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IBM Introduces a New Computer for Schools

Focus: Artificial Intelligence in Education and Training

Instruction **Delivery Systems**

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International Business Machines Corp. recently introduced the Personal System/2 Model 25 computer, targeted at the education market which is dominated by other vendors. IBM says the Model 25 can be networked in a classroom environment, using one of the more powerful PS/machines as a file server (as depicted.) See News Briefs on page 23 for more information.

The cover photo is provided by IBM Corp.

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Building an effective knowledge base is extremely difficult

By Bernard F. Mayoff Contributing Writer



xpertise, by definition, is a rare commodity. Course developers have always been faced with the challenge of extracting the information they need from subject matter experts (SMEs). The growing interest in artificial intelligence (AI) has made the demand

for SMEs even greater.

Artificial intelligence is portrayed by some as the key to the future and by others as a great waste of time. Since Alan Turing addressed the question of machines and thought in 1950 researchers have been working toward implementing useful AI systems. Science fiction writers have taken advantage of the wonders of AI for decades. Of course, they are not constrained by economics and project approvals.

Artificial intelligence is simply a system that appears to be doing what an intelligent creature would do in a given set of circumstances. Turing proposed an experiment in which a person would sit in a room and carry on a conversation via a computer terminal. Today many readers have had that experience at work or perhaps on a computer bulletin board system. If you haven't had the experience yourself, ask any teenager who has a home computer and a modem to describe the process. But at the time of Turing's proposal the idea was novel.

The significant part of Turing's proposal is this: If the person believed he was carrying on a conversation with an intelligent entity, then he was carrying on a conversation with an intelligent entity. If that entity turned out to be a computer program then the computer program was simulating intelligence; thus it was "artificial intelligence."

The writer is an IBM senior systems engineer, responsibile for marketing and supporting the InfoWindow interactive video system. The opinions expressed herein are his and not those of IBM. He may be reached at IBM, Information Systems Group, 20-06-SP6, 1605 LBJ Freeway, Dallas, Texas 75234; telephone: (214) 888-5157. One branch of artificial intelligence receiving a great deal of attention today is expert systems. An expert system appears to be knowledgeable in a specific subject area. This may be accomplished by building up a "knowledge base" in that area. Of course the knowledge is not useful unless it can be applied or queried so the ability to respond to queries is another requirement of an expert system.

The knowledge base can be built by loading a computer database with facts and the relationships between them. A program is then used to search through these facts and use these relationships to respond to queries. Many systems also

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have the ability to explain what facts and relationships they have used in arriving at an answer.

Another approach to building up a knowledge base is to let the system acquire knowledge interactively and in response to circumstances. For example, if you ask a question and the system examines its knowledge base and reaches a dead end it has to respond that it has reached the limits of its knowledge. But it can also request additional data or relationships so that its limits are expanded and if it ever goes down that path again it will be able to go further. Many readers will have seen the computer game usually called *Animal*, a program which tries to guess an animal that

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you are thinking of through a series of yes/no questions. If it cannot guess your animal, the program asks for a fact that will allow your animal to be distinguished from the program's best guess. This new data is added to the knowledge base and the program is ready to play again, a little smarter because of what you have taught it.

By now it is obvious that to build an expert system which depends on a knowledge base, it is necessary to have a source of expertise to prime the system. The source of this expertise, the area expert, supplies the knowledge engineer, the creator of the knowledge base, with area expertise. In



the remainder of this article we will explore an alternative use of this expertise.

In the creation of a course the developer must consider the objectives, the students, the environment and the other factors which will influence the educational approach. Technology and budgets are among them. Beyond all of these factors we are faced with the issue that somebody has to know the material that is to be taught—the subject matter expert. Everyone who has tried to build

Mayoff

a course, regardless of media, has run into the challenge of getting adequate support from SMEs. Even finding them can be a challenge. Often the course developer becomes the SME, not out of choice, but of necessity. This leads to its

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In Service, Inc. (312) 860-9822 765 Route 83, Suite 114, Bensenville, Illinois 60106 One of the challenges facing us is the ability to build a knowledge base complete and thorough enough to be the SME for the course developer. That is no small undertaking.

own set of problems as the instructor has to make decisions between being an educator and being a consultant.

The subject matter expert, or experts, must supply the author with basic material, answer questions, provide references or demonstrations and, hopefully, review the material. If we don't expect the SME to develop the basic course itself then the author must extract the facts and relationships from the SME. These facts and relationships must be organized into a logical approach in which they build upon each other to finally transfer a body of knowledge to the students.

The requirement for an area expert in developing a knowledge base and the requirement for a subject matter expert in developing a course have just been shown to have parallels. These parallels lead to at least two common problems and to a requirement for future work.

First, the expert is always a limited, and sometimes scarce, resource. Demands for time are often difficult to satisfy, even when there is a willing attitude. Secondly, there may be the reluctance by the SME to foster competition. This may be even more likely to occur in the knowledge base arena than in the educational one. The problems are compounded if the expert is asked to support BOTH an AI project and a course development project.

One of the challenges facing us is the ability to build a knowledge base complete and thorough enough to be the SME for the course developer. That is no small undertaking.

Beyond that comes the desire, suggested by Maj. Ronald E. Daniel ("Delivery or Education?," *Instruction Delivery Systems*, March/April, 1987), for the AI system to use the subject matter knowledge base, combined with an educator knowledge base, to actually design and build significant portions of the course.

Lurking behind all of this is the question about when the course should even be taught, and to whom. With a knowledge base this thorough and accessible how many students need to be educated in the subject matter? Plato wrote: "The tools that would teach men their own use would be beyond price." As we get better and better at building these tools we will also have to examine the price we pay for having them.