Revisiting the Web-based Performance Support Systems for Lifelong Learning: Learner-Centered Resource Development Tool

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Abstract: Influenced by generative and intentional learning environment strategies and tools, a Web-based tool has been developed to empower learners to build their own Web-based Performance Support Systems (WPSS) to support their learning, professional development, and performance within a domain. The original version of the WPSS tool was presented at ED-MEDIA 98. The original version did not address the need to create unique Web-based resources when available WWW resources did not meet the learners' needs. Using document sharing, synchronous chat and whiteboard technologies, a learner-centered resource development tool has been incorporated into the original WPSS structure. In this way, the WPSS not only enables learners to (1) build a learning and performance resource that will provide them with immediate support and guidance and (2) help them develop structure, strategies, and skills for subsequent lifelong learning activities, but also (3) take responsibility for creating original resources that support lifelong learning and performance support.

[**Note:** A full version of this paper is available at http://www.cudenver.edu/~jdunlap]

What do you do if...?

- Your company has just completely a major reorganization in which a number of number of positions — including yours — have been restructured and responsibilities reassigned. Now you are required to work on tasks you've not done before.
- You're a UNIX programmer for a company that has decided to replace its UNIX servers with PCs. Now, all new application development must be done for the PC platform.
- You've been a technical writer in your organization for three years. Now, in a move to reduce costs and build in quality assurance measures, instead of out-sourcing the desktop publishing of the documents and manuals you develop you will be required to "publish" the documents yourself.
- Your company has caught the WWW bug and wants to implement a company-wide Intranet. You've been assigned to convert the print-based Employee Handbook to an HTML document — by next Friday!

In a climate of rapid change, increasing innovation, emerging technologies, and proliferating knowledge, lifelong learning is a necessary professional development objective. In order to keep current, people have to be willing and able to continually "retool" their knowledge and skill base. Simply knowing how to use tools and knowledge in a single domain at a specific point in time is not sufficient to remain productive and competitive. People have to face new domains and novel situations with increasing frequency due to the information explosion (Nash, 1994). The need to be a continuous learner is especially apparent in domains influenced by scientific and technological advances; these advances cause knowledge and skills to become obsolete overnight. To deal with today's complex workplace environment, employers need personnel who possess contemporary skills and knowledge, and are willing and able to proactively update their abilities to meet the ever-changing needs of the organization. Employees who are able to keep up with the information explosion are valuable assets; employees who fail to "grow with the flow" are restructured out of their positions. Therefore, lifelong learning is essential to staying current, competitive, productive, and innovative in today's workplace, and therefore employed and in-demand.

Following the prescriptions of the generative and intentional learning methodologies that promote the development of metacognitive and self-directed learning skills to support lifelong learning activities, a Web-based development tool was created. This tool was designed to help people in a workplace environment

generate their own, individualized Web-based performance support systems (WPSS) to address the concerns described above by encouraging and providing a supportive structure for lifelong learning activities.

Lifelong Learning Defined

Lifelong learning is any purposeful learning that people engage in throughout their lives; it is an activity engaged in. to gain greater individual self-fulfillment and to improve the quality of life for the individual and the emerging society (Overly, McQuigg, Silvernail, & Coppedge, 1980). The knowledge explosion requires professionals to engage in lifelong learning if they intend to stay current — let alone evolve, advance, and remain competitive — in their profession. Therefore, lifelong-learning skill development is imperative if people are expected to learn over the full expanse of their professional lives. In order to better prepare for lifelong learning activities, learners must be exposed to learning activities that require them to take on and develop many of the responsibilities normally afforded to educators. To achieve this requires moving away from a view of learning that is controlled outside the individual — by a teacher, trainer, instructional designer, or subject matter expert — to a view of learning that is internally controlled by the individual (Overly et al., 1980). Therefore, in order to internally control the learning process, the development, and subsequent successful application, of two skill areas -- metacognition and self-directedness – is required.

Metacognition

Von Wright (1992) defines metacognitive skills as "the steps that people take to regulate and modify the progress of their cognitive activity: to learn such skills is to acquire procedures that regulate cognitive processes." Glaser (1984) describes metacognitive or self-regulatory skills as knowing what one knows and does not know, predicting outcomes, planning ahead, efficiently apportioning time and cognitive resources, and monitoring one's efforts to solve a problem or learn. More specifically, metacognitive skills that are required for lifelong learning include the (Ridley, Schutz, Glanz, & Weinstein, 1992):

- recognition of content and skill limitations;
- ability to set goals and create action plans based on those defined limitations;
- ability to activate the appropriate prior knowledge to achieve set goals;
- ability to accurately assess progress in learning and task performance and effectiveness of learning resources selected;
- awareness of what still needs to be completed to reach a set goal, and how best to allocate time and resources; and
- ability to modify strategies, tactics, processes, and resource selection based on the needs of the task at hand.

Self-directedness

Self-directed learning is:

> …the process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing learning strategies, and evaluating learning outcomes (Knowles, 1975).

The domain of medicine provides a perfect example of self-directedness. When dealing with patients, the doctor has to begin assessing the patient's condition before having all of the data necessary to evaluate, diagnose, and treat the patient. Characteristically, the patient provides the doctor with fragments of information ("My stomach hurts. I can't hold any food down. No one else in my family is experiencing any problems."). The rest of the information needed to solve the patient's problem comes from the study of a variety of other resources: patient and family history, laboratory results, x-rays, other doctors' opinions, past experiences, similar cases in the case file, and current research findings on new diagnostic and treatment procedures. These skills utilized by the doctor to collect the necessary information to solve the patient's problem are described as "self-directed learning skills" (Barrows, 1985, 1986).

Barrows (1995) defines the process of self-directed learning as utilizing the following skills to solve a problem or fulfill a learning requirement:

- the ability to identify and define a problem/learning need;
- the ability to identify, find, use, and critique resources for solving the problem or meeting the learning requirement;
- the ability to capture and apply information from resources to the problem or learning need; and
- the ability to critique information, skills, and processes used to solve the problem or meet the learning requirement.

So, how do we develop lifelong learning skills?

In order to develop lifelong learning skills, the learners need to be directing and driving the learning process and activities based on their learning and performance needs. Two instructional methodologies that specifically address the development of lifelong learning skills are generative learning and intentional learning.

Generative Learning Environments

Generative learning environments require students — individually and collaboratively — to be responsible for creating, elaborating, and representing domain knowledge in an organized manner (Cognition and Technology Group at Vanderbilt, 1992; Hannafin, 1992; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989; Scardamalia & Bereiter, 1991). Through a this process of "generating" knowledge, instead of passively receiving information, learners develop structure, strategies, and habit for lifelong learning.

Generative learning environments require students to take responsibility for determining what it is about a particular domain they need to know, and then direct their activities accordingly to effectively research, synthesize, and present their findings. Schank and Jona (1991) describe a generative learning environment in their discussion on the research method of teaching. Under the research method of teaching, students are asked to research a particular topic and then present their results to others (the class, a collaborative group, etc.). In this way, students are taking over the responsibility of information gathering and synthesis and dissemination/presentation from the teacher. For this teaching method to lead to successful learning, students need to be allowed to select their own topics to research and report on, so that they have a real interest in proceeding with the assignment and have more control over their learning. Because the learning is student-directed, where each student makes choices and takes responsibility for those choices, the learning is more meaningful; "...in general, material that is organized in terms of a person's own interests and cognitive structures is material that has the best chance of being accessible in memory" (Bruner, 1961). In addition, because students are responsible for selecting a topic, developing a question to research, making decisions about how to gather information, analyzing and synthesizing information, etc., they are engaging in activities that help to develop high-level thinking and problem solving abilities.

Intentional Learning Environments

Intentional learning refers to the "cognitive processes that have learning as a goal rather than an incidental outcome" (Bereiter & Scardamalia, 1989). Intentional learning encourages students to take "an intentional stance toward cognition" (Scardamalia & Bereiter, 1991), which means that learners must learn how to monitor and be aware of their own learning processes, and take responsibility for pursuing desired and/or required learning outcomes. Intentional learning is learning that is actively pursued by and controlled by the learner (Resnick, 1989). Palincsar and Klenk (1992) describe intentional learning as an achievement resulting from the learner's purposeful, effortful, self-regulated, and active engagement. By encouraging students to take "an intentional stance toward cognition", intentional learning helps students learn how to not only monitor and be aware of their own thinking and learning processes (i.e., metacognitive skills), but also to take responsibility for pursuing individually-determined learning goals (i.e., self-directed learning).

The objective of an intentional learning environment is to create a supportive structure in which students can engage in cooperative knowledge building as they move towards greater autonomy. Addressing students' need for higher-order abilities in thinking and learning, intentional learning helps students develop the general metacognitive and self-directed learning skills that facilitate autonomous lifelong learning (Palincsar, 1990; Scardamalia et al., 1989). These skills are developed by engaging students in situations in which they need to build a body of knowledge based on their learning interests and needs using a variety of information resources. While building the knowledge base, students practice tactics for making claims, collecting evidence in support of their claims, and evaluating and responding to counterarguments from peers and teachers. Throughout this knowledge-building process, students reflect on specific aspects of their learning and thinking processes, and consider the effects of collaboration on each other's learning, such as the impact of opinion, bias, controversy, debate, and negotiation (Glaser, 1991).

Throw them all together and what do you get?: Web-based Performance Support Systems (WPSS)

Influenced by generative and intentional learning methodologies as well as electronic performance support systems (EPSS) technology, I developed a Web-based tool empowers learners to build their own Web-based Performance Support Systems (WPSS) to support their learning, professional development, and performance within specific domains. Similar to electronic performance support systems (EPSS), a WPSS uses the Web to provide on-demand access to integrated information, guidance, advice, assistance, training, and tools that support high-level job performance. In fact, using the Web to create performance support systems is a perfect fit because the Web is actively used by professionals as a forum for the distribution of current and up-to-date references, instruction, and guidance.

By creating a structure that supports individualized and collaborative knowledge building by the people who will actually be using the knowledge, the higher-order thinking, problem-solving, and decision-making involved in the selection and utilization of appropriate learning materials and performance support is done by those who can get the most out of the process. In addition, because these activities occur in the workplace and are driven by the needs of the job at hand, the learning activities are contextualized, authentic, and meaningful. Enabling people to utilize an easy-to-use tool to develop their own WPSS accomplishes two goals:

1. they learn about the domain while they are locating, evaluating (which requires utilization of resources), and organizing resources to support their job performance activities and/or their generative and intentional learning activities; and
2. once the WPSS is completed it can be used to support performance and further professional development while working in that domain.

In this way, the WPSS not only enables learners to build a learning and performance resource that will provide them with immediate support and guidance, but also helps them develop structure, strategies, and skills for subsequent lifelong learning activities.

Overview of Original WPSS Development Tool Components

The WPSS development tool helps employees -- collaboratively and as individuals – organize, assess, and utilize Web-based resources. In order to build an effective WPSS, the development tool enables employees to organize Web resources into a variety of self-determined categories. Categories may include:

- cue cards: brief definitions, reminders, directives, job aids, best practices
- computer-based instruction: tutorials, case studies, practice activities
- wizards: intelligent demonstration/application functions; assistance
- coaches: response sensitive correction and feedback
- mentors: individualized responses to questions from experts in the field
- practitioner forum: access to other practitioners in the field
- examples
- tools

In order to build a WPSS that meet individualize, specific learning and job performance needs, employees engage in a number of generative and intentional learning activities including:

- determining their learning needs and goals
- developing a plan for action for finding resources to help fulfill those goals
- researching Web resources that meet the appropriate needs
- utilizing Web resources in order to evaluate usefulness, difficulty level, strengths and weaknesses
- updating links to Web resources when appropriate
- responding to other learners' comments regarding WPSS contributions
- developing Web resources via HTML pages and threaded discussion forums

In other words, employees practice and develop the very skills and strategies needed to engage in lifelong learning activities while they are learning domain-specific content and skills needed for their jobs.

Overview of New WPSS Development Tool Components: The Learner-Centered Resource Development Tool

Although the original implementation of the WPSS was successful, it had a major flaw: it relied on pre-existing Web resources. People using the WPSS had to rely on the WWW to provide the various resources needed to create a knowledge base that would support their learning and performance support activities. For the most part, the WWW provided the resources needed. However, especially in Intranet environments in which employees needed access to organizational specific resources that did or did not already exist, the WPSS failed to meet the learners' needs. Therefore, a tool was created to enable people -- as individuals or in collaborative groups – develop unique Web-based resources for inclusion in the WPSS.

The Learner-centered Resource Development Tool (LRDT) combines the technologies of document sharing and synchronous chat and whiteboard to create an environment in which people can develop -- from scratch -- their own Web-based resources. The LRDT uses synchronous chat and whiteboard features to provide a forum for group brainstorming about the contents of a new resource document. The document sharing feature:

- enables learners to track and archive various versions of new resource documents,
- utilizes asynchronous threaded discussion technology to allow reflective discussion around the development of new Web-based resources, and
- provides easy uploading and downloading of resource documents for revision purposes.

The LRDT, now in beta testing, extends the usefulness of the WPSS by empowering WPSS users to develop their own Web-based resources.

Examples of the WPSS in Use

Although still in a formative stage with enhancements being added all the time, there are a number of examples of the WPSS tool in action. These WPSS examples can be viewed for examination purposes only at the following URL: http://www.cudenver.edu/~jdunlap/wpss.html

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