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# USING COMPUTERS IN THE CLASSROOM

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Twenty years ago, programmed instruction and individualisation strategies in teaching certain groups of people were introduced to education. A decade later, calculators were introduced to the classroom in teaching mathematics and other related areas requiring the use of computation. Now, in the mid-eighties, many developed countries are using microcomputers. With the advance of science and technology, the extensive use and application of computers in the near future is already upon us.

The use of computers in teaching and learning in schools began a few years ago when microcomputers were introduced. The question now is not whether computers can be used in education for teaching and learning purposes but how computers can be of assistance to most subjects in the curriculum. This article will discuss the different ways of applying and integrating microcomputers into the curriculum, ranging from drill and practice to more recent approaches of teaching.

## Teaching Model

What is the basis for using computers in the area of the teaching and learning of a subject in school? Before we can really know the who, how and why of using computers in the area of teaching, we have to understand the nature of teaching. When the computer came into existence, its main application was not Computer Assisted Instruction (CAI) or specifically educational; but soon it was adapted for use in other fields besides education.

In education, it is possible to analyse the structure of a teaching situation to see the range of activities in which computers could be used within the curriculum. We are not only concerned with what could be done but also with the best possible ways of using computers to help teaching and learning. A mathematics subject is used for this purpose.

No one can claim that his or her method is the most effective in teaching any mathematics lesson. This is not because he is incompetent but probably because of individual differences in cognitive styles of learning. Explicitly no one can be assured of any method of teaching mathematics that may work in other situations. However we are quite certain that in each and every lesson, there are some patterns in delivering a lesson.

Using mathematics as an example, the teacher will be concerned with the transferring of mathematical concepts and skills to their students. In the process of getting his learners to understand and accommodate what they are required to master, the mathematics educator attempts to apply some effective strategies to help them acquiring the new knowledge. Drill and practice is the next stage of learning. This helps learners to master their skills and strategies. **Lastly**, in this learning procedure, pupils will be evaluated to see how much they have learned. The following figure summarises the whole sequence of teaching a mathematics unit:

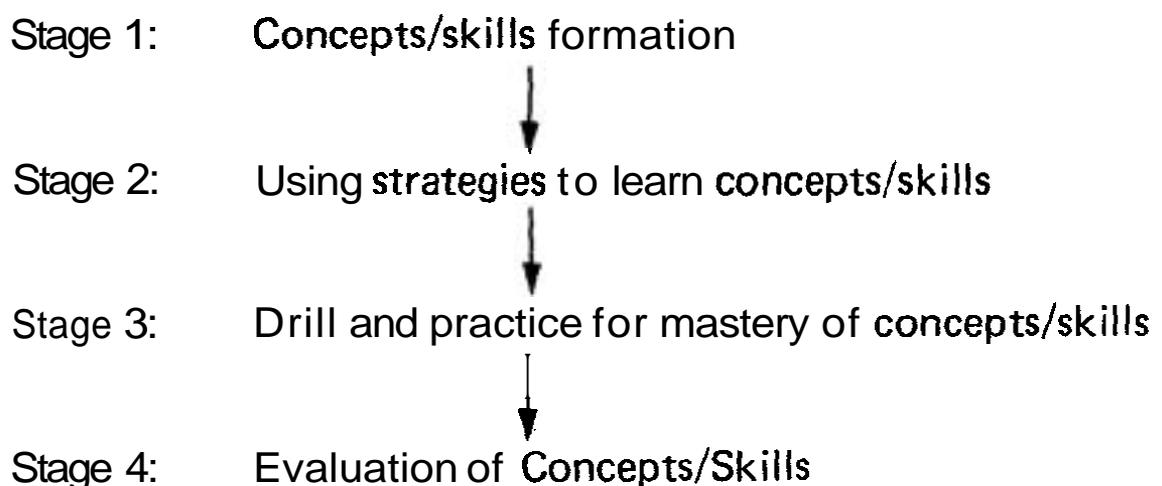


Figure 1

### Computer Educationists' Views On the Functions of Computers

Atkinson (84) made a summary of the different types of basic uses of Computer Assisted Instruction (CAI). He generalised that a computer could be used either as a supplementary material to the regular classroom or as a substitute for other modes of instruction. Alternatively he stressed that a computer could be

useful in (classified into) the following types of activities: drill and practice, tutorial, simulation, instructional game and computer managed instruction. His views were also shared by other computer educationists.

According to Taylor (80), the application of CAI to education has three modes of activities. The first two modes of activities are the tutor mode and the tutee mode. In the third mode, the computer is used as a tool. In the tutor mode, the students are tutored by the computer executing the programmes. Activities include the computer presenting some subject materials, students responding, computer evaluating the responses and computer determining what to present next. When a computer acts as a tutee, the student is actually doing the tutoring. In order to communicate with the computer, he must learn to programme, i.e. to talk to the computer using the language it understands. When the computer is used as a tool, the classroom teacher could use the computer for statistical analysis, calculation or word processing.

The works of Bork (80) and Atkinson (80) were related to the computing activities in the tutor mode. Bork's main concern in this mode was the application of computing to instruction. Atkinson's concept of CAI was the interactive presentation in teaching while integrating sophisticated teaching aids in the lesson.

On the other hand Papert (80) and Luehrmann (80) were involved with the computer in the tutee mode. His major contribution to mathematics education was to teach mathematical thinking using LOGO software. Through play, children are able to learn intuitively and master mathematical concepts. Luehrmann also felt that in teaching the computer, the child learns more deeply than he does from being tutored by software written by others.

## | Fitting Computers into Mathematics Curriculum

In view of the stages of teaching and learning mathematics, mathematics educators should think of how a computer could be

used to fit into his curriculum, especially in this case a teaching lesson. With reference to figure 1 (pp. 3), it seems that the tutorial programme could be used at stage 1 (concepts/skills formation). Using this type of programme, the teacher can organise his class to help the students to acquire the necessary concepts and skills by working on some routine activities.

At stage 2 (Figure 1), tutorial and simulation programmes could be presented to teach students the different types of strategies of problem solving. Problem solving skills will be enhanced when the computer interacts with the learner using the simulation programme. According to Taylor, this is the tutor mode at which students will learn the subject materials. At this stage, instructional games can also be used to enhance learning. One unique feature of these games is that they have some conceptual skills embedded in them which the student must master to play successfully.

The drill and practice software could fit into Stage 3. This type of programme usually generates practice exercises for students to complete. Before entering this stage, students are expected to master the necessary skills. Problems will be displayed to allow the student to enter an answer. The computer then reports whether the students' response is correct or incorrect. To make the drill and practice software interesting, software developers usually build in some capabilities such as graphics, animation and sound. These features will help to keep students' interests and encourage them to follow the lesson over and over again. This is the stage where the learners will reinforce the concepts and skills learned earlier.

At the evaluation stage, besides using the tutorial programme, a teacher could also use the Computer Management Instruction (CMI) programme, specifically an 'expert' system programme. In the area of mathematics, not many of these programmes have been written. The main reason is not because of the computer's lack of expertise in programming but the lack of evaluation models in the area of mathematics. However, there is quite an abundance of tutorial software which would be able to help teachers to evaluate the pupils' performance in their learning.

## Feasibility of the Use of Computers in Education

Educationists will always attempt to improve their quality of teaching students and hence computers may be used as intermediate aids to help them achieve their objectives. To administrators, their main concern is the cost of purchasing the item. Hence it is necessary to look into the cost effectiveness of the use of computers in the area of education.

In view of the cost-effectiveness, another issue a teacher needs to consider is whether other means of teaching can be as effective as the use of the computer. Generally the cost of computers is still high compared to other means of instruction despite recent tremendous price reductions. For example a teacher should find out whether the paper and pencil is feasible for drill and practice in the classroom. Another alternative which he can consider is the use of calculator. It is important that a teacher should not just use the computer for the sake of using it. He should also evaluate the cost-effectiveness of such use.

With limited resources, a classroom teacher should also consider how to organise a classroom using the number of microcomputers available. Another point which a computer educationist has to bear in mind is the type of programmes implemented in the school. Conversely the number of computers required will depend on the type of programmes.

If we are conducting a computer literacy and awareness programme, we aim at training the masses and hence in such programme, at least one computer lab is required. Usually a school possesses only one computer lab and if the population of the school is too big then the designer has to rethink the strategy for handling the whole student population. For example, one possible solution is to limit the programme to a certain level and/or the number of hours could be reduced if further problems arise.

Sometimes a teacher may only want to demonstrate a certain concept of a topic. For example he may want to show how the linear graph changes when the variable  $m$  (coefficient of variable  $x$ ) or the constant value  $c$  varies. For demonstration

purposes he may need only one or two computers. In this example the computer is used as a form of teaching aid to help students learn certain concept. It could replace some teaching aids such as video tapes, slides or transparencies. In fact, according to Murray and Vogler (84), the use of the microcomputer could contribute more features than the ordinary teaching aids such as those cited above because it involves more than just a static presentation. An additional element added to it is interactivity. Using one computer in the class will not maximise the benefit of the interactive feature. The ideal situation is to enable everyone to work with one computer. If it is not possible, then the class should be organised into groups to cater for specific purposes.

As stated earlier, it is not a question of whether a computer lab is a necessity. A planner of the programme needs to consider how well he can minimise the cost and maximise the benefit. Sometimes he may need a couple of computers so that a few classes can share one computer. If the budget allows, it would be helpful if each class possesses one microcomputer. Since it is not possible to have many labs in one school because of the cost, one possible solution is to have one major lab and install a microcomputer in each classroom. When a teacher needs to use a micro for a specific purpose he can bring his students to the laboratory or else he can utilise the class computer for demonstration or for computation.

## Conclusion

The discussion above has given us an idea of the different CAI software such as tutorial, drill and practice and simulation. The existence of the different types came about from the way we usually teach our students. We can use the micro either as a supplement or a substitute. However a teacher should take into consideration whether the use of the computer is cost-effective. Research in the area of the use of CAI is still in its infancy with respect to certain types of software like interactive and tutorial types of programmes. Hence in the organisation of a computer laboratory a teacher needs to consider the following variables: types of programmes, the stages the teacher is teaching and availability of budget.

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