A Framework for Reusing and Repurposing Knowledge Work in Organisations

Mark Salisbury
Organisational Learning and Instructional Technology
University of New Mexico, (505) 277-9678
College of Education, COB 109, Albuquerque, NM
USA, 87131-1231
salisbu@unm.edu

Abstract. This article describes a framework for managing the life cycle of knowledge in organisations and to utilise this framework for reusing and repurposing knowledge work. The framework emerges from years of work with the laboratories and facilities that are under the direction of the US Department of Energy (DOE). The article begins by describing the phases in the life cycle of knowledge in organisations. Next, the article describes the theoretical foundation for the framework, the Collaborative Cognition Model, followed by sections that detail the implementation of the framework. Finally, a discussion section summarises the framework and discusses future directions to enhance and extend the framework for reusing and repurposing knowledge work in organisations.

Keywords: Knowledge management; collaborative cognition model; knowledge life cycle; organisational learning; reuse; repurpose.

1. Problem Statement

This article describes a framework for managing the life cycle of knowledge in organisations and how to utilise this framework for reusing and repurposing knowledge work. This framework was initially used to successfully build a knowledge dissemination and application system for the laboratories and facilities that are under the direction of the US Department of Energy (DOE) (Salisbury and Plass, 2001). The follow-on to this effort was the development of a collaboration application that fed the dissemination and application system for the DOE laboratories and facilities. The resulting system managed the life cycle — creation, preservation, dissemination and application of organisational knowledge (Salisbury, 2003). Recent work has focussed on extending the theoretical foundation for reusing and repurposing knowledge work. This recent work grew out of a goal by DOE to improve quality and performance, DOE adopted a common development process — the Product Realisation Process (PRP) for all of its laboratories and facilities. PRP is defined in a set of documents labelled as the “Technical Business Practices”, or TBP. The TBP describes the requirements that must be met in each step of the PRP (Plass et al., 2000). These requirements can be quite detailed and specific to a manufacturing procedure or broad and regulatory in nature. A DOE cross-functional laboratory and facility team for process improvement found that many of these requirements are addressed in more than one place in a development process — and they are addressed in different ways at different physical sites in the same process. It became evident that in order to make significant improvements in processes, the process improvement team would have to be able to identify the requirements for a process, create a better way to address those requirements, and update all the materials describing the process improvement in every place they are used in the development process. How to do this became a problem. Reusing and repurposing work became not only desirable — but also became necessary since addressing a requirement would have to be done the same way at every place in the development process and at every site — or, it would have to be documented as to why it was addressed differently. To solve this problem, the process improvement team utilised the requirements described in the TBPs to identify, track, reuse and repurpose knowledge work across the laboratories and facilities of DOE (Salisbury, 2003). This article attempts to broaden this approach and create a general framework for reusing and repurposing knowledge work in organisations beyond this initial DOE experience. In the next section, the life cycle of knowledge in an organisation is discussed. Afterwards, the theoretical foundation for the framework, the Collaborative Cognition Model, is described followed by
sections that detail the implementation of the framework. Finally, a discussion section summarises the framework and discusses future directions for enhancing and extending the framework for reusing and repurposing knowledge work in organisations.

2. The Life Cycle of Knowledge in an Organisation

Figure 1 illustrates the ongoing life cycle of knowledge in successful organisations. The first phase is the creation of new knowledge. This takes place when members in the organisation solve a new unique problem, or when they solve smaller parts of a larger problem such as the ones generated by an ongoing project. The next phase is the preservation of this newly created knowledge. This includes recording the description of the problem as well as its new solution. This phase feeds the next one, the dissemination and application of this new knowledge. The dissemination and application phase involves sharing this new knowledge with the other members of the organisation. It also includes sharing the solutions with the stakeholders affected by the problems that were solved. Disseminated knowledge then becomes an input for solving new problems in the next knowledge-creation phase. An organisation’s ability to solve problems increases with the utilisation of this disseminated knowledge. In this way, each knowledge life cycle phase provides input for the next phase — creating an ongoing cycle. Since this cycle continues to build upon itself, it becomes a knowledge spiral in the organisation as described by Nonaka and Takeuchi (1995).

While the growth and sharing of knowledge is recognised as one of the most important elements in becoming a learning organisation (Easterby-Smith, 1997; Marsick and Watkins, 1994; Senge, 1990), what has been missing, according to many researchers and practitioners in the field, is the development of a theoretical foundation for describing how people learn and perform in an organisation (Raybould, 1995; Salisbury, 2000). This theoretical foundation is needed by today’s organisations to avoid the development of technological solutions that do not support their entire life cycle of knowledge (Plass and Salisbury, 2002). To address this situation, the Collaborative Cognition Model, a theoretical foundation, was developed. It describes how learning can take place with one individual, be preserved, and transferred to other individuals in an organisational setting (Salisbury and Plass, 2001; Salisbury, 2003).

3. Theoretical Foundation

To represent the complexity of organisational knowledge, a revision of Bloom’s Taxonomy (Bloom, 1956) developed by Anderson et al. (1998) was used to provide the basis for extending the description of knowledge utilised within the Collaborative Cognition Model. One of the major differences in the revised taxonomy by Anderson et al. (1998) is the identification of knowledge as a separate dimension that describes it as factual, conceptual, procedural and metacognitive. Another major difference is that Anderson and colleagues recast Bloom’s other categories into a “process dimension” which describes the learner’s cognitive processes when processing knowledge of that category. These process dimension categories were also renamed from Bloom’s original “knowledge, comprehension, application, analysis, synthesis, and evaluation” to “remember, understand, apply, analyse, evaluate, and create”. Note that Anderson and colleagues place “create” as the highest level of cognition; it describes individuals putting elements together to form a novel coherent whole or make an original product.

Anderson et al. (1998) describe factual knowledge as terminology, specific details and elements. Conceptual knowledge relates to theories, models, principles and generalisations. Procedural knowledge includes skills, algorithms, techniques and other methods that are specific to a product or process. Metacognitive knowledge was added by Anderson and colleagues to Bloom’s Taxonomy. It is “knowledge about knowledge”, and involves general strategies for learning, thinking and problem solving. Metacognitive knowledge also includes knowledge concerning the appropriate contexts and conditions for the use of the strategies themselves. Additionally, it includes the “heuristics” or “rules of thumb” that experts use to solve problems.

At the individual level, the Collaborative Cognition Model has elements of Situated Cognition as described
by Brown et al. (1989). The Collaborative Cognition Model supports learning in the context of the work at the moment — creating an “authentic context” for learning. Knowledge workers can access knowledge — and other people — to learn how to construct solutions to pressing organisational problems in a just-in-time manner. Furthermore, the Collaborative Cognition Model supports Situation Cognition for learners with differing cognitive needs by providing different types of knowledge as defined by Anderson and his colleagues (1998) in their revision to Bloom’s Taxonomy (Factual, Conceptual, Procedural and Metacognitive). As a result, the Collaborative Cognition Model supports work and learning to “live in the same space”, “occur at the same time”, and become interdependent. As a result, learning is situated in the authentic task of organisational work and takes place during that work.

At the team level, the Cognitive Collaboration Model is an extension of the theory of distributed cognition (see Salomon, 1996; for an overview of distributed cognition). One of the best documented examples of distribution cognition in a work environment is by Edwin Hutchins in his book “Cognition in the Wild” (Hutchins, 1996). Hutchins studied how a crew collaborated to operate a large ship at sea. According to his description of the theory of distributed cognition, cognition is distributed across individuals, their artefacts and the history of their artefacts. That is, no one individual has complete knowledge as to how to accomplish a complex task such as operating a large ship. Hutchins also describes that cognition is distributed across the artefacts of an organisation’s work. On the ship that means the instruments provide critical decision-making information to the crew members. And, according to the theory of distributed cognition, cognition is in the history of those artefacts. On the ship, the previous version of an instrument gives a context for the present version of that instrument. In an office environment, artefacts are the knowledge products of the organisation. These are the “intermediate products” of a larger process and are such things as design documents and quality plans. Another set of artefacts are the knowledge assets that document the organisation’s processes, instruction, work examples and expert advice that are used as resources by the members of the organisation to make the knowledge products. In the Collaborative Cognition Model, the theory of distributed cognition is extended to involve different types of knowledge as defined by Anderson and his colleagues (1998) in their revision to Bloom’s Taxonomy (Factual, Conceptual, Procedural and Metacognitive); these different types of knowledge are present in the distribution of cognition across individuals, their artefacts and the history of their artefacts.

At the organisational level, the Collaborative Cognition Model is an extension of Nonaka and Takeuchi’s (1995) description of creating a knowledge spiral in an organisation. In Nonaka and Takeuchi’s knowledge-creation process, transferring knowledge from one organisational member to another begins by the first member converting tacit knowledge (intuitions, unarticulated mental models and embodied technical skills) into explicit knowledge (a meaningful set of information articulated in clear language including numbers or diagrams). This explicit knowledge can then be passed on to another member of the organisation — who must convert it into tacit knowledge (internalisation) before he or she may use it. Again, the Collaborative Cognition Model extends this description of knowledge creation by identifying the different categories of knowledge as defined by Anderson and his colleagues (1998) — Factual, Conceptual, Procedural and Metacognitive — that are involved in the knowledge creation and transfer process.

4. Disseminating and Applying Organisational Knowledge

Figure 2 shows the phase of disseminating and applying knowledge in the life cycle of knowledge in an organisation. In this example, disseminating and applying knowledge begins with an engineer who needs to make a quality plan for a new product. The engineer goes to the system, clicks on the area of Design, then clicks on the area of ‘Detailed (Design)’, and drills down to the area of ‘Quality Plan’ — the engineer finds all the materials that he or she will need to develop a Quality Plan. There will be documents describing what needs to be addressed in the Quality Plan. There will be instructions available on the general principles and techniques behind a Quality Plan. The instruction addresses the “why” part — that is, why do we need a quality plan? There are also examples available of successful quality plans. They illustrate how someone applied the general principles of developing Quality Plan to a specific project. Finally, there is expert advice available that provides some direction as to when to use one approach over another when developing a Quality Plan.

But that is not all the engineer would find at that Quality Plan area in the system. The engineer would also find links to the people that are responsible for the content of the area. There is contact information for the creators of the documents, instructions, examples and expert advice. In contacting these content providers directly, the engineer has the opportunity to understand the subtleties of the content and its application to specific projects.
Need to Make a Quality Plan?

![Diagram](image)

There Are All The Materials You Need Linked to the People that Made Them

Fig. 2. Disseminating and applying organisational knowledge.

Note that with these resources — materials and an opportunity for an exchange with the people who created them — the engineer can learn what is needed to get the job done. In this case, it is the creation of a Quality Plan. With adequate materials and the help of others, the engineer learns — only what is needed, in a “just-in-time” manner to create the Quality Plan. This is learning situated in the context of an authentic task — the pressing work of the moment. It describes the essence of Situated Cognition as described by Brown and Duguid (1989).

This example described above is the result of managing the life cycle of knowledge in an organisation. However, what we have seen is simply the technology that serves up the information. Technology-based solutions leave us here — wondering how the information gets into the system — and more importantly, how it is updated and maintained. It is quickly apparent that the technology is simply the “tip of the iceberg” — a by-product of managing the life cycle of knowledge — that has provided this information. This article discusses how to identify, manage, reuse, and repurpose the information of such a system.

5. Identifying Performance Objectives for Knowledge Products

As Fig. 3 shows, a Quality Plan is a knowledge product. That is, it embodies conclusions, judgements and decisions about what goes into a particular Quality Plan for a specific product. Also, every Quality Plan has a set of criteria, or performance objectives that need to be met by its developers for its successful completion. These performance objectives are sometimes implicit — or in the “eye of the beholder”. Recognising the existence of these performance objectives but not able to easily articulate them is found in such phrases as “I know a good Quality Plan when I see one” or “shouldn’t a Quality Plan have a….”. Uncovering these underlying performance objectives is essential for improving the quality of the ongoing work in an organisation. These performance objectives tell an organisation what needs to be done and how well it should be done. Time and energy used for identifying the performance objectives of a knowledge product is well spent. Borrowing from the field of Instructional Systems Design (ISD), one way to go about identifying performance objectives is to conduct a content analysis. A content analysis always starts off with the same question, “What knowledge does a person need to know to create this knowledge product?” (Davis et al., 1974). That is, it focuses on identifying the cognitive skills needed to create the knowledge product. Cognitive skills underlie learning.
how to learn, that is, getting at the heart of the problem (Gagne et al., 1992). Once the knowledge is identified, it is listed by topic and each topic is rewritten as a performance objective. For example, the topic “Completeness and Correctness Criteria” is rewritten as the performance objective “In the Quality Plan, the developer will list all approved criteria for judging the plan as complete and correct”. (For a complete description of the steps for conducting a content analysis and an overview of the ISD process, see Rothwell and Kasanas, 2004).

Figure 3 shows three performance objectives that have been identified for creating a Quality Plan. The process of stating performance objectives begins by identifying the kinds of objectives that must be written. The most commonly used classification system for performance objectives was first described in 1956 by Bloom and his colleagues (Bloom, 1956). Performance objectives make a precise statement of what learners should “do” in order to accomplish the stated performance (Mager, 1997). They contain a performance component, a criterion component and a condition component. The performance component describes how proficiency will be demonstrated. The criterion component describes how well the proficiency must be performed. And, the condition component describes what conditions must exist when the proficiency is demonstrated.

Figure 3 also shows that the performance objectives of a knowledge product provide the basis for creating metrics to measure the knowledge work of organisations. Measuring how well the performance objectives have been met provides data relating to the “quality” of the knowledge product. Measuring how much time is spent in creating a knowledge product provides data relating to scheduling and cost for the knowledge product.

6. Differentiating Types of Knowledge

Figure 4 shows the four different types of knowledge taken from the revision of Bloom’s Taxonomy (Bloom, 1956) developed by Anderson and his colleagues (1998). Figure 4 also shows that documents provide access to factual knowledge. While other media forms can be used to capture factual knowledge, documents are probably the most well known and used medium for capturing and disseminating factual knowledge (i.e., terminology, specific details and elements). The colour coding in Fig. 4 shows that for most organisations, it would be desirable to have most of the factual knowledge reside in an explicit form. That is, most organisations would not want most of their factual knowledge floating around in the heads of its members.

Figure 4 also shows that instruction provides access to conceptual knowledge. As with the factual knowledge, other resources can provide access to conceptual knowledge, but instruction provides the best medium for capturing and disseminating this kind of knowledge (i.e., general principles and concepts). As for the desired visibility of knowledge, the same idea is true for the conceptual knowledge as for factual knowledge. While access to conceptual knowledge may be provided in an informal way, as with individual “on the job” instruction, most organisations would want to make most of their conceptual knowledge explicit. This is what is done when new courses are developed. The conceptual knowledge residing in the heads of the members of the organisation is made explicit in the form of course materials. However, as Fig. 4 shows, not all conceptual knowledge can be made explicit; this means that some informal instruction will always exist in organisations.

Also shown in Fig. 4, is that examples provide access to procedural knowledge. Examples describe the step-by-step process for applying conceptual and factual knowledge to create a unique solution for a specific problem. While other means can provide access to procedural knowledge, examples are the best medium for providing access to this kind of knowledge. Figure 5 also shows the desired visibility for procedural knowledge in an organisation. Most organisations will want to make many of their examples of good work explicit so that they can provide access to procedural knowledge for the members of their organisation. Some of these “best examples” may become “best practices” for the organisation. Note that it will not be possible to “write up” each example and make the knowledge that went into that example explicit. Consequently, a large amount of procedural knowledge will remain tacit in an organisation.

In addition Fig. 4 shows that expert advice provides access to metacognitive knowledge — “knowledge about knowledge”. Again, while other means can be used to
provide access to metacognitive knowledge, expert advice is the oldest, most direct and accepted means for providing access to this kind of knowledge. Figure 4 also shows that organisations will want to make some of the “gems” of expert advice explicit for all the members of the organisation. However, since it is not possible given today’s understanding of cognition to make all metacognitive knowledge in an organisation explicit, most of it will remain tacit in the organisation.

Even though Fig. 4 shows that large amounts of knowledge will remain in the tacit domain in an organisation, organisations can still manage that knowledge. And it can be managed through the direct connection between two or more people. For example, a member of an organisation can provide specific details, on the job instruction, step-by-step description of previous work, or some expert advice to other members of the organisation. In all these cases, the knowledge begins as tacit knowledge in the first person. Next, it becomes explicit through the first person’s elaboration. This explicit form is internalised by a second person and resides as tacit knowledge in that person. Although no artefacts remain of the explicit form of the knowledge (no documents, no video, etc.) the Tacit–Explicit–Tacit cycle was executed. The managing piece comes in by facilitating an environment where those who need to know something can be connected to those who know it (French and Bazalgette, 1996). It also creates another link between individual and organisational learning (Kim, 1993).

7. Differentiating Learners and the Knowledge They Seek

Figure 5 shows that when Anderson and colleagues revised Bloom’s taxonomy, they made knowledge a separate dimension with four categories: factual, conceptual, procedural and metacognitive (Anderson et al., 1998). They recast Bloom’s other categories into a “process dimension” which describes the learner’s cognitive processes when solving a problem in that category. Figure 5 also shows that novices are usually working at the level of trying to understand and remember. This is why it takes novices so long to get anything done. They are really “stuck” at the level of just trying to “get what is going on” and put it to memory. Also, Fig. 5 shows that practitioners are usually working at the level of analysing the situation and applying knowledge to form a solution. They already understand what to do and remember how to do it. Give them a problem similar to the one that they have solved before and they will quickly analyse the problem and take a previous solution, adapt it, and apply it to their new problem. Finally, Fig. 5 shows that experts should be working at the level of evaluating solutions and creating new and unique ones. The word “should” is put in this explanation because if an organisation is using its experts like practitioners — doing the everyday work — then the organisation is not getting the most from its experts. If the organisation’s experts are spending all their time on the work of the day, then the opportunity is lost for better ways to do tomorrow’s work.

Figure 5 illustrates how to provide learners with appropriate knowledge assets. Of course, an appropriate knowledge asset depends on the type of knowledge that they seek. Novices use the system to become practitioners, practitioners use the system to become experts, and experts utilise the system to create new knowledge. In the process of becoming practitioners, novices seek to understand and remember conceptual knowledge. Instructional materials are appropriate knowledge assets for them as they provide access to conceptual knowledge. Note that novices will still require factual knowledge to fully understand and remember the conceptual knowledge — similar to a student requiring access to the manual to understand the instruction presented in the classroom. In the process of becoming experts, practitioners utilise examples to analyse and apply procedural knowledge. Note that practitioners will still require factual and conceptual knowledge to apply and analyse procedural knowledge. Experts
create and evaluate expert advice. By doing so, they pro-
vide access to metacognitive knowledge for others in the
organisation.

8. Reusing Knowledge Assets

Considerable attention has gone into developing method-
oologies for reusing knowledge work in recent years. Much
of it has focussed on the methodologies for develop-
ing “learning objects” or “content objects” (Barritt and
Alderman, 2004; Hamel and Ryan-Jones, 2002; Rebok,
2003; Robson, 2002). However, while quite a bit has been
published on sharing knowledge, especially, in the area of
communities of practice (Brown and Duguid, 2000; Lave
and Wenger, 1991), little has focussed on the mechanics
of how to identify and track knowledge for reuse (Oster-
lund and Carlile, 2005; Wiley, 2004). The result has been
that for most organisations, reuse is addressed only at the
institutional level, if at all (Davenport, 2004).

Figure 6 illustrates how performance objectives can
be utilised for reusing knowledge work. The business
process in Fig. 6 has two main steps of “Design” and
“Build” for a manufacturing process. The Design step
contains two sub-steps — “Preliminary” and “Detailed”.
The Build step also contains two sub-steps — “Imple-
mentation” and “Delivery”. Similarly, the Design Docu-
ment is the knowledge product for Preliminary Design
sub-step, the Quality Plan is the knowledge product for
Detailed Design sub-step, the Testing Report is the knowl-
edge product for Implementation sub-step and the User
Document is the knowledge product for Deliver sub-step.

Figure 6 also shows two performance objectives that were
originally described differently but were later found to be
fundamentally the same. Performance objective 2 for a
Quality Plan is really the same as performance objective
4 for a Testing Report.

Figure 7 shows that the same performance objective
that appears in two places in the business process creates
the opportunity for reusing a knowledge asset. Since both
performance objectives could now have the same identical
text, this text can be a single document that is referenced
by both performance objectives. Now, when users click on

![Diagram of Business Process]

**Fig. 6.** Identifying knowledge assets for reuse.

![Diagram of Reusing Knowledge Assets]

**Fig. 7.** Reusing knowledge assets.
Performance objectives 2 & 4, they are taken to the same text — regardless of if they are addressing the performance objective for a Quality Plan or a Testing Report. (The "&" operator means that the two performance objectives have been combined into one objective.) This way, whenever the document for this combined performance objective is changed, it will be changed for users no matter which knowledge product they are working on (Quality Plan or Testing Report).

9. Repurposing Knowledge Assets

Figure 8 shows four performance objectives that are almost the same. Performance objectives 3 and 7 are both labelled “creating completeness and correctness criteria” for a Quality Plan. While they are written very similarly, there are some subtle differences. Performance objective 3 is specifically written for the workers at Site A. Performance objective 7 is written specifically for workers at Site B. In a similar situation, Performance objective 6, “applying completeness and correctness criteria” for a Testing Report is written for workers at Site C. It has some subtle differences from Performance objective 8 “applying completeness and correctness criteria” for a Testing Report which is written for workers at Site D.

As in Fig. 7, Fig. 9 shows that since Performance objectives 3, 6–8 are very similar, knowledge workers will apply the same general principles and techniques to satisfy them. This means that the instruction module for all four performance objectives can be the same. This situation forms the basis for repurposing a knowledge asset.

While the instruction is a shared knowledge asset, not all knowledge assets are shared between the four performance objectives. Each performance objective has its own unique set of knowledge assets that describes the context (place in the process, physical site) in which the performance objective is addressed.

As in Fig. 7, Fig. 9 shows that one of the documents has text that describes the common elements of the
performance objective. This text is the same regardless of the performance objective $3 + 6 + 7 + 8$ accessed by a worker writing a Quality Plan from Site A or Site B — or a worker writing a Testing Report from Site C or Site D. (The “+” operator means that the four performance objectives share common knowledge assets, but each has additional knowledge assets that are not shared with the others.)

Note that all workers that access this performance objective will also access the same instructional module as well. However, depending on what part of the process they are coming from (Quality Plan or Testing Report) or what site they are coming from (Site A–D), workers will see a different contextual document. For example, a worker from Site A trying to write a Quality Plan would see “Qual Document — Site A”, while a worker from Site B trying to write a Quality Plan would see “Qual Document — Site B”. On the other hand, a worker from Site C trying to write a Testing Report would see “Test Document — Site C”. And to be complete, a worker from Site D trying to write a Testing Report would see “Test Document — Site D”.

10. Discussion

This article describes a framework for managing the life cycle of knowledge in organisations and how this framework can be used for reusing and repurposing knowledge work. The theoretical foundation for the framework, the Collaborative Cognition Model, details how learning can be supported at the individual, team and organisational levels. At the individual level, the Collaborative Cognition Model supports learning in the context of the work at the moment — creating an “authentic context” for learning. At the team level, the Collaborative Cognition Model supports learning in the context of a “distributed environment” where cognition is distributed across individuals, their artefacts and the history of their artefacts. And, at the organisational level, the Collaborative Cognition Model supports creating a knowledge spiral in an organisation where transferring knowledge from one organisational member to another begins by the first member converting tacit knowledge into explicit knowledge before passing it on to another member of the organisation — who must convert it into tacit knowledge before he or she may use it. The Collaborative Cognition Model also supports “different types” of learning at the individual, team and organisational levels. It supports novices, practitioners and experts in their need of different types of knowledge: factual, conceptual, procedural and metacognitive.

While the Collaborative Cognition Model provides a theoretical foundation for a framework for managing the life cycle of knowledge in organisations, reusing and repurposing knowledge work is part of this larger framework and provides a means for supporting learning in a collective and ongoing manner. Much has been written about learning in organisations; however, little attention has been placed on modelling that learning — at least, not in the same vigor that has been done with modelling and optimising work processes. This article has put forth a means to model the “learning processes” of an organisation. The premise is that for organisations to reach their potential, they must integrate learning into their work. Or said another way, effective organisations must be able to work and learn together — concurrently. That means that the “learning processes” must be modelled and combined with the work processes. That is, the work processes and learning processes must “live in the same space”, “occur at the same time”, and are interdependent.

The view of learning supported by reusing and repurposing knowledge work is an entirely different view of learning than the one based upon the “learning occurs after training” approach. In the learning occurs after training approach, training is done for tomorrow’s production. When training is complete, workers will be able to apply that training when the opportunity presents itself. As a result of this view, training is typically looked upon as a “non-critical” input to production. It can be delayed, or eliminated, because there is enough time to develop a work-around for the missed training before it can affect tomorrow’s production.

In a contrary view of learning supported by reusing and repurposing knowledge work, learning is part of the work process in the “learning during work” approach, and it has to occur during today’s work process to get today’s work done. It is essential to today’s production, and without it, the work does not get done right and on time. In this view, eliminating learning, or delaying it, only reduces an organisation’s ability to get today’s work done. Consequently, learning is looked upon as a critical part of the work process.

Ultimately, this means that for organisations which desire to improve the results of their work processes, they will need to reuse and repurpose their work. To get there, these organisations need to uncover the drivers of knowledge work — the performance objectives that need to be met by the work. These performance objectives provide the key for improving the workflow process and overall knowledge worker productivity. They determine what to measure for providing feedback on how well they are working together and how to go about making improvements in the way they work together. They also determine what knowledge to reuse and repurpose and why it should be reused and repurposed.
11. Future Directions

One area for further work should focus on empowering leaders to create a vision for managing the life cycle of knowledge in their organisation. This vision includes why the “whole brainpower” of an organisation is greater than the sum of its parts. It shows that value lies in the knowledge provided to customers and the only way to increase that value is by bringing more brainpower to it.

And most importantly, it helps organisational members to paint a picture of what reusing and repurposing knowledge will look like and how it will facilitate learning in their organisation.

More experience is needed in using performance objectives for reusing and repurposing knowledge in organisations. Issues needing further examination are the “size” or granularity of the knowledge assets that are managed for reuse and repurpose. Initial experience documented in this article suggests that each performance objective “map” to a Reusable Learning Object (RLO) which addresses that performance objective. Each RLO is comprised of smaller objects called Reusable Information Objects (RIO). These RIOs map to knowledge assets such as documents, instruction, examples and expert advice that provide access to the different types of knowledge as defined by Anderson and his colleagues (1998) in their revision to Bloom’s Taxonomy (factual, conceptual, procedural and metacognitive). A logical extension is to map each enabling — or during — objective to a RIO that addresses that enabling objective. Borrowing again from Instructional Systems Design, each performance objective has an associated list of enabling objectives that are to be completed during instruction (see Mager (1997) for an overview of writing performance objectives with associated enabling objectives). Completing all the enabling objectives means by implication that the learner will be able to accomplish the performance objective (in this situation, sometimes called a terminal performance objective). Note that novices need access to all the knowledge assets (documents, instruction, examples and expert advice) to achieve the level of performance desired. However, practitioners may only need access to one knowledge asset, an example, to achieve the level of performance desired. More work is needed in defining a “second” level of enabling objectives that can be used to manage the knowledge assets that provide quick and easy access to the different types of knowledge as defined by Anderson and his colleagues (1998).

Finally, further work is also needed to utilise performance objectives for evaluating the performance of knowledge workers. From this perspective, performance should be evaluated in terms of the knowledge that individuals bring to bear on the problems of the organisation. The contribution of individuals to the organisation’s “stockpile” of factual, conceptual, procedural and metacognitive knowledge can be used as an information source for individual performance assessments. Obviously, a “count” could be conducted to quantify contributions to procedure manuals, online instructional modules, documented work examples and recorded expert advice. However, as discussed earlier in this article, these contributions can take place informally — sharing a fact, providing on the job instruction, sharing an example, or giving a nugget of expert advice. Further research is needed into the development of new methods for using performance objectives to “measure” and track these contributions.

References


A Framework for Reusing and Repurposing Knowledge Work in Organisations


Mark Salisbury has over 20 years of experience in designing and developing human-computer systems. Mark has published many articles related to knowledge management in engineering, business, and education journals such as the Institute of Electrical and Electronics Engineers (IEEE), Journal of Knowledge Management and Performance Improvement Quarterly (PKQ). Mark has also presented at many international conferences sponsored by organisations such as American Society for Training and Development, International Society for Performance Improvement, Society for Applied Learning Technology and Association for the Advancement of Computing in Education. He has a master’s degree in computer and information science and a PhD in curriculum and instruction from the University of Oregon. Mark also holds a master of arts in teaching economics from Western Oregon University. After completing his graduate studies, he worked for 11 years at The Boeing Company on developing software to improve human performance. His time at Boeing was split between research and development efforts and commercial products. Mark was also CEO of Vitel, Inc., a knowledge management solution provider that has developed knowledge management systems for the US Department of Defense (DOD), US Department of Energy (DOE), the national laboratories and public utility companies. Currently, Mark is an associate professor in the Organisational Learning and Instructional Technologies program at the University of New Mexico where he teaches graduate courses and conducts research in the area of knowledge management.