

# Closing the Contextual and Chronological Gap: An HPT Tool for the Selection of Learning and Performance Support Interventions

**James Knapp III**  
**United States Coast Guard**  
**Hampton, Virginia**  
**james.knapp@uscg.mil**

## ABSTRACT

Gaps in human performance resulting from a lack of skills and knowledge require solutions—interventions. The process of selecting the most effective intervention (solution) for closing a skills and knowledge gap—such as classroom training, e-Learning, Structured on-the-job Training (SOJT), or job-aid—is a fundamental and vital practice for Human Performance Technology (HPT) practitioners. Unlike other activities in the Performance Improvement/HPT (PI/HPT) model, the activity of intervention selection is ambiguous. Meaning, there is currently no systematic process or tool in place for selecting learning and performance-improvement solutions that is reflective of the learning science. Consequently, the critical activity of intervention selection is often more art than science, especially in contrast to other phases of the PI/HPT model.

HPT is, first and foremost, a technology. HPT practitioners apply scientific and organized knowledge to practical ends using rigorous inquiry to provide initial evidence of possible interventions for performance gaps (Stolovitch, 2015). The results-driven approach of HPT empowers performance-improvement practitioners to select and design interventions that are beyond the scope of traditional classroom training. The ambiguity of the intervention selection process presents a persistent challenge for HPT practitioners when selecting between learning and performance-support solutions as well as determining specific modalities for delivery.

The United States Coast Guard have been exemplar practitioners of HPT for over two decades, but the need for a systematic intervention selection methodology persisted. To address the need for a new process, a systematic decision-aid tool was developed called the Learning Intervention Type and Modality (LITAM) tool. The tool was designed to integrate seminal literature and research in the learning science field relative to train-to-memory decisions, and modalities of instruction. The LITAM tool was put through rigorous field-testing and evaluations, which validated that these new methods for generating performance intervention recommendations were both accurate and effectual. This paper shares the factors and implications for systematizing the intervention selection process for closing human performance gaps.

## ABOUT THE AUTHOR

**James Knapp III** is an instructional designer and human performance technologist with the United States Coast Guard. As an instructional designer for the Coast Guard, his work is centered upon designing Advanced Distributed Learning (ADL) interventions as well as finding innovative means of delivering learning and performance support solutions for the contextual needs of performers in the field. He is currently a Ph.D. candidate at Old Dominion University in the Instructional Design and Technology program, where he also earned his Master of Science degree. His research interests include the influence of cognitive science upon learning interventions, use of performance support to facilitate situated learning, integrating experiential data (xAPI), and the relationship between situated and structured learning,

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## INTRODUCTION

The challenge of applying Human Performance Improvement (HPI) principles, specifically through the activity of intervention selection for closing skills and knowledge gaps, remains an ambiguous domain and one in need of a scientific approach. The Performance Improvement/Human Performance Technology (PI/HPT) model provides the conceptual framework for using the activity of selecting interventions (solutions) as the cornerstone for change management. The PI/HPT model uses a series of scientific strategies for improving performance, but some phases are more systematic than others. For example, the process of identifying performance gaps and their respective root causes is both systematic and methodical—but the activity of intervention selection is not; intervention selection is an imperfect and ambiguous endeavor (Stolovitch, 2004). There has been a void in the performance improvement field in that there has been no validated intervention selection tool that is both systematic and reflective of the learning science literature. A skills and knowledge gap may be best met with different interventions, such as classroom instruction, self-paced online learning, electronic performance support systems (EPSS), or facilitated virtual training. Consequently, vital decisions relative to selecting interventions are left to the discretion of those who may, or may not, be intimate with the learning science.

The United States Coast Guard (USCG) have been exemplar practitioners of HPT for over two decades, but the need for a systematic intervention selection tool persisted. Therefore, the necessity to embed elements of learning science into a systematic intervention selection tool was the impetus for the design of the Learning Intervention Type and Modality (LITAM) tool. The LITAM tool uses a series of critical learning theories as decision factors for selecting interventions. It was constructed specifically for USCG HPT practitioners who have a foundational knowledge of critical theories relative to HPI, adult learning (andragogy), and instructional design. As the end-users of the tool, USCG HPT practitioners generally have a graduate level education in HPT or instructional systems design and serve as analysts or designers who specialize in identifying and closing human performance gaps that involve skills and knowledge. Furthermore, the LITAM tool (see Figure 1 for a sample intervention report) is web-based so that USCG HPT practitioners can access the tool from anywhere on the USCG network. This paper discusses the factors that influenced the design of the tool and how the tool was constructed to make critical intervention selection decisions.

## DEMAND SIGNAL

**Training is expensive and resource intense.** Organizations that have provisional limitations must be certain that training is truly needed so that constrained resources are allocated efficiently; therefore, training, like surgery, should be treated as a last resort (Mager, 1997). In doing so, a determination has to be made as to what is actually needed to improve human performance when closing a skills and knowledge gap—information or knowledge. Although the terms of information and knowledge are often synonymous, they are distinct. Gilbert (1978) posited that information existed at the environmental level while knowledge existed within individual repertoire. This dichotomy is addressed in the first decision point of the LITAM tool by first determining what is more appropriate for a skills and knowledge gap, performance support (information) or training (knowledge). The work of Joe Harless (1994) provided a theoretical framework for information storage and suggested that information storage in human memory is seldom needed when a job-aid suffices. Consequently, Harless provided the field of HPT a new dichotomy for addressing skills and knowledge gaps by determining if information related to skills and knowledge needed to be stored in “long term memory” (internally) or in a “job-aid” (externally). Gustafson (2000) addresses this dichotomy by recommending that practitioners first determine if the goal is *black box*—supporting performance without intentionally increasing the user’s skills or *glass box*—intentionally increasing a user’s independent skills and knowledge. The consideration of

interventions beyond training unlocks the possibility of providing real-time performance support to employees as they perform their job rather than sending them to formal training events disconnected from the work. (Lanese & Nguyen, 2012). Taking a systematic approach to determining when training is actually needed allows leadership to allocate resources accordingly, knowing that training is only utilized when performance support (job-aid) is not sufficient.

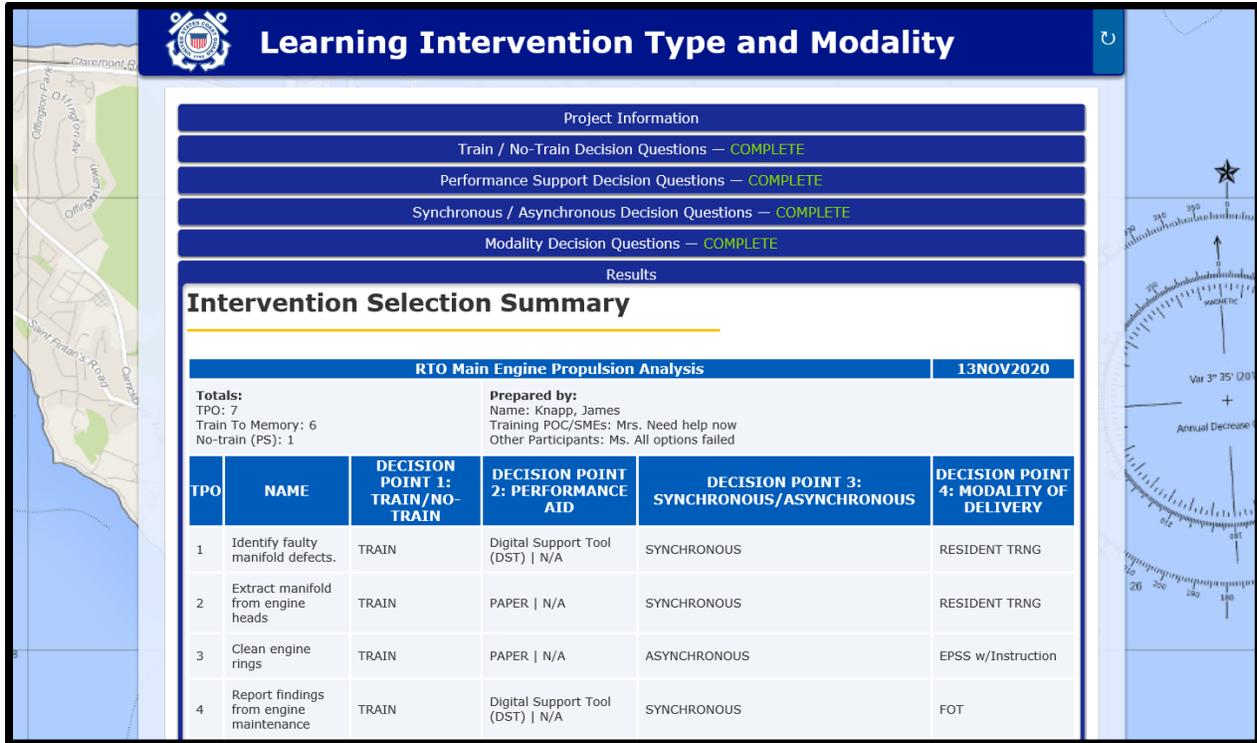


Figure 1. Learning Intervention Type and Modality (LITAM) Decision-aid Tool (Summary Report)

When training is truly needed, the process of selecting the optimal modality for instruction becomes critical for achieving learning outcomes. For example, selecting the most effective means of delivering training became a critical concern when the COVID-19 pandemic impacted USCG classroom training program in 2020. Because of a need to limit resident (RES) (classroom) instruction, learning objectives that were previously delivered in the classroom had to be re-examined to determine what was suitable for other modalities of instruction, particularly online instruction, in an effort to reduce the classroom training footprint. During the COVID-19 pandemic, the USCG successfully deployed many (approximately 60) of their RES training programs to online environments, which poses the question moving forward—what is truly the best modality for instruction? The LITAM tool provides a systematic methodology for determining which learning objectives need to be delivered in traditional classroom (RES) environments and which objectives can be delivered via online modalities, such as self-paced e-Learning (SPeL) or facilitated online training (FOT). Additionally, the tool provides recommendations (Figure 1) for each instructional task (as seen on Decision Point 4 of report) on the intervention selection summary report, which provides the optimal modality of instruction for each task such as SPeL, RES, FOT, or structured on-the-job training (SOJT), and does so based upon learning science, context of the performance environment, experience and expertise of the learners, and the moment of need.

### CONCEPTUAL FRAMEWORK

The conceptual framework for the LITAM tool was based upon the foundations of the PI/HPT model (Van Tiem et al., 2012) as adopted by the International Society of Performance Improvement (ISPI). The PI/HPT model "...represents a unifying process that helps accomplish successful change, create resiliency and sustainability, and make things better in the workplace" (Dessinger et al., 2012, p. 10). Specifically, the LITAM tool is an abstraction of the *Intervention Selection, Design, and Development (ISD&D)* stage (see Figure 2) of the PI/HPT model; the tool

isolates a particular activity from the model and precisely addresses performance gaps resulting from skills and knowledge gaps. The ISD&D stage offers several types of performance interventions, but only two are relative to closing skills and knowledge gaps: (1) learning and (2) performance support. The LITAM tool was designed to systematize the critical delineation between the need for learning (training) versus performance support (job-aid).

The tool's creation was also a consequence of the author's professional experience with performance-intervention projects as an instructional designer. When an analysis validates that performance in the workplace is less than optimal because of a lack of training, selecting the appropriate type of learning intervention (solution) to close a skills and knowledge gap with a target population of performers is just as important as the design of the learning strategies used within the solution. The initiation of the tool was also reflective of previous research investigating how USCG practitioners select interventions. Research (Knapp, 2019) found that most intervention-selection decisions in the USCG Training System (TRASYS), even those made by experts, were reflective of practitioner preferences and inclinations, and that systematic models or tools were seldom utilized. Additionally, the study found that there was a lack of standardization for the selection of interventions across the USCG TRASYS, as indicated by the finding that over 20 different methodologies were reported being used by practitioners in the field. The lack of standardized and systematic processes across the enterprise supported the need for the integration of more data-driven tools into critical TRASYS decisions. Extensive research was conducted to determine if a commercial-off-the-shelf (COTS) tool already existed that systematized the intervention selection process. Nothing has been developed of this nature previously.

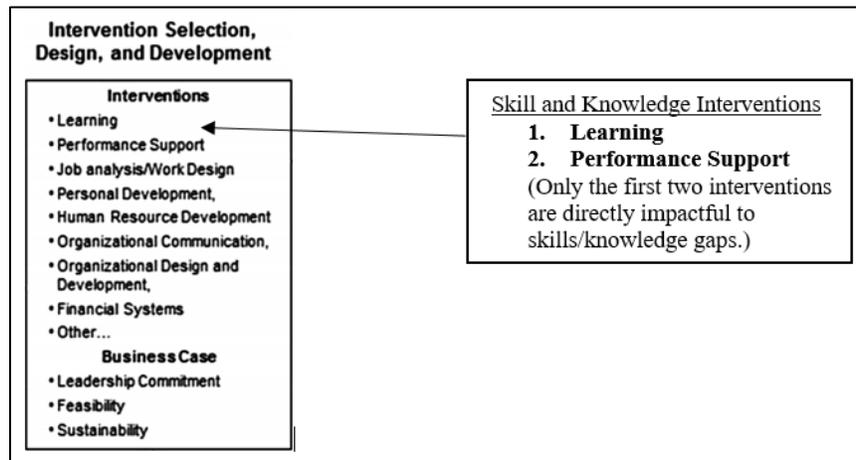


Figure 2. Intervention Selection, Design, and Development Stage of PI/HPT Model

One of the implications from the research findings was that the USCG TRASYS could benefit from more data-driven decision-aid systems, such as the LITAM tool. The need for more data-driven decision systems was central to the summation of the research findings conveyed by Andrew McAfee and Erik Brynjolfsson (2017) in *Machine Platform Crowd: Harnessing our Digital Future*. When McAfee and Brynjolfsson (2017) examined over 100 empirical studies and directly compared the predictions of human experts and data-driven systems, the researchers found overwhelming support for the use of data-driven systems. The study could only locate even a weak tendency in six comparisons in favor of the experts and posit that when a systematic model can be created and tested, it tends to perform as well as, or better than, human experts making similar decisions.

## DESIGN

The intent in creating the LITAM tool was to build upon the foundations of the HPT model offered by Van Tiem et al. (2001; 2004; 2012), who persistently conveyed the activity of intervention selection as a succinct and pivotal activity of performance improvement. Additionally, the LITAM tool was designed to integrate seminal research in the field relative to the Train versus Performance Support (job-aid) decision and modalities of instruction. The LITAM tool specifically addresses skills and knowledge gaps by first deciding whether learning (training) or performance support (job-aid) is more appropriate, and then determining which intervention would be most effectual by examining when and where performance occurs. The LITAM tool integrates multiple domains relative to learning science and

HPT. As presented in Table 1, the design was influenced by pivotal research in the fields of HPT, learning science, intervention selection, dichotomy between learning and performance support, and modalities of instruction.

**Table 1. Influences Categorized by Domain**

<b>LITAM Tool Influences by Domain</b>		
<b>Learning</b>	<b>L</b>	Bandura, 1977; Bloom, 1986; Brown, Collins, & Duguid, 1989; Gagne, 1985; Knowles; 1978; Lave & Wenger, 1990
<b>Intervention</b>	<b>I</b>	Deterline & Rosenberg, 1992; Langdon, Whiteside, & McKenna, 1999; Pershing, 2006; Spitzer, 1991; Van Tiem, Moseley, & Dessinger, 2012
<b>Type</b>	<b>T</b>	Gilbert, 1978; Harless, 1994; Lave, 1988; Molenda, & Pershing, 2004; Rossett & Schaffer, 2007; Stolovitch & Keeps, 2011
<b>and</b>	<b>A</b>	
<b>Modality</b>	<b>M</b>	Dean & Ripley, 1998; Gottfredson & Mosher, 2012; Rummler & Brache, 1990; Tessmer & Richey, 1997; Zaguri & Gal, 2016

## DECISION POINTS

The LITAM tool is a web-based application designed to provide USCG HPT practitioners with a means of systematically conducting the vital activity of intervention selection. It systematically arrives at four critical decision points, each one building on the previous to ultimately arrive at the appropriate intervention needed to close a skills and knowledge gap. The four decision points are listed in the same sequence in which they are presented in the tool.

1. train/job-aid decision
2. performance support recommendation
3. synchronous/asynchronous decision
4. modality of instruction decision

Each decision point utilizes a series of questions through dynamic-decision paths, which impact potential selections through the progression of all four decision points. For example, if the decision to train has been made and a synchronous determination is made, the remaining questions about modality of instruction will be channeled upon selecting the most appropriate synchronous training solution. Examples of such training solutions are FOT, SOJT, or classroom (RES) instruction. The same dynamic principle applies, regardless if the user is selecting an asynchronous intervention or performance support when the job-aid determination is made.

The LITAM process begins when the user enters project-specific data into the opening page (see Figure 3) of the tool. The accuracy and completeness of the administrative data entered on the opening page is critical because it is conveyed on the intervention-selection summary report, which is part of the tool's systematic output. The opening page of the tool also includes information that is fundamental for placing the tool's selections in context with the particulars of the project.

The systematic nature of the tool makes appropriate data critical; poor input may result in poor output. In order for the LITAM tool to generate a valid intervention recommendation, three vital elements of data are required to ensure accurate selections.

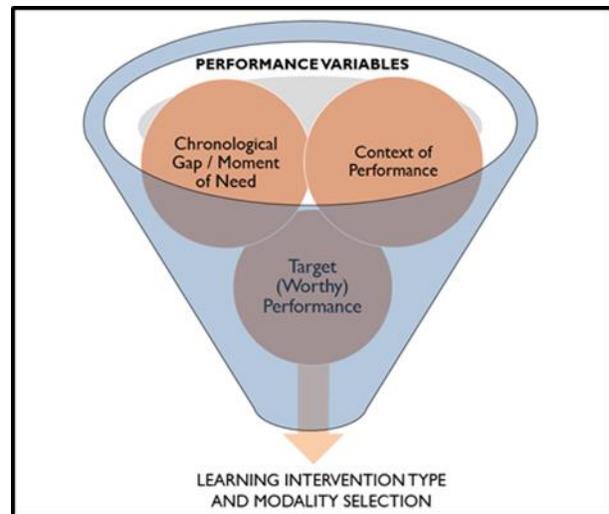
- target performance at the task level
- context of the performance environment, including target population
- performers' moment of need

**Figure 3. Opening Page of the Learning Intervention Type and Modality (LITAM) Decision-aid Tool**

These three performance variables (see Figure 4) are critical to the intervention-selection process, particularly for selecting an intervention that closes the contextual and chronological gaps that often persist with traditional training interventions. All selections are generated at the task level; therefore, having data from some type of performance analysis is vital. After entering the administrative components of a project into the opening page, the LITAM tool begins with Decision Point 1—the Train/Job-Aid decision. The Train/Job-Aid decision utilizes several factors relative to the dichotomy of whether information supporting a skills and knowledge gap needs to be stored internally in long-term memory or externally in some type of performance support. The Train/Job-Aid selection is determined by the following factors.

- the chronological gap between skill/knowledge acquisition and application on the job
- subjectivity of performance steps within a task to change
- frequency level of task performed on the job
- necessity for speed, from task stimuli to response
- consequence of error if task is not performed properly
- type of cognitive behavior: rote association/abstraction, discrimination/generalization, or procedural/sequential
- worthy performance needed at initial stimuli

As discussed, the LITAM tool utilizes a series of queries—such as those seen in Figure 5—that reflect the factors for each decision point. For each query in the tool, there is a contained set of options that impacts the direction of the selection path within each decision point. To arrive at the appropriate selection, the responses to the queries must accurately reflect the dynamics of the performance variables at the task level with an emphasis on the outcome of performance—the accomplishment.



**Figure 4. Conceptual Model of Performance Variables**

**Q5**

What type of **cognitive behavior** is involved?

Rote association/Abstraction

Discrimination/Generalization

Procedural/Sequential

---

**Q6**

What is the **consequence of error** with this task?

Dire (Intolerable: death, severe injury, intolerable economic impact)

High (injury, hazard, economic penalty – but not devastating)

Manageable (no considerable hazard or economic loss – but would require correction)

**Figure 5. Sample Queries**

Decision Point 2 determines what type of performance support is appropriate for each task. The value of Decision Point 2 is applicable to the Train/Job-Aid selection. In the event that a Job-Aid selection is determined, the LITAM tool selects a specific performance-support (job-aid) intervention. Even if a Train selection is identified in Decision Point 1, a performance support alternative is still generated. Training interventions are often expensive and resource intense; consequently, decision makers are usually left with an impractical option for addressing performance deficiencies. The LITAM tool ultimately provides a performance-support alternative for every task, and thereby leaving decision makers with a broader—and often times more practical—set of options for improving performance.

Decision Point 2 is designed to select a specific performance-support (job-aid) solution. The LITAM tool determines whether performance support needs to be in paper or digital form, requires expert decision-making capacity, and necessitates mobile delivery. Additionally, Decision Point 2 will take a holistic view in determining whether an EPSS is justified. This is done by quantifying the responses for all of the performance tasks from a specific project through a set of EPSS criterion. Ultimately, the performance-support recommendation for Decision Point 2 is determined by the following factors.

- digital versus analog delivery feasibility
- quantity of steps and content (information) supporting the task
- need for performance modeling (demonstration of task)
- complexity of task and need for decision-making support
- mobility of performers under normal task conditions
- context of the performance environment

Before establishing the appropriate potential modality of instruction, Decision Point 3 determines whether each task is best delivered synchronously or asynchronously. Doing so provides a recommendation for selecting instructional strategies and concurrently narrows the options of potential interventions. Some instructional solutions are typically synchronous in nature, such as classroom (RES) instruction, while other solutions are normally designed for asynchronous delivery, such as SPeL. By first determining whether task-level instruction is best presented synchronously or asynchronously, the options for the modality of instruction decision (Decision Point 4) are centered upon methods that support synchronicity discernment and benefits. The synchronous/asynchronous decision point utilizes the following factors.

- complexity of the cognitive acumen using Bloom's Taxonomy
- need for safety oversight or physical supervision
- conditions and need for collaboration with others (teamwork)
- need for coaching or scaffolding
- experience and expertise (level) of the target performer
- performers' "moment of need"
- potential need for accessing learning support (anytime, anywhere)

Finally, Decision Point 4, the modality of instruction decision, provides a specific learning intervention for a skills and knowledge gap. The modality of instruction selection is only presented if training was selected during Decision Point 1. Decision Point 4 generates a selection from a defined set of options in the USCG TRASYS repertoire of learning solutions. The training interventions offered through the TRASYS include RES, FOT, SOJT, exportable (mobile) training teams (known as ETT), and SPeL. Therefore, Decision Point 4 recommends the most effective of these five learning solutions. The LITAM tool closes the transfer gap, from training to application, by examining the desired context of performance as well as the feasibility to learn in the same environment in which performance will occur. Ultimately, Decision Point 4 leverages the following critical factors to make the final intervention selection recommendation.

- the potential need for indoctrination or acculturation into an organization
- facilitation of optimal critical decision making and development environments
- supervision presence to prevent loss of life, limb, or money
- task behavior relative to cognitive, psycho-motor, or affective
- context of performance environment
- the need to use tools or equipment and feasibility of coming offline at the organizational level
- standardization of training and viability of doing so at organizational level
- potential need for performance modeling and cognitive apprenticeship

With each of the four selection points in the tool, users are presented a series of queries that address the aforementioned factors. To determine the appropriate queries, the LITAM tool utilizes a series of consequential decision paths for each of the four critical selections. The responses to the queries impact the navigation within a decision path, and ultimately, the selection for that decision point.

Furthermore, the LITAM tool is adaptive so that user options are dynamically reactive and unique to the responses of each previous query. This allows tailored selections to be generated for each task entered into the tool. For example, if a user selects that a task behavior is primarily *cognitive* in nature, they will be posed with a follow-up question concerning the context of performance, while if the user selects that the same task is *affective* in nature, they will receive a follow-up question concerning the need for physical (non-verbal) affirmation. Therefore, each user experience is unique and the questions posed for any given performance task is unique to the characteristics of that task.

Once all of the required input data have been entered into the LITAM tool, a summary report is generated that provides specific recommendations for each decision point relative to each task entered into the tool. The summary report (see Figure 6) is also designed to serve as a consulting tool for sharing intervention selection results with customers and stakeholders.

## CONTEXTUAL AND CHRONOLOGICAL GAPS

The LITAM tool is designed to close the contextual and chronological gap associated with learning- and performance-support interventions. A fundamental principle in the design is that **it is better to have a learned workforce rather than a trained workforce**. That is, the outcome (learning and performance) of an experience is more important than the training episode itself. Training is often episodic, while learning can be ubiquitous and persistent. This is not to imply that training is not fundamental, but rather that training that does not address the context of performance (where) and learners' moment of need (when) is simply wishful thinking and less optimal for the necessity for learning transfer.

Results					
Intervention Selection Summary					
RTO Main Engine Propulsion Analysis					13NOV2020
<b>Totals:</b> TPO: 7 Train To Memory: 6 No-train (PS): 1			<b>Prepared by:</b> Name: Knapp, James Training POC/SMEs: Mrs. Need help now Other Participants: Ms. All options failed		
TPO	NAME	DECISION POINT 1: TRAIN/NO-TRAIN	DECISION POINT 2: PERFORMANCE AID	DECISION POINT 3: SYNCHRONOUS/ASYNCHRONOUS	DECISION POINT 4: MODALITY OF DELIVERY
1	Identify faulty manifold defects.	TRAIN	Digital Support Tool (DST)   N/A	SYNCHRONOUS	RESIDENT TRNG
2	Extract manifold from engine heads	TRAIN	PAPER   N/A	SYNCHRONOUS	RESIDENT TRNG
3	Clean engine rings	TRAIN	PAPER   N/A	ASYNCHRONOUS	EPSS w/Instruction
4	Report findings from engine maintenance	TRAIN	Digital Support Tool (DST)   N/A	SYNCHRONOUS	FOT
5	Determine spark and combustion feasibility	NO-TRAIN (PS)	Digital Support Tool (DST)   MOBILE	N/A	N/A

Figure 6. Intervention Selection Summary Report

**The focus is on learning.** Learning, by definition, is a persisting change in knowledge, skill, attitude, and overall capacity for performance as a result of experience. Training and other intervention types can be thought of as experiences designed to promote learning. To put learning first is to recognize the primacy of the learning experience in making decisions relative to a whole host of instructional choices, especially intervention type and modality selections. Therefore, the selection of interventions (solutions) should be based upon the premise that it ultimately more important to have a learned workforce than a trained workforce; thus, supporting the critical nature of the Coast Guard mission which requires far-transfer and adaptability during dynamic situations.

**A learning experience is a contextual phenomenon—the where, when, how, and with whom of a learning experience shapes the occurrence.** Learning and context are, therefore, inseparable. To be more effective, a learning experience should be contextualized within the framework of where, when, how, and with whom the new skills or knowledge will be applied on the job. For far too long, the focus has been on delivering instruction in the classroom or how best to replicate the classroom in an online learning environment. Both of these focuses are void of the target context for job performance.

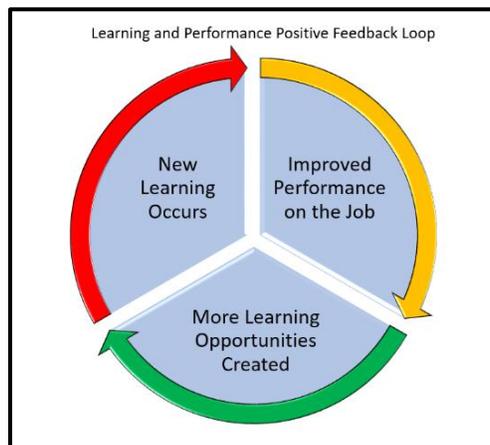


Figure 7. Learning and Performance Positive Feedback Loop

Tessmer and Richey (1997) suggest that context has a complex and powerful influence on successful performance-based learning, and yet is largely ignored—or at the least de-emphasized—in most instructional models. Moreover, Tessmer and Richey (1997) posit that a lack of contextual consideration is the reason that many instructional interventions fail over time. A focus on learning in context closes the (learning) transfer gap between skill acquisition and skill application because learning occurs in the same context in which it is to be applied. This emphasis on contextual learning ensures the where, when, how, and with whom that so fundamentally define the experience are fully comprehended before a specific type of experience or intervention is selected.

**The LITAM tool also aims to close the chronological gap associated with training by focusing on learners’ moment of need.** This concept has been expressed many ways, including “point of performance,” “on-demand,” or “just-in-time,” but the premise is the same. Learning is often most impactful when a job situation demands the application of skills or knowledge in real time in order to solve a real problem.

When learning support is made available at the point of performance, the chronological gap between learning and application is diminished as learning immediately becomes inherent to performance. Furthermore, learning at the moment of need not only makes the learning experience more meaningful, it produces a dynamic in which performance produces situated learning outcomes (learning occurs as a secondary consequence of performance). This dynamic creates a positive feedback loop (see Figure 7) in which learning informs performance and performance promotes learning.

The concept of the moment of need is significantly consequential to intervention selection and the dichotomy between learning and performance support. The dynamic relationship between learning and performance support was advanced through the work of Gottfredson and Mosher’s “Five Learning Moments of Need” model (see Figure 8). The model details five moments (situations) that span the spectrum of learning- and performance-support opportunities that performers might encounter when arriving at competency.

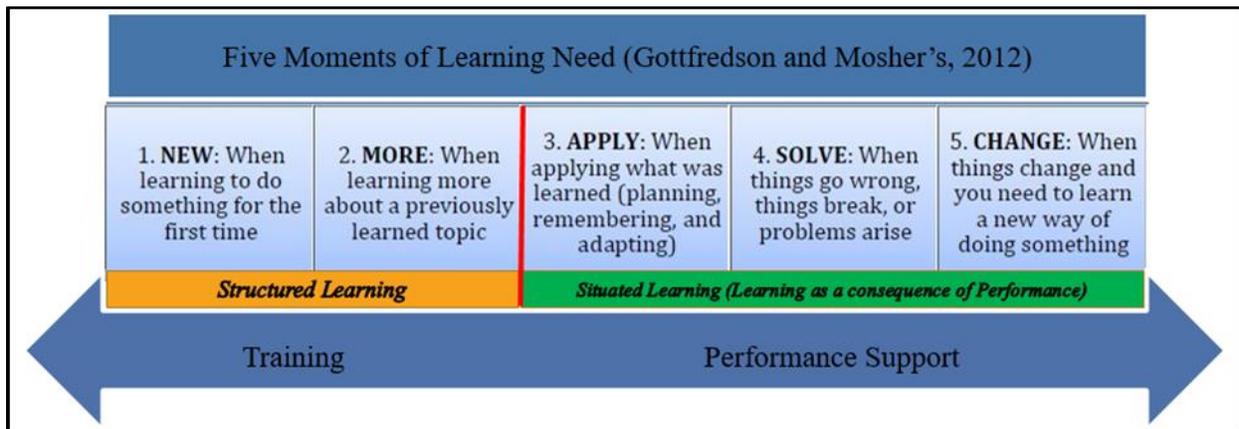


Figure 8. Five Moments of Learning Need<sup>1</sup>

The first two moments of need in the model refer to traditional learning situations: *new* learning for the first time and then learning *more*. The subsequent three moments relate to situations in which learning occurs in the context of performance, often during the job when skills and knowledge are required in real time. These moments are *applying* knowledge at point of performance, *solving* unanticipated problems, and *change* in the work environment. Using the moments of need framework suggests that training may be more appropriate for the first two moments (new learning and more learning), while performance support may be appropriate for the subsequent three moments (applying knowledge, changing situations, and solving problems).

The moments of need framework is often reduced to the time of performance; however, context is still critical to understanding the chronological gap. A moment of need is often influenced by the dynamics of the performance

<sup>1</sup> Adapted from Gottfredson and Mosher 2011. The five moments of need are theoretically merged with Knapp’s conception of structured learning versus situated learning.

environment; the where, how, and with whom significantly influences the when. A focus on a particular moment of need promotes the selection of customizable learning- and performance-support interventions that can be readily accessed when the need arises and in the context of performance. To close the chronological gap, interventions should be considered through the moments of need framework, as influenced by the context of performance, so that the design of learning experiences becomes so intimately connected with real performance that they become virtually synonymous.

## VALIDATION AND TESTING

Overall, the study utilized 10 different data collection methods to evaluate and advance the development of the LITAM tool. This was an iterative approach that utilized a cyclical process of evaluation by collecting data, analyzing results, making tool improvements, and evaluating again. The methods and results for each phase are summarized below as well as in Table 2.

Once a rough prototype of the LITAM tool was constructed, field-testing was performed. The author utilized a design and development research approach to validate and evaluate the tool's efficacy and efficiency, as the approach is innately grounded at the practitioner level. Its foundation at this particular level stems from its focus on formative development and evaluation procedures. Richey and Klein (2005) write that the crux of design and development research is to systematically examine tools, products, and models in order to provide reliable and usable information to both practitioners and theorists. Design and development researchers are often, "...in a position to directly impact the work of practitioners because of the propensity of these researchers to situate their studies in natural work settings and to address the pressing problems of the workplace" (Richey & Klein, 2007, p. 14). A three-phase study was designed to validate, test, and evaluate the LITAM tool using USCG HPT practitioners as participants within the same working environment as the tool would be deployed.

The first phase of research involved having an expert review panel validate the critical factors, decision paths, and output (selections) of the tool. The participants for this phase of the study were HPT experts with at least 20 years of practice within the USCG TRASY. The panel procedures consisted of three rounds of review and rapid prototyping. During each round, the participants entered a performance analysis and corresponding task list into the tool. Data were collected using both qualitative and quantitative methods (questionnaire, interviews, and surveys), which provided the data needed to improve the tool. This process addressed needs identified during data analysis until all members of the expert panel agreed to the design and future use of the tool. The findings from Phase One resulted in a total of 41 improvements to be made to the tool to improve the internal components of the tool. Additionally, the findings were integrated for further development of the LITAM tool prior to Phase Two.

Once the critical factors, decision paths, and output (selections) of the tool were validated by the review panel, the LITAM tool was ready for field-testing. The focus of the second phase was examining the technical elements and functionality of the tool. HPT analysts from across the USCG TRASY participated by performing three rounds of field try-outs to test the tool's functionality and intuitiveness relative to user design, interfacing, and navigation. A combination of qualitative and quantitative methods (surveys, focus groups, and observation checklists) were employed to capture the data needed to make improvements to the tool. The procedures of the try-outs were repeated until a point of saturation was reached in the data, which conveyed that the functional elements of the user experience were positive, intuitive, and consistent. As with Phase One of the study, the data collected and analyzed from the three field try-outs informed the tool's further development until all functionality and interfacing issues identified were addressed. This process resulted in a polished prototype of the LITAM tool that was ready for further assessment. Therefore, the findings from Phase Two validated the strengths and weaknesses of the tool's usability and provided feedback to advance interfacing and navigation intuitiveness. The data from the try-outs were integrated to inform the development of the tool prior to Phase Three.

The third phase of the study involved a formal evaluation of the tool using real analysis projects that required intervention selections. The focus of this phase was on tool efficacy and effectiveness. The participants for the evaluation phase of the study were four HPT analysts from the Analysis, Consultation, and Evaluation (ACE) team from the Performance Technology Center (PTC). The ACE team used the LITAM tool with three active projects in order to generate intervention selections for their customers. Data were collected from the ACE team before, during,

and after tool use through the employment of expert record logs for intervention predictions, a survey questionnaire, and a content analysis using the intervention-selection summary reports.

The data analytics from the evaluation phase supported the efficacy and effectiveness of the tool. More specifically, the data from Phase Three validated the efficacy of the tool by quantifying that the tool generated intervention selections for 100% of tasks (176/176) entered into tool. Furthermore, the data supported the effectiveness of the tool in that LITAM tool intervention selections aligned with participant intuition 79.54% of time. Also, the data revealed that the tool generated a balanced set of intervention outcomes: Train-to-Memory = 47% and Performance Support = 53%, which is fundamental to the principles of HPT. The findings also conveyed positive reporting of user confidence in sharing selections with stakeholders:  $m=4.75$  (5.0 scale), positive reporting of user confidence in selections as optimal solutions:  $m=4.75$  (5.0 scale), and positive reporting of user confidence in selections for closing skills and knowledge gaps:  $m=4.75$  (5.0 scale). Collectively, the results validated the efficacy of the tool and quantified the tool's current state of effectiveness. Ultimately, the findings from the field-test advanced the final development of the tool and informed the appraisals for further use of the tool in the USCG TRASYS.

**Table 2. Summary of Findings Categorized by Phase**

Phase	Question(s)/ Focus	Summary of Outcomes	
1	Research Question #1:  Internal Components & Questions	1. Total of 41 improvement items identified 2. Identification of opportunities to make critical component changes a. Reduce duplicating data entry points (integrate questions collecting same data) b. Expand item responses to reflect complex learning/performance situations c. Increase guidance for explaining complex components and questions such as the <i>moment of need</i> 3. Positive reporting of perceptions for questions used; $m=4.5$ (5.0 scale) 4. Positive reporting of perceptions of components used to make selection; $m=4.75$ (5.0 scale)	
2	Research Questions #2 & 3:  Usability and Navigation	Strengths	Weaknesses
		1. Positive reporting of user interfacing experience; $m=4.92$ (5.0 scale) 2. Positive reporting of tool structure (logic); $m=4.75$ (5.0 scale) 3. Positive reporting of user navigation experience; $m=4.59$ (5.0 scale)	1. Inability for user to navigate backward 2. Inability to store data internally for future use 3. Use of “no-train” terminology is confusing and makes use of tool with stakeholders more difficult
3	Research Question #4:  Level of LITAM tool Effectiveness	1. Generated intervention selections for 100% of tasks (176/176) entered into tool 2. Selected interventions that aligned with participant intuition 79.54% of time 3. Generated a balanced set of intervention outcomes: Train-to-Memory = 47% and Performance Support = 53% 4. Resident (classroom) instruction was the selected at 59.03% for training 5. Positive reporting of user confidence in sharing selections with stakeholders; $m=4.75$ (5.0 scale) 6. Positive reporting of user confidence in selections as optimal solutions; $m=4.75$ (5.0 scale) 7. Positive reporting of user confidence in selections for closing skills and knowledge gaps ; $m=4.75$ (5.0 scale)	

Note: Results taken from the findings section of each phase of the study.

## MOVING FORWARD

The LITAM tool went through a rigorous evaluation process, which involved several cycles of rapid prototyping with experts and practitioners until a polished product was ready for broader dissemination within the USCG community. The results of the summative evaluation accentuated the importance of systematically formalizing the intervention selection process as an integral part of the HPT and instructional design process when grounded in learning science because of the need for consistency across the enterprise. The tool is now available to the entire field of HPT practitioners across the USCG training enterprise and is currently being utilized as a means of making intervention recommendations for analysts, and to stakeholders and customers. The LITAM tool was designed and developed specifically for the USCG HPT community and is not available commercially. Accordingly, development of a similar tool for another service or industry could be readily facilitated by leveraging the same learning science and decision paths discussed herein with adaptations for the interventions offered by their respective organization.

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