Cognitive design for instructional design

PHILIPPE C. DUCHASTEL
LearnTech, 612 George, Birmingham, MI 48009, USA

Abstract. There is strong interest in the field of instructional design in building expert systems that can provide advice to inexperienced instructional designers. This paper questions whether the expert systems model to advice-giving is in fact appropriate for a design process such as instructional design. An alternate approach based on case-based reasoning and the critic approach to advice-giving is considered to be better adapted to the cognitive needs of this task. The cognitive constraints of the task are used to orient the design of an instructional design workbench. The concept of an ID workbench illustrates the direct application of cognitive science to a complex practical task in the area of design.

Introduction

The aim of this paper is to lay the foundations for the cognitively-based architecture of an instructional design workbench. An ID workbench is a computer-based system that serves as the primary drafting board for the design of instruction. It provides a framework within which instruction is designed, and provides access to all the tools and information that are needed to accomplish this task in an efficient manner. It should also serve as a skill-building tool for the novice, enabling one's experience to be broadened through access to the instructional design knowledge contained in the tool.

Two existing systems are early prototypes of an ID Workbench. One, called IDioM for Instructional Development Method (now renamed the ID Library), is a workbench used by Apple Computer Inc. for its training development (Gustafson and Reeves, 1988). The other, IDE (for Instructional Design Environment), was developed at Xerox as a workbench for its own trainers (Russell et al., 1988). Both are considered in their own context as ID Workbenches and used as such, even if not on an intensive basis. Each has interesting features, borrowed in the design proposed later. Each is also considered to have limitations, which could potentially be overcome, hence their characterization here as prototypes.

Our aim is to design the ideal ID Workbench, within the constraints imposed by the current state of near-term computer technology (the technology expected to be available shortly) and, even more importantly, by the current state of the art.
in instructional design. These two factors time-stamp what is ‘ideal’ in both the practical sense of building such an ID Workbench, and in the more abstract sense of what is theoretically possible. One interesting aim later will be to ‘unconstrain’ the design to see what might come along in the future.

We deal here with the cognitively-based architecture of an ID Workbench. By that we mean that we are concerned not so much with the technical details of the system (although these are important), as we are with the task requirements of the design process and how these interact with the designer’s own level of experience as he or she engages in instructional design. We will thus be concerned with the cognitive needs of the designer faced with an instructional design task and how these needs can orient the architecture of the ID Workbench. Such a needs-based approach is always present in the design of any system, but often implicitly so. What we want to do here is make the cognitive needs explicit and have them be the main driver of the Workbench architecture.

This brings us to a discussion of the main competitor of an ID Workbench as the designer’s main job aid, the ID expert system. We believe the expert system approach has drawbacks which make it inappropriate for instructional design.

The expert system approach to instructional design

Expert systems technology has been around for quite some time now, and it has been applied to numerous application domains. In the field of instructional design, it was thought that the ID process could be formally represented as a set of rules that would drive an ID expert system (Merrill, 1987). That goal is still one which is currently being actively pursued (Merrill, 1990). There are reasons to believe, however, that that particular approach may be ill-founded.

Expert systems are part of the larger class of consultation systems that provide specific information to users to help them with particular problems. Other systems within that larger class are advisory systems, which can coach a user in performing a given task, critiquing systems, which comment on the performance of a task, and tutorial systems, which teach how to perform a task. These systems are all similar to one another in that they assist a user in one way or another in the performance of a task. Another commonality between them is that they all encourage growth in the skill being performed, the tutorial systems being explicitly aimed at that function. Thus consultation systems have an assistance function and a skill improvement function.

Where the systems differ is in their emphases on certain aspects of the situation. Table 1, adapted from Duchastel and Brahan (1989), summarizes some of these emphases (note that the critiquing systems class has been subsumed within others, for it is either advisory or tutorial in nature depending on circumstances).