whether to orient a revised model around a single method, such as *fractionation*, or whether to accommodate multiple part task methods. It is possible that one or

more factor rating scales would need revision. The current factors for both individual and collective tasks may be sufficient, but these would also necessitate a more detailed analysis to determine whether another rating factor may be required.

EXTENSION 2: SUSTAINMENT TRAINING.

Several potential users have expressed an interest in adapting the decision aid to recommend which delivery method can be used for skill sustainment, independent of how the task was initially trained. Skill sustainment refers to the maintenance of task proficiency after a period of nonuse. It is also called refresher training and is closely related to the psychological concepts of skill retention and skill decay.

Background. Forgetting occurs over periods where knowledge is not applied or skills are not performed. Research on memory for knowledge and skills has a long history, with more than a century of formal, empirical research. One antidote to forgetting a skill is to maintain proficiency with periodic sustainment training. Sustainment training can differ from initial training in terms of length, depth, structure, and method of delivery. An issue of specific interest here is that different categories of tasks (the Domain factor in the decision aid) have different rates of decay. The decay of knowledge and skill levels for step-by-step procedural tasks, for example, is governed by the characteristics of the specific task (e.g., number of steps, internal cues). Furthermore, the variability in retention between tasks can be substantial. For instance, in field research with Soldiers who have been recalled to service after being away for more than a year, analysts report skill losses ranging between 27 percent and 83 percent for hands-on tasks, such as the combat lifesaver task Apply a Tourniquet. Knowledge retention curves may vary with the nature of the content learned; however, the general shape of the curve is that of a rapid deceleration shortly after a learning criterion has been reached, with slight deceleration following that. Research clearly indicates that most of the knowledge loss occurs within ten weeks of initial learning. On the other hand, psychomotor skills can be retained for prolonged periods without practice, such as riding a bicycle for the first time in years. Of note, many studies indicate that the single most important factor affecting retention is the degree of original learning. In particular, skills regularly used become ‘overlearned’ and resist decay, reducing the required frequency of sustainment training. In summary, there are numerous variables at play in determining a skill sustainment strategy.

Factors for Use. Sustainment training is a needed and planned activity in military training. Individuals, teams, and units must stay sharp, so drills and exercises are constant allowances for maintaining this aspect of readiness. Feedback from several users questioned whether the Decision Aid could assist in determining how to deliver sustainment training, through live or virtual means. The immediate answer is no, as the Decision Aid was not designed with this in mind. However, a safe assumption is that a task that was originally trained in a virtual manner can be sustained in a virtual manner. The principal question, then, is whether a task that was originally, and necessarily, trained through live methods could be later sustained through virtual methods.

Issues and Procedures: First, the large majority of work on skill sustainment relates to individual skills. Collective tasks have received relatively little attention in the research literature, in part due to the difficulties of conducting this type of field research. For instance, teams are re-composed over the course of time due to personnel turbulence in which members of a unit change. So, it is difficult to understand the retention of team performance when 'skill decay' may be due more to the effect of integrating new team members rather than the natural forgetting of intra-team skills over a period of nonuse. Of course, all is not lost after initial training. Research has shown that skills can be refreshed to an acceptable level of proficiency in about one-third of the time of initial training. Re-performing a task triggers internal cues and unique memories specific to the task, even after years of nonuse. Fortunately, a little training goes a long way. It is important to note that safety steps are often the first to be forgotten, so care needs to be taken to address these during sustainment training.

Adjustments to Decision Aid. To accommodate the sustainment question, the individual task decision aid would need to be re-examined for each domain (Factor 1) since skill/knowledge decay rates vary by each domain. In the case of an 'outside-the-box' rating (i.e., live methods are needed), the factors that caused such a rating in the current decision aid would need to be scrutinized to determine whether they still hold in a sustainment-training condition. Perhaps an additional category would need to be added to indicate 'sustainment or original' training. Additional research and discussions with experts in this field would be needed. For the collective task decision aid, the environmental factors would require close re-examination with the question of whether those sub-factors rated as essential become less essential once a task has been trained to a level of proficiency but not practiced over a period of time. The domain

factors would also need re-examination. An important assumption of the collective task decision aid for this extension is that all members of the trained team remain in place.

Guidelines on Expanded Use and Maintenance of the Decision Aid

The decision aid presented and materials developed to support it were developed as a public domain resource that can be used and modified as needed by the Services. From its conception and throughout development, the decision-making aid was intended to be a supplement to other processes and metrics used by the Services to tackle training media selection, specifically related to live and virtual training. As part of formative research conducted that was the foundation of this decision aid (as well as in feedback received during validation efforts with stakeholders) additional factors typically included in the decision-making process emerged. These include (but are not limited to) factors such as cost, occupational health and safety, and training technology already available for delivering instruction. These factors are external to a task, not a characteristic of a task.

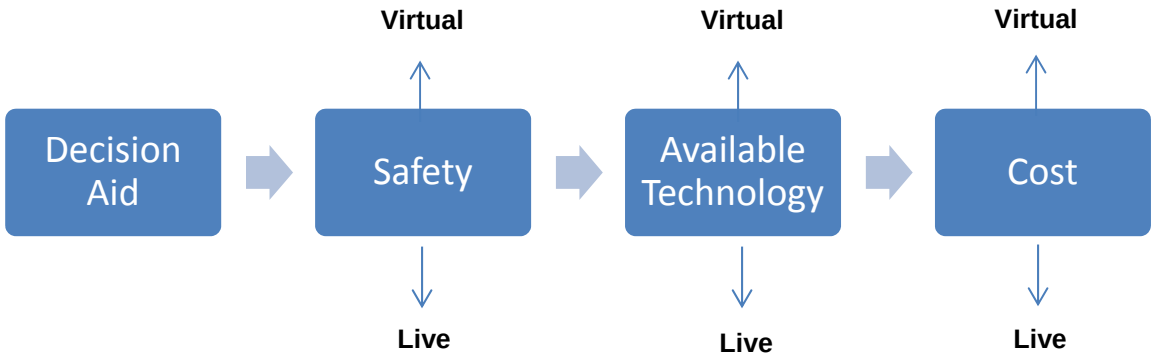
When planning to include output of the decision-making aid as part of a larger decision-making framework, there are several considerations that should be addressed. A key issue is which additional factors or metrics are to be included in the framework. Another key consideration is concerned with the process for incorporating additional metrics. It should be determined whether use of the aid's outputs is to be part of a sequential process, or considered concurrently with other factors/metrics.

It should be noted that, in general, considerable care should be taken when considering processes and people involved in the decision-making activities. It is also important to ensure that those providing judgments have reasonable knowledge of the tasks being considered or that they are provided detailed information and materials that sufficiently substitute for this direct experience. Along the same lines, the process in which decision-making is conducted should be well thought through. It should be relevant, efficient and systematic.

Incorporating Results into a Sequential Decision-Making Framework

In the case of a sequential decision-making framework, it is envisioned that based on outputs from each metric/factor, the 'live vs. virtual' decision would advance to be an 'input' into a larger decision-making context. A simplified notional diagram of this process is provided in Figure 3.

Figure 3. Notional Sequential Decision-Making Framework



From examining Figure 3, one can see that in this scenario, after a single criterion has been considered, a task can either be subject to consideration by additional factors/metrics (by proceedings further in the process), or can be 'fast-tracked' for an immediate decision at one point in the process. In this example, if a task was judged by the decision aid to be capable for virtual training, it was also determined that due to safety concerns in a live training environment a virtual solution would be needed, an immediate determination of 'live training' could be made.

Maintaining the Decision Aid

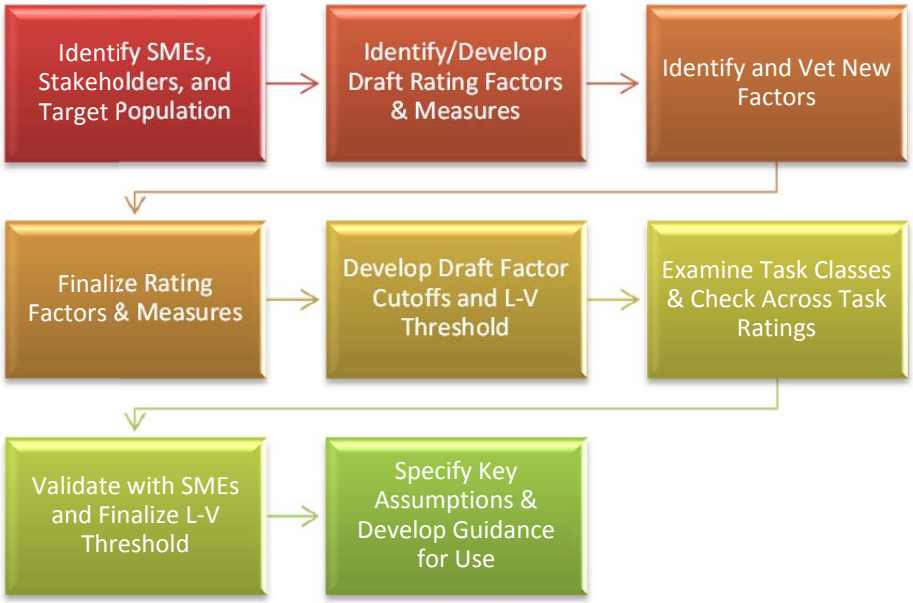
One characteristic of the decision aid is that the rating factor cutoffs (that discriminate between a prediction of 'live training' and 'virtual training') will likely need to be updated periodically to account for advances in the capabilities of training technologies. Any organization using this decision aid over an extended period should consider revisiting these cutoff scores at regular intervals. Based on our work, we recommend revisiting cutoff scores for the rating factors every 3 to 5 years. It is recommended that a group of training technology experts with knowledge of what is in use and commercially available be in charge of periodic adjustments to the thresholds or cutoff scores. In general, given that the maturation of training technology has consistently increased in the ability to effectively train in a virtual environment, it is most likely that factor cutoff values will increase, not decrease, over time.

MODIFYING THE DECISION AID FOR SPECIFIC ORGANIZATIONAL NEEDS

The Services have the option to modify the aid and/or its supporting materials (e.g., the e-Reporting Tool, this User's Guide) to meet the specific needs of a particular unit or organization. Nonetheless, it should be cautioned that, modifications to this tool without appropriate consideration (and related supporting activities) could result in the compromising of the aid's validity. The existing aid was developed and validated using a rigorous and systematic process, incorporating an evidence-based approach with foundations in psychology, education and training research, focusing on task characteristics and learning. Before changing the existing aid (i.e., modifying, adding, or deleting rating factors) we strongly recommend first considering whether incorporating the existing decision aid as part of a higher-order decision-making framework would be sufficient before making significant changes to the aid itself.

There are several issues to consider when deciding whether to make direct changes to the decision aid. Figure 4 shows a general process that can be used. First, the target population for the training must be determined as well as any considerations for specific skill levels or content areas. The existing aid was designed under the assumption that tasks analyzed are to be those specific to initial task training. If the organization wishes to apply the decision aid to some sub-set of the training population (or to be sensitive to varying levels of homogeneity of a target training population), focus on a particular skill acquisition level other than initial training (such as sustainment training) or a apply the decision aid only to a narrow content area, these will be new considerations as the existing decision aid was not originally designed to apply in these cases. In all of these cases, the decision aid may require "revalidation" to consider these parameters to result in valid decision outcomes.

Figure 4. Example Process for Decision Aid Modification.



The next step is to identify new rating factors (or modify or eliminate existing ones) that will modify the decision aid, as well as developing related measurement scales of the factors. If the unit or organization has already progressed thus far in revising the decision aid, it is likely that one or several additional factors have already been proposed. The rating factor should be at least implicitly related to the determination of the live/virtual training issue (i.e., *relevance*). Secondly, the factor, should contribute to, to at least some degree, the ability to discriminate when making the determination between the live/virtual training outcome. It would be ideal to conduct a literature review on the criteria considered to identify any research (particularly within the behavioral sciences, human factors, training, and education literature) that would support a link for the proposed factor to the live-virtual training issue.

Measures related to the factors in the decision aid (such as a rating scale or index) that quantify or characterize the existence or level of a factor will need to be developed. In addition to the basic requirement that the measure is logically related to the rating factor, it also should have the sensitivity to discriminate effectively to an adequate degree. In other words, the measure must support discrimination of the factor to the appropriate degree that would be required to make adequate judgments on the live/virtual determination. Another characteristic that is important to consider is reliability. Reliability, in the context of developing a measure or metric, is the characteristic of a measurement to be free from any unsystematic errors of measurement. In other words, it is the characteristic of a measure, when applied repeatedly to the same instance

of measurement, to show the same (or adequately similar) result. For any measurement, a reduction of reliability is directly linked to the ability to generalize the results. For example, if a measure shows low reliability, then any outcome from using this measure would be suspect.

Once an additional factor is identified and an adequate measure is developed, the decision aid should be validated by sampling a number of tasks (for the specific population, content area, level of training) and have several SMEs apply the ratings to the sample tasks. One effective strategy is to have a pair of raters, with expert knowledge of the tasks, rate each task individually, and then come together, discuss their ratings and develop consensus ratings. An important function of this activity is for the raters to discuss the rating factors and suggest modifications to the factor (e.g., definition) or the measures used (e.g., changing the rating scale). This process will refine the factor and the related measure to mature the revised decision aid (particularly the new factors). Since factors in the decision aid are implicitly related, this exercise may also have the added implication that other factors already included in the decision aid may need to be adjusted for the specific use of the revised decision aid. Therefore, review and discussion of the other existing factors should likely be performed in this context as well during this stage.

Once review and testing of the revised decision aid is complete, a new cutoff(s) should be determined for the new factor (or factors). In addition, cutoffs set for the existing factors should be considered (again, with respect to the targeted use of the revised decision aid). Several SMEs, particularly those with specific knowledge of training technology used by the organization (or planned for acquisition), should be identified for this activity. These individuals should examine each factor and determine the level of the factor that would be the boundary at which a higher-, or lower-level score on the factor would separate those training situations where a virtual training solution would be feasible, and the level of the factor that would imply a live training solution would be necessary. These could be considered ‘standard cutoffs’ and would be recorded for the group of factors. Once all the factors have been considered in this fashion, various combinations of factors should be considered together where a factor (or group of factors) would compensate to alter the outcome. These could be considered ‘special cutoffs,’ where the live/virtual training determination is contingent on a compensatory effect of the various factors. In other words, scenarios where various combinations of factor ratings should be considered together and any special situations where these rating combinations would strongly influence the live/virtual training recommendation should be codified into a ‘special

cutoff.' It could also be the case that a single factor score would so strongly influence the outcome, that a particular score on that factor would 'override' several or all other factor ratings.

Once cutoffs are developed, a general live/virtual decision threshold (L-V Box) for the decision aid can be created. In general (not considering 'special cutoffs'), when task ratings using the revised decision aid all fall below the factor cutoffs, the determination by the aid can be considered adequate for virtual training, and tasks where task ratings all fall outside of the L-V Box would be identified as requiring a live training strategy. Of course, special cutoffs would need to be considered first before applying the general cutoffs.

As a final check, once various cutoff rules have been developed, a list of all possible *task classes* should be generated, with the corresponding live/virtual determination. In other words, a table of all possible rating permutations should be developed alongside the live/virtual training recommendation that is recommended based on the existing cutoffs. Groups of tasks from the initial sample used to develop the new and revised factors can be compared with others in the same group with the same rating. It is also useful to compare rated tasks across groups (to determine if tasks are significantly different in their characteristics to warrant a different outcome recommendation). This can be useful to compare various outcomes that are recommended and confirm that the tasks with similar ratings have consistently similar characteristics that would reasonably infer a similar training recommendation outcome or live or virtual. Once the cutoffs have been finalized, a radar chart (or charts) can be developed for use with general cutoffs. Of course, special cutoffs will need to be considered first, in most cases, before applying the general cutoffs.

Once the decision aid has been finalized, guidance (such as a revised User's Guide) should be developed for those utilizing the decision aid. Any changes to references to the target population, content and learning/skill level targeted will need to be addressed. Also, it is very important to review and revise the assumptions specific to the modified aid. Note that it is also a good idea to document all activities through the process of modifying the decision aid, so that there is a record of the key activities and decisions involved in the modification of the aid. This will be important when communicating the decision aid to potential users and explaining and justifying use of the decision aid to higher-level decision makers.

Final Comments

The Live-Virtual Decision Aid has been completed and is ready for use by the military Services. It is available through the sponsor. This final report summarizes the contents of earlier reports, which concerned the development of the underlying model and a parallel decision algorithm, and details the activities conducted in Task 4: validating the usability with the Services, publishing a report on the underlying model and decision algorithm, presenting the work at a national conference, publishing an article on its availability in a targeted trade journal, developing a User's Guide and an accompanying e-Tool to assist in the rating process, considerations for extending the underlying model to accommodate part-task training and sustainment training issues, recommending a timetable for adjusting the cut-off scores to account for advances in training technology, the inclusion of external factors in the decision-making process, and offering insights into adding new factors to the original model. In summary, this work represents the completion of an extensible model and methodology to recommend whether to consider virtual training as a viable option for a training program.

Appendix A

Final Individual Task Categorizations

Final Individual Task Categorizations								
Task ID	**Service**	**Rank**	**MOC**	**MOC Title**	**Task Number**	**Task Description**	**Rating Category**	**LIve/GreyArea/ Virtual**
1	Army	Enlisted	11B	Infantry	071-600-0001	Destroy Supplies and Equipment	2.1.2.1	Virtual
2	Army	Enlisted	11B	Infantry	113-609-2053	Operate Automated Net Control Device (ANCD) AN/CYZ-10	2.2.2.1	Virtual
3	Army	Enlisted	11B	Infantry	071-008-0001	Mount a Night Vision Sight, AN/PVS-4, on an M16-Series Rifle	2.3.1.1	Virtual
4	Army	Enlisted	11C	Indirect Fire Infantryman	071-076-0010	Compute Angle T	2.1.2.2	Virtual
5	Army	Enlisted	11C	Indirect Fire Infantryman	071-082-0024	Compute Data for an Immediate-Suppression or Smoke Mission Using a Mortar Ballistic Computer	2.1.1.3	Virtual
6	Army	Enlisted	11C	Indirect Fire Infantryman	071-820-0003	Install Communication Wire Lines	3.2.3.2	Live
7	Army	Enlisted	11B	Infantry	113-587-2059	Operate Radio Set AN/PRC-77 With an TSEC/KY-57	1.2.1.1	Virtual
8	Army	Enlisted	11B	Infantry	052-191-1501	Perform Individual Camouflage	3.2.2.2	Live
9	Army	Enlisted	11B	Infantry	071-705-0004	Boresight an M68 Sight	3.2.2.1	Live
10	Army	Enlisted	11B	Infantry	071-008-0006	Zero an AN/PAS-13 Thermal Weapon Sight to an M16-Series Rifle	3.4.3.1	Live
11	Army	Enlisted	11B	Infantry	071-034-0002	Unload an M243 or M259 Smoke Grenade Launcher	1.1.1.1	Virtual
12	Army	Enlisted	11C	Indirect Fire Infantryman	031-503-1031	Use the Chemical Agent Monitor	2.2.5.2	Gray Area
13	Army	Enlisted	11C	Indirect Fire Infantryman	071-323-4102	Lay a 60-mm Mortar for Deflection and Elevation	3.2.4.1	Live
14	Army	Enlisted	11C	Indirect Fire Infantryman	071-074-0004	Engage Targets with a 60-mm, 81-mm, or 120-mm Mortar Using Direct Lay'	3.2.3.2	Live
15	Army	Enlisted	11C	Indirect Fire Infantryman	071-082-0015	Compute Data for a Traversing Mission Using a Mortar Ballistic Computer	2.2.2.2	Virtual
16	Army	Enlisted	11C	Indirect Fire Infantryman	071-074-0012	Conduct Occupation of a Mortar Firing Position by a Squad	2.3.2.1	Virtual

Final Individual Task Categorizations								
Task ID	**Service**	**Rank**	**MOC**	**MOC Title**	**Task Number**	**Task Description**	**Rating Category**	**LIve/GreyArea/ Virtual**
17	Army	Enlisted	11B	Infantry	113-594-2014	Operate Switchboard, Telephone, Manual SB-22/PT	1.2.2.1	Virtual
18	Army	Enlisted	11B	Infantry	113-573-4003	Encode and Decode Messages Using KTC 600(*) Tactical Operations Code	2.2.3.3	Virtual
19	Army	Enlisted	11B	Infantry	113-573-4006	Use the KTC 1400(*) Numerical Cipher/Authentication System	1.2.3.2	Virtual
20	Army	Enlisted	11B	Infantry	071-331-0001	Perform as a Member of a Patrol	2.4.2.2	Gray Area
21	Army	Enlisted	11B	Infantry	071-706-0001	Operate Night Vision Device, AN/PVS-14	3.4.4.1	Live
22	Army	Enlisted	11B	Infantry	071-317-0000	Prepare an Antiarmor Range Card	2.4.3.2	Gray Area
23	Army	Enlisted	11B	Infantry	052-192-1021	Locate Mines by Visual Means	2.2.2.3	Virtual
24	Army	Enlisted	11B	Infantry	071-056-0061	Stow M220 Encased Missiles in a Missile Storage Rack	3.2.1.1	Live
25	Army	Enlisted	11C	Indirect Fire Infantryman	071-074-0002	Determine a Grid Azimuth Using an M2 Compass	3.4.4.3	Live
26	Army	Enlisted	11C	Indirect Fire Infantryman	031-506-1052	Protect Yourself and Others From Chemical and BiologicalInjury/Contamination by Using a Collective Protection Shelter	3.4.3.2	Live
27	Army	Enlisted	11C	Indirect Fire Infantryman	071-084-0004	Engage Targets with a 60-mm Mortar While Firing in the Handheld Mode	1.2.2.1	Virtual
28	Army	Enlisted	11C	Indirect Fire Infantryman	061-283-1003	Locate a Target by Polar Plot	2.2.2.2	Virtual
29	Army	Enlisted	11C	Indirect Fire Infantryman	071-326-5605	Control Movement of a Fire Team	2.4.3.1	Gray Area
30	Army	Enlisted	11C	Indirect Fire Infantryman	071-076-0004	Compute Meterological Firing Corrections	2.1.4.3	Virtual
31	Army	Enlisted	11C	Indirect Fire Infantryman	071-078-0012	Compute Data for a Grid Mission Using a Plotting	2.1.2.3	Virtual

Final Individual Task Categorizations								
Task ID	Service	Rank	MOC	MOC Title	Task Number	Task Description	Rating Category	LIve/GreyArea/ Virtual
						Board		
32	Army	Enlisted	11C	Indirect Fire Infantryman	071-321-4000	Declinate an M2 Aiming Circle	3.2.2.2	Live
33	Army	Enlisted	13B	Cannon Crewmember	071-030-0004	Engage Targets with an MK19 Machine Gun	3.2.2.1	Live
34	Army	Enlisted	13B	Cannon Crewmember	061-357-1019	Perform Ammunition Transfer Operations by Using the M992 Carrier Ammunition Tracked	3.2.1.1	Live
35	Army	Enlisted	13B	Cannon Crewmember	061-271-1410	Disassemble and Assemble Breechblock and Firing Mechanism (M198)	3.3.4.2	Live
36	Army	Enlisted	13B	Cannon Crewmember	061-266-0001	Ground Guide a Wheeled or Tracked Vehicle	1.3.1.1	Potentially Virtual
37	Army	Enlisted	13B	Cannon Crewmember	061-271-1456	Maintain the Recoil Mechanism (M198) (U6)	1.2.4.2	Virtual
38	Army	Enlisted	13B	Cannon Crewmember	061-266-2002	Lay a Howitzer for Initial Direction of Fire by Reciprocal Lay by Using the Panoramic Telescope	1.3.2.3	Potentially Virtual
39	Army	Enlisted	13B	Cannon Crewmember	061-266-2238	Establish a Distant Aiming Point (DAP)	1.2.1.2	Virtual
40	Army	Enlisted	13B	Cannon Crewmember	061-270-3430	Perform Prefire Checks (M109A2-A5)	3.2.3.1	Live
41	Army	Enlisted	13B	Cannon Crewmember	061-266-3311	Perform Gunner's Quadrant End-for-End Test	3.4.3.1	Live
42	Army	Enlisted	13B	Cannon Crewmember	061-266-3318	Lay for Quadrant with the Gunner's Quadrant	3.1.1.1	Potentially Virtual
43	Army	Enlisted	13B	Cannon Crewmember	061-266-3323	Maintain DA Form 2408-4 (Weapon Record Data Card)	2.1.3.2	Virtual
44	Army	Enlisted	13B	Cannon Crewmember	061-266-3705	Process a Fire Mission on the Gun Display (GDU)	1.3.4.2	Potentially Virtual
45	Army	Enlisted	13B	Cannon Crewmember	061-266-4004	Determine Location by Graphic Resection by Using an M2 or M2A2 Aiming Circle	2.3.3.2	Virtual
46	Army	Enlisted	13B	Cannon Crewmember	061-266-4010	Transfer the Orienting Station (ORSTA) and the End of the Orienting Line	1.2.3.2	Virtual

Final Individual Task Categorizations								
Task ID	Service	Rank	MOC	MOC Title	Task Number	Task Description	Rating Category	LIve/GreyArea/ Virtual
						(EOL) by Using Graphic Traverse		
47	Army	Enlisted	13B	Cannon Crewmember	061-320-5305	Orient the GLPS for Direction Using Back Polar Plot Method	1.2.3.2	Virtual
48	Army	Enlisted	13F	Fire Support Specialist	091-109-7000	Operate a Power Generator Set	3.3.1.1	Live
49	Army	Enlisted	13F	Fire Support Specialist	061-276-1012	Install Antenna Group OE-254/GRC	3.3.1.1	Live
50	Army	Enlisted	13F	Fire Support Specialist	061-299-5304	Build a Fire Plan	2.2.5.3	Gray Area
51	Army	Enlisted	13F	Fire Support Specialist	061-283-1011	Request and Adjust Area Fire	2.3.4.2	Gray Area
52	Army	Enlisted	13F	Fire Support Specialist	061-274-2000	Conduct Fire for Effect Mission with the AN/TVQ-2 Ground/Vehicular Laser Locator Designatorl (G/VLLD) (Dismounted Mode Only)	3.2.2.2	Live
53	Army	Enlisted	44C	Financial Management Technician	805A-44C-1010	Maintain a Bills Register Card	1.1.2.2	Virtual
54	Army	Enlisted	44C	Financial Management Technician	805A-44C-1484	Process Treasury Checks	1.1.1.1	Virtual
55	Army	Enlisted	44C	Financial Management Technician	805A-44C-3012	Prepare an Activity Budget	2.2.4.2	Virtual
56	Army	Enlisted	44C	Financial Management Technician	805A-44C-3405	Verify Military Pay Input	1.1.2.2	Virtual
57	Army	Enlisted	44C	Financial Management Technician	805A-44C-3455	Finalize Check Write Transactions	1.2.2.2	Virtual
58	Army	Enlisted	44C	Financial Management Technician	805A-44C-3477	Prepare Transition Payments	1.2.3.2	Virtual
59	Army	Enlisted	44C	Financial Management Technician	805A-44C-4452	Review the Accelerated Reporting of Receipt and Outlay Data (CSCFA-302) Report	1.1.3.2	Virtual
60	Army	Enlisted	44C	Financial Management Technician	805A-44C-4457	Enter Vault Transactions	1.1.3.2	Virtual
61	Army	Enlisted	44C	Financial Management Technician	805A-APA-8206	Prepare Miscellaneous Vouchers for Payment	1.1.2.2	Virtual

Final Individual Task Categorizations								
Task ID	**Service**	**Rank**	**MOC**	**MOC Title**	**Task Number**	**Task Description**	**Rating Category**	**LIve/GreyArea/ Virtual**
62	Army	Enlisted	44C	Financial Management Technician	805A-FSC-8107	Maintain Commitment and Obligation Records	1.1.2.2	Virtual
63	Army	Enlisted	68W	Health Care Specialist	081-833-0159	TREAT A CARDIAC EMERGENCY	2.4.3.1	Gray Area
64	Army	Enlisted	68W	Health Care Specialist	081-833-0194	PREPARE AN AID BAG	1.2.1.1	Virtual
65	Army	Enlisted	68W	Health Care Specialist	081-833-0209	TREAT A CASUALTY FOR CONTUSIONS OR ABRASIONS	3.4.3.1	Live
66	Army	Enlisted	68W	Health Care Specialist	081-833-0212	APPLY A PRESSURE DRESSING TO AN OPEN WOUND	3.3.2.1	Live
67	Army	Enlisted	68W	Health Care Specialist	081-833-0170	PERFORM ENDOTRACHEAL SUCTIONING OF A PATIENT	3.4.4.1	Live
68	Army	Enlisted	68W	Health Care Specialist	081-833-0185	INITIATE A FAST 1	3.4.3.1	Live
69	Army	Enlisted	68W	Health Care Specialist	081-833-0195	REMOVE A PATIENT'S RING	1.3.2.1	Potentially Virtual
70	Army	Enlisted	68W	Health Care Specialist	081-833-0181	APPLY A LONG SPINE BOARD	3.4.3.1	Live
71	Army	Enlisted	68W	Health Care Specialist	081-831-0038	TREAT A CASUALTY FOR A HEAT INJURY	1.4.4.2	Potentially Virtual
72	Army	Enlisted	68W	Health Care Specialist	081-835-3054	ADMINISTER BLOOD PRODUCTS	3.3.2.1	Live
73	Army	Enlisted	88M	Motor Transport Operator	551-88M-1364	Operate Vehicle With Standard or Automatic/Semiautomatic Transmission	3.2.3.1	Live
74	Army	Enlisted	88M	Motor Transport Operator	551-88M-1384	Perform as Wheeled Vehicle Ground Guide Day or Night	1.3.2.1	Potentially Virtual
75	Army	Enlisted	88M	Motor Transport Operator	551-88M-1600	Operate the Movement Tracking System	2.2.3.2	Virtual
76	Army	Enlisted	88M	Motor Transport Operator	551-88M-1663	Operate Vehicle-Mounted Crane	3.3.2.1	Live
77	Army	Enlisted	88M	Motor Transport Operator	551-88M-1380	Transport General Cargo in Trailer/Semitrailer	3.2.2.1	Live

Final Individual Task Categorizations								
Task ID	**Service**	**Rank**	**MOC**	**MOC Title**	**Task Number**	**Task Description**	**Rating Category**	**LIve/GreyArea/ Virtual**
78	Army	Enlisted	88M	Motor Transport Operator	551-88M-1382	Perform Payload Vehicle Loading/Unloading Operations With a Semitrailer	1.2.2.1	Virtual
79	Army	Enlisted	88M	Motor Transport Operator	551-88M-1363	Operate Vehicle With or Without Trailer/Semitrailer Under Blackout Conditions	1.2.1.1	Virtual
80	Army	Enlisted	88M	Motor Transport Operator	551-88M-1410	Read Strip Maps	1.2.2.2	Virtual
81	Army	Enlisted	88M	Motor Transport Operator	551-88M-1659	Transport Hazardous/Sensitive Cargo	1.3.3.2	Potentially Virtual
82	Army	Enlisted	88M	Motor Transport Operator	551-88M-2374	Supervise Loading/Unloading a Tracked/Wheeled Vehicle Onto/From Semitrailer	2.3.2.2	Virtual
83	Army	Enlisted	91A	Abrams Tank System Maintainer	091-109-0003	Maintain Assigned Tool Kits	1.2.1.2	Virtual
84	Army	Enlisted	91A	Abrams Tank System Maintainer	091-91A-0015	Correct Malfunction on the Exterior Light System of the M1 Series Track Vehicle	1.4.3.1	Potentially Virtual
85	Army	Enlisted	91A	Abrams Tank System Maintainer	091-91A-0039	Correct Malfunction on the Turret Electrical Systems of the M1 Series Track Vehicle	1.3.3.1	Potentially Virtual
86	Army	Enlisted	91A	Abrams Tank System Maintainer	091-ABV-1011	Maintain ABV Turret Electrical System	1.2.2.1	Virtual
87	Army	Enlisted	91A	Abrams Tank System Maintainer	091-H8T-2009	Recover a Mired Tracked Vehicle	3.3.2.1	Live
88	Army	Enlisted	91A	Abrams Tank System Maintainer	091-AK4-0105	Maintain Hull Mission Processor Unit (HMPU)	1.2.2.1	Virtual
89	Army	Enlisted	91A	Abrams Tank System Maintainer	091-AK4-0134	Maintain Fire Control Electronics Unit (FCEU)	1.2.3.1	Virtual
90	Army	Enlisted	91A	Abrams Tank System Maintainer	091-CLT-3009	Supervise Maintenance Operations	2.3.4.2	Gray Area
91	Army	Enlisted	91A	Abrams Tank System Maintainer	091-91A-3073	Repair the Turret Race Ring Assembly on the M1 Series Track Vehicle	3.3.2.1	Live
92	Army	Enlisted	91A	Abrams Tank System Maintainer	091-91A-3094	Replace the Main Gun Tube on the M1 Series Track Vehicle	3.4.2.1	Live

Final Individual Task Categorizations								
Task ID	Service	Rank	MOC	MOC Title	Task Number	Task Description	Rating Category	LIve/GreyArea/ Virtual
93	Army	Enlisted	94M	Radar Repairer	093-94M-1101	Repair the System Power Function of the AN/TPQ-36 Radar Set	1.3.2.1	Potentially Virtual
94	Army	Enlisted	94M	Radar Repairer	093-94M-1113	Repair the Receiver Function of the AN/TPQ-36 Radar Set	1.3.2.1	Potentially Virtual
95	Army	Enlisted	94M	Radar Repairer	093-94M-1205	Repair the Exciter/Clock Function of the AN/TPQ-37 Radar Set	1.3.2.1	Potentially Virtual
96	Army	Enlisted	94M	Radar Repairer	093-94M-1213	Repair the Receiver Function of the AN/TPQ-37 Radar Set	1.3.2.1	Potentially Virtual
97	Army	Enlisted	94M	Radar Repairer	093-94M-1314	Perform Preventive Maintenance Checks and Services (PMCS) on the AN/TPQ-36(V)8 Shelter	1.3.2.2	Potentially Virtual
98	Army	Enlisted	94M	Radar Repairer	093-94M-1401	Repair the Radar Control Terminal (RCT)/Mass Storage Device Function of the AN/MPQ-64 Sentinel	1.3.2.1	Potentially Virtual
99	Army	Enlisted	94M	Radar Repairer	093-94M-1707	Repair the CPDU Assembly of Muzzle Velocity Radar Sets M-93 and M-94	1.2.3.1	Virtual
100	Army	Enlisted	94M	Radar Repairer	093-SSG-3005	Submit Equipment Improvement Recommendation (EIR)	2.3.2.2	Virtual
101	Army	Enlisted	94M	Radar Repairer	093-SSG-3009	Perform Initial Inspections	1.4.2.2	Potentially Virtual
102	Army	Enlisted	94M	Radar Repairer	093-SSG-3016	Monitor Bench Stock Operations	1.1.1.1	Virtual
103	Army	Enlisted	21B (12B)	Combat Engineer	052-192-3166	Supervise Installation of a Modular-Pack Mine System (MOPMS) Minefield	1.3.2.1	Potentially Virtual
104	Army	Enlisted	21B (12B)	Combat Engineer	052-193-2014	Determine the Safe Distance When Firing Explosives	1.1.1.2	Virtual
105	Army	Enlisted	21B (12B)	Combat Engineer	052-194-3500	Conduct a Patrol	2.3.4.2	Gray Area
106	Army	Enlisted	21B (12B)	Combat Engineer	052-194-4007	Execute a Complex Obstacle Breach	2.3.3.1	Virtual
107	Army	Enlisted	21B (12B)	Combat Engineer	052-194-4010	Supervise Engineer	1.3.3.2	Potentially Virtual

Final Individual Task Categorizations								
Task ID	Service	Rank	MOC	MOC Title	Task Number	Task Description	Rating Category	LIve/GreyArea/ Virtual
						Support to Engagement Area Development		
108	Army	Enlisted	21B (12B)	Combat Engineer	052-195-4060	Supervise the Construction of a Defensive Perimeter	2.3.2.1	Virtual
109	Army	Enlisted	21B (12B)	Combat Engineer	052-196-2101	Determine the Percent of Slope	1.2.2.2	Virtual
110	Army	Enlisted	21B (12B)	Combat Engineer	052-196-4012	Conduct Platoon Reconnaissance Missions	1.3.2.1	Potentially Virtual
111	Army	Enlisted	21B (12B)	Combat Engineer	052-198-2007	Classify Vehicles Using Expedient Methods	1.2.2.3	Virtual
112	Army	Enlisted	21B (12B)	Combat Engineer	052-200-1075	Tie Knots	3.2.2.2	Live
113	Army	Enlisted	21B (12B)	Combat Engineer	052-225-4125	Advise the Supported Commander of Engineer Combat Vehicle Capabilities	2.3.2.1	Virtual
114	Army	Enlisted	21B (12B)	Combat Engineer	052-226-3100	Select a Route to Accommodate an Armored Vehicle-Launched Bridge (AVLB)	2.3.2.2	Virtual
115	Army	Enlisted	21B (12B)	Combat Engineer	052-227-1110	Unfold the Blade of an Armored Combat Earthmover (ACE), M9	3.3.3.1	Live
116	Army	Enlisted	21B (12B)	Combat Engineer	052-227-3101	Direct Recovery Operations on an M9 Armored Combat Earthmover (ACE)	3.3.3.1	Live
117	Army	Enlisted	21B (12B)	Combat Engineer	052-227-3301	Estimate Tank Ditch Production Requirements	2.2.2.2	Virtual
401	Marine Corps	Enlisted	351	Infantry	0351-DEMO-1207	Detonate a grapeshot charge (D)	3.2.1.2	Live
402	Marine Corps	Enlisted	351	Infantry	0351-DEMO-1212	Employ mechanical breaching techniques (B)	3.2.3.1	Live
403	Marine Corps	Enlisted	351	Infantry	0351-DEMO-1216	Create an entry using a detonation cord oval charge (D)	3.2.1.2	Live
404	Marine Corps	Enlisted	351	Infantry	0351-DEMO-1217	Construct a detonation cord linear charge (D)	3.2.1.1	Live
405	Marine Corps	Enlisted	351	Infantry	0351-SMAW-1001	Perform operator maintenance for a MK153 SMAW (D)	3.2.2.1	Live

Final Individual Task Categorizations								
Task ID	Service	Rank	MOC	MOC Title	Task Number	Task Description	Rating Category	LIve/GreyArea/ Virtual
409	Marine Corps	Enlisted	351	Infantry	0351-APOB-2107	Breach an anti-personnel mine with the APOBS using the non-electrical command mode initiation(D)	3.2.3.1	Live
410	Marine Corps	Enlisted	351	Infantry	0351-APOB-2111	Perform misfire procedures for an Anti-personnel obstacle breaching system (APOBS) in command modewith good continuity (D)	1.1.1.1	Virtual
411	Marine Corps	Enlisted	351	Infantry	0351-DEMO-2212	Employ breaching charges (B)	2.2.3.2	Virtual
412	Marine Corps	Enlisted	351	Infantry	0351-SMAW-2101	Inspect an SL-3 complete MK153 SMAW (D)	1.2.1.2	Virtual
413	Marine Corps	Enlisted	143	Career Retention Specialist	0143-COMM-1031	Apply coaching your commander skills	4.4.4.2	Live
414	Marine Corps	Enlisted	143	Career Retention Specialist	0143-COMM-1032	Apply interpersonal management skills (IMS)	4.4.3.2	Live
415	Marine Corps	Enlisted	143	Career Retention Specialist	0143-INTV-1053	Conduct an Initial Interview	1.3.2.1	Potentially Virtual
416	Marine Corps	Enlisted	143	Career Retention Specialist	0143-INTV-1064	Explain special duty assignments	2.3.3.1	Virtual
417	Marine Corps	Enlisted	143	Career Retention Specialist	0143-INTV-1065	Explain the contact to contract process	2.4.2.1	Gray Area
418	Marine Corps	Enlisted	143	Career Retention Specialist	0143-ADMN-2507	Create reports in Operational Data StoreEnterprise (ODSE)	1.2.3.1	Virtual
419	Marine Corps	Enlisted	143	Career Retention Specialist	CRSM-ADMN-2901	Authorize a telephonic extension	1.3.2.1	Potentially Virtual
420	Marine Corps	Enlisted	143	Career Retention Specialist	CRSM-ADMN-2912	Process a reenlistment extension lateral move request (RELM)	2.2.2.1	Virtual
421	Marine Corps	Enlisted	317	Scout Sniper	0317-MARK-1001	Prepare a sniper range card (B)	3.4.3.2	Live
422	Marine Corps	Enlisted	317	Scout Sniper	0317-SURV-1002	Collect/report Information (D)	2.4.2.1	Gray Area
423	Marine Corps	Enlisted	317	Scout Sniper	0317-TACT-1004	Establish a Final Firing Position (FFP) (B)	3.4.3.2	Live
424	Marine Corps	Enlisted	317	Scout Sniper	0317-WPNS-1001	Perform operator maintenance for optics (D)	1.2.2.1	Virtual

Final Individual Task Categorizations								
Task ID	Service	Rank	MOC	MOC Title	Task Number	Task Description	Rating Category	LIve/GreyArea/ Virtual
425	Marine Corps	Enlisted	317	Scout Sniper	0317-M40-2004	Engage targets with an M40 series sniper rifle at unknown distances using various shooting positions(B)	3.4.2.1	Live
426	Marine Corps	Enlisted	317	Scout Sniper	0317-MARK-2004	Operate a firing solution device (B)	3.3.3.2	Live
427	Marine Corps	Enlisted	317	Scout Sniper	0317-OPS-2101	Operate a sniper control center (SCC) (B)	2.3.3.1	Virtual
428	Marine Corps	Enlisted	317	Scout Sniper	0317-TACT-2001	Lead a link-up (B)	1.3.2.1	Potentially Virtual
429	Marine Corps	Enlisted	481	Landing Support Specialist	0481-ADMN-1001	Utilize automated information systems (AIS) insupport of throughput operations	1.2.3.2	Virtual
430	Marine Corps	Enlisted	481	Landing Support Specialist	0481-ADMN-1002	Perform In-Transit Visibility (ITV) Asset Tracking Functions	1.2.3.2	Virtual
431	Marine Corps	Enlisted	481	Landing Support Specialist	0481-LOAD-1401	Execute helicopter support team (HST) operations	3.4.3.1	Live
432	Marine Corps	Enlisted	481	Landing Support Specialist	0481-OPS-1701	Execute amphibious landing support operations	1.3.3.1	Potentially Virtual
433	Marine Corps	Enlisted	481	Landing Support Specialist	0481-OPS-1704	Prepare supplies and equipment for throughput operations	1.3.3.1	Potentially Virtual
434	Marine Corps	Enlisted	481	Landing Support Specialist	0481-LOAD-2401	Prepare a load plan report using the approved airload plan automated information system	1.2.2.2	Virtual
435	Marine Corps	Enlisted	481	Landing Support Specialist	0481-OPS-2701	Direct landing zone support operations	2.3.2.2	Virtual
436	Marine Corps	Enlisted	481	Landing Support Specialist	0481-OPS-2702	Direct sea-port operations	2.3.3.2	Virtual
437	Marine Corps	Enlisted	5812	Working Dog Handler	5812-MWD-1001	Perform feeding/watering of a MWD	1.2.2.1	Virtual
438	Marine Corps	Enlisted	5812	Working Dog Handler	5812-MWD-1004	Perform procedures to ship a MWD on military airtransportation	1.2.2.1	Virtual
439	Marine Corps	Enlisted	5812	Working Dog Handler	5812-MWD-1005	Perform crowd control techniques accompanied by	3.4.3.1	Live

Final Individual Task Categorizations								
Task ID	**Service**	**Rank**	**MOC**	**MOC Title**	**Task Number**	**Task Description**	**Rating Category**	**LIve/GreyArea/ Virtual**
						a MWD		
440	Marine Corps	Enlisted	5812	Working Dog Handler	5812-MWD-1025	Conduct obedience training with a MWD	3.4.2.1	Live
441	Marine Corps	Enlisted	5812	Working Dog Handler	5812-CTD-2015	Conduct a track having a right angle turn with a CTD	1.3.2.1	Potentially Virtual
442	Marine Corps	Enlisted	5812	Working Dog Handler	5812-MWD-2033	Move by helicopter accompanied by a MWD	1.4.2.1	Potentially Virtual
443	Marine Corps	Enlisted	5812	Working Dog Handler	5812-MWD-2034	Manage an explosive qualification/certification program	2.3.3.1	Virtual
444	Marine Corps	Enlisted	5812	Working Dog Handler	5812-WDFA-2063	Provide first aid to a MWD for eye irritation/trauma	1.3.2.1	Potentially Virtual
445	Marine Corps	Enlisted	5832	Correctional Counselor	5832-PROG-2001	Review an inmate personal history questionnaire	2.4.3.2	Gray Area
446	Marine Corps	Enlisted	5832	Correctional Counselor	5832-PROG-2004	Employ stress management techniques on an inmate	4.3.4.1	Live
447	Marine Corps	Enlisted	5832	Correctional Counselor	5832-PROG-2006	Conduct a Classification and Assignment (C&A) board	1.3.2.1	Potentially Virtual
448	Marine Corps	Enlisted	5832	Correctional Counselor	5832-PROG-2008	Conduct an inmate “Life Skills” program	2.4.3.1	Gray Area
449	Marine Corps	Enlisted	5832	Correctional Counselor	5832-PROG-2010	Conduct an inmate group counseling session	4.4.3.1	Live
450	Marine Corps	Enlisted	5832	Correctional Counselor	5832-PROG-2014	Conduct a restoration program	2.3.3.1	Virtual
451	Marine Corps	Enlisted	5832	Correctional Counselor	5832-PROG-2018	Conduct an inmate pre-release interview	1.3.2.1	Potentially Virtual
452	Marine Corps	Enlisted	5832	Correctional Counselor	5832-PROG-2019	Conduct corrections counselor training	2.4.4.2	Gray Area
453	Marine Corps	Enlisted	5822	Forensic Psycho-physiologist (Polygraph Examiner)	5822-INV-1010	Conduct a counter-intelligence scope phase (CSP)	1.3.3.1	Potentially Virtual
454	Marine Corps	Enlisted	5822	Forensic Psycho-physiologist (Polygraph Examiner)	5822-INV-1011	Analyze collected polygraph charts utilizing currentfederal polygraph guidelines	2.3.3.2	Virtual
456	Marine Corps	Enlisted	5822	Forensic Psycho-physiologist (Polygraph Examiner)	5822-INV-1013	Report results of a polygraph examination	2.2.3.1	Virtual

Final Individual Task Categorizations								
Task ID	Service	Rank	MOC	MOC Title	Task Number	Task Description	Rating Category	LIve/GreyArea/ Virtual
457	Marine Corps	Enlisted	5822	Forensic Psycho-physiologist (Polygraph Examiner)	5822-INV-2001	Identify the use of suspected polygraph counter-measures	2.4.3.2	Gray Area
201	Navy	Enlisted	1589	Aviation Support Equipment Technician	NA	Inspect aircraft crash and salvage equipment systems	2.2.4.1	Virtual
202	Navy	Enlisted	1589	Aviation Support Equipment Technician	NA	Maintain aircraft Peculiar Support Equipment (PSE) systems	2.2.4.1	Virtual
203	Navy	Enlisted	1589	Aviation Support Equipment Technician	NA	Recover air condition and refrigeration equipment refrigerants	2.2.4.1	Virtual
204	Navy	Enlisted	1589	Aviation Support Equipment Technician	NA	Test Common Support Equipment (CSE) components	2.2.4.1	Virtual
205	Navy	Enlisted	1589	Aviation Support Equipment Technician	NA	Test support equipment hydraulic purification components	2.2.5.1	Gray Area
206	Navy	Enlisted	1589	Aviation Support Equipment Technician	NA	Manage flight deck troubleshooter operations	2.3.4.1	Gray Area
207	Navy	Enlisted	3556	Hull Systems Technician	NA	Fabricate piping templates	1.2.2.1	Virtual
208	Navy	Enlisted	3556	Hull Systems Technician	NA	Manufacture metal cofferdams	1.2.2.1	Virtual
209	Navy	Enlisted	3556	Hull Systems Technician	NA	Perform advanced de-smoking procedures	3.4.3.2	Live
210	Navy	Enlisted	3556	Hull Systems Technician	NA	Test repaired piping systems, tubing, and components	2.2.2.1	Virtual
211	Navy	Enlisted	3556	Hull Systems Technician	NA	Update calibration records	2.2.2.1	Virtual
212	Navy	Enlisted	4805	Ship Survivability Systems Technician	NA	Conduct portable Damage Control (DC) equipment training	4.4.3.1	Live
213	Navy	Enlisted	4805	Ship Survivability Systems Technician	NA	Doff chemical protection ensembles	4.4.3.1	Live
214	Navy	Enlisted	4805	Ship Survivability Systems Technician	NA	Operate atmospheric test equipment	1.1.2.1	Virtual
215	Navy	Enlisted	4805	Ship Survivability Systems Technician	NA	Calculate stability curves	2.2.3.1	Virtual
216	Navy	Enlisted	4805	Ship Survivability	NA	Update Quality Assurance	2.2.3.1	Virtual

Final Individual Task Categorizations								
Task ID	**Service**	**Rank**	**MOC**	**MOC Title**	**Task Number**	**Task Description**	**Rating Category**	**LIve/GreyArea/ Virtual**
				Systems Technician		(QA) repair forms		
217	Navy	Officer	9425	Survey and Inspection Officer (Non-Engineering)	NA	CONDUCT SURVEYS AND INSPECTIONS OF NON-ENGINEERING SECTIONS OF MERCHANT SHIPS	2.3.4.1	Gray Area
218	Navy	Officer	9425	Survey and Inspection Officer (Non-Engineering)	NA	ASSIST WITH MERCHANT SHIP ACTIVATION, DEACTIVATION, LOADING, STOWAGE, AND ACCEPTANCE PROCEDURES FOR DOD USE	2.3.4.1	Gray Area
219	Navy	Officer	9425	Survey and Inspection Officer (Non-Engineering)	NA	INSPECT MARINE EQUIPMENT AND MACHINERY TO DRAW UP WORK REQUESTS AND JOB SPECIFICATIONS	2.4.5.1	Gray Area
220	Navy	Officer	9425	Survey and Inspection Officer (Non-Engineering)	NA	CONDUCT ENVIRONMENTAL, OPERATIONAL, OR PERFORMANCE TESTS ON MARINE MACHINERY AND EQUIPMENT	2.4.5.1	Gray Area
221	Navy	Warrant Officer	9550	Water Craft Operator (Mates- Ship, Boat, and Barge)	NA	STAND WATCHES ON VESSELS DURING SPECIFIED PERIODS WHILE VESSELS ARE UNDER WAY	4.4.5.2	Live
222	Navy	Warrant Officer	9550	Water Craft Operator (Mates- Ship, Boat, and Barge)	NA	INSPECT EQUIPMENT SUCH AS CARGO-HANDLING GEAR, LIFESAVING EQUIPMENT, VISUAL-SIGNALING EQUIPMENT, AND FISHING, TOWING, OR DREDGING GEAR, IN ORDER TO DETECT PROBLEMS	1.2.3.1	Virtual

Final Individual Task Categorizations								
Task ID	**Service**	**Rank**	**MOC**	**MOC Title**	**Task Number**	**Task Description**	**Rating Category**	**LIve/GreyArea/ Virtual**
223	Navy	Warrant Officer	9550	Water Craft Operator (Mates- Ship, Boat, and Barge)	NA	PARTICIPATE IN ACTIVITIES RELATED TO MAINTENANCE OF VESSEL SECURITY	2.3.4.2	Gray Area
224	Navy	Warrant Officer	9550	Water Craft Operator (Mates- Ship, Boat, and Barge)	NA	OBSERVE LOADING AND UNLOADING OF CARGO AND EQUIPMENT TO ENSURE THAT HANDLING AND STORAGE ARE PERFORMED ACCORDING TO SPECIFICATIONS	1.3.3.1	Potentially Virtual
225	Navy	Warrant Officer	9550	Water Craft Operator (Mates- Ship, Boat, and Barge)	NA	SUPERVISE CREW MEMBERS IN THE REPAIR OR REPLACEMENT OF DEFECTIVE GEAR AND EQUIPMENT	1.3.3.1	Potentially Virtual
226	Navy	Warrant Officer	9550	Water Craft Operator (Mates- Ship, Boat, and Barge)	NA	SUPERVISE CREWS IN CLEANING AND MAINTAINING DECKS, SUPERSTRUCTURES, AND BRIDGES	4.3.4.1	Live
227	Navy	Enlisted	na	Electronics Technician	NA	AC Test Equipment	2.2.2.2	Virtual
228	Navy	Enlisted	na	Electronics Technician	NA	Flip-Flop Circuts	2.2.2.2	Virtual
229	Navy	Enlisted	na	Electronics Technician	NA	Relays & Switches	2.2.2.2	Virtual
230	Navy	Enlisted	na	Electronics Technician	NA	Digital Logic Functions	2.2.3.2	Virtual

Appendix B

Final Collective Task Categorizations

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
Army	CBRN	Conduct CBRN Company Operations (Chem Co Hvy)	03-2-9209	React to an Obscuration	3.2.2.2.3.2.2	Live
Army	Field Artillery: WLRS (TPQ-37) TEAM	Conduct Counterfire Radar Operations (06-RC-4350)	06-4-2046	Prepare Radar Equipment For Operations	3.1.2.2.1.1.1	Live
Army	Combat Engineers	Conduct Platoon Combat Opeartions, Sappar Plattoons	05-1-1006	Plan for Counter-IED (C-IED) Operations	2.2.2.1.1.1.1	Virtual
Army	Combat Engineers	Conduct Platoon Combat Opeartions, Sappar Plattoons	05-1-2000	Prepare an Obstacle Plan	2.2.2.1.1.1.1	Virtual
Army	Combat Engineers	Conduct Platoon Combat Opeartions, Sappar Plattoons	05-2-1004	Support a Water Crossing Operation	3.3.3.2.3.3.2	Live
Army	Combat Engineers	Conduct Platoon Combat Opeartions, Sappar Plattoons	05-2-1013	Conduct a Water Crossing Site Reconnaissance	3.2.2.2.3.2.1	Live
Army	Combat Engineers	Conduct Platoon Combat Opeartions, Sappar Plattoons	05-2-3002	Camouflage Vehicles and Equipment	3.2.2.3.3.1.2	Live
Army	Combat Engineers	Conduct Platoon Combat Opeartions, Sappar Plattoons	05-2-3005	Conduct and Extraction from a Minefield	3.2.3.1.2.2.2	Live

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
Army	Combat Engineers	Conduct Platoon Combat Opeartions, Sappar Plattoons	05-3-0202	Disable a Bridge with Explosives	3.2.3.3.2.2.2	Live
Army	Combat Engineers	Conduct Platoon Combat Opeartions, Sappar Plattoons	05-3-0912	Prepare Equipment for Air Assault Operations	3.2.1.2.1.2.2	Live
Army	Combat Engineers	Conduct Platoon Combat Opeartions, Sappar Plattoons	05-3-1001	Create a Lane through an Obstacle using Mechanical Techniques	3.2.3.2.2.2.2	Live
Army	Combat Engineers	Conduct Platoon Combat Opeartions, Sappar Plattoons	05-3-3000	Construct Bunkers and Shelters	3.3.3.3.3.2.3	Live
Army	CBRN	Conduct CBRN Company Operations (Chem Co Hvy)	03-2-9201	Implement CBRN Protective Measures	3.2.2.2.2.2.1	Live
Army	CBRN	Conduct CBRN Company Operations (Chem Co Hvy)	03-2-9203	React to a Chemical or Biological (CB) Attack	3.2.2.2.1.3.2	Live
Army	CBRN	Conduct CBRN Company Operations (Chem Co Hvy)	03-2-9208	Cross a Radiological Contaminated Area	3.2.2.1.1.2.2	Live
Army	CBRN	Conduct CBRN Company Operations (Chem Co Hvy)	03-2-9223	React to the Initial Effects of a Nuclear Attack	3.2.2.1.1.2.2	Live
Army	CBRN	Conduct CBRN Company Operations (Chem Co Hvy)	07-2-5081	Conduct Troop-leading Procedures (Platoon-Company)	2.2.1.1.1.1.1	Virtual

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
Army	CBRN	Conduct CBRN Company Operations (Chem Co Hvy)	08-2-0002	Perform Field Sanitation Functions	3.2.2.2.1.1.1	Live
Army	CBRN	Conduct CBRN Company Operations (Chem Co Hvy)	08-2-0004	Evacuate Casualties	3.2.2.2.1.2.2	Live
Army	CBRN	Conduct CBRN Company Operations (Chem Co Hvy)	55-2-4002	Prepare Unit for Tactical Convoy	2.2.2.1.1.2.2	Grey Area
Army	CBRN	Conduct CBRN Company Operations (Chem Co Hvy)	63-2-4017	Maintain Communications	3.2.2.2.1.1.1	Live
Army	Military Police	Conduct MP Company Internment/Resettlement Operations (MP I/R CO)	19-2-3200	Process U.S. Military Prisoner into Confinement	3.2.2.1.1.2.1	Live
Army	Military Police	Conduct MP Company Internment/Resettlement Operations (MP I/R CO)	19-2-3200	Process U.S. Military Prisoner into Confinement	2.1.1.1.1.1.1	Virtual
Army	Military Police	Conduct MP Company Internment/Resettlement Operations (MP I/R CO)	19-2-3204	Conduct Work Activities for U.S. Military Prisoners	3.2.2.1.1.2.1	Live

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
Army	Military Police	Conduct MP Company Internment/Resettlement Operations (MP I/R CO)	19-2-3205	Conduct Detainee Visitation	2.2.2.1.1.1.1	Virtual
Army	Military Police	Conduct MP Company Internment/Resettlement Operations (MP I/R CO)	19-2-3207	Conduct Detainee Meal Procedures	3.2.2.1.1.1.1	Live
Army	Military Police	Conduct MP Company Internment/Resettlement Operations (MP I/R CO)	19-2-3208	Perform Restraint Procedures at a Facility	3.1.2.3.1.1.2	Live
Army	Military Police	Conduct MP Company Internment/Resettlement Operations (MP I/R CO)	19-2-3504	Conduct Detainee Evacuation/Transfer Procedures	3.2.2.1.1.2.1	Live
Army	Military Police	Conduct MP Company Internment/Resettlement Operations (MP I/R CO)	19-2-3511	Process Detainee into an Internment and Resettlement (I/R) Facility	3.2.2.2.1.2.2	Live
Army	Military Police	Conduct MP Company Internment/Resettlement Operations (MP I/R CO)	19-2-3603	Conduct Perimeter Security for an Internment Facility	3.2.3.2.2.1.2	Live

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
Army	Military Police	Conduct MP Company Internment/Resettlement Operations (MP I/R CO)	19-2-3605	Supervise Work Projects Operations for Detainees	2.1.1.1.1.1.1	Virtual
Army	Finance	Conduct Financial Management Company Operations	14-2-8001	Provide Travel Pay Services	2.1.1.1.1.1.1	Virtual
Army	Finance	Conduct Financial Management Company Operations	14-2-8002	Perform Disbursing Operations	1.1.1.1.1.1.1	Virtual
Army	Finance	Conduct Financial Management Company Operations	14-2-8003	Conduct Commercial Vendor Operations	1.1.2.1.1.1.1	Virtual
Army	Finance	Conduct Financial Management Company Operations	14-2-8004	Process Commercial Accounts Transactions	2.1.1.1.1.1.1	Virtual
Army	Finance	Conduct Financial Management Company Operations	14-2-8005	Conduct Transactions with Agent Officers	1.1.2.1.1.1.1	Virtual
Army	Finance	Conduct Financial Management Company Operations	14-2-8006	Provide Resource Management (RM) Assistance	2.2.2.1.1.1.1	Virtual
Army	Finance	Conduct Financial Management Company Operations	14-7-8017	Conduct Internal Control Operations	2.1.1.1.1.1.1	Virtual

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
Army	Transportation	Conduct Company Transportation Mission Operations	43-2-0001	Perform Vehicle Recovery	3.3.3.3.2.2.2	Live
Army	Transportation	Conduct Company Transportation Mission Operations	43-2-4508	Perform Combat Repair Team Functions	3.2.1.2.1.2.2	Live
Army	Transportation	Conduct Company Transportation Mission Operations	55-2-0007	Set up Truck Platoon	3.2.2.1.1.2.2	Live
Army	Transportation	Conduct Company Transportation Mission Operations	55-2-0009	Provide Command and Control of Transportation Ops	2.1.2.1.1.1.1	Virtual
Army	Transportation	Conduct Company Transportation Mission Operations	55-2-0011	Transport Personnel and Cargo	2.2.2.2.1.1.2	Grey Area
Army	Transportation	Conduct Company Transportation Mission Operations	55-2-0016	Redirect Vehicle Operators using Movement Tracking System (MTS)	2.2.1.2.1.1.1	Virtual
Army	Transportation	Conduct Company Transportation Mission Operations	55-2-0038	Transport Dry and Refrigerated Containerized Cargo	3.3.2.3.2.3.2	Live
Army	Transportation	Conduct Company Transportation Mission Operations	55-2-4006	Defend Convoy Elements	3.3.3.3.2.2.2	Live
Army	Transportation	Conduct Company Transportation Mission Operations	55-2-4557	Manage Transportation Ops	2.2.2.2.1.1.1	Virtual

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
Army	Transportation	Conduct Company Transportation Mission Operations	55-2-4573	Transport Palletized or Containerized Medium General Cargo	3.2.2.2.2.2.2	Live
Army	Air Defense Artillery	AMD Battery (Patriot/Meads)	44-1-9002	Perform Air Battle Engagement	3.3.2.1.1.1.1	Live
Army	Air Defense Artillery	AMD Battery (Patriot/Meads)	44-1-9046	Conduct Reconnaissance, Selection and Occupation	3.2.2.3.2.2.1	Live
Army	Air Defense Artillery	AMD Battery (Patriot/Meads)	44-2-2295	Emplace the Battery	3.2.2.3.2.2.2	Live
Army	Air Defense Artillery	AMD Battery (Patriot/Meads)	44-3-3220	Perform Passive Air Defense Measures	3.2.3.3.3.2.2	Live
Army	Air Defense Artillery	AMD Battery (Patriot/Meads)	44-4-1046	Conduct Survey Activities	1.1.2.2.1.1.1	Virtual
Army	Air Defense Artillery	AMD Battery (Patriot/Meads)	44-4-9030	Provide Multichannel Communications for the ECS	3.2.2.3.2.1.2	Live
Marine Corps	INFANTRY	T&R NAVMC_3500.44	INF-MGUN-5001	Provide Fires	3.2.3.2.2.1.1	Live
Marine Corps	INFANTRY	T&R NAVMC_3500.44	INF-MAN-5019	Detain personnel	3.2.3.2.1.2.2	Live
Marine Corps	INFANTRY	T&R NAVMC_3500.44	INF-MAN-5013	Breach an obstacle	3.3.3.3.2.1.2	Live
Marine Corps	INFANTRY	T&R NAVMC_3500.44	INF-MAN-5011	Conduct Assembly Area Actions	3.2.2.2.2.1.1	Live
Marine Corps	INFANTRY	T&R NAVMC_3500.44	INF-MAN-5014	Support by fire/overwatch	3.3.2.2.2.2.1	Live
Marine Corps	INFANTRY	T&R NAVMC_3500.44	INF-MAN-5018	Operate from a patrol base	3.3.3.2.2.2.2	Live

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
Marine Corps	INFANTRY	T&R NAVMC_3500.44	INF-FP-5003	Operate an entry control point	3.2.2.3.2.2.1	Live
Marine Corps	INFANTRY	T&R NAVMC_3500.44	INF-ANTI-5001	Provide direct fires	3.2.3.2.2.2.1	Live
Marine Corps	INFANTRY	T&R NAVMC_3500.44	INF-ANTI-5002	Occupy firing positions	3.2.3.2.2.1.1	Live
Marine Corps	Personnel & Admin	T&R NAVMC_3500.03	PERS-CORP-4003	Process naval messages	1.1.1.2.1.1.1	Virtual
Marine Corps	Personnel & Admin	T&R NAVMC_3500.03	PERS-GENA-4035	Supervise Service Records audits	2.1.1.2.1.1.1	Virtual
Marine Corps	Personnel & Admin	T&R NAVMC_3500.03	PERS-MPSP-4061	Develop manpower requirements	2.2.1.1.1.1.1	Virtual
Marine Corps	Personnel & Admin	T&R NAVMC_3500.03	PERS-SCTY-4131	Safeguard personal information	3.1.1.1.1.1.1	Live
Marine Corps	Artillery	T&R NAVMC_3500.07	ARTY-GUNS-6329	EMPLACE THE HOWITZER	3.3.3.3.3.2.3	Live
Marine Corps	Artillery	T&R NAVMC_3500.07	ARTY-FDC-6851	PREPARE FOR INDIRECT FIRE	2.2.2.2.2.2.2	Grey Area
Marine Corps	Artillery	T&R NAVMC_3500.07	ARTY-FDC-6858	UPDATE FIRING DATA	1.2.2.2.1.1.1	Virtual
Marine Corps	Artillery	T&R NAVMC_3500.07	ARTY-FDC-6881	EXECUTE A SCHEDULE OF FIRES	2.2.2.1.1.1.1	Virtual
Marine Corps	Artillery	T&R NAVMC_3500.07	ARTY-COMM-6154	ESTABLISH AND OPERATE WIRE COMMUNICATIONS	3.2.2.2.1.2.2	Live
Marine Corps	Artillery	T&R NAVMC_3500.07	ARTY-COMM-6158	PERFORM UNIT MISSION WITH DEGRADED RADIO COMMUNICATIONS	3.2.2.2.1.1.1	Live

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
Marine Corps	Artillery	T&R NAVMC_3500.07	ARTY-FO-6201	LOCATE OBSERVER POSITION	2.2.2.2.3.1.1	Live
Marine Corps	Artillery	T&R NAVMC_3500.07	ARTY-LNO-6401	ESTABLISH THE LIAISON SECTION	1.2.2.1.1.1.1	Virtual
Marine Corps	Artillery	T&R NAVMC_3500.07	ARTY-AMMO-6104	PREPARE AMMUNITION FOR EXTERNAL LIFT	3.2.2.3.2.2.2	Live
Marine Corps	MP & Corrections	T&R NAVMC_3500.10	MPOF-ASO-3005	Clear a building	3.3.3.2.2.3.2	Live
Marine Corps	MP & Corrections	T&R NAVMC_3500.10	MPOF-MMS-3024	Perform area reconnaissance	2.2.2.2.3.1.1	Live
Marine Corps	MP & Corrections	T&R NAVMC_3500.10	MPOF-MMS-3029	Conduct an assault	3.3.3.3.2.2.2	Live
Marine Corps	MP & Corrections	T&R NAVMC_3500.10	MPOF-WPNS-3040	Prepare a range card	1.1.2.2.2.1.1	Virtual
Marine Corps	MP & Corrections	T&R NAVMC_3500.10	MPOF-CMDC-5001	Complete a MP estimate of supportability	2.2.2.2.2.1.1	Virtual
Marine Corps	MP & Corrections	T&R NAVMC_3500.10	MPPM-GSS-4014	Conduct logistics support	2.1.1.2.1.1.1	Virtual
Marine Corps	Logistics	T&R NAVMC_3500.27A	LOG-OPS-3701	Determine Logistics Requirements	2.1.1.1.1.1.1	Virtual
Marine Corps	Logistics	T&R NAVMC_3500.27A	LOG-OPS-3704	Conduct Unit Level Personnel and Equipment Allowance Reviews	2.2.1.1.1.1.1	Virtual
Marine Corps	Logistics	T&R NAVMC_3500.27A	LOG-OPS-3707	Conduct Beach Operations	3.3.3.3.2.2.3	Live
Marine Corps	Logistics	T&R NAVMC_3500.27A	LOG-OPS-	Conduct Search and Recovery Operations	3.2.2.3.2.2.2	Live

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
			3713			
Marine Corps	Logistics	T&R NAVMC_3500.27A	LOG-OPS-3717	Conduct Disaster Relief Operations	3.2.2.2.2.2.2	Live
Marine Corps	Logistics	T&R NAVMC_3500.27A	LOG-RIG-3902	Pack a Cargo Parachute for Airborne Operations	3.1.1.3.1.1.1	Live
Marine Corps	Logistics	T&R NAVMC_3500.27A	LOG-EXCU-4302	Conduct Amphibious Embarkation	2.2.2.2.1.1.1	Virtual
Marine Corps	Logistics	T&R NAVMC_3500.27A	LOG-RIG-4901	Conduct Airborne Operations	3.2.2.2.1.1.2	Live
Air Force	E-3 Mission Crew Commander	NA	01.01	Determine mission tasking, command/control/communications arrangementsand employment plans from planning/tasking documents.	2.2.2.1.1.1.1	Virtual
Air Force	E-3 Mission Crew Commander	NA	01.02	Obtain, analyze mission planning details and resolve conflicts	2.2.2.2.1.1.1	Virtual
Air Force	E-3 Mission Crew Commander	NA	01.04	Prepare for and conduct the initial coordination planning meeting	3.2.2.1.1.1.1	Live
Air Force	E-3 Mission Crew Commander	NA	01.05	Conduct crew coordination meeting	3.2.2.1.1.1.1	Live
Air Force	E-3 Mission Crew Commander	NA	01.06	Jointly plan and execute a RON	2.1.1.1.1.1.2	Grey Area

Final Collective Task Categorizations						
Service	**Occupational Family**	**Task Set**	**Task Number**	**Task Description**	**Combination**	**Live/Grey/Virtual**
Air Force	E-3 Mission Crew Commander	NA	04.01	Request, interpret, analyze and update tabular displays and situation displays to monitor mission performance and systems operation	2.2.3.2.1.1.1	Grey Area
Air Force	E-3 Mission Crew Commander	NA	04.02	Conduct Station Changover	3.2.2.1.1.1.1	Live
Air Force	E-3 Mission Crew Commander	NA	04.03	Manage the Air Battle/Mission Execution	2.2.2.2.1.1.1	Virtual
Air Force	E-3 Mission Crew Commander	NA	04.04	AWACS Monitor	3.3.3.2.2.1.1	Live
Air Force	E-3 Mission Crew Commander	NA	04.11	Conduct E-3 Air Refueling	3.3.3.3.3.2.2	Live
Air Force	E-3 Mission Crew Commander	NA	07.03	Debrief Mission	3.1.1.1.1.1.1	Live
Air Force	E-3 Mission Crew Commander	NA	08.01	Plan Instruction	1.1.1.1.1.1.1	Virtual

Appendix C

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Live or Virtual Military Training? Developing a Decision Algorithm

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ABSTRACT

This paper describes the development of a decision algorithm for determining what military tasks can be taught virtually (e.g., simulator, advanced distributed learning) and which tasks should only be taught in classroom or field environment (live). The decision algorithm, based on a DoD study, addressed both individual and collective tasks across the military Services. The goal was to develop a user-friendly system to aid military training developers in making 'first-cut' decisions about training delivery methods, specifically live or virtual. To develop the algorithm, we first examined thousands of military training tasks, reviewed the literature on training tasks and developed a rating system to categorize tasks. The categorization scheme resulted in a variety of task classes with each class encompassing common training characteristics (e.g., level of interactivity or availability of feedback). We conducted an extensive review of the research literature and developed rating factors, which formed the basis of the live vs. virtual decision model. We then drew a random sample of 302 military tasks, categorized the tasks and then applied the rating factors to each task category. Next, using the rating factors we developed a decision algorithm for determining whether each class of tasks can be adequately trained using virtual technologies (costs withstanding) or whether it would be necessary to train the task in a live application. The algorithm is based on a variety of elements from established, peer-reviewed research, current technology, and current military practices. Finally, we applied the algorithm to the task categories developed earlier in the project and conducted an initial validation of the algorithm with training developers. In addition to describing the development and validation process, we will solicit feedback and comments from audience members for consideration during further development, validation, and refinement of the algorithm.

ABOUT THE AUTHORS

Dr. Christina K. Curnow is the Director of the Workforce Research Center and a Vice President at ICF International. She has over 18 years of experience conducting research and evaluations related to military training, leadership and distance education. Dr. Curnow has published peer-reviewed journals articles and book chapters and presented at national and international conferences. She has had the opportunity to conduct research within the Army, Air Force, Marine Corps and Joint Forces. Dr. Curnow holds a Ph.D. in Industrial and Organizational Psychology from the George Washington University.

Arthur Paddock is a Senior Associate with ICF International in the Applied Organizational Research Group. His work focuses on applied research projects within training, personnel selection, competency development and organizational assessment. He has directed organizational analysis projects for the Defense Logistics Agency (DLA) and the Air Force Research Laboratory (AFRL). Mr. Paddock received his M.S. in Industrial-Organizational Psychology from the University of Baltimore in 2001.

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Live or Virtual Military Training? Developing a Decision Algorithm

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INTRODUCTION

This paper describes the construction of a decision-making framework to designate whether military tasks *can* (not necessarily *should*) be trained entirely through virtual methods (e.g., simulator, advanced distributed learning) or need to be taught through traditional live methods (e.g., instructor-led classroom, field site with actual equipment). The framework essentially offers a first-cut, categorical estimation, rendered as a simple radar chart, intended for use by training developers or policy makers working in collaboration with a subject matter expert. The intention is to offer planners a tool that proposes whether to consider further virtual training as an alternative. The study was sponsored by the Office of the Under Secretary of Defense (Personnel & Readiness).

We developed separate frameworks for individual and collective tasks. Within each framework, we propose thresholds that separate virtual from live methods that are sensitive to the current state of proven, off-the-shelf training technology. The thresholds can be adjusted as new technologies become available. The framework is also sensitive to psychological factors established in the literature on individual and team training, which was the emphasis of the study and is the primary focus of this paper.

A review of the classification criteria selected for each framework is presented, first for individual and then for collective tasks. We then detail our assumptions and provide a tally of how several hundred military tasks place in the categorization scheme. We describe the thresholds that divide virtual from live methods, offer examples of the radar charts that reflect the live-virtual decision framework and provide a tangible example.

CLASSIFICATION FACTORS AND CRITERIA FOR INDIVIDUAL TASKS

Although there are numerous task taxonomies and categorization schemes already designed for various purposes, our interest was in isolating those factors that are sensitive to the live versus virtual training issue. (Note: Our use of the terms live and virtual is associated with the live, virtual, constructive taxonomy used in modeling and simulation but applied here to any training delivery, rather than the sense of a virtual classroom common in the distance or online learning communities.) We conducted a review of the research literature to identify factors and criteria upon which to categorize tasks for this purpose. We searched a wide range of task categorization methodologies and sought to isolate specific criteria capable of differentiating tasks solely on the basis of whether they can be trained through a virtual instructional method (i.e, exclusively technology based). We determined that no single task classification model satisfied our objective.

The review identified a set of categorization factors and criteria that can be used to group individual tasks into discrete categories that underpins a live-virtual decision framework. We reviewed models from the following technical perspectives:

- Bloom's Taxonomy – domains such as cognitive, affective, psychomotor
- Levels of Analysis – branch, occupational series, duty position
- Time and Motion Analysis – examination of work systems
- Worker Functions (Functional Job Analysis) – Data, people, things
- Task Characteristics – time spent, difficulty to learn, perishability, importance, frequency, criticality, standardization.
- Position Analysis Questionnaire – information input, mental processes, work

output, interpersonal activities, work situation and job context
- Cognitive Task Analysis – the cognitive structures and processes associated with task performance
- Instructional Requirements that Limit Media Selection – sensory mode, conditional knowledge, synchronous feedback
- Level of Interaction – communication for exploration or for teambuilding
- Perishability and Task Retention Models – how quickly will a particular skill or knowledge be forgotten?

Integration of Technical Perspectives

Our approach examined existing schema on task classification and selected specific criteria from each that differentiates tasks, principally with respect to whether they *can* be taught in a live or virtual environment. Of the criteria that merited further consideration, we looked for similarities and overlap between the constructs advocated from multiple perspectives. The result was a partition incorporating four factors, described below with the categories and criteria.

Domain Factor, categorical scale

We recommend using the *domains* (cognitive, psychomotor, and affective) from Bloom's taxonomy with the added category of "procedural" that fits many military tasks. Although many tasks can be described as a procedure, some include a dominant psychomotor or a critical cognitive component that overrides the routine nature of step-by-step execution that we count as procedural. In the scheme, then, the four categories are:

1. Procedural—routine step-by-step, limited cognitive complexity or psychomotor activity
2. Cognitive—knowledge and development of intellectual skills
3. Psychomotor—involving physical movement, motor skills, or perceptual and physical coordination
4. Affective—involving emotions, motivation, and attitudes

Interaction/Fidelity Factor, ordinal scale

This factor relates to the criteria of data, people, or things derived from functional job analysis as well as the interpersonal activities category of the position analysis questionnaire. We recommend using four categories for this factor:

1. One-way interaction with data or things, low fidelity requirements
2. Two-way interaction with data or things, moderate fidelity requirements
3. Two-way interaction with people, moderate fidelity requirements
4. Two-way interaction, high fidelity requirements

Learning Complexity Factor, ordinal scale

This factor refers to how complicated a task is to learn and how difficult it is to maintain. To determine learning complexity, we recommend using multiple considerations that can be integrated into a single complexity factor. The first two considerations are derived from the work of Rose, Czarnolewski, Gragg, Austin, & Ford (1985) on skill retention. The next consideration relates to mental requirements discussed by Rose et al., Bloom's (1956) levels, and cognitive task analysis criteria. We call this factor *learning complexity.* The mental requirement category is based on Bloom's taxonomy, resulting in five discrete categories with criteria ranging from 'consistently highly complex' to 'not complex at all.'

Task Certainty or Feedback, ordinal scale.

Finally, *task certainty* is the extent to which a task has built in feedback, such that an individual knows when he/she has successfully completed the task without feedback from an instructor. This criterion is based on Rose et al. (1985) and Clark, Bewley, and O'Neil (2006), and has three levels of feedback:

1. Built in/synchronous
2. Sometimes available/Sometimes delayed
3. Never available or very delayed

The four factors were used to establish task classes by assigning a numerical category to each permutation of each domain, much like the Dewey decimal system, where each task receives a numerical assignment for each of the four categories. Applying these criteria to an individual task would result in a four-tuple sequence that identifies a particular class of tasks. For example, marksmanship is a psychomotor skill (category 3), requires interacting with a weapon (category 2), is

occasionally complex (category 2), and has built in certainty about whether it has been done correctly (category 1). Therefore, this task would be part of category designated 3.2.2.1 tuple. The total combination of factors results in 240 possible classes of tasks.

CLASSIFICATION FACTORS AND CRITERIA FOR COLLECTIVE TASKS

Psychological research on team performance spans more than 50 years, with a voluminous literature of thousands of studies reporting on the processes and factors that underlie team effectiveness, or what mediates the relationship between team inputs and outcomes. Numerous studies suggest that performance on a collective task can be predicted, to a certain extent, from individual capabilities. But not all performance can be accounted for, and in many cases most cannot be accounted for by simply combining the performance on individual tasks. When substantial interaction between individuals is required, for example, the relationship is greatly diminished. Training of teamwork, demands of synchronous activities, and communication cues come into play.

Taxonomies to describe teams, and team or collective tasks, are plentiful. They tend to focus on particular aspects of team composition and performance, such as selection, internal dynamics, leadership, performance, and numerous other variables. This emphasis on team characteristics is consistent with literature that endorses competency modeling as an analytical technique. Competency modeling involves focusing on the employee characteristics required for effective job performance, rather than focusing on the characteristics of the job itself (Alliger, Beard, Bennett, Colegrove, & Garrity, 2007). The competency-based approach to training can be applied to both individuals and teams training for situations ranging from relatively simple to highly complex (Colegrove, Rowe, Alliger, Garrity, & Bennett, 2009).

The interest in the use of technology, however, has been investigated more as a set of tools used by team members, rather than as a preferred method of training the collective effectiveness of the team. There are numerous categorization schemes for collective tasks, however our interest was in isolating those with factors that address the choice between virtual versus live training.

The literature review further identified a set of categorization criteria that can be used to group tasks into discrete collective task categories that lead to the construction of a decision algorithm. We reviewed models from the following technical perspectives:

- Team performance, input-process-output models (McGrath, 1984)
- Team composition (Dyer, 1984)
- Teamwork and team processes (Bennett, Alliger & Colgrove, 2009)
- Temporal dynamics (Marks, Mathieu, & Zacarro, 2001)
- Environmental factors – e.g., equipment, environment, safety, non-verbal cues

Our model for categorizing collective tasks drew from a chapter in the *Handbook of Industrial/Organizational Psychology* (Cannon-Bowers and Bowers, 2011), which synthesizes many recent models and taxonomies of teams and team tasks. Much of the framework for the decision-making model is rooted in the syntheses presented in that chapter, with added refinements drawn from related articles. The goal was to develop a taxonomic scheme that parallels the taxonomy developed for individual tasks.

To determine an appropriate model for task classification for this study, we examined potential factors identified in the literature review. Of the criteria that had merit for further consideration from the live versus virtual training issue, we looked for similarities and overlap. This led to four factors described in the following section.

FACTORS AND CRITERIA FOR THE COLLECTIVE MODEL

Described here is a summary of the key elements from the research literature that led to the development of four factors. Each is described along with its categories and criteria.

Domain Factor, categorical scale

This factor addresses the nature of the team in terms of what they need to accomplish for a specific task. There is no single, universally agreed on taxonomy of teams. For our purposes, we reduced the classifications to three categories, focusing on the outcomes of team performance

in generic terms, stemming from the influential early work by McGrath (1984), which led to many variations of a general input-process-output model. The three categories and criteria are:

Category 1 - Project/Development
Members of this team category are typically involved with planning, analysis of alternatives, and so forth. They likely need to collaborate on project work. An "output" or product may be complex and unique, such as a mission analysis, a course of action, or a piece of software.

Category 2 - Action and Negotiation
Action and negotiation production teams are highly skilled specialists who must cooperate in brief performance events. For our purposes, the main outcome is a decision or recommendation rather than a formal document.

Category 3 - Production and Service
Production and service teams work together in a physical environment where the use of equipment, movement of assets, or reactions to tangible conditions (e.g., terrain) influence performance. This category can include construction teams, assembly line work, or field activities of small units.

Teamwork Training Factor, ordinal scale

Collective tasks can engage more than the knowledge and skills of individuals, (such as teamwork, communication, and physical activities) and may depend on coordinated performance that is not necessarily trained at the individual level. The training of teamwork skills is distinguished from the training of individual skills. Prerequisite capabilities of individual members are essential for successful team training (Dyer, 1984).

The categorization assumes that individuals are proficient on tasks performed in isolation, so teams rather than individuals are the basic unit of analysis. This factor concerns the development of roles and interaction patterns among members of the teams. It consolidates the supporting competencies that underlie successful performance of a mission essential competency used in the Air Force (Bennett, Alliger, & Colegrove, 2009), such as situational awareness, multi-tasking, and internal teamwork. For our purposes, the model simply recognizes teamwork training as a factor with three rating categories (Low (1), Medium (2), and High (3)), indicated by degree to which collective task training emphasizes teamwork.

Synchronous Activity Factor, ordinal scale

This factor concerns the degree to which teams are required to coordinate their actions in order to perform their collective task successfully. These are also known as team processes. This factor relates to the supporting competency of external teamwork, or knowing when, how and to whom to handoff tasks and accept handoff of tasks. A number of taxonomies have been previously proposed as organizers. The model proposed by Marks, Mathieu, & Zaccaro (2001) has the strongest technical support in statistically fitting team processes to team performance. We generalize this temporal dynamic consideration in the collective categorization scheme as overall synchronous activity and the extent to which coordination and task dependencies are present, with three rating categories (Low (1), Medium (2), and High (3)).

Environmental Conditions Factor, ordinal scales

This factor addresses issues that are relevant to instructional delivery, rather than to team processes and performance. These issues have not generally been included in taxonomies of team performance, but they are important for the purposes of the present study. The environmental factor includes four subcategories: The actual equipment subfactor asks whether use of actual equipment is needed, versus using a virtual representation and is rated in three categories (not needed (1), preferred (2), essential (3)). The special environment subfactor addresses whether certain conditions are necessary for collective training, such as darkness or background noise and is rated in three categories (not needed (1), preferred (2), essential (3)). The non-verbal subfactor relates to the synchronous factor but asks directly of the presence of cues that can be seen or otherwise sensed but not heard and is rated in three categories (none (1), occasional (2), frequent (3)). Finally the multi-motoric subfactor seeks to rate whether two or more members of the team must engage simultaneous strength or dexterity in performing an action and is rated in three categories (none (1), occasional (2), frequent (3)).

Decision-Making Framework

The concern here is essentially whether a task is suited for virtual training method. Factors such as costs, infrastructure, courseware maintenance, etc. are not addressed, but obviously would come into play after the first-cut estimation offered in this decision-making framework is made.

Assumptions

Two overarching assumptions were (1) all tasks can be trained through live training methods unless a task is entirely virtual at the outset, and (2) the decision-making methodology requires minimal instruction for trainers or subject matter experts, so we sought to include the most important factors rather than all possible factors. Therefore, we chose a simplified approach with a high, but imperfect, level of accurate prediction rather than a complex approach that may have greater refinement and technical accuracy but is beyond everyday usage. This tradeoff mainly occurred in determining the number of task factors and categories to use in classifying tasks. A separate assumption was that the virtual technology contemplated is currently in use and commercially available, not in an R&D stage, prototype form, or concept formation stage. Specific assumptions were on two topics:

Individual Task Assumptions

A. The model assumes that tasks are trained to a level sufficient for proficiency, as recognized by the Service, using the training method selected;
B. The model does not account for a blended learning approach. Therefore, if a virtual method is selected, then the model assumes that the entire task *can* be trained virtually, so blended learning falls into the live side of the dichotomy;
C. Tasks deemed appropriate for virtual *can* be wholly taught through virtual technology, with no live instructor input other than for administrative and technical procedures;
D. The final certification of task performance can occur either through virtual or live testing, depending on military Service regulations and preferences.

Collective Tasks Assumptions

A. Individuals and subgroups are proficient in all prerequisite individual and subgroup tasks;
B. The model assumes that tasks are trained to a level sufficient for collective proficiency, as recognized by the Service, using the training method selected (i.e., live or virtual);
C. The current model does not account for a blended learning approach. Therefore, if a virtual method is selected, then the model assumes that the entire task can be trained virtually, so blended learning techniques fall into the live side of this dichotomy;
D. When deemed acceptable for virtual training, the collective task is wholly taught through virtual technology, with no live instructor input other than a human-in-the-loop for administrative and technical procedures;
E. The virtual technology contemplated is currently in use and commercially available (not in an R&D stage, concept formation etc.);
F. The size of the collective, or group, is between 5 and 24. The recommendation from the decision-making framework may hold for larger or smaller groups, but with reduced certainty as to its validity.

DEVELOPMENT OF A MILITARY TASK DATABASE

We developed a two-pronged approach to developing a military task database – one for identifying individual tasks and one for identifying collective tasks. The process for developing the database included:

- Identify Individual Tasks by Military Service
- Sample Military Occupations
- Acquire Military Occupational Task Lists
- Acquire Common/Mandatory Tasks Lists
- Identify Collective Tasks by Military Service and Joint
- Identify Universal Task Lists (UTL) and mission essential task lists (METL)
- Explore the use of Joint Tasks

Upon determining the individual and collective tasks to be included in the task inventory, we designed and compiled a database of these tasks.

Initial Application of Individual Task Categories

We identified individual tasks by sampling from military occupational task lists and common or mandatory task lists. From this pool of thousands of tasks, 200 individual tasks were drawn from the Army (61%), Navy (14%) and Marine Corps (26%) and then analyzed according to the classification scheme. These are preliminary data that largely represent the

findings from the Army and Marine Corps. The sample was stratified and representative of the types of individual tasks that used the most frequently. In addition, we added tasks to ensure coverage across task types such as the affective domain which tended to be less common.

Tables 1 through 4 provide information about what Service the tasks are from and how they were distributed among the task classification categories.

Table 1. Ratings for Domain Factor	
Categories	**Percentage**
Procedural	38%
Cognitive	34%
Psychomotor	25%
Affective	4%

Table 2. Ratings for Interaction/Fidelity Factor	
Categories	**Percentage**
Low	10%
Medium	39%
Medium/High	32%
High	20%

Table 3. Ratings for Learning Complexity Factor	
Categories	**Percentage**
Not complex	11%
Complex at times, but usually not complex	40%
Moderately complex	34%
Varying between moderately complex and high complexity	13%
Consistently highly complex	3%

Table 4. Ratings for Task Certainty/Feedback	
Categories	**Percentage**
Built in/synchronous	59%
Sometimes available, sometimes delayed	37%
Never available or very delayed	5%

Individual task ratings are represented by 77 types of combined rating categories, of the 240 possible combinations.

Decision-Making Framework for Individual Tasks

Based on the four factor categorization scheme, the literature review of media selection methods, and the set of assumptions outlined above, the recommendation regarding whether a task qualifies to be trained through virtual technologies can be viewed as a decision threshold based on the pattern of ratings. The mapping of where each of the possible 240 combinations of ratings (4 x 4 x 5 x 3) fit into the decision framework is not always purely dichotomous (live vs. virtual). In general, tasks that rated lower on each factor are candidates for instruction through virtual training and those that rate high on each factor are candidates for live training, but there are gray areas. For example, there may be certain psychomotor tasks that have moderate interaction/fidelity ratings that may or may not be suited for virtual training, depending on complexity and task certainty/feedback ratings.

The Radar chart in Figure 1, a multivariate plot of factor rating values, presents a notional view of the decision-making framework, shown as a border inside or outside the LV (Live Virtual) Threshold line. Basically, individual tasks that fall inside the box outlined by the dashed blue line are strong candidates for virtual training. Those that appear outside the blue box probably need to be trained through a live training method.

These notional cutoffs are as follows:

- If Domain is 2.5 or greater, and Interaction/Fidelity is greater than 3, and Learning complexity is greater than 3.5 and Task Certainty is greater than 2.5, then the recommendation is for live training.
- If Domain is 2.4 or less, interaction/fidelity is 3 or less, learning complexity is 3.5 or less, and task certainty is 2.5 or less, then the recommendation is for virtual training.

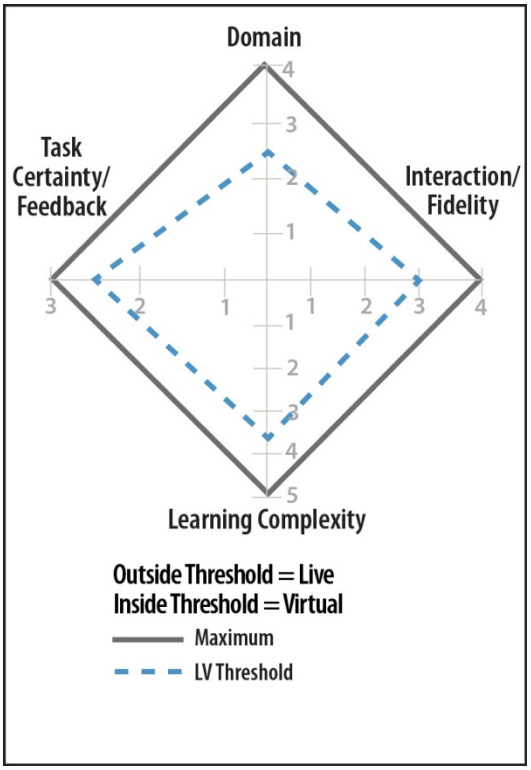
In addition to these notional cutoffs, we have developed additional cutoffs to be evaluated during the validation of the model. These are not depicted in the radar graph, but are applied in our analyses. These include the following:

- For procedural tasks: If interaction is 1-2, complexity 1-4 and task certainty is 1-3, then the recommendation is for virtual training. Then for all other tasks classes that are in the procedural category, the recommendation is

that the tasks are "potentially virtual, but require additional consideration."

- For cognitive tasks: If interaction is 1-2, complexity 1-4 and task certainty is 1-3, then the recommendation is for virtual training.
- For psychomotor tasks – all psychomotor tasks need to be trained live except when fidelity requirements are low (1), in which case this category is "potentially virtual, but requires additional consideration."
- For affective tasks – All affective tasks should be trained live, unless fidelity requirements are low and learning complexity is 2 or less and task certainty is 1 or 2.

Figure 1. RADAR Decision Framework for Individual Tasks.[1]



Initial Application of Collective Task Categories

A total of 102 collective tasks; from the Army, Marine Corps and Air Force; were collected and rated. The data reported below are from collective tasks in the following occupational areas: Field Artillery, Infantry, Military Police, Chemical Biological Radiation Nuclear, Combat Engineer, E-3 Mission Crew, Corrections, Transportation, Personnel & Administration, and Finance. A breakout of collective task by service indicates 53% Army, 12% Air Force, and 35% Marine Corps.

Collective task ratings are represented by 62 sets of combined rating categories. For the Domain factor, Project/Development accounted for 9% of tasks, action/negotiation 30%, and production/service 61%. For the ratings of Teamwork Training, the low category accounted for 22% of tasks, medium 64%, and high 15%. For the ratings for synchronous activity the low category accounted for 21%, medium 58%, and high 22%. Table 5 presents the breakout for tasks in the Environmental factor, with four subfactors.

Table 5. Ratings for Environmental Factor & 4 Subfactors	
Actual Equipment Subfactor	
Categories	**Percentage**
Not needed	36%
Preferred	44%
Essential	20%
Special Environment Subfactor	
Categories	**Percentage**
Not needed	61%
Preferred	29%
Essential	10%
Non-verbal Cues Subfactor	
Categories	**Percentage**
None	59%
Occasional	37%
Frequent	4%
Multi-motoric Activity Subfactor	
Categories	**Percentage**
None	60%
Occasional	37%
Frequent	3%

[1] For purposes of graphical representation, the category values for the individual task ratings were transformed to 5-point scales.

Collective Task Decision Framework

Based on the seven factor categorization scheme for collective tasks, the literature review of media selection methods, and the set of assumptions outlined above, the recommendation regarding whether a task qualifies to be trained through virtual technologies can be viewed as a decision threshold based on the pattern of ratings. The mapping of where each of the possible 2,187 combinations of ratings (3 x 3 x 3 x 3 x 3 x 3 x 3) fit into the decision framework is not completely dichotomous (live vs. virtual). In general, tasks that rated lower on each factor are candidates for virtual training and those that rate high on each factor are candidates for live training, but there are gray areas.

Following the decision framework for individual task, the framework for collective tasks is presented as a Radar chart with a similar design logic: those factor ratings that lead to a point inside the innermost polygon, defined by the LV Threshold, are candidates for a virtual training method while those outside this polygon are candidates to be trained through a live method.

In the Radar chart in Figure 2, a multivariate plot of factor rating values, presents a notional view of the decision-making framework, shown as a border inside or outside the LV (Live Virtual) Threshold line. Basically, individual tasks that fall inside the box defined by the dashed line are strong candidates for virtual training. Those that appear outside the blue box probably need to be trained through a live training method.

These notional cutoffs are as follows:

- If Domain is greater than 2.25, and Team work Training is greater than 2.25, and Synchronous is greater than 2.25 and Actual Equipment is greater than 2.25 and Special Environment is greater than 2.25 and Nonverbal cues is greater than1.75 and Multi-motoric is greater than 1.75, then the recommendation is to train in a live environment.
- If Domain is less than or equal to 2.25, and Team work Training is less than or equal to 2.25, and Synchronous is less than or equal to 2.25 and Actual Equipment is less than or equal to 2.25 and Special Environment is less than or equal to 2.25 and Nonverbal cues is less than or equal to 1.75 and Multi-motoric is less than or equal to 1.75, then the recommendation is to train in a virtual environment

In addition to these notional cutoffs, we have developed additional cutoffs to be evaluated during the validation of the model. These include the following:

- Anytime that Multi-motoric activity is frequent (3) then the recommendation is to train in a live environment.
- Anytime that Non-verbal cues are frequent (3) then the recommendation is to train the task in a live environment.
- Anytime that a special environment is essential (3) then the recommendation is to train in a live environment.
- Anytime that actual equipment is essential (3) then the recommendation is to train in a live environment.
- Any time Production/Service (3) is the domain then the recommendation is to train in a live environment.
- Anytime Teamwork training factor is high (3) then the recommendation is to train in a live environment.
- If the domain is Project/Development (1), then the recommendation is to train in a virtual environment, unless the cutoffs for Multi-motoric, non verbal, special environment of actual equipment specified above are met.

Individual Task Example

An example of individual task ratings, as displayed in the radar decision framework, is listed below. The task, shown in Figure 3, displays the ratings of an Army task for Radar Repairers (Monitor Bench Stock Operations) in comparison to the LV threshold. As shown, based on the assumption of the framework, this task *can* likely be trained in a virtual environment.

Figure 2. RADAR Decision Framework for Collective Tasks.

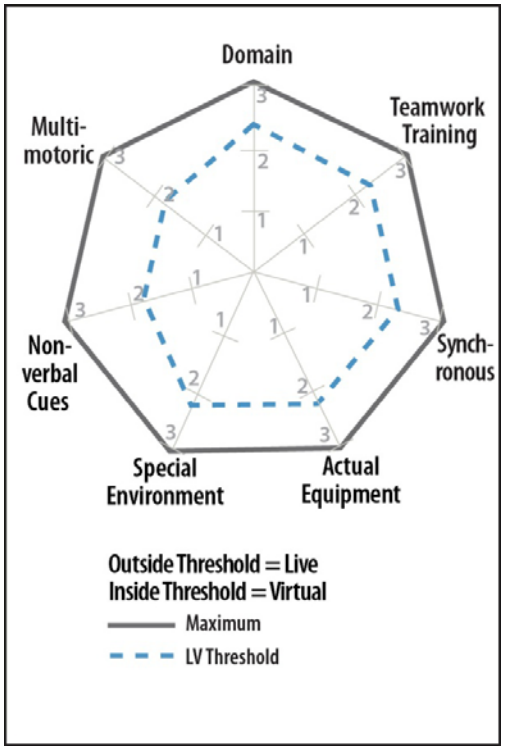
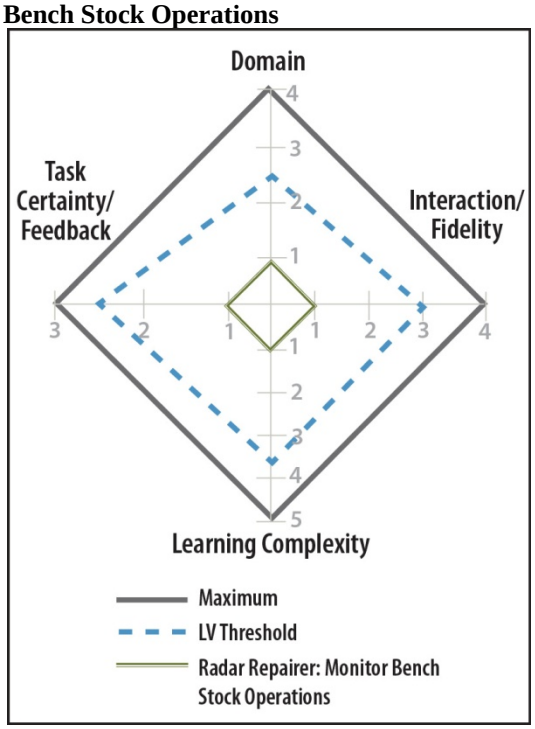


Figure 3: Radar Decision Framework for Individual Task – Radar Repairer: Monitor Bench Stock Operations



Inter-rater Agreement of Factor Ratings

The strategy for rating tasks across factors is dependent on development of consensus ratings from multiple raters. Therefore, dependence on agreement of raters during preliminary steps is mitigated. In order to gain additional insight into factors that influence consensus ratings, we examined the agreement among individual raters at this preliminary stage. Appropriate inter-rater agreement statistics were calculated for ratings of initial samples of tasks used to test the model.

For the individual task model, 154 tasks had individual rater data from two raters. Results of analysis of inter-rater agreement varied across factor scales based on data type (i.e., categorical, ordinal, scale) and varying scale levels (e.g., 3-, 4-, and 5-level scales). Examples include the Interaction/Fidelity and Learning Complexity factors. The average measure of interclass correlations (i.e., assuming average ratings across raters) for Interaction Fidelity is 0.6 and Learning Complexity is 0.7, supporting the strategy to use consensus ratings

Next Steps and Future Applications

Based on the tasks that we collected and rated to date, and our review of the literature, we have preliminary decision frameworks for both individual and collective tasks. The next step in this process will be to validate the model and get feedback from potential users. Based on the outcome, we will plan to revise and refine the decision framework to make it more useful for the intended user audience.

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Appendix D

Publication in *Military Training Technology*

Taking a Virtual Approach

Can, or should, training be virtual?

By Christina Curnow

Under the right conditions, there are noted benefits to a virtual approach to training military tasks, in terms of readiness, costs, effectiveness, and safety. With steady advances in technology, how can a planner decide whether to consider a technology-based solution (referred to here to as virtual) or utilize instructors and actual equipment?

Christina Curnow

This question is of interest to Frank DiGiovanni, director, Training and Readiness Strategy, Office of the Deputy Assistant Secretary of Defense (Readiness), who sponsored a study to construct a decision-making framework to indicate whether a military task can (not necessarily should) be trained through virtual methods or remain being taught through live methods. The study developed categorization schemes to classify individual and collective tasks by factors sensitive to instructional methods. The intention is to offer a front-end analytic tool as part of a service's larger decision-making process on training delivery.

Classification of Tasks

Although there are numerous task-categorization schemes designed for various purposes, the interest was in isolating factors sensitive to the live versus virtual training issue. Carl Rosengrant of OSD [Office of the Secreatry of Defense] stated, "We sought to develop a decision-making methodology that would require minimal training for subject matter experts to use in making an initial assessment, so when considering factors we sought to include the most relevant, rather than all possible, factors. We chose a simplified approach with a high, but not perfect, level of accuracy rather than a complex approach that may have greater refinement but is beyond everyday usage in the training community."

A review of relevant findings from the industrial psychology and training research literature, and discussions with experts, identified a set of categorization factors and criteria for grouping tasks into discrete categories, separately for individual and collective tasks. For individual tasks, the review encompassed models from numerous technical perspectives, such as time and motion analysis, Bloom's taxonomy, and cognitive task analysis. For collective tasks, the review included models from technical perspectives such as input-process-output, teamwork processes and temporal dynamics.

Integration of Perspectives

For individual tasks, an integration of these perspectives led to the development of four factors and several subfactors, each with its own scale. The main factors are: individual domain, learning complexity, interaction/fidelity, and task certainty or feedback. For collective tasks, the main factors are: collective domain, teamwork training, synchronous activity, and environmental conditions. The permutations result in 240 possible classes of individual tasks and 2,187 possible classes of collective tasks.

Decision-Making Framework

The framework assumes that tasks are going to be trained to a level sufficient for individual or team proficiency, as established by the service. Using the training method selected and that tasks deemed appropriate for virtual can be wholly taught through technology, with no live instructor input other than a human-in-the-loop for administrative procedures. The rating procedure requires that a subject matter expert and training analyst develop a consensus rating for each factor. The result may be plotted in a radar chart format. In general, tasks that are rated lower on each factor are candidates for instruction through virtual training while those high on each factor are candidates for live training, but there are gray areas.

The radar chart in the figure, a multivariate plot of rating values, presents a notional view of the framework for individual tasks. An L-V (live-virtual) threshold line, based on the current capabilities of training technologies commercially available, is depicted with a dashed line. Generally, individual tasks falling inside the dashed box are strong candidates for virtual training and those falling outside the box probably should be trained live. In the sample rating, the plot falls inside the box, suggesting a virtual method is viable for that task. A similar chart can be rendered for collective tasks. Of course, costs, safety factors and other considerations drive any final decision, so the result reflects only the raw capabilities of a virtual method for a given task.

The framework developed in the study is preliminary, and the services are invited to provide feedback. For further information on the study or the tool, contact Carl Rosengrant in the OSD Training and Readiness Strategy Directorate, carl.rosengrant.ctr@osd.mil. ✭

Christina Curnow is the principal at ICF International.

For more information, contact *MT2* Editor Brian O'Shea at briano@kmimediagroup.com or search our online archives for related stories at www.mt2-kmi.com.

Appendix E

e-Reporting Tool Programmer's Guide

Programmers Guide

This guide provides a brief overview of the components of the ***e-Reporting Tool*** and is intended for use by programmers with knowledge of Microsoft Excel and Visual Basic for Applications. This tool is to be used in conjunction with the ***User Validation Guide*** (***UVG***). The ***e-Reporting Tool***, as well as the **UVG**, was developed by ICF International in support of development of a Live/Virtual training decision aid for the Office of the Under Secretary of Defense, Training & Readiness (T&R). The ***e-Reporting Tool*** is meant to exist as an electronic conceptualization of the ***UVG***. Specifically, the ***UVG*** can be used in in a paper-based version or through the use of the ***e-Reporting Tool***. The ***UVG*** is based on extensive research, literature reviews, and interviews with subject matter experts. The ***e-Reporting Tool*** is simply an electronic version of the **UVG**. Changes to the structure, functionality, or programming of the ***e-Reporting Tool*** can potentially affect the original project and invalidate the original model.

Overview of Relationships

As depicted in Appendix B, the ***e-Reporting Tool*** exists as a Microsoft Excel workbook (OSD TMF) that consists of multiple interrelated worksheets and supported by Visual Basic for Applications (VBA) programming and UserForms. Further, each worksheet consists of Excel-based functions that yield results based on 1) user entered information (via UserForms) and 2) prewritten formulas, data, arrays, and graphs.

Additionally, the VBA programming is used to create Microsoft Word and additional Excel documents based on entered data saved within the workbook. The majority of this work exists 'behind the scenes' as the worksheet 'OSD_TNAS' serves as the document dashboard; all other worksheets are hidden from view. Command buttons in the 'OSD_TNAS' are linked to VBA coding within the worksheet itself. Once a user interacts with these buttons, the code is executed and the user progresses through the code (presented as UserForms) based on their selections.

UserForm Functionality

Once a user has selected which e-Reporting Method (*Manual Data Entry* or *e-Rating*) to use, a series of UserForms appear that 1) provide the user with an overview of the tool and instructions and 2) request user-related information and responses to a series of questions (or numerical values based on values obtained from the use of the **UVG** for the *Manual Data Entry* method). Appendix C depicts the process map for users who select the *Manual Data Entry* method. Appendix D depicts the process map for users who select the *e-Rating* method. All UserForms are documented with thorough notes. Additionally the code makes references to six (6) macros housed in Modules 1 – 6 respectively (*sumitandprint*, *submitandprint2*, *appquit*, *exporter*, *exporting*, and *merging*).

Additional labels, textboxes, radio buttons, and other data capturing methods can easily be added to any of the UserForms. The onus is on the programmer to determine where these changes should occur, how to use this information, and how these changes will impact the current structure of the worksheets, forms, and underlying VBA programming.

WORKSHEET FUNCTIONALITY

Within the workbook, a total of 14 worksheets exist. Only the OSD_TNAS worksheet is visible; the rest are hidden. Hidden worksheets are made viewable by right clicking the worksheets tab and selecting unhide. These worksheets are hidden for the user's protection; within each worksheet are predefined formulas that interact with other worksheets and the VBA programing. Changes to any of these cells without careful consideration can negatively impact the use of the tool, and even render it inoperable. Below, Exhibit 1 lists each worksheet and a brief description of its contents. Following Exhibit 1 is a walkthrough of the logic behind the tool.

Exhibit 1. Worksheet list and descriptions.

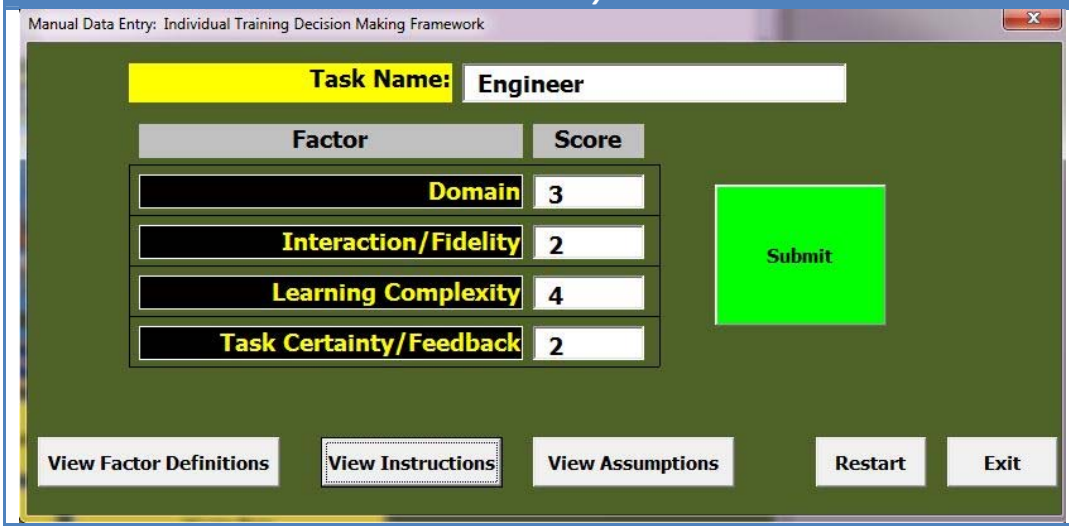
Worksheet	Description
OSD_TNAS	Serves as the ***e-Reporting Tool*** Dashboard. This is the only visible worksheet by default. From here a user can: 1) Use the *Manual Data Entry* method, 2) Use the *e-Rating* method, 3) Export data to the 'Your Saved Data', and 4) Merge data found in the 'Data to Merge' folder.
Intro	Information regarding Task Type (Individual vs. Collective), Task Name, and the decision of whether or not to use the *Manual Data Entry* or *e-Rating* method are stored in this worksheet in cell ranges A1:E4.
IndRate	Data for Individual task ratings (regardless of input method) are stored here. The range of cells used are A1:V7. Here responses are entered into a cell where a predefined formula makes use of logical and concatenation parameters to yield an alpha-numeric value for each question/response rating. For example, if the user selected response 1 for question A (questions are labeled as letters in ascending order), the worksheet would yield the value of 'A1'. This process continues across all questions in the range of C1: R3. These values are then concatenated to create a final alphanumeric string (ex. A1B1C1D1). This string is then matched to an array in the IndAlg worksheet and the corresponding decision associated with this string is yielded in cell V2. The rating process is outlined below, following the table. Additionally, predetermined rating caveats are also programmed in this worksheet.
IndAlg	Houses an array containing all possible rating permutations and each permutation's corresponding rating (i.e., LIVE, VIRTUAL, and POTENTIALLY VIRTUAL). The cells used in this sheet are in range A1:E240.
IndAns	Contains a final list of user responses for task ratings that include their rating as well as the text-based response that is affiliated with that rating. The predefined string is compared to user responses in the IndRate worksheet and populated using a logical IF function. The range used is A1:B16.
IndGraph	Values are taken from users responses housed in the IndRate worksheet and stored in a predefined array to automatically create a user Radar Chart based on rating factors, thresholds, and user responses.
ColRate	Data for Collective task ratings (regardless of input method) are stored here. The range of cells used are A1:AG10. Here responses are entered into a cell

Worksheet	Description
	where a predefined formula makes use of logical and concatenation parameters to yield an alpha-numeric value for each question/response rating. For example, if the user selected response 1 for question A (questions are labeled as letters in ascending order), the worksheet would yield the value of 'A1'. This process continues across all questions in the range of C1: W3. These values are then concatenated to create a final alphanumeric string (ex. A1B1C1D1). This string is then matched to an array in the ColAlg worksheet and the corresponding decision associated with this string is yielded in cell AA2. Additionally, predetermined rating caveats are also programmed in this sheet in cell range AB2:AG2. The rating process is outlined below, following the table.
ColAlg	Houses an array containing all possible rating permutations and each permutation's corresponding rating (i.e., LIVE, VIRTUAL, and POTENTIALLY VIRTUAL). Further caveats are programmed into the cells based on user responses. These caveats will appear in the worksheet ColRate when appropriate. The cells used in this sheet are in range A1:U2187.
ColAns	This sheet contains a final list of user responses for task rating that include their rating as well as the text-based response that is affiliated with that rating. The predefined string is compared to user responses in the ColRate worksheet and populated using a logical IF function. The range used is A1:B21.
ColGraph	Values are taken from users responses housed in sheet ColRate and stored in a predefined array to automatically create a user Radar Chart based on rating factors, thresholds, and user responses.
EXPORTERIND	Houses all user data for individual tasks. Upon submitting data via the Userform (OSD_DataEntryInd and OSD_IDMF), user info data (via UserForm OSD_UserInfo) and values from the IndRate worksheet are transferred to this worksheet. The current structure of this worksheet includes a header row. New values are placed underneath each row of data in an iterative process.
EXPORTERCOL	Houses all user data for collective tasks. Upon submitting data via the Userform (OSD_DataEntryCol and OSD_CDMF), user info data (via UserForm OSD_UserInfo) and values from the ColRate worksheet are transferred to this worksheet. The current structure of this worksheet includes a header row. New values are placed underneath each row of data in an iterative process.
MERGEDIND	Contains all merged individual data from the 'Data to Merge' folder. This sheet serves mainly as a template as each time a user merges data, a new workbook is created based on the data in this worksheet. The current structure of this worksheet includes a header row. New values are placed underneath each row of data in an iterative process.
MERGEDCOL	Contains all merged collective data from the 'Data to Merge' folder. This sheet serves mainly as a template as each time a user merges data, a new workbook is created based on the data in this worksheet. The current structure of this worksheet includes a header row. New values are placed underneath each row of data in an iterative process.

TOOL PROCESS OVERVIEW

This overview assumes that the user has begun a session with the *Manual Data Entry* method via the Dashboard (worksheet OSD_TNAS), has viewed the tool overview and instructions, has entered their user information (via the UserForm OSD_UserInfo), has selected to rate an individual task, and is inputting ratings via the UserForm OSD_DataEntryInd. Below is a screen shot of this user's ratings (Exhibit 1).

Exhibit 1: *Manual Data Entry* for Individual Task



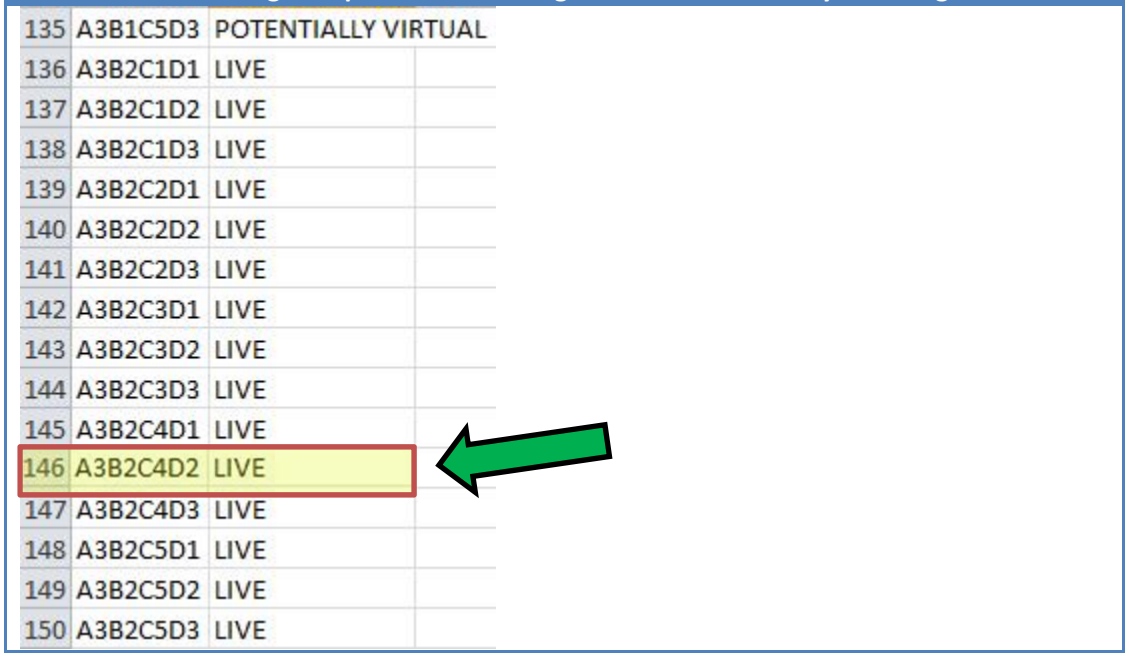
Once the user hits the Submit button, this information is transferred to the IndRate worksheet in the cells specified by the VBA coding. Predefined functions in this formula assign each user rating an alphanumeric value based on the question (starting with the letter "A" in ascending order) and user response (numerical values starting with 1 in ascending order). These responses are then concatenated to create a final alphanumeric string as shown in Exhibit 2. In this example the string is A3B2C4D2.

Exhibit 2: Creation of Alphanumeric String in IndRate Worksheet

C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
		TRUE			TRUE						TRUE			TRUE			
		A3			B2						C4			D2			A3B2C4D2

This string is then matched to an array that contains all possible permutations of responses and the respective decision (LIVE, VIRTUAL, POTENTIALLY VIRTUAL) in worksheet IndAlg as shown in Exhibit 3.

Exhibit 3: Matching of Alphanumeric String to Permutation Array in IndAlg Worksheet



135	A3B1C5D3	POTENTIALLY VIRTUAL
136	A3B2C1D1	LIVE
137	A3B2C1D2	LIVE
138	A3B2C1D3	LIVE
139	A3B2C2D1	LIVE
140	A3B2C2D2	LIVE
141	A3B2C2D3	LIVE
142	A3B2C3D1	LIVE
143	A3B2C3D2	LIVE
144	A3B2C3D3	LIVE
145	A3B2C4D1	LIVE
146	A3B2C4D2	LIVE
147	A3B2C4D3	LIVE
148	A3B2C5D1	LIVE
149	A3B2C5D2	LIVE
150	A3B2C5D3	LIVE

This row number (146) and decision (LIVE) are then placed in cells U2 and V2 respectively in the IndRate sheet as shown in Exhibit 4. This is the task decision value that will be yielded to users.

Exhibit 4: Yielded Decision Value in IndRate Worksheet

C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
		TRUE			TRUE						TRUE			TRUE					
		A3			B2						C4			D2			A3B2C4D2	146	LIVE

This process is followed for all individual tasks (regardless of method). The same process occurs for collective tasks, albeit with the use of worksheets and UserForms associated with collective task ratings.

EXPORTING AND MERGING DATA

Exporting Data

Upon submitting data via the Userform (OSD_DataEntryInd , OSD_IDMF, OSD_DataEntryCol and OSD_CDMF), two simultaneous processes occur. First, user info data (via UserForm OSD_UserInfo) and values from the IndRate and ColRate worksheets are transferred to the EXPORTERIND and EXPORTERCOL worksheets, respectively. The current structure of each worksheet includes a header row. New values are placed underneath each row of data in an iterative process. Second, a new workbook is created (based on the data and structure of the EXPORTERIND and/or EXPORTERCOL

worksheets). All individual ratings are exported to one workbook. Collective ratings are exported to a separate workbook. These workbooks are automatically saved with the following file naming mechanism (<Rater Name> <Task Type> <Timestamp>). This file is then automatically saved in the 'Your Saved Reports' folder. Users can then attach these files to an email to send the data to a data manager to merge into one Excel workbook using the Merging functionality (see below). The data found in the EXPORTERIND and EXPORTERCOL worksheets are retained until a manual deletion. When performing a manual delete, you must unhide the worksheet and delete all information, excluding the header row.

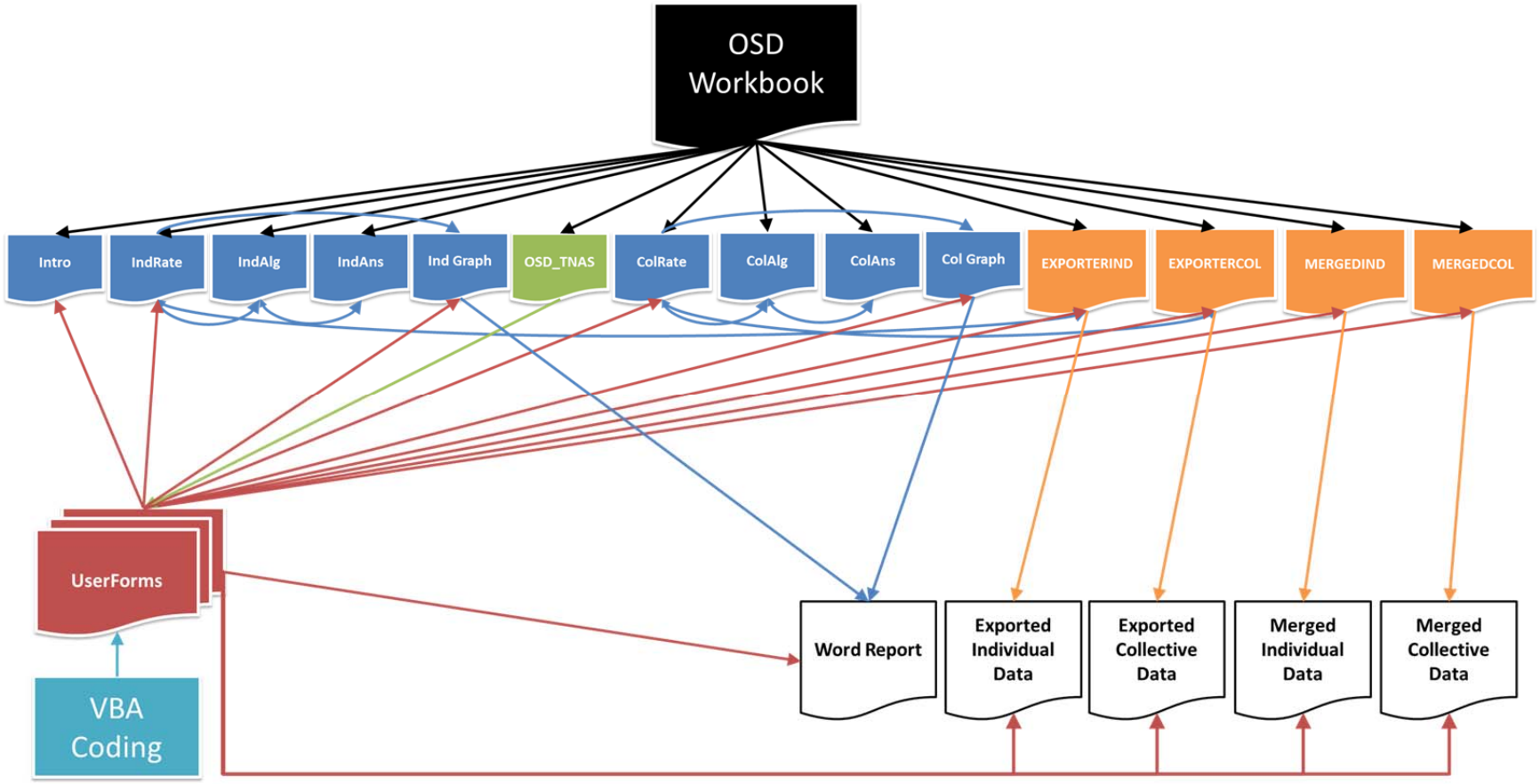
Merging Data

Only individuals tasked with merging data from multiple users (i.e., data manager) should use the merge functionality found in this tool. Users' exported data workbooks *can be* saved in the data manager's 'Your Saved Reports folder for archiving. However, all user workbooks (Individual and Collective) must be placed in the 'Data to Merge' folder to merge the data. Workbooks not in this folder will **not** be merged. After the desired workbooks have been placed in the 'Data to Merge' folder, the data manager will open the ***e-Reporting Tool*** and select the Merge Data button on the Dashboard.

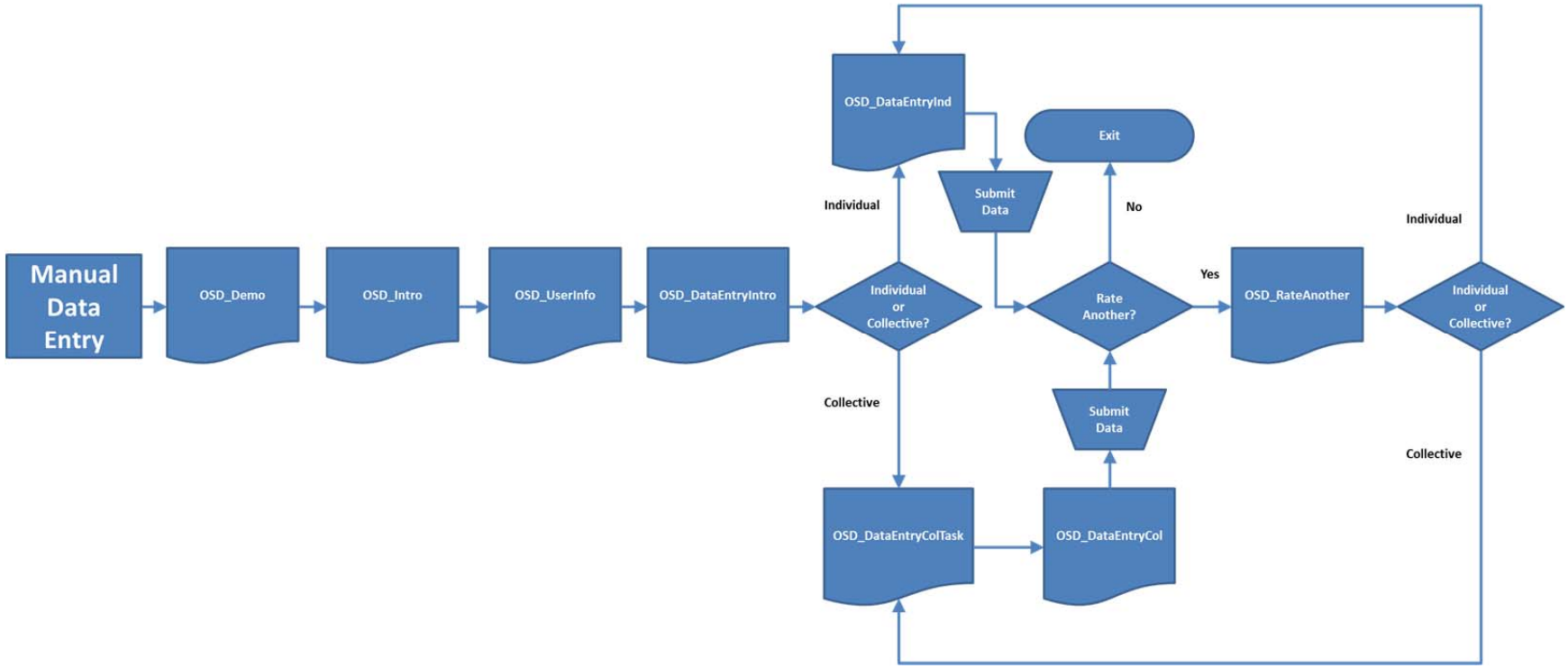
Upon hitting the button, two simultaneous processes occur. First, all data from the user workbooks found in the 'Data to Merge' folder are transferred to the MERGEDIND and MERGEDCOL worksheets, respectively. The current structure of each worksheet includes a header row. New values are placed underneath each row of data in an iterative process. Second, a new workbook is created (based on the data and structure of the MERGEDIND and/or MERGEDCOL worksheets). All merged individual ratings are exported to one workbook. Merged collective ratings are exported to a separate workbook. These workbooks are automatically saved with the following file naming mechanism ("'Your <Task Type> Merged Data " <Timestamp>). This file is then automatically saved in the 'Your Merged Data' folder. The data found in the MERGEDIND and MERGEDCOL worksheets are retained until a manual deletion. When performing a manual delete, you must unhide the worksheet and delete all information, excluding the header row.

Managing Duplicate Data. To avoid the merging of duplicate data, it is important to purge the 'Data to Merge' folder after merging an exported data file. However, it is still possible to merge duplicate data even if merged files have been removed from the 'Data to Merge' folder. If a user sends an exported data file to a data manager more than once and the user's EXPORTERIND and EXPORTERCOL worksheets have not been deleted between submissions, subsequent versions of this user's exported file **will** contain data from tasks previously rated by the user. Thus, it is important to use Microsoft Excel's 'Remove Duplicates' feature before running any analyses to ensure that duplicate data are not erroneously retained.

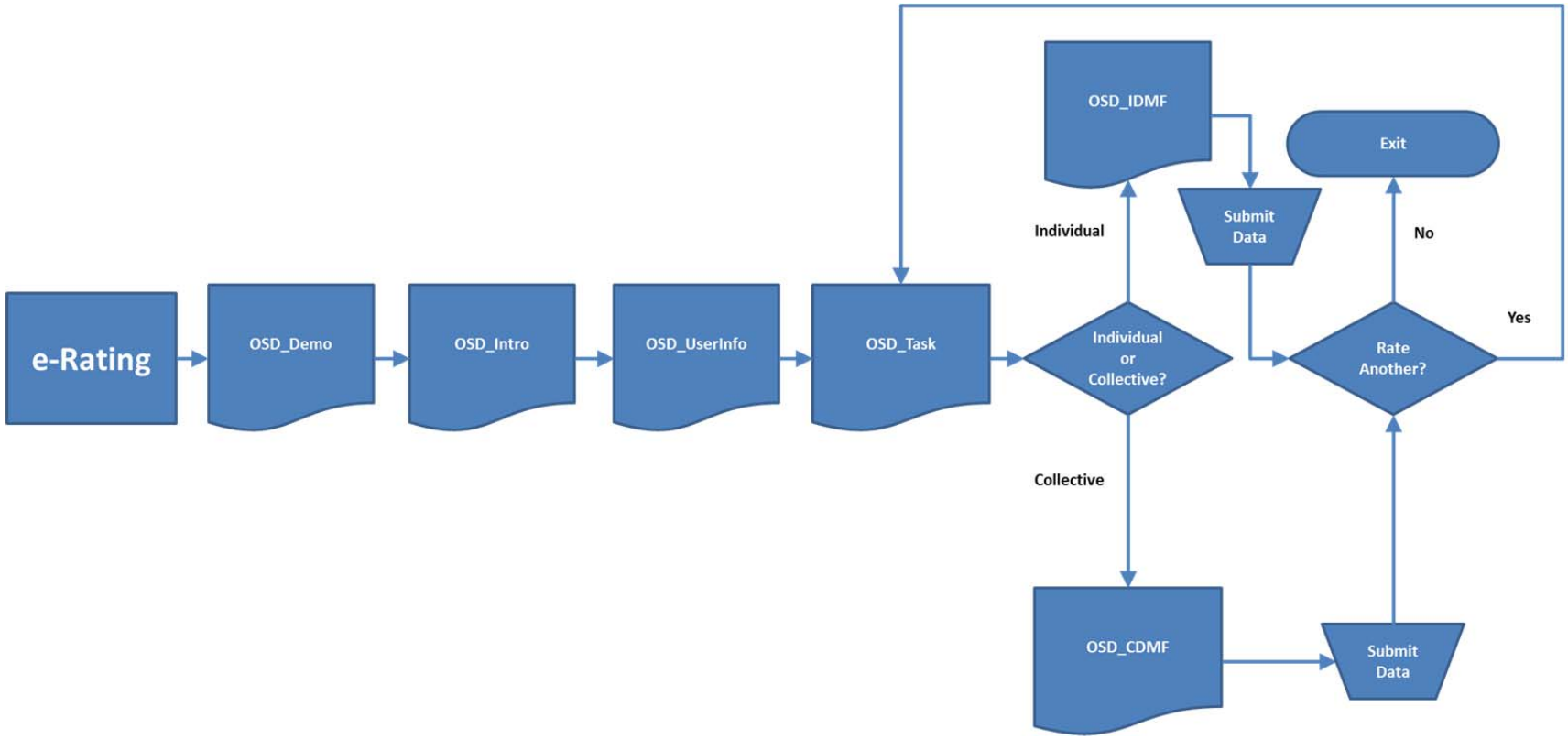
Appendix B – Overview of Relationships


OSD Workbook
Intro
IndRate
IndAlg
IndAns
Ind Graph
OSD_TNAS
ColRate
ColAlg
ColAns
Col Graph
EXPORTERIND
EXPORTERCOL
MERGEDIND
MERGEDCOL
UserForms
VBA Coding
Word Report
Exported Individual Data
Exported Collective Data
Merged Individual Data
Merged Collective Data

Appendix C – Manual Data Entry UserForm Process


Manual Data Entry
OSD_Demo
OSD_Intro
OSD_UserInfo
OSD_DataEntryIntro
Individual or Collective?
Individual
Collective
OSD_DataEntryInd
Submit Data
OSD_DataEntryColTask
OSD_DataEntryCol
Submit Data
Rate Another?
Exit
No
Yes
OSD_RateAnother
Individual or Collective?
Individual
Collective

Appendix D – e-Rating UserForm Process


e-Rating
OSD_Demo
OSD_Intro
OSD_UserInfo
OSD_Task
Individual or Collective?
Individual
Collective
OSD_IDMF
Submit Data
OSD_CDMF
Submit Data
Rate Another?
No
Yes
Exit