Chapter 11
Just-in-Time Knowledge and User Interface Design for Effective Hybrid Learning

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ABSTRACT
The means for hybrid learning take on many forms. In this chapter, the author looks at learning facilitators that can be embedded within the user interface. He argues that these learning means can be even more effective than formal training. The author describes different features of the user interface that can provide just-in-time knowledge and fosters learning: immersing the student into a rich environment where he can readily have access to the information for the task at hand.

INTRODUCTION
The European Commission is devoting over 50M Euros annually in recent years to fund projects that are aimed at developing new means of learning and new means of creating and managing digital content. Few of the funded research, if any, aim to develop technologies intended for the classroom. Instead, the emphasis is on developing technologies to make the delivery of learning content more individualized, interactive, and embedded into our everyday environment. In this chapter, we look at how the issue of enriching our everyday environments with just-in-time knowledge delivery technologies that can foster autonomous and highly effective forms of hybrid learning.

LEARNING WITHIN TASK-ORIENTED ENVIRONMENTS
Why are just-in-time learning technologies the focus of such interest? One of the reasons is that it draws upon factors that naturally foster learning.

Looking at the learning phenomena in general, we know that most of what we learn occurs outside of a structured context such as a classroom. Any researcher in Artificial Intelligence can attest that most cognitive tasks that humans perform involve a phenomenal amount of knowledge that was acquired...
throughout life. Much of this knowledge has to do with problem solving skills and "common sense" inference, which is mostly acquired in a semistructured or non-structured environment, through practice.

Language is a good example of our ability to learn in an unstructured context. Learning a language starts with the imperative need to communicate, and with the environment in which that language is omnipresent. The combination of need plus environment is sufficient to incur the learning of a complex skill.

Now, this is not to say that we should aim to ultimately replace structured learning with unstructured learning. The point is that when we get the co-occurrence of the need to know, or the need to perform some task, and an environment that provides the elements to learn and perform, then learning will effectively and efficiently occur.

What makes unstructured learning so powerful, is that learners often have a constant need to know or to perform. It is up to us to provide them with the proper environment that can foster that learning. The constant availability of that environment and the prevalence of the need to know and perform can far outweigh the time and the attention the learner can devote to learning in a structured context, such as a classroom.

Furthermore, learning in the context in which one performs a task is also more effective. The influence of contextual cues greatly increase the ability to recall knowledge and to act appropriately when needed (Bouton, 1993). This phenomenon stems from the fundamental nature of human associative memory and the statement that we learn better in the context where our knowledge is put to practice should not be considered as a mere belief in one of many flavor of learning. That statement is rooted in the notion of associative learning which is a well studied and accepted phenomena (Wasserman and Miller, 1997).

**JOB AIDS IN WORK ENVIRONMENTS**

The advantages of just-in-time learning in the context of doing a task have been recognized by many, in particular in the domain of professional training. Gloria Gery is probably the best known proponent of the approach known as Electronic Performance Support System (EPSS) which aim at providing on the job training electronic aids. The concept is not totally new and, as Rossett and Shafer (2006) notice, job aids have been around since prehistoric times. But the availability of electronic devices to deliver this aid is giving this old concept a new life. Not only are computers more readily available, in all forms, from PDAs to large display workstations, and in all contexts with the advance of wireless networks, but they are also more and more instrumental to do our tasks.

Kasvi (2003) picks a compelling example of how the computer has become instrumental with a modern lumberjack cockpit which, nowadays, is filled with several computer and communication screens and control devices (see figure 1). Here, the computer can become a far more efficient tool in providing job aids than, say, a checklist or a user manual. In principle, such device could provide highly context sensitive aid and can even volunteer relevant information or recommendations.

As long as the machine’s operations are entirely controlled through a computer, then all kinds of means can be deployed to assist the user in performing a given task, from reminders of what operations need to be performed, to highly context sensitive help and information, warnings for dangerous or apparently abnormal operations, automation of repetitive operations, etc.

Performance and learning aids for forestry machine operation is currently limited because the computer has limited information about the objects being manipulated and the outside environment in general. As more sophisticated sensors such as cameras and object recognition features become