

Moesund, D. (2002). Information and communications technology in education: A personal perspective. *Contemporary Issues in Technology and Teacher Education* [Online serial], 2(2), 243-262.

**Note:** At its March 2002 annual conference the Society for Information Technology and Teacher Education presented David Moursund with its Lifetime Achievement Award. At SITE's request, Dr. Moursund prepared the following overview of his perspectives on technology in education.

## Information and Communications Technology in Education: A Personal Perspective

DAVID MOURSUND  
*University of Oregon*

Throughout my professional career I have worked, played, studied, taught, experienced, and learned about Information and Communications Technology (ICT) in Education. I have been an active participant in this field as it has slowly moved from infancy into early childhood. In this article, I will share some of the things that I have learned and that I think are particularly important. I will illustrate some of these things with personal stories and reflections. My goal is to help move the field of ICT in education out of its current early childhood phase.

My first experience in the field of Information and Communications Technology (ICT) was in the summer of 1963, shortly after I received my doctorate in mathematics. My area of specialization was numerical analysis, and this involved developing computational methods for solving various types of math problems. In the summer of 1963 (nearly 40 years ago), I helped teach talented and gifted high school students who were learning about computers and computer mathematics. This remains one of my interest areas (see <http://www.brainconnection.com>)

In the summer of 1965 I taught a course for secondary school teachers in a National Science foundation (NSF) summer institute, and by the summer of 1966 I was running my own NSF summer institute for teachers. All of the summer institutes and other NSF programs that I have run have focused on uses of ICT in precollege education.

My professional career has been one of learning and of sharing my learning. I have been fortunate in having job situations that supported this approach. I have held faculty appointments in mathematics at the University

of Wisconsin, in engineering and mathematics at Michigan State University, and in mathematics, computer science, and education at the University of Oregon. In addition, I started the professional society that eventually became the International Society for Technology in Education (ISTE), and I headed that organization for 19 years.

This document is divided into somewhat isolated pieces, but readers may find that some of the pieces tie together as they work to create meaning from the document. The organization of the document is fuzzy, as are the messages I am attempting to convey.

Throughout my professional career I have had an increasingly broad range of interests. These can be thought of in terms of discipline areas such as mathematics, computer science, and education. Significant chunks of my professional career have been spent in each of these three fields.

Or my interests can be thought of in terms of more general ideas, such as teaching, learning, problem solving, and research. The academic positions I have held have all allowed me considerable time to pursue these general ideas.

In the next few sections of this document I explore some topics that I would like to share with you. Some of the topics will be illustrated through personal stories. Over the years, I have gradually come to understand that story telling is an important aspect of teaching.

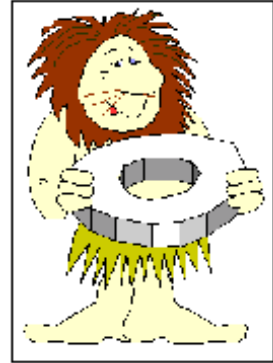
## RESEARCH

You have all heard the expression, “Don’t reinvent the wheel.” This is a profound idea. There are many problems that people want to solve. For some problems, once one person solves the problem, others need only imitate the solution. This is sometimes called the Einstein effect. For example, perhaps it was an “Einstein” living many thousands of years ago who invented the wheel. Others saw how useful the wheel was, learned to make wheels, and taught still others to make and use wheels.

I view research as solving problems in a manner so that others can build upon the results—so that others do not have to reinvent the wheel. My initial research was in mathematics. As a mathematician I posed and solved

some problems, wrote and published some papers, and achieved both promotion and tenure at the associate professor level. While at Michigan State University early in my teaching career, I also researched various methods used to teach freshman mathematics at that university.

One of the key ideas in mathematical research is that a problem gets posed and solved. If the statement of the problem and the solution are carefully done, then that problem is solved once and for all. People have been able to depend on the correctness of the Pythagorean Theorem for more than 2,000 years.



Imagine my surprise later in my career when I eventually began to read the research literature in education and ran into the idea of a metastudy. In essence, a number of studies are carried out on various versions of an education problem. A metastudy analyzes the results, attempting to discern results that others can build upon. However, what one typically finds is that the problem being studied is so complex and involves so many variables that no clearcut solution emerges. We pose such problems as, “What is the best way to teach a child to read?” At the same time that we know that a combination of nature and nurture makes every learner different. Thus, education problems are not solved once and for all. Moreover, changes in technology lead to changes in possible solutions to educational problems.

Thus, my career as a researcher in mathematics and in education feels somewhat schizophrenic. My father was a research mathematician. One of his favorite statements was, “Either it is or it isn’t.” Fuzzy logic had not yet been invented back in those days. Fuzzy logic is now important in mathematics, engineering, and other fields. It helps to describe our research findings in education.

My career as a researcher is thoroughly intertwined with those of a large number of master’s and doctorate students. In 1970, I created this country’s second master’s degree program in the field of computers in education. In 1971 a student asked me if the University of Oregon offered a doctorate in that field. After a brief discussion with Keith Acheson, a math education colleague in the College of Education, we decided the answer was “yes.” I

think it was more than ten years before the dean of the College of Education realized that such a new program had been created and was graduating a large number of students. I have been the major professor or comajor professor of about 75 doctoral students in this field (along with five in mathematics). By and large I have been able to work with whatever area of interest the students have had. Thus, I have had the opportunity to work in a huge number of different aspects of the field of computers in education.

## COMPUTER SCIENCE

I was one of three people who worked together to create the University of Oregon's Computer and Information Science Department in 1969, and I served as chair of the department for its first six years. In those days I believed strongly in the importance of computer and information science and such topics as computer programming, artificial intelligence, computer graphics, and information retrieval. Although I didn't have any undergraduate or graduate coursework in these areas, I eventually learned enough to teach a variety of such courses.

During those years, a colleague of mine suggested that the most important ideas that were coming out of computer science in the 20<sup>th</sup> century were *effective procedure* and *procedural thinking*. A computer program can be thought of as being an effective procedure, even if it contains bugs and fails to solve the problem it was intended to solve. Procedural thinking is the type of thinking that one uses when developing computer programs and in making use of computer programs to solve problems.

The early master's degree and doctorate of computer in education programs at the University of Oregon required a substantial amount of computer and information science coursework. There was a considerable emphasis on the ideas of effective procedure and procedural thinking. I considered that to be one of the strengths of the programs. A number of my doctoral students went on to hold positions in the Computer and Information Science Department.

To a large extent, this emphasis on computer science has disappeared from both the University of Oregon programs and from computer in education programs throughout the country. We are producing ICT master's and

doctoral students who tend to have very little knowledge in the field of computer and information science. This saddens me.

## SCIENCE OF TEACHING AND LEARNING (SOTL)

In recent years I have become quite interested in the science of teaching and learning (SoTL). Bransford, Brown, and Cocking (1999) and Bruer (1993) provided excellent summaries of this field. Bruer's book contains an example that resonates with me and helps to illustrate what SoTL means.

One of my earliest memories is of my parents doing some gardening in our backyard, and my father asking me a question somewhat like "What is 9 plus 14?" I had no idea what the answer might be or how to solve such a problem. A few minutes later, however, I happened to walk past our picket fence, and it occurred to me that I could answer the question by counting pickets. I "discovered" *counting on* as a way to solve such a problem. I was so excited that I ran to find my father to tell him my answer.

Bruer's book contains an example of research suggesting that perhaps one third of first graders have not discovered or been taught counting on prior to entering the first grade. This is a significant barrier to learning the arithmetic in the typical first grade curriculum. The SoTL intervention was to develop a short unit about the number line and counting on that could be taught to first grade students. Less than an hour of instructional time was required to make a significant difference in the mathematics education of many students who had not previously discovered or been taught these ideas.

This research result and educational intervention illustrates a very important idea. Think for a moment about whether all first grade teachers are able to determine which, if any, of their students would benefit by such an intervention and which have the knowledge and skills to implement the intervention. We immediately see a major problem in our efforts to improve education. How can we "bring to scale" our educational research findings? How can we translate good research results into widespread practice?

For the most part, we are not successful in doing so. The difficulty is that teacher knowledge and skill cannot be mass produced and mass distributed. Over the years I have done lots of staff development, written books and

articles on staff development, and taught both courses and workshops on staff development. It is clear to me that staff development is a critical component of improving our education system.

However, we need better ways to turn educational research into practice. ICT is a powerful aid to doing so. In addition, computers and computerized equipment are contributing significantly to progress in brain science. This helps explain my current interests in brain science, SoTL, and ICT in math education (Moursund, 2002).

## INTELLIGENCE

Howard Gardner's (1983) book on multiple intelligences had a significant impact on my thinking about teaching and learning. Both my father and mother taught in the mathematics department at the University of Oregon, and my father served as head of the department for about 30 years. It is clear that my father raised me to be a mathematician. My report card from early in the first grade indicated, "Now that we have hit numeration, David really shines." It turned out that the combination of nature and nurture facilitated my getting a doctorate in mathematics and achieving some level of success as a research mathematician.

I have a reasonably high level of logical/mathematical intelligence from Howard Gardner's multiple intelligences point of view. However, my spatial intelligence is below average. Spatial intelligence is considered to be very important for success in mathematics. But my other talents, supported by our formal and informal educational systems along with intrinsic and extrinsic motivation, allowed me to achieve success as a mathematician. I find this particularly interesting as our educational system continues to label children and pigeonhole them. The State of Oregon vocational tests that I took during my senior year of high school indicated that I should not seek a career in mathematics.

Of course, I heard about the idea of IQ long before I graduated from high school. But it was only when I ran into Howard Gardner's first book on multiple intelligences that I began to take a serious interest in this topic. The following definition appears in Moursund (1996, 2001) and is synthesized from the work of Howard Gardner, David Perkins, and Robert Sternberg.

Intelligence is a combination of the ability to:

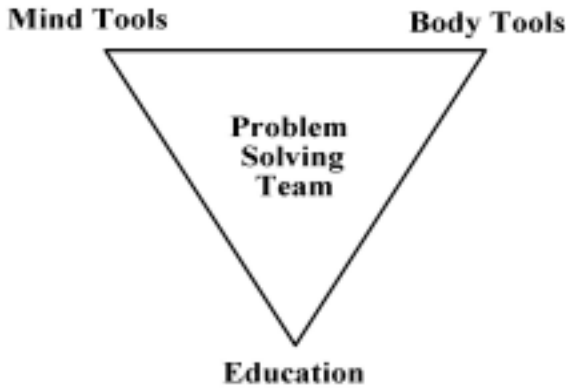
1. Learn. This includes all kinds of informal and formal learning via any combination of experience, education, and training.
2. Pose problems. This includes recognizing problem situations and transforming them into more clearly defined problems.
3. Solve problems. This includes solving problems, accomplishing tasks, and fashioning products. It involves creativity and higher-order thinking skills.

I find that this definition works well both in being a teacher and in being a computer-using educator. For example, ICT is a powerful aid to solving problems. Thus, Item 3 of the definition allows me to argue that computers make us more intelligent. In addition, ICT contributes SoTL.

## **PROBLEM SOLVING**

In this document, I use the term problem solving in a broad sense. Thus, it includes activities such as accomplishing a task, making a decision, answering questions, and solving a problem.

Problem solving has been a unifying theme of my professional work (Moursund, 1970). In my teaching and writing I make frequent use of the diagram of Figure 1.



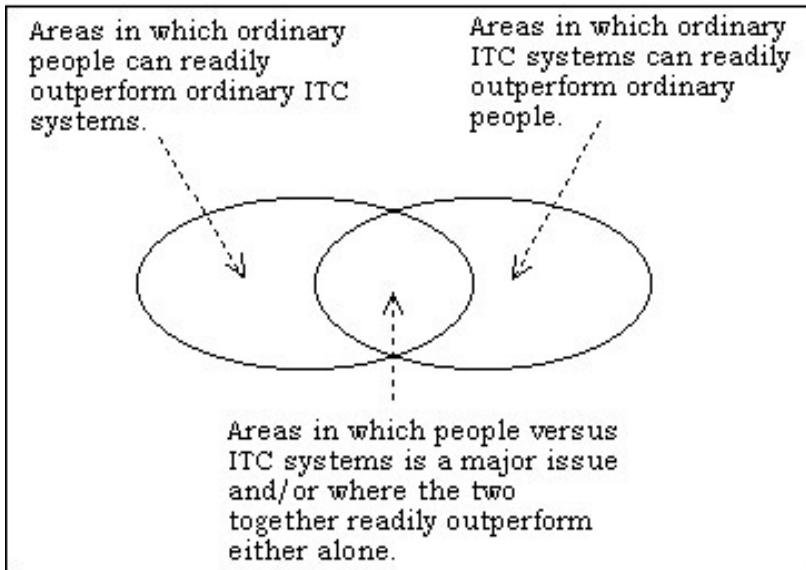
**Figure 1.** Aids to problem solving

The central focus in Figure 1 is a one-person or a multiperson team that wants to solve a problem. This team is assisted by mind tools, body tools, and the formal and informal education of the team members. This education includes learning to make effective use of the mind and body tools, as well as the (human) members of the team. Thus, we have a clear representation of three areas for focus in improving the capabilities of a problem solving team.

ICT provides us with improved mind tools, body tools, and education. Moreover, ICT is an aid to integrating these three aspects of problem solving. For example, a mind tool or a body tool can contain intelligent computer-assisted learning (ICAL) that “just in time” can help members of the problem solving team learn to use the tools. If the ICAL is sufficiently intelligent, the instruction can take into consideration the specific problem to be solved. We see this in contextual help being built into software applications.

One of the key ideas in problem solving is building on the previous work of others and one’s own previous work. Throughout my professional career I have studied, written, and taught about problem solving. One of the points I stress is that ICT provides a new way to build upon previous work. Some types of previous work can be stored in a “the ICT system can do it for you” form. ICT has allowed us to accumulate a huge number of computerized procedures and automated machines that can automatically solve certain types of problems.

Our educational system is severely challenged by the pace of progress in these aspects of ICT. Much of our formal education still focuses on having people learn to do things that ICT systems can do much better than people. Some of this teaching and learning effort should be moved into domains in which people far outperform computers. I often use Figure 2 in discussing this idea in my teaching and writing.



**Figure 2.** ICT versus people in solving problems

I am particularly interested in identifying teaching/learning situations in which an ITC system can readily outperform a teacher. A simple example is the contextual help built into a computer application. A teacher with a classroom of students—each using different components of a computer application and/or different applications—cannot compete with this steadily improving computer capability.

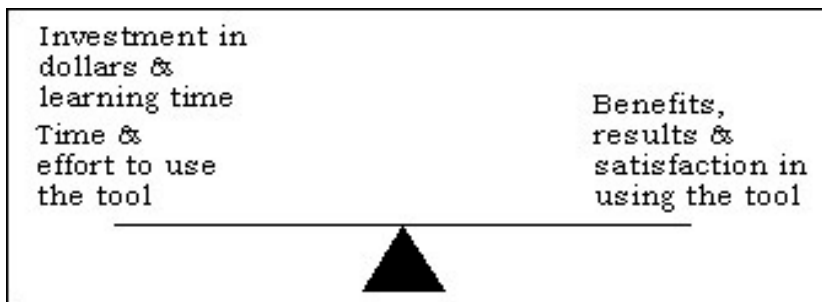
I will close this section with a story from my graduate school days. I was taking a course in complex variable, and we were using a text written by the course instructor. However, the professor kept giving us really hard homework problems that were not in his book. Finally, a student got up the courage to ask where these problems were coming from. The answer was that these were research problems from papers published about 30 years earlier.

A little thinking about this helped me decide to do my dissertation work in numerical analysis. The recent advent of computers made posing and addressing new problems possible. At the same time, it made solving old problems in new ways possible. In some sense, I could skip over much of what had been done in the past, moving directly to the frontiers.

This idea, of course, applies to all areas of human intellectual endeavor in which an ICT system is a powerful aid to representing and solving problems. It helps explain why many young people—often without advanced college degrees—have been so successful in the ICT field. They used their brainpower and the new tools to solve new problems, rather than spending so much time and effort learning to solve problems that had already been solved. Readers of this document may want to do some introspection about their own lines of scholarly activity!

### COST/BENEFIT ANALYSIS

Figure 3 portrays the balance between some of the obvious costs and benefits of making use of ICT in one's professional and nonprofessional activities.



**Figure 3.** Cost/benefit balance

At a conscious or subconscious level people make decisions all the time about how to use their personal resources such as money and time. This simple diagram helps explain why many teachers are not making significant use of ICT in their classrooms and in their other professional work. They face a severe shortage of time. Their perceptions of potential benefits to themselves and their students are not sufficient to tip the scale to the right.

I can think of numerous personal examples in which I have made conscious or subconscious decisions that might be analyzed from a cost/benefit point of view. For example, I know that I am relatively inept in dealing with computer hardware and software problems. The time and effort to gain the needed knowledge and skills is not forthcoming. Fortunately for me, my wife is highly skilled in this aspect of ICT.

Thinking along these lines led me to write about compelling applications (Moursund, 2000) of ICT in education. These are applications that are so intrinsically motivating and intrinsically valuable to a teacher (or to someone else faced by the cost/benefit decision) that the scale is heavily tipped to the right. Most teachers are not finding many compelling applications.

## LEARNING AND LEARNING THEORIES

I have no recollection of ever having heard about transfer of learning or about any learning theory other than behaviorism during my K-20 education and early years as a university faculty member. In retrospect, this makes a strong statement about our education system. What do we know about learning and learning to learn? Why don't we place more emphasis on this topic in each course that students take? I would think that mathematics teachers would know quite a bit about how to learn mathematics and would share this knowledge with their students. But I do not recall ever receiving any explicit instruction in this area.

I recall being rather impressed when I first learned about "near transfer" and "far transfer." But this "theory" doesn't seem to be very useful in teaching and learning. I was far more impressed when one of my doctoral students worked on "low road" and "high road" transfer. This theory appears relevant to teaching and learning. It helps explain why rote memory approaches to education do not work well, and why teaching a computer application such as a word processor at a keystroke level is not a good approach to facilitating learning that transfers.

In more recent years, one of my doctoral students did his dissertation on cognitive learning theories. I have learned that constructivism and situated learning are all quite important in the field of ICT in education, and that there are many other learning theories (see [http://otec.uoregon.edu/cognitive\\_science.htm](http://otec.uoregon.edu/cognitive_science.htm)).

Figure 4 is a model of how a typical person learns to use a mind tool or a body tool. It is a “learn by doing” model. This model is supported by constructivism and by situated learning. Our formal educational system does only a modest job of following this model. People learning ICT on their own or on the job typically follow this model.



**Figure 4.** Learning to use a Mind or Body Tool

The teaching/learning model in Figure 4 is highly dependent on the individual learner obtaining feedback on when more learning may be needed. This feedback may come from self, peers, teachers, the tools being used, and so on. As more instructional intelligence is built into ICT systems, more feedback—as well as more contextual, just-in-time instruction—will occur. In ICT, aids to learning include peers, teachers, oneself, ICT systems, books, reference manuals, and so on. Learning from one’s colleagues and fellow students is quite common.

## INTELLIGENT COMPUTER-ASSISTED LEARNING

When I first encountered the computer-assisted learning (CAL) work being done by Pat Suppes in the 1960s, I could not help but laugh. Very expensive computer systems were being used to teach students to do paper and pencil arithmetic. The computer system “knew” how to solve the problems that it was helping students learn to solve. Also, even in those days the computer was thousands as times as fast as students, as well as more accurate, at doing arithmetic. Handheld calculators were beginning to be reasonably priced.

However, over the years my attitudes about and approach to CAL have changed. Here are a few reasons for my changing attitude:

- Research on individual tutoring, small class size, and individual education plan (IEP) points to potential changes that could greatly improve the effectiveness of our educational system.
- Studies, metastudies, and a metameta study on CAL suggest that in a wide variety of settings, even CAL of modest quality can produce better learning gains than typical whole class instruction.
- Microworlds, computer simulations, and virtual realities have moved CAL well beyond the behaviorist drill and practice approach to learning.
- Significant progress is occurring in intelligent CAL (ICAL). This entails increased machine understanding both of the materials to be learned and of the learner. We are beginning to see a significant number of examples of ICAL systems that can out perform a classroom teacher working in a whole class setting. Indeed, some can out perform an individual tutor. See, for example, Fast ForWord's use with severe speech-delayed children and with people receiving cochlear implants (see <http://www.brainconnection.com>).
- The cost effectiveness of CAL and ICAL continues to improve, both because of research and because of continued rapid decreases in the cost of computation and telecommunication.

During all of the years since first encountering the work of Pat Suppes, I have held onto my amusement about using a computer to teach a person to compete with a computer. In many cases it makes far more sense for a person to learn to use the ICT tools and then for the person and ICT tools to work together (see Figure 2).

Here is an example of what I mean. Handheld ICT systems (including cell phones, calculators, palmtop computers, etc.) are now small enough, cheap enough, rugged enough, and useful enough that many people find them and their applications to be compelling. Such devices have had a significant impact on the world. And, of course, the ICT systems need not be handheld. Wearable ICT systems and implanted systems are alternatives. But they have had minimal impact on education (see <http://www.handheld.hice-dev.org/>).

## DISTANCE EDUCATION

Over the past two years I have served on the Oregon Department of Education's K-12 and K-20 Distance Education Committees. In addition, I currently have a student doing her dissertation on distance education. My experience in this field goes back about 50 years. My parents ran the math education correspondence courses for the University of Oregon. I began grading correspondence course lessons about the time I finished the ninth grade. In more recent years I created some distance education courses for the International Society for Technology in Education and made use of them in the University of Oregon's master's and doctorate programs.

Last year it occurred to me that all education is distance education and all learning takes part in a person's head. From a teaching point of view, the issue is how distant the education is and how interactive it is. A hardcopy library may be both distant and not very interactive. A large lecture course is rather distant and not very interactive. A small seminar is better than a large lecture, both because of the smallness and because it allows a high level of interactivity. A contextual help feature in a computer application is not very distant and may be highly interactive. (Note that much of the interaction may be trial and error on the part of the learner, with feedback coming from the machine and the learner.)

We all agree that one of the goals of education is to help students to gain expertise in being an independent, self-sufficient, intrinsically motivated, lifelong learner. This was true well before ICT came on the scene. But ICT adds some new dimensions. I see this in my own life. For all practical purposes, I cannot read e-mail without also being on the Web. Many of the messages I receive lead me to looking up stuff on the Web, so that I will have a better understanding of the messages received and of the responses I want to send.

Moreover, I find the built-in dictionary and thesaurus in my word processor to be excellent examples of distance education. They provide me with just-in-time instruction.

The point I am trying to make is that that most people today think of distance education in terms of an entire course being delivered over the Internet, over a two-way video network, over television, or via videotapes and disks. But the size of the desired unit of instruction is often much smaller than a course—it might well be instruction on the definition or

spelling of a word. ICT can help move our educational system toward distance education being an integral, every minute component of teaching and learning. As we move our education system in this direction, we can place significantly more emphasis on learners becoming increasingly responsible for their own learning.

## COMPUTATIONAL SCIENCE, SOCIAL SCIENCE, AND SO FORTH

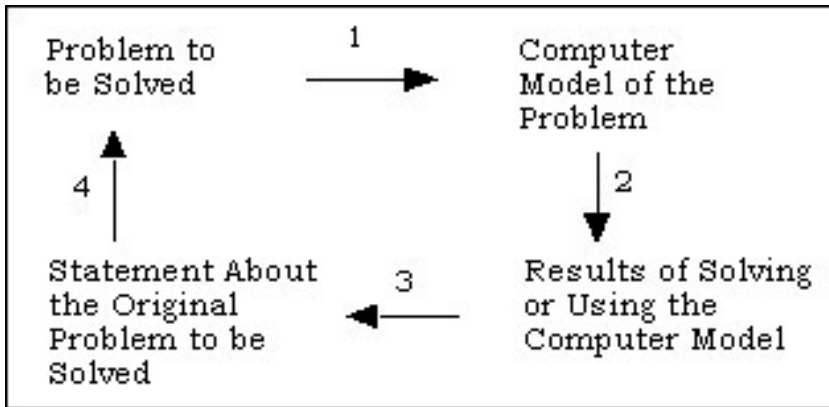
I first encountered computer algebra systems while I was still in graduate school. In the 1960s and 1970s quite a bit of work occurred on developing artificially intelligent computer systems that could solve a huge range of mathematics problems. In essence, discipline-specific knowledge and skills was built into the ICT system.

In the 1980s and continuing to the present, such work has blossomed. For example, the 1998 Nobel Prize in chemistry went to a pair of computational chemists for work they had done during the previous 15 years or so.

The change in the sciences is clearcut. We now have computational biology, computational chemistry, computational mathematics, computational physics, and so on. Scientists now tend to be classified as experimental, theoretical, and computational. In all fields of science, computational scientists are helping to push the frontiers.

But this phenomena is not limited to research in the sciences. We have seen major changes in the mechanical drawing and graphic arts curriculum due to ICT. We have also seen major changes in certain parts of the business curriculum. We have seen scientific and graphing calculators become commonplace in mathematics and science courses. Indeed, students are now allowed to use calculators on some state and national tests.

Still, we have a very long way to go. Take a look at Figure 5. I use this figure in discussing educating in a variety of disciplines. For example, our current K-12 math curriculum appears to place about 75% of its time and effort on students learning to do Step 2. This is, of course, the step that ICT systems do best. If we merely cut this component of math education to 50% of the curriculum, that would allow a doubling of the time spent on problem posing, problem representation, mathematical modeling, meaning making, interpreting the results, and other higher-order processes in math education.



**Figure 5.** Using computer model/simulation to solve a problem

I like to think about “profound” issues, such as allowing students to use a full range of ICT facilities when learning, doing seatwork and homework, and taking tests. Of course, this topic has been addressed in a variety of science fiction stories I have read. Indeed, I have found that science fiction has provided me with many interesting ideas. Recently, I read Kingsbury (2001), a novel that extends ideas from Isaac Asimov’s Foundations books and includes a major focus on people having external computers wired into their brains. I have begun to think of some of my websites as being parts of my auxiliary brain.

Closely related to this is my contention that each researcher should be developing a website in which they share their steadily growing expertise with the world. I think of this as an expanded or extended professional vita designed to help oneself and others.

## PROJECT-BASED LEARNING AND OTHER BOOKS

Earlier I indicated that “don’t reinvent the wheel” is one of the most important ideas in problem solving. At the same time I have suggested that in certain cases one might skip over or touch upon quite lightly what is already known in a field. These two ideas seem somewhat contradictory. But they shed some light on one of the major activities of my professional career.

I write books. This began with my initial teaching at Michigan State University, when I repeatedly taught an introductory numerical analysis course for juniors in engineering. I did not find a book that reflected my newly learned ideas in this field—ideas that assumed that students would have good access to powerful computers and would learn how to write programs in FORTRAN. So I enlisted the help of two of my colleagues, and we wrote an introductory numerical analysis book (Moursund & Duris, 1967).

Since then I have written a lot of books, some individually and some with coauthors. In most cases what I did was write a book for a course I was teaching. I would find that the existing books did not adequately reflect my thinking about and approach to the course. I would prepare extensive handout materials during the course, polish them into a draft book, use it the next time I taught the course, and eventually end up with a publishable book.

Perhaps the key to all of this was my feeling that I was “ahead of the curve.” That is, I felt that my ICT knowledge and skills in education were at the frontiers. Thus, I believed that whatever I taught should be put into book form, published, and shared with others.

### **AN EXAMPLE: ICT-ASSISTED PROJECT-BASED LEARNING**

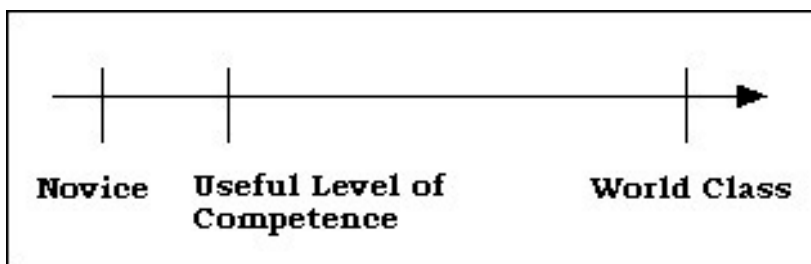
Project-based learning (PBL) has a long history, going back to Dewey and earlier. Research supports this as an effective mode of instruction. I can still recall some of the projects I did in high school.

But ICT brings some new dimensions to PBL. Thus, it seems natural that in recent years I have written a book in this area, developed courses and workshops in this area, and supervised a doctoral dissertation in this area.

One of my key thrusts in ICT-assisted PBL came from a professor in architecture who was an outside member for a student of mine doing a dissertation on problem solving. At the dissertation defense the architecture professor asked if I understood the principle of “and.” I hemmed and hawed, trying to think about what A. N. D. might stand for that was related to problem solving. Finally the professor explained that architects solve many problems simultaneously, and often added new problems as they

proceed in solving a problem. For example, designing a fountain for the City of Springfield included addressing the idea that the name of the town came the springs in a nearby field. *And* this region was a center of logging, so the fountain should capture this idea. *And* this was one of the early towns in Oregon, so the fountain should capture a pioneering spirit. *And...*

Now, apply the idea of *and* to anything you teach. As you become more skilled in a course area, you find more and more ideas you can weave into the course. This helps you move up the expertise scale (see Figure 6). I use such an expertise scale in discussing roles of ICT in teaching and learning. ICT is a powerful aid to helping a person move up the expertise scale in areas of personal interest.



**Figure 6.** A general-purpose expertise scale

Now, think about PBL and ICT. It is possible to use PBL in essentially any course. *And* at the same time students can be learning and using ICT. *And* at the same time students can be gaining skill in cooperative learning, self-assessment, peer assessment, problem posing, and so on. *And* a teacher employing ICT-assisted PBL can be learning ICT, authentic assessment, a wide variety of subject areas, and so on.

A year ago I was asked to do a workshop on ICT-assisted PBL. This was to be done in a hands-on environment, making use of a wireless network. Wow! An opportunity to develop a new type of workshop and, hence, a new book. This time, however, I decide that the book should be interactive and made available on the Web. This was my first endeavor in writing a “never ending” book. When the muse hits me, I add to and revise the book. Whenever I do a workshop on the topic, I tend to make significant additions to the book (Moursund, 2001).

## CURRENT PROJECT: MATH, BRAIN, AND ICT

This past summer (2001) I did a workshop with two of my long-time colleagues. The workshop was for inservice teachers who provide workshops and courses for the Math Learning Center (MLC), a nonprofit organization located in Portland, Oregon (see <http://www.mlc.pdx.edu/MAIN.html>). I have served on the board of this organization since its inception in 1976, and I have been chair of the board from time to time.

After the workshop was completed, I reflected about what it had covered and its overall success. It soon dawned on me that the workshop provided a good starting point for my next project. Thus, I am now working in the area of math, brain, and ICT (Moursund, 2002). I applied to do workshops on this topic at three different conferences, and I began work on a website to support my studies and workshops. The workshop, as well as the overall combination of topics, provides a great environment to practice *and*.

## FINAL REMARKS

Some of you may have heard the foul rumor that I am moving toward retirement. The University of Oregon allows a faculty member to work one third time for five years as a phase-in to full retirement. My current intent is to begin this five-year plan starting this next fall.

Meanwhile, I am trying to develop hobbies and other activities that will help to keep me active and involved over the next decade or so. I hope to continue to come to conferences, doing presentations and workshops. I hope to continue to do consulting, lending my advice even when it is not asked for.

*And* I have made a major commitment to a new nonprofit organization, the Oregon Technology in Education Council (<http://otec.uoregon.edu/>). Currently, I am serving in the volunteer positions of chair of the board and the webmaster. This environment requires me to read widely and communicate with a lot of people. It also allows me to write almost anything that I want to write, and to have an immediate audience. I believe that you and

some of your students will find this website to be quite helpful to your work and learning.

## References

- Bransford, J.D., Brown, A.L., & Cocking, R.R. (Eds.). (1999). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press [Online]. Available: <http://books.nap.edu/catalog/6160.html>
- Bruer, J.T. (1993). *Schools for thought: A science of teaching and learning*. Cambridge, MA: MIT Press.
- Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.
- Kingsbury, D. (2001). *Psychohistorical crisis*. New York: TOR.
- Moursund, D.G., & Duris, C. (1967). *Elementary theory and application of numerical analysis*. New York: McGraw-Hill. Reprinted by Dover Publications in 1988.
- Moursund, D.G. (1970). *Problem analysis and solution using FORTRAN IV*. Belmont, CA: Wadsworth Publishing Company.
- Moursund, D.G. (1996, 2001). *Increasing your expertise as a problem solver: Some roles of computers* [Online]. Available: <http://darkwing.uoregon.edu/~moursund/PSBook1996/index.htm>
- Moursund, D.G. (2000, October). Roles of IT in improving our educational system. Part 2: Compelling Applications [Editor's Message]. *Learning and Leading with Technology* [Online]. Available: [http://darkwing.uoregon.edu/~moursund/dave/editorial\\_2\\_2000-2001.htm](http://darkwing.uoregon.edu/~moursund/dave/editorial_2_2000-2001.htm)
- Moursund, D.G. (2001). IT-assisted project-based learning [Online]. Available: <http://darkwing.uoregon.edu/~moursund/PBL/>
- Moursund, D.G. (2002). Mathematics education: Roles of brain science and information and communications technology [Online]. Available: <http://darkwing.uoregon.edu/~moursund/Math/>

## Contact Information:

David Moursund  
University of Oregon  
Eugene, OR USA  
[moursund@oregon.uoregon.edu](mailto:moursund@oregon.uoregon.edu)