Introduction

This paper discusses a model we developed for using the computer to help introductory students learn economics. Each semester that we teach introduction to macro or micro, students inevitably make statements such as, "I know the theory but I don't understand the graphs", or "I understand the problems when you work them in class but I can't do them on the exams", or even "The problems you did in class were easy, but the problems on the test were hard". Strober and Cook (1992) carefully documented these types of student responses by viewing videotapes of students discussing course material. The authors found that difficulties were rooted in students' inability to understand basic concepts and then to apply those concepts to graphical or mathematical constructs. Students are able to accumulate information, but cannot use it. Fels (1990) relates the story of a student who knows that a higher price means a lower quantity demanded, but when asked whether an increase in the price of gasoline will lower quantity demanded, responds "no, because people have to use their cars to get to work and school" (p. 89). These examples illustrate the difficulty that students often have when they attempt to apply economic concepts.

As we recognised the significance of these problems for our students, we began to search for ways to encourage active use of economic concepts in our introductory courses. The model we developed involves sets of problem-solving exercises that students perform by using computer spreadsheets. This paper will describe our model as it answers the following questions: Why should we use the computer in introductory economics courses? How should we use the computer to teach introductory economics? Can computer use improve students' ability to apply basic economic concepts?

Why Should We Use The Computer?

The first and most important reason we use computers in our introductory courses is to introduce students to the types of problem-solving skills that economists use, to show students how economists "do" economics. Bartlett and King (1990) address this issue as they describe

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curriculum revisions that allowed them to teach economics as a "lab" science. The problem, they state, is that "we expect students to eventually learn to think like economists without providing them with any real opportunity to learn how economists go about 'doing' economics" (p. 182). We encourage students to see the computer as a tool that they can use to organise, understand, and analyse the information that they need to solve economic problems. The computer becomes an indispensable tool in advanced economics courses, so its use in our introductory sequence makes the latter more reflective of the content and methods of economic analysis.

A second reason to use the computer in the introductory economics course is to help students bridge the gap between the economic concepts that they learn, and the graphical illustrations and mathematical analysis that follow. As more complex mathematical derivations enter economic theory at the frontier of the science, instructors find themselves fighting students' math insecurity as they attempt to expose students to current methods of economic analysis. Wilkins (1992) explains the importance of this problem, and describes a series of lectures and class handouts that he uses to show students the relationships between economic concepts, mathematical equations, and diagrams. We expand on this idea by having students create these linkages for themselves with the help of the computer. Students use the computer to translate mathematical equations into spreadsheet data. They then use their data to create diagrams and also to complete written problem-solving exercises that require them to interpret their equations, data, and diagrams.

A third reason for using computers in the introductory economics course is to make use of skills and interests that many students bring to the course. With the explosive development of computer technology has come a new generation of computer literate students; even those who did not learn word processing and spreadsheets in high school have used educational software or at least played video games. Economic educators can use this knowledge as a bridge to economic concepts that are unfamiliar to students. As Saunders (1990) states, "Creating connections between new information and previously learned information is a key step in encoding information in a meaningful learning set rather than a rote learning set" (p. 67). Use of the computer can link the known to the unknown; something students understand and enjoy helps them gain access to material that is unfamiliar.

**How Should We Use The Computer?**

Several recent articles have addressed the "proper" use of computers in the economics curriculum. Walbert (1989) identifies five ways in which the PC can enhance the learning of economics: 1) as a patient tutor; 2) as a drillmaster; 3) to create a "what if...?"learning environment; 4) to monitor and enhance the learning of graphical models, and 5) to keep a record of progress. He correctly points out that most of the current software available with principles textbooks contains either tutorial programs or drill/pretest programs, and as such, falls into categories 1 and 2 above. He then continues,

"Spreadsheets and simulations...promote higher-order student involvement in learning than that provided by tutorials and drills... Spreadsheets should let the student view and vary the underlying models' parameters, and then instantly see the results of any parameter changes graphically as well as in the tabular form of the spreadsheet" (pp. 285-86).