

Integrating Training through a Bonded Star Knowledge Information Network – The Influence of Learning Theory on Portal Structure

Alex Hoover
US Joint Forces Command
Suffolk, VA
alex.hoover@jfc.com.mil

Jeff Krinock
Concurrent Technologies Corporation
Suffolk, VA
krinockj@ctc.com

ABSTRACT

The Joint Knowledge Development and Distribution Capability has the responsibility to integrate the various individual training services with other knowledge, education, and training services. This integration enables Joint training to be managed as a continuum by allowing different content sources to be used by trainers to reinforce and amplify each other. There are two semantic loci around which the Joint content can be organized – the individual warfighter and the tasks the warfighter carries out within the battlespace. Each locus supports a star-topology information network. Around the individual warfighter, we organize characterizing information such as, “What is my job?” “What are my roles and responsibilities within my unit?” “Where am I in my career?” “What is my experience?” Around the tasks, we organize information such as, “What training is available for this task?” “Who is supposed to carry it out?” “What is the corporate knowledge about this task?”

JKDDC has characterized this learning in three areas – on the job experience, collective training, and individual training – to merge the information networks. The resulting structure supports the integration of the different knowledge services to develop individual training solutions for the warfighter. Additionally, this network allows crosswalking requirements against capabilities. Examples of the types of integration that are supported by the information network are:

- When a new lesson learned is published, we can identify which personnel have been recently trained in that area and forward it to them.
- If a commander has to cross-fill a Joint billet, he can identify who are the best trained people for that billet within his organization.
- When a warfighter receives new orders to a Joint billet, they can determine what training they need and from where it is provided.
- Exercise planners can select prerequisite or post-exercise mitigation training options from a list targeted to the training objective of concern.

ABOUT THE AUTHORS

Alex Hoover is the Assessment/Capabilities Improvement Division chief within the Joint Knowledge Development and Distribution Capability at US Joint Force Command. He had seven years of combined experience assessing Joint training and Joint training systems on active duty, as a contractor, and now as the government. He holds a BS(ENG) in Computer Science from Ohio State and an MS in Computer Science from the University of Phoenix. He is a member of the Military Operations Research Society, the Institute of Electrical & Electronics Engineers, the Association for Computing Machinery, and the Society for Computer Simulation International.

Jeff Krinock is the Knowledge Distribution contractor lead with the Joint Knowledge Development and Distribution Capability at US Joint Force Command. He is a contributing editor to three versions of the Sharable Content Object Reference Model (SCORM) and a former USAF Training Officer, fighter pilot, and helicopter pilot.

Integrating Training through a Bonded Star Knowledge Information Network – The Influence of Learning Theory on Portal Structure

Alex Hoover
US Joint Forces Command
Suffolk, VA
alex.hoover@jfcom.mil

Jeff Krinock
Concurrent Technologies Corporation
Suffolk, VA
krinockj@ctc.com

INTRODUCTION

If knowledge is dynamic in the most general sense—if it changes over time—then caretakers of the places where knowledge is collected and shared should adapt, adjust, and change as well. Libraries, the trailblazers for and companions to our modern learning portals, have changed over time—as knowledge in a given field evolves and authors generate new books and articles, sections of libraries expand, shelves are added, card catalogs (and their digital equivalents) are broadened, and older books are removed and replaced. Learning portals, with their digital capabilities, can exchange content many times more rapidly than libraries of printed works. Not only do they move content about more rapidly, they can also host, persist, and recombine varieties of content in ways that stretch the understanding of how libraries work. The nature of knowledge hosted by learning portals is therefore sometimes quite similar to the stock in trade of libraries (books, magazines, course material, videos), but also potentially very different due to the capability to manipulate and recast the component content based on the immediate learning requirement.

This additional capability of learning portals raises questions about how to manage change in relation to changing content and requirements, and how it should adjust in relation to external context such as local, national, and world events, which provide a source of both dynamic content and requirements. Should knowledge portals adapt to change as mandated by experts external to the portals (i.e., an

intentional design approach similar to that used by libraries in which the keepers of the knowledge are experts at labeling, storage, and delivery)? Or should portals adjust indirectly, perhaps “reacting” to changes in a given field of knowledge somewhat slowly and methodically as instructional designers build and upload content and courseware? Or perhaps the portal should morph “continuously” as lessons learned and contributors to communities of interest steadily compile new material?

These questions define a trade space between validity and immediacy for the delivery of content. This trade space must be managed to meet both established and active requirements in a way that allows the decision maker (whether that is the learner, an educator, or a training manager) to understand the impact of the dynamic nature of knowledge on the learner. This paper will discuss the information topology used to organize and manage the requirements and content, how that topology is influenced by learning theories, and some impacts of practical implementation of the topology.

The Joint Knowledge Development and Distribution Capability (JKDDC) portal, Joint Knowledge Online (JKO), can adapt in all of these ways. By design, JKO supports management of learner knowledge according to influences related to three different learning theories. A brief look at three of the learning theories currently most influential on the JKO e-learning environment will provide a framework for analyzing the learning design of JKO.

Behaviorism	Cognitivism	Constructivism
Learning happens when a correct response is demonstrated following the presentation of a specific environmental stimulus	Learning is a change of knowledge state	Learners build personal interpretation of the world based on experiences and interactions
Learning can be detected by observing an organism over a period of time	Knowledge acquisition is described as a mental activity that entails internal coding and structuring by the learner	Knowledge is embedded in the context in which it is used (authentic tasks in meaningful realistic settings)
Emphasis is on observable and measurable behaviors	Learner is viewed as an active participant in the learning process	Create novel and situation-specific understandings by "assembling" knowledge from diverse sources appropriate to the problem at hand (flexible use of knowledge)
Uses a "black box" metaphor - the learner is a black box, what happens inside is unknown	Emphasis is on the building blocks of knowledge (e.g. identifying prerequisite relationships of content)	Believes that there are many ways (multiple perspectives) of structuring the world and its entities
Emphasis is on relationships between environmental variables and behavior	Emphasis on structuring, organizing and sequencing information to facilitate optimal processing	Believes that meaning is imposed by the individual rather than existing in the world independently
Instruction utilizes consequences and reinforcement of learned behaviors	Focus is on how learners remember, retrieve, and store information in memory	
Believes behavior is guided by purpose	Examines the mental structure and processes related to learning	
Cues are antecedents to behavior and set the conditions for its occurrence	Learning is viewed as an active process that occurs within the learner and which can be influenced by the learner	
	The outcome of learning is not only dependent on what the teacher presents but also on what the learner does to process this information.	

Figure 1. Three Major Learning Theories (Dabbagh 2007)

LEARNING THEORY AND PORTAL REQUIREMENTS

A portal—even conceptualized simply as a content repository—can be understood from the standpoint of these learning theories in a variety of ways. From the Cognitivism column of Figure 1: “Emphasis is on the building blocks of knowledge (e.g. identifying prerequisite relationships of content).” “Building blocks” and “prerequisite relationships” suggest a formal organization of content that could imply the need to adjust content hosted by a portal based on changing content or context requirements. If primary emphasis of deployed US forces suddenly shifted from Iraq back to Kosovo, a knowledge portal might quickly adapt by emphasizing new or different information. With such a significant shift in regional focus, altering a portal could involve shifting its menu of subject matter to include highlighting regional-specific content—providing the user more appropriate building blocks. That is, a clear change in external context could indicate the need for a corresponding change in the building blocks of content that a portal emphasizes for its end users.

As time evolved and troop experience in-theater matured, a knowledge portal might opt to host a new “community of interest” for collaborative discussions about theater-specific experiences. Such discussion areas provide timely exchange of content that enables sharing of potentially valuable lessons without the often cumbersome process involved in formally building courseware. This approach borrows at least in part from the view of the learner described in the Constructivism column of Figure 1: “Learners build personal interpretation of the world based on experiences and interactions” and “Knowledge is embedded in the context in which it is used (authentic tasks in meaningful realistic settings).” This view relies less on a previously defined structure of relationships between content; in this case, users gain experience in context and the portal’s ability to facilitate sharing of that experience within a “community” affords troops with the opportunity to build meaningful and timely interactions via the immediacy digital exchanges provide.

In addition to the shift in regional emphasis that support the cognitivist and constructivist views, content can be managed from a behavioral aspect to ensure that the universal truths that underlie the context are still available to the learner. Formal task lists that partition the behavior space would allow context independent knowledge to be leveraged and

incorporated into the new presentation and capability. This will reflect, at least in part, this view of learning taken from the “Behaviorist” column of Figure 1: “Learning happens when a correct response is demonstrated following the presentation of a specific environmental stimulus” and “Emphasis is on relationships between environmental variables and behavior.”

In short, the structure and operation of JKO, even in its simplest mode of operating, provides instances of support for a variety of learning theories. Links to doctrine and publications, as well as tasks and communities of interest and collaboration, provide opportunities to adjust the structure and content of the portal in direct reaction to changing world conditions (and personal situations) and to keep the portal’s “shelves” appropriately stocked and adapting properly.

AN OVERVIEW OF THE JKO STRUCTURE

The three learning theories just mentioned of course demonstrate overlap within given real-world situations. Rarely does a given event that triggers the need to adjust a learning portal fit neatly into a single category of learning theory. Returning to the library analogy, one can easily imagine the offerings on library shelves coming under scrutiny and influence from a variety of directions. A visiting professor, expert in a given field, might notice works on a specific field of specialty missing from the shelves and offer a list of “must have” book acquisitions to the reference librarian. The same library might choose to expand selections based upon “popular demand”, i.e., based upon numbers of requests collated for a given topic (or author). Libraries at times also promote seasonal and regional topics through temporary displays. The content of a given library can also be temporarily influenced on a small scale by even individual requests for a book or article on a given topic (via inter-library loan). None of these stimuli to change are mutually exclusive, of course, and variations of all of them potentially apply to change processes within a portal as well.

As noted, such content changes do reflect a certain parallel to various learning theories, and carried to the digital environment of a portal, they can offer new levels of responsiveness and timeliness for users. Speed, combined with a portal’s improvement in breadth and depth of resources, provide a distinct advantage over libraries, even before introduction of a portal structure that takes full advantage of the depth of computation and search capabilities its digital roots afford.

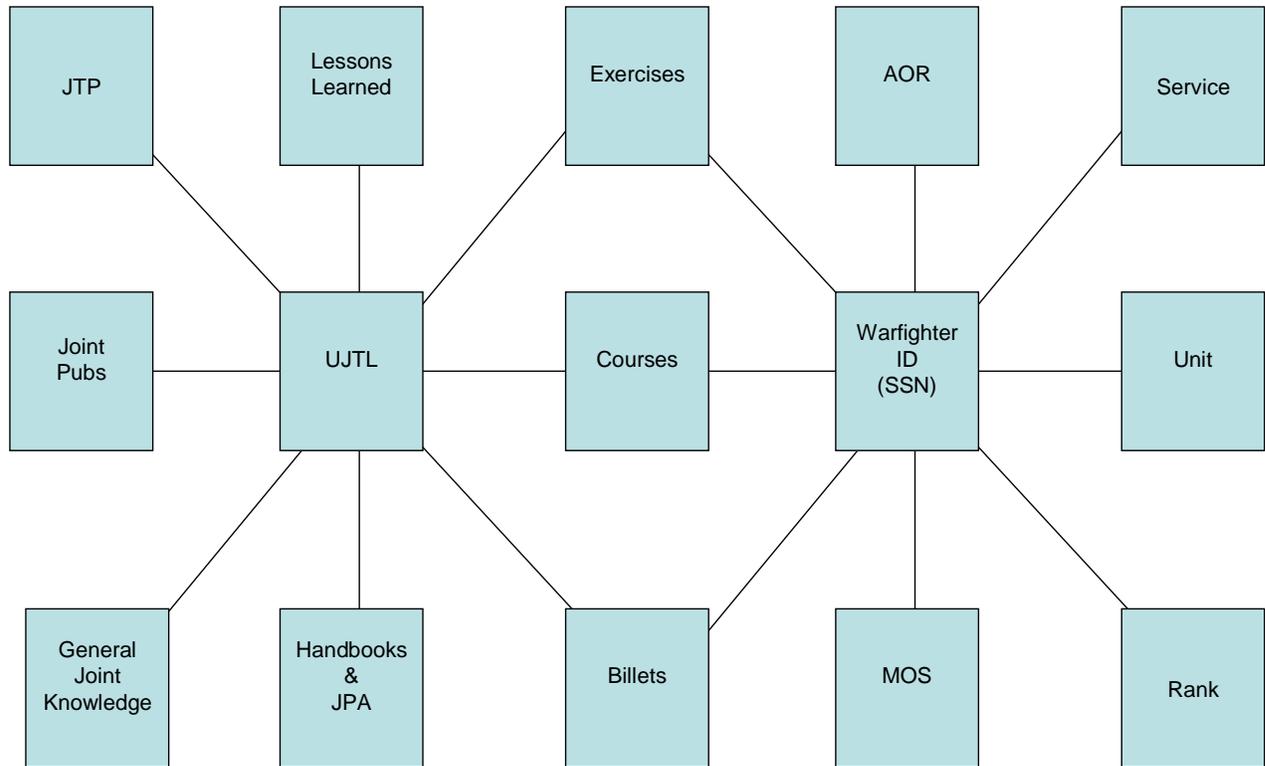


Figure 2. High Level View of the JKO Information Structure

Many of the elements represented on the left side of Graphic 1 are roughly of the category of “content.” The portal hosts handbooks, joint publications, courseware, general joint knowledge and links to lessons learned, all of which reside in the portal in accessible form. On the right side of the structure we see elements that are related to individual and group experience and background. This “left/right” structure alone offers two alternatives roughly supportive of two different learning theories. The collection of content on the left and its interlinking supports a cognitive approach—“Emphasis on structuring, organizing and sequencing information to facilitate optimal processing.” Similarly, the interlinking of data about users on the right side of the structure, to include their exercise experience, unit, and area of responsibility, supports a constructivist approach—“Learners build personal interpretation of the world based on experiences and interactions.”

Learning: Linking Individual Experience and Content

Recent experience about learning in a modern military environment shows that knowledge and experience garnered in the field can translate to impacts on publications and doctrine much more rapidly in a digital environment than was possible 50 years ago.

Daniel Baum describes yesterday’s unwieldy pre-digital process for moving lessons learned in the field to a more permanent and distributable form (Baum 2005):

Prior to the Second World War, officers heading into combat buttonholed veterans or gleaned what they could over evening beers at the Officers’ Club to fill holes in their training. After Guadalcanal, the Army knocked together the insights of soldiers in combat and published them in cheap newsprint booklets called “The Mailing List.” The booklets were imprecise, slow to arrive in the field, and unidirectional. “Teach not to waste ammunition,” wrote one Marine colonel. “The Japanese fire is not always aimed,” a sergeant wrote. “It is harassing fire and scares recruits.” The system for recycling combat experience didn’t improve much for the next forty years.

By comparison, Baum describes a similar sharing of lessons learned between two company commanders (Allen and Burgess) in a post-internet environment:

...the daily puzzles a company commander faces, even in peacetime, are dizzying, and both Allen and Burgess felt isolated. “If I had a

good idea about how to do something, there was no natural way to share it," Allen said. "I'd have to pass it up, and it would have to be blessed two levels above me, and then passed down to Tony." Luckily, they lived next door to each other and spent many evenings sitting on Allen's front porch comparing notes. "How are things going with your first sergeant?" one would ask. Or "How are you dealing with the wives?" "At some point, we realized this conversation was having a positive impact on our units, and we wanted to pass it along," Allen told me. They wrote a book about commanding a company, "Taking the Guidon," which they posted on a Web site. Because of the Internet, what had started as a one-way transfer of information—a book—quickly became a conversation. "Once you start a project, amazing people start to join," Allen said.

As Baum went on to explain, not everyone in Army leadership appreciated Allen and Burgess's innovation as a means to disseminate information quickly. Whatever its strengths and weaknesses, the existing Army system had a process for vetting "knowledge"

before moving it into documents such as training manuals, field manuals, and doctrine in general. Allen and Burgess found their informal ways of sharing lessons learned valuable nonetheless, and judging by the participation level at their Web site, many others did as well. Baum describes something of a tug-of-war between these men with their useful "homemade" content exchange and elements in the Army more interested in a formal vetting process.

Application: Lessons Learned to the warfighter

What if a knowledge network was constructed in a way that would enable quicker vetting of informally generated information via comparison with existing doctrine and training materials? Figure 3 depicts a potential search of the JKDDC portal that could apply to just the kind of situation Allen and Burgess encountered. The portal is constructed in such a way that lessons learned can be quickly compared against UJTLs. JKDDC provides the capability to reference billet requirement against the same formal taxonomy of warfighting tasks that characterize the most recent knowledge from the battlefield and assist in routing that knowledge to the appropriate warfighters.

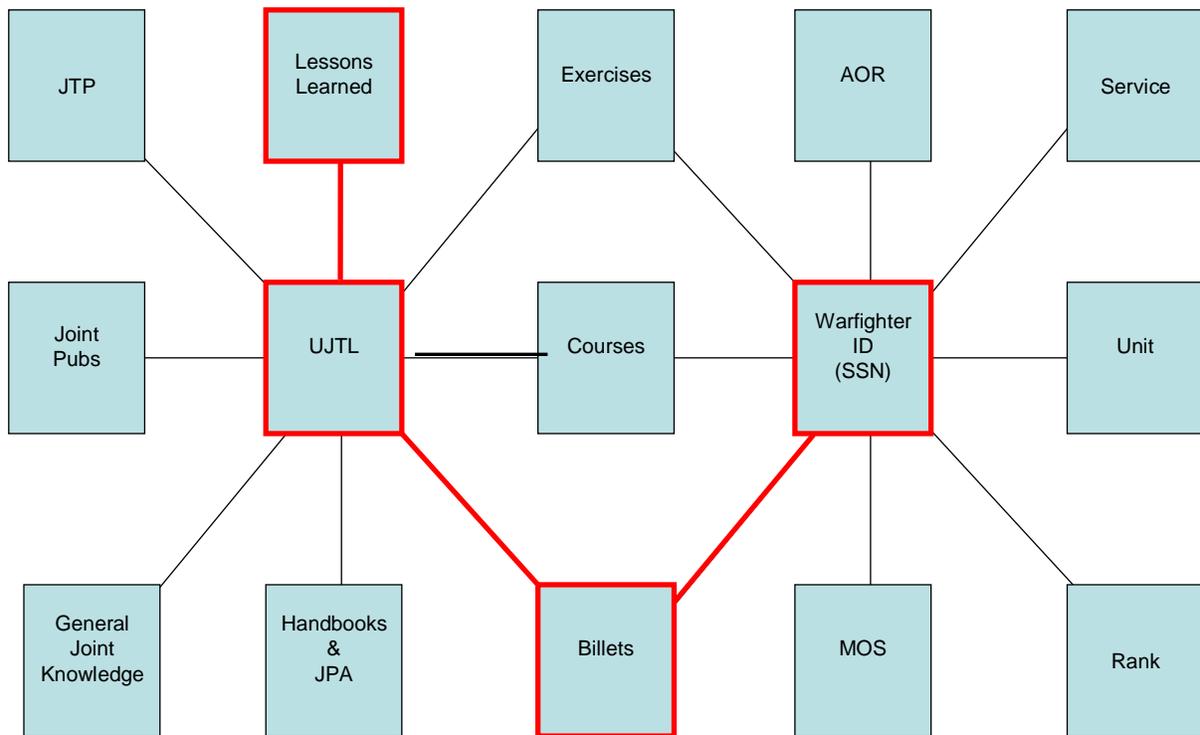


Figure 3. Behavioralist Mapping of Knowledge

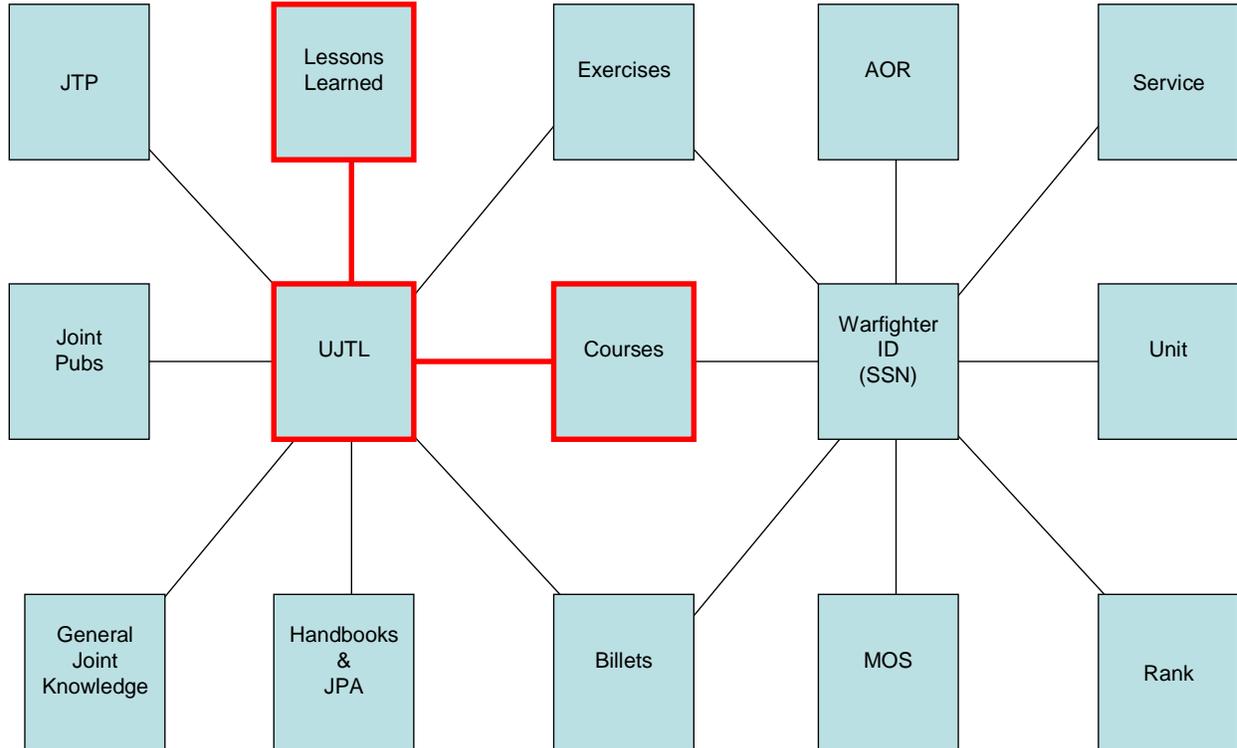


Figure 4. Behavioralist and Constructivist Binding of Content

Learning: Crossing Learning Theory Boundaries

Figure 4 shows further search possibilities as well. From the same search interface in the JKDDC portal, users can compare lessons learned to existing courseware. In this case, UJTJs—representing established understanding of military tasks—provide a central binding point for the search. In a sense, the search depicted in Figure 4 addresses the user’s search from the point of view of two learning theories; courseware, with its typical built-in assessments and “instructor” roots speaks to behavioralism, while lessons learned potentially address the same topic from a constructivist approach.

Application: Minding the Gaps and Seams

A search such as that depicted in Figure 4 could uncover discrepancies. If the warfighter were trying to find gaps in current courseware, one can easily imagine situations in which a lesson learned mapped to an existing UJTL, but no formal courseware could be found in support of the same topic. Likewise, if the warfighter is concerned with the currency of a course for which he is responsible, the linkage between the constructed and behavioral knowledge can be used to

identify procedures (that is, learning objectives) not in direct alignment with recently acquired lessons learned.

Learning: Transiting the Theories Both Ways to Find and Solve a Problem

Binding content with information about users provides for a different type of search and analysis as well. We can use the same structure to both identify a gap in individuals’ knowledge and then proscribe tailored solutions.

Application: Who Knows What?

Figure 5 depicts the type of search a commander might consider at such a time, asking something like, “How many people in my unit have received training on Joint Pub 2-3 in the last 3 months?” The answer might be straightforward; the commander might find apparently obvious cause and effect, with the results of his search showing the bulk of those assigned to his unit having little or no training on a given problem area. In such a situation, a first order resolution might be to have the unit’s training officer assign courseware that addresses the content to the appropriate personnel.

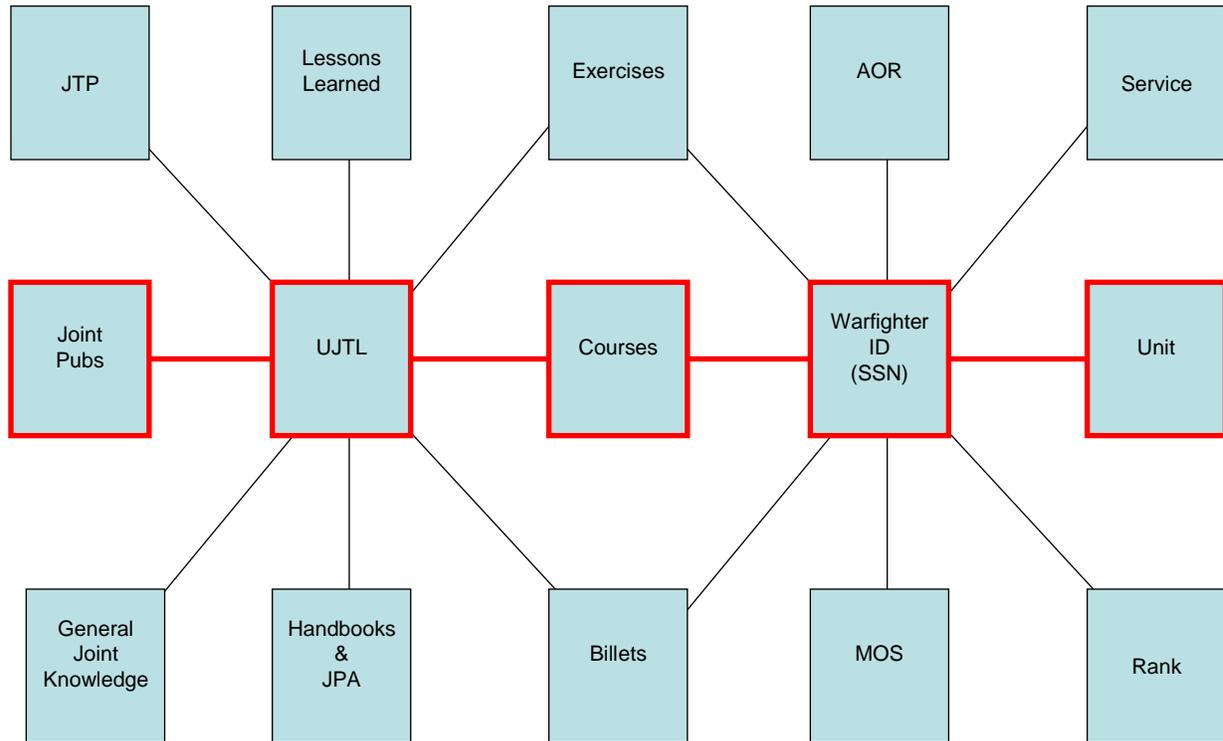


Figure 5. Transiting Across and Theories and Organizing Principles

Such a broad and simple gap is equally undesirable and unlikely. No commander would want a force with zero training in an important operational area. It is not likely that the Service personnel systems would assign a complete contingent of unqualified personnel. The most likely situation is that the mix of personnel have a mix of different training experiences that cover different areas of the operation of concern to the commander. By being able to identify specific, task related gaps in knowledge in one direction, we can then turn around and identify tailored solutions for the individuals that give them only the training they need. Just as the degenerate case of zero training is unlikely and undesirable, the case of a heavy-handed “everybody trains on everything starting now” solution is undesirable and likely ineffective. The lack of efficiency in such an approach is obvious. Additionally, training, especially web-based training, which lacks direct instructor interaction, retrieval cues, and other classroom training effects, is moderated by the individual’s engagement with the material (Sitzmann et. al., 2005). What could cause greater dissociation and less engagement than being directed to

do something your superiors “should know” you have already done?

Learning: Changing Approaches for Problem Finding and Solution Finding

A commander could, however, uncover different outcomes on this example search. Discovering that all assigned personnel successfully participated in courseware on a given topic while that topic remained a problem area for the unit would likely call into question the efficacy of the courseware itself. In that situation, even more complex searches could reveal other facets of how troops are most effectively prepared; i.e., the training-versus-experience factor could be uncovered by comparing the results of the search in Figure 5 with an additional factor, such as exercise participation. Adding in this additional element, exercise participation, as shown in Figure 6, could reveal correlations between the effectiveness of courseware when combined with reinforcement of learning in a related exercise.

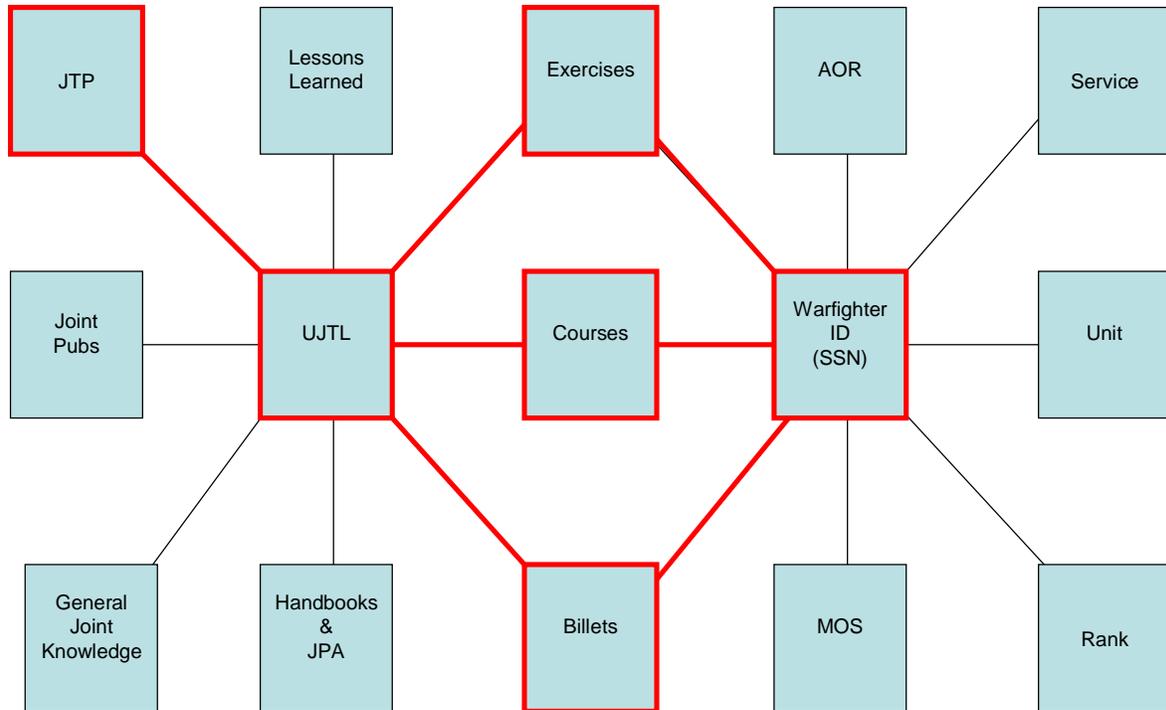


Figure 6. Merging of Behavioralist, Constructivist, and Cognitivist Mappings

The realities of military training—as required by the breadth of tasks undertaken in a nearly indefinable array of circumstances—suggest that aspects of several learning theories may be relevant at times. For example, Daniel Baum (Baum 2005), quoting studies commissioned by high-ranking Army leadership, makes a strong pitch in favor of a constructivist approach to learning, suggesting troops spend too much time in formal training, to the detriment of developing creativity and other elements of leadership important in crisis-level decision making. Yet Baum begins the same article by relating a story about troops quietly following their officer’s lead, taking a knee and obediently lowering their guns among hostiles—a story that would make the most behaviorist-oriented commander smile.

Application: Using the Information Network to Enable Technology

No matter what direction military learning and training is moving toward, digital technology has unleashed new possibilities that go beyond a simple instructor/learner model, and e-learning in its many forms already goes far beyond offering a simple digital version of yesterday’s library. Much of the literature of e-learning and post-digital training in

general talks about taking “user-centric” approach, and the Sharable Content Object Reference Model—now a mainstay of e-learning for all the military—talks extensively about the value of intelligent tutors in making tomorrow’s digital offerings more effective. The realities of most knowledge portal efforts to date, though, are that they are so occupied with making content available, that efforts to provide anything approaching intelligent tutoring—perhaps the ultimate user-centric approach—are lost. In short, there’s a lot of content out there, and simply keeping it relevant, current, and constantly available is a full-time job.

SUMMARY

Delivering courseware and similar content—and tracking user performance within that content—are long-term hallmarks of learning management systems (LMSs). Too often, tracking of other aspects of student experience remains locked away in the personnel and human resource management systems of individual services. Relevant background information such as exercise participation or other experiences, such as those compiled in lessons learned or shared within a community of interest typically remain “stovepiped” within systems external to an LMS as well.

Whether one believes a portal should be knowledge-centric or user-centric, behaviorist or constructivist, the JKDDC portal's structure provides opportunities for change and adaptation based on a variety of complex inputs. Built upon courseware provided from joint and multi-national sources and inclusive of a broad array of documents and instruments ranging from doctrinal to incidental, provides a foundation for building a knowledge portal that can be broadly responsive, meeting the needs of traditional users as well as those who need to understand complex inter-relationships between training content, experience, and the backgrounds of those depending upon the portal for everything from the mundane to crisis-response.

The structure of JKO, and the emphasis on searching and linking to as many sources of user experience as possible—in addition to traditional performance as tracked with in an LMS—set JKO apart. Early users of JKO may be asked at times to augment background information; JKO links to existing personnel systems will not automatically provide complete background on specific exercise participation, for example. Nonetheless, constant referencing of JKO with UJTLS and with user

experience broadly defined, will continue to offer both individual users and commanders the opportunity to verify efficacy of training, courseware, real-world experience, and individual performance in increasing detail, while keeping formally defined and vetted goals at the forefront. In the end, the structure of the learning portal itself may make the difference.

REFERENCES

- Baum, D. (2005) , “Annals of War”, *New Yorker*, Jan 17, 2005, 2007, from http://www.newyorker.com/archive/2005/01/17/050117fa_fact
- Dabbagh, N. (2007). “The Instructional Design Knowledge Base”, *Nada Dabbagh's Homepage, George Mason University, Instructional Technology*, 3 MAY 2007, from http://classweb.gmu.edu/ndabbagh/Resources/IDKB/models_theories.htm
- Sitzmann, T, Wisher, R., Stewart, D., Kraiger, K., (2005) “Moderators on the Effectiveness of Web-Based Instruction,” *Proceedings of the 20th Annual Conference on Distance Teaching and Learning*.