Of all creatures on earth, humans are the best at creating and solving problems. One of the main goals of education is to help students become even better at these endeavors.

I have been deeply interested in problem solving for many years, and I have spent much time studying this field. During the past two years, I have presented a number of workshops on the topic of appropriate roles of human brains and computers in problem solving (Moursund, 1988). Here are some of the ideas from my workshop; you may find a number of them useful in your teaching.

1. With the exception of some people who are severely brain damaged, all people have a substantial ability to create and solve problems. The human brain is designed to be quite good at this endeavor and does it routinely.

2. While some people have more natural talent than others, all people can get better at problem posing and solving through study and practice.

3. One of the most important goals of education is to help students improve their ability to pose and solve problems. Both problem posing and problem solving are higher-order cognitive skills.

4. Teachers can play a significant role in helping students to improve their problem posing and solving skills.

5. To be good at posing and solving problems within a particular domain, one needs both considerable general knowledge and a great deal of knowledge and skills specific to the domain.

6. Most real world problems are interdisciplinary. Posing and solving such problems requires a broad range of knowledge and skills from many different disciplines.

7. There is a considerable body of knowledge and skills useful over a wide range of problem posing and solving. Transfer of such knowledge and skills from an initial learning environment to a variety of somewhat different application environments is relatively difficult for most people. However, we know how to teach in a manner that helps to increase transfer.

8. Computers can solve or make a significant contribution to solving a large number of problems. The number and scope of such problems will continue to grow quite rapidly through research, advances in computer science, and advances in computer hardware/software.
9. There is some good computer software designed to help improve students' ability to pose and solve problems, and the amount of this type of software is growing.

The list could easily be extended. The point is, we know a lot about problem posing and solving. A number of people have taken some of this knowledge and created courses that can be taught at the precollege or college level. An excellent survey of eight of these courses is given in Chance (1986). Many such courses have been implemented and are backed by substantial research. In the opinions of the course creators and their followers, these courses work.

You might ask, then, why don't all students encounter such courses as part of their regular academic programs of study? There are several possible answers, and perhaps the following three capture the spirit of the most common ones.

1. The courses are too general and do not focus on any particular discipline. They do not fit well within the domain specific nature of our current curriculum.

2. It takes considerable knowledge to teach problem posing and solving. Relatively few teachers are prepared to teach this general topic in a wide-ranging, interdisciplinary manner that facilitates transfer of learning.

3. Problem posing and solving is so domain specific that it is best integrated into the existing disciplines, and this should be done by the teachers of these disciplines.

The last point is particularly interesting. It is an argument that students don't need specific courses on problem posing and solving because they already receive such instruction in all their courses. All teachers teach problem posing and solving. (What teachers would be willing to admit they don't do well in this regard?)

But this approach leaves us with a difficult dilemma. We know computers are a substantial aid to problem solving. Thus, we might expect that all teachers would teach the appropriate roles of computers as an aid to problem solving within the disciplines they teach. But this is terribly inefficient for two reasons. First, it requires that every teacher have a good understanding of the computer's role in solving the problems within their discipline. This is a worthy goal, but it will not be achieved with the majority of current educators.

Second, this approach leads to considerable duplication of effort. There are many rudiments of computer use that easily transfer from one discipline or application area to another. It is not appropriate to expect all teachers to start from scratch in teaching their students to use a computer as an aid to problem solving.

I have two conclusions. My first conclusion is that all students should learn the rudiments of using a computer quite early in their educational careers. Certainly, students could be well grounded in using a word processor, database, and presentation graphics by the time they enter middle school or junior high school. All teachers at the middle school and higher could then build upon this initial level of computer knowledge.

My second conclusion is that there is a need for a course in problem posing and problem solving that takes into consideration capabilities and limitations of computers. I believe such a course should become part of the regular curriculum for all students. Such a course would
require a reasonable level of maturity (some functionality at the Piaget level of formal
operations) on the part of students. It would contain material and ideas that should be practiced
and used over several years of schooling. Thus, the course might best be offered at the eight or
ninth grade level.

There is substantial non-computer material available for use in courses on problem posing
and solving. And, of course, there is substantial computer-oriented material. Thus, there is ample
material for a year-length course. But even a half-year course would make a significant
contribution to the education of most students.

I'd like to see such a course become common in the middle school or junior high school
curriculum. If you are teaching such a course or are aware of such a course, please send me
information on it.

References

College Press.

OR: ICCE.

Retrospective Comment 8/26/08

Notice the statement in this 1988 editorial:

My first conclusion is that all students should learn the rudiments of using a computer quite early
in their educational careers. Certainly, students could be well grounded in using a word processor,
database, and presentation graphics by the time they enter middle school or junior high school. All
teachers at the middle school and higher could then build upon this initial level of computer
knowledge

In essence, this became part of the 1999 ISTE National Educational Technology Standards
for students completing the fifth grade. In educational change, “Slow but steady wins the race.”