Roles of IT in Improving Our Educational System. Part 6:
Creating Human–Computer Teams

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In the past few months, I have been a reviewer for three different agencies that were funding educational improvement projects. All of the proposals I was asked to rate fell in the general area of information technology (IT) in education. For the most part, these proposals were not very good. They tended to suffer from two things:

1. The authors did not demonstrate that they know the general Science of Teaching and Learning (SoTL) or the specifics of roles of IT in the SoTL. Many of the proposals might best be described as attempts to reinvent the wheel.

2. The authors presented simplistic and narrow answers to very complex and difficult educational problems. Often these proposed solutions were backward looking (all we need to do is do what we have been doing, but do it better). Few were forward looking (IT can facilitate significant changes and major improvements in the basic nature of an educational system).

This editorial discusses the second problem.

An Example from Chess

Very early in the history of artificial intelligence (AI) people began to develop computer programs that could play chess. The rules of chess are relatively simple, and it takes a human being many years of study and practice to get good at the game.

In 1958, a chess program beat a human player for the first time. The human player, a secretary of the team of programmers who had never played chess before, was taught how to play just an hour before the game, and was beaten by the chess program. As unremarkable as this feat may seem today, it served to show that knowledge could be embedded into a chess program (about an hour’s training worth of knowledge, to be precise). (López-Ortiz, 1993)

The idea that knowledge can be embedded in a computer program—knowledge that takes a human a significant amount of time to learn—is fundamental to the future of our educational system. Today’s computer chess programs contain an immensely greater amount of knowledge than did the 1958 computer chess program.

As researchers made progress in the theory of computer chess and as computers became more powerful, the capabilities of computer chess programs gradually improved. Still, the better human chess players could easily defeat the best chess programs.

Then people got the idea of having a relatively good chess player team up with a good computer program with the expectation that this team would readily outperform chess players.
who were equal to the human member of the team. It turned out this was not the case. The difficulty was that humans and computers bring substantially different approaches to playing a good game of chess. It takes a substantial amount of training and experience for a human to learn to take advantage of the computer capabilities when working in a human–computer chess-playing team.

I use this story to make two points. The first is that people and computers bring different areas of expertise to solving a problem or accomplishing a task. It can take a substantial amount of training and experience for a human to learn to be an effective member of a human–computer team.

The second point is that on May 11, 1997, a computer defeated the reigning human world chess champion (IBM, 1997). This indicates that there are some problem areas in which the computer member of a human–computer team can dispense with the human. There are a steadily increasing number of problems for which this is the case.

An Example of Web Use

While writing this article, I used the Google™ search engine (www.google.com) to do a search using keywords Deep Blue. Google™ dutifully reported that its index currently covered more than 1.2 billion Web pages, and that 1,070,000 of them contained a reference to Deep Blue. This took the search engine just .12 seconds. I clicked on the topmost item suggested, and voilà, I had a reference to meet my needs. This was an example of a human–computer team working together to solve an information retrieval problem. I knew that a computer named Deep Blue had defeated the human world chess champion Garry Kasparov a few years ago. A combination of my knowledge (the name Deep Blue) and the computer’s capabilities easily solved the problem.

Suppose I had not remembered Deep Blue? Keying computer chess into Google™ produced approximately 188,000 hits in .08 seconds. None of the titles of the first 20 hits mentioned Kasparov or Deep Blue. I browsed the results. The fourth site provided good coverage of the May 11, 1997, Kasparov vs. Deep Blue chess match. Without my knowledge of the name Deep Blue, it took me considerably more time to find the answer to my question.

Continuing to use simple search strategies, I keyed the four words computer chess world champion into Google™. In 1.15 seconds it produced more than 8,000 hits, the first being Kasparov vs. Deep Blue. Google™ looked for Web pages containing all four of the words I keyed in.

I am proud of how well Google™ and I worked together to quickly solve my information retrieval problem. I am proud that I brought to the task the knowledge and skills to be a valuable member of the team. I formulated the problem. I know how to access the Web and to use a search engine. I know how to read and to keyboard. I am also proud of the fact that I know how to use the Advanced Search features of a variety of search engines.

Educational Implications

People can do many things better than computers. Foremost among them are being a human being, understanding human values and what it is like to be a human being, posing problems that humans want to answer, and interpreting the results that are produced as attempts are made to solve the problems.
On the other hand, computers can do a steadily increasing number of things better than humans. Educators are faced with the problem of how to educate children for adult life in a world in which computer capabilities will continue to grow very rapidly and already exceed humans in many areas.

Moreover, our educational system needs to develop and use authentic assessment methods to measure its success in addressing this problem. A non authentic test of my information retrieval skills would be to send me to a conventional, “hard copy” library and ask me to solve my computer chess information retrieval problem. Without a significant amount of training in the use of the various types of indexes available in a library, I might well fail to find the needed information. Of course, even if I succeeded, it would have taken me a huge amount of time relative to what I actually expended while sitting at home using my computer. For me, the educational implications are clear.

1. Students need an education that prepares them to work in a human–computer team.

2. Students need an education that helps them understand the capabilities and limitations of humans versus those of computers.

3. Students need to be assessed in an authentic hands-on human–computer team environment rather than in some non authentic environment.

References