Abstract: This paper is concerned with the application of computer-based techniques for the teaching of programming languages. Here the concepts and ideas of computer-aided teaching are discussed within the context of an Ada-specific role. Issues covered include the psychology of teaching and learning, the perception of teaching material by students, and the use of animation to enhance learning. The essential features of a specially developed Ada computer-based teaching package are described within the paper.

Keywords. Computer aided teaching, animation and simulation, programming languages, Ada.

1 Introduction - Fundamental Issues

1.1 Teaching - a role for computers?

Educators generally agree that passive listening is an ineffective method of learning. This method yields only 10% retention rate, although good visual aids double this [1]. Much greater improvement in retention rates can be achieved through interactive dialogue between teacher and student. Such interaction can be carried out in many ways, though in modern computer-based techniques, three distinct strands predominate.

The first, Computer Aided Learning (CAL), is a student-centred learning process, where the 'teacher' is a computer program. The second, distance learning, is primarily student-centred, but with significant support from a remote teacher/mentor. This modern version of the correspondence course is here called Computer Based Teaching (CBT). Both CAL and CBT are intrinsic to distance learning via the world
wide web. And, from the recipients point of view, both are low-cost training techniques.

Computers, however, even though they are a powerful instructional medium, are no substitute for a good human teacher. This is why there is a significant role for Computer Aided Teaching (CAT), where the computer is basically a support tool for the teacher/lecturer. What CAT does is support traditional teaching methods and enhance student appreciation of concepts and theories. Thus it is an augmentation, not a replacement technique. The combination of man and machine can deliver quality teaching and training.

Programmed instruction made an appearance in Britain in the 1960's. Its innovators claimed that it helped to overcome some of the deficiencies of classical classroom teaching techniques. It was from this background that Computer Aided Teaching emerged. Results have shown [1, 2] that learning is more successful when traditional lectures are supplemented by such methods. Moreover students seem to enjoy being taught via this medium, finding it a much more interesting approach. It is clear that good CAT techniques provide:

- An initiating learning stimulus
- A stimulating environment over a period of time.

The operative word is good. Such methods support:

- Active participation of students.
- Feedback and reinforcement.
- Individualization.
- Controllable teaching pace.

However, to produce an effective CAT package, it isn't sufficient to understand teaching requirements; learning processes are equally important.

1.2 Teaching and learning - a psychological detour

For any teaching technique to work it must:

- Attract the students' attention.
- Hold their attention for the duration of the course.
- Make the learning process easy.

Everyone is born with a certain capacity to learn. By 'learn' we here use a restricted definition: 'to gain knowledge or skill by study or being taught'. It is essentially a process of storing a sequence of neural events in memory. This memorising of information depends on the process of attention. Usually it is not the entire 'picture'