NATIONAL COMPUTER OLYMPIAD PRIZEGIVING ; CARLTON HOTEL
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Ladies and Gentlemen, I should like to begin by thanking the Computer Society of South Africa and the Old Mutual for doing me the honour of inviting me to address you this evening. As a Fellow of the former and a customer of the latter I am grateful to them for having briefly brought me out of "computer retirement", since I have not been an active participant in that field for over a decade. In speaking about Computers in Education I do, however, have the advantage of being able to draw both on my past computer experience and my present role as an educational administrator.

We have come together here tonight to pay tribute to some very young people, and to congratulate them on their achievements. It has often been observed that the more abstract an activity is, the more inherent ability and motivation dominate over experience in contributing to success. In ability and enthusiasm youth has

no disadvantage - in fact a potential advantage. Music, especially in its more classical forms, can be very abstract, and so there are many examples of prodigies in that field. Wolfgang Amadeus Mozart is the most famous At the age of five he was taken by his father to hear an as yet unpublished work, whose score was a jealously kept secret, to prevent unauthorised use. He went home and wrote out the score, with only one minor mistake !

In mathematics we have the same phenomenon in Blaise Pascal. His father forbade him the study of Euclid until he was about twelve, for fear of injury to his always precarious health. By sixteen he had proved his first original theorem. William Hamilton, the 9th Century Irish mathematician, could boast at the age of thirteen that he had mastered a different language for every year of his life, and at twenty-two he was a professor of astonomy. Bobby Fischer, the chess maestro, had won his first US Chess Championship, also at thirteen, making a spectacular queen sacrifice in one of the key matches.

Computers have this quality of abstraction in common with the other examples I have mentioned. We have seen that in such pursuits young people are not at any serious disadvantage. On the contrary, they have the distinct advantage of not having the burden of unlearning any misconceptions. Hence our presence here tonight. My own first direct experience of this occurred some sixteen years ago when I helped devise a weeklong computer workshop for some very gifted children in the ten to twelve year age group. We had selected 22 boys and girls, eleven of each in point of fact, with a minimum IQ of 44. The first day our instructor threw away his notes, and proceeded at about twice the pace he would have done for university students. After the first double period he announced that there would be a break for ice cream and cool drinks, after which they would have their first hands-on session. Such mundane delicacies were spurned with scorn, and there was a gold-rush stampede for the terminals. That evening one of the fathers asked his son what it was like, just for once, not being the smartest kid in the class. Back

shot the answer, "Dad, I bet there are 21 other fathers right now, asking the same question".

Let us turn now to the serious business of discussing the use of computers in education, some aspect of which has been the basis of the Olympiad projects. Four major areas of application come readily to mind. The first and most obvious is that of administration. At a certain level education is a business, just like most other organised human activities. As such it needs accounting, record-keeping and word-processing, all of which by this time have become fairly well understood computer applications, for which popular and well-tried packages have gained widespread acceptance. Not much excitement can be expected here. To be sure, there are some particular school related applications, such as mark and attendance lists and examination results. One rather less mundane application is that of time-tabling and examination scheduling. The question of detecting clashes in a proposed timetable is straightforward, but the task of trying to establish an optimum timetable or

schedule suffers from intractable combinatorial complexities, once the problem grows beyond even modest dimensions. If any budding young genius can make progress in this field he really will make a name for himself.

The use of computers in research tasks, or those requiring extensive calculation, has by now had a comparatively long history, and much progress has been registered. Although one usually associates research with postgraduate endeavours, this type of computer usage is definitely part of tertiary education, increasingly at the undergraduate level as well. The practice of certain important professions, such as engineering or accounting, would be unthinkable today without routine access to computers, and so familiarity with them must be part of the educational preparation for entry into such professions.

A third computer application area, not generally thought of as applying directly to education, is that of simulation. A little introspection, however, will soon convince us of its relevance.

Take the example of aircraft simulation. In the education, or more properly one might call it the training, or a pilot a considerable amount of actual flying, under the control of an experienced instructor, is essential. In a large plane, such as a Boeing 747, this can be very expensive, and prohibitively so if the neophyte should actually crash the craft through inexperience or unusual weather conditions. As we all know, airlines now universally use flight simulators for this purpose. Today's simulators, which are placed in mocked-up flight cabins and are computer controlled, can provide convincing replicas of almost any conceivable flying circumstances and approaches to any airport in the world. The human instructor is no longer needed, and the would-be pilot can "crash" as often as he likes, without harm to himself or the equipment.

A rather specialised and exciting form of simulation is now coming to the fore. Part of any advanced educational process is having access to experts in the field. Unfortunately real experts in most fields are scarce and consequently rather

expensive. We are just entering the era of computerised expert systems. These consist of a programmed shell into which can be entered an appropriate database and an "inference engine", which simulates how an expert in a particular field would draw conclusions from the circumstances presented to him. Expert systems are now proliferating like the proverbial green bay trees. Some will obviously be expensive failures, while others will be spectacular successes. We often refer to the brightest kid in the class as a walking encyclopaedia. Usually he is an "expert" in doing assignments and homework, much in demand with and the envy of his classmates. He is obviously a candidate for expert systemization. Perhaps some future Olympiad winner would like to come up with the answer.

The fourth and final application of computers to education that I wish to mention is in the actual field of <u>teaching</u> itself. This goes by various names such as Computer Associated Instruction (CAI), Computer Managed Education (CME), or Computer Based Education (CBE). Perhaps the best known and most widely used

system is PLATO. I am happy to say that Rhodes is in fact the second university in South Africa to make a serious commitment to this system. PLATO, which is available on multiple terminals connected to a mainframe, has elaborate authoring and record keeping components, together with a mail facility, which enable the pupil to proceed at his own pace and at his own time. The instructor can utilise the existing 20,000 lessons in a wide variety of subjects at every educational level, from primary to post graduate, or else he can add his own material. He is able to monitor the progress of every student, to communicate with him and to answer his queries, no matter how physically distant he is. At the moment such systems are in their infancy and are not very cost effective, but I am confident that they will expand and play a significant role in the education delivery systems of tomorrow.

In the four major application fields that I have considered - administration, research, simulation and teaching - the keyword is undoubtedly simulation. A good case can be made that

everything a computer does is really a form of simulation. In administrative applications a computer can be said to be simulating at least part of the work of a bookkeeper, a clerk or a typist with phenomenal memory and patience. In many research areas the task of an engineer or mathematician with an unlimited supply of paper and pencils and a prodigiously large sliderule is being mimicked. In CAI the classroom scene itself is repeatedly re-enacted, with an inhumanly patient teacher in attendance on each single pupil. As in all good simulations, it is the goal that is shared with the original, not the means. Airplanes in some sense simulate birds, by flying from A to B, though not necessarily by flapping their wings. In some ways birds are superior, in that they can take off or land almost anywhere without benefit of expensive runways or radar. As regards speed, payload and range, however, they are no match for planes.

Simulation of what goes on in the classroom is particularly instructive. It enables teaching to take place without the constraints of a communal meeting place, of specific times, or

lock step rates of learning and collective interaction, It does unfortunately have one major disadvantage. The interpersonal interaction between pupil and teacher, amounting almost to inspiration in the case of a dedicated and enthusiastic mentor, is sadly lacking. The story is told of two parallel classes in first year Statistics at a certain university. One class was taught by conventional lecturing techniques. The second class was "untouched by human hand", so to speak, the medium in this case being CCTV rather than computers. The two carefully matched groups sat a common examination. There was much excitement when the difference beween the two sets of results was found to be statistically not significant. The sting in the tail came at registration time for Statistics II the following year. Not a single TV-taught student wanted to carry on with the subject.

It would seem to me that the long-term results of computers in the classroom will be that the teacher will remain on, to provide human contact, encouragement, vision and motivation, while the

computer will increasingly take over the humdrum tasks of record keeping, marking and the supervision of revision exercises. In other words, it will act as a lever or amplifier to extend the teacher's range and capacity, just as it has already largely done for the accountant and the engineer.

There is no doubt that the future of computers in education, especially in South Africa, is very bright. We are already committed, at least in principle, to a substantially improved educational programme for the disadvantaged majority of our population. A major bottleneck will be the provision of sufficient number of adequately trained teachers. People are understandably impatient. We shall have to telescope the timescale, and computers are an obvious avenue for this. They furthermore have the advantage of being far less suceptible to the ravages of boycotts and strikes than a conventional school system. Indeed, they are almost viewed as being ideologically neutral. The major present inhibitory factor is that of cost. Our experience at Rhodes is that the cost of PLATO is of the

order of R5 per hour of individual instruction delivered. This is acceptable if it is compared with the cost of individual extra lesson tuition, but it is clearly still far too expensive for mass application. For example, let us consider a simplified example of a representative teaching cost in the white high school. An experienced teacher probably costs the state of the order of R30 000 per annum. Let us say that he delivers 30 lessons a week for 40 weeks to an average class of 25, or 30000 pupil hours of instruction at a cost of R1 per pupil hour. In Black high schools the figure would be considerably less, perhaps of the order of R0,50 per pupil hour of instruction. PLATO-like systems will therefore have to come down in cost by an order of magnitude before they can compete in the mass market. Here is an important and specific challenge: perhaps some of our olympiad participants will find a rewarding career in this field.

I should like to congratulate both the Old Mutual and the Computer Society of South Africa for bringing to fruition this national computer olympiad programme. It signals most clearly

that computers are to be taken as seriously as mathematics, science or english, which have had the benefits and stimulus of olympiads for quite a number of years. It is also my pleasant duty to congratulate the winners. It doing so let us not lose sight of the exertions of the other participants, who, while not gaining specific accolades, obviously benefitted enormously from the experience. I am sure that both their imaginations and ambitions will have been expanded, and that we shall see them back again. A particular commendation is due to those whose schools do not have computers. I am reminded of a boy who had a burning ambition to be a concert pianist, but whose parents could not conceivably have afforded a piano for him. Undaunted, he painted a keyboard on an old kitchen table, and practised on that. Eventually his determination inspired an anonymous donor to supply him with his dream, and he went on to achieve his ambition. Such desperation tactics would probably not bear fruit in the computer field, but nonetheless entrants without ready access to a school computer must have demonstrated imagination and persistence in reaching their goals. Let us

also give credit to the teachers at many of the schools who must have given unstintingly of their time and expertise.

It is widely believed that boys shine in mathematics, while girls excel at languages. In the computer world mathematical and linguistic talents converge and so there is no reason why girls should not be able to compete on an equal footing. I am sure that in future years we will see them coming more and more to the fore.

Dr Samuel Johnson, the great 8th Century English man of letters, would clearly have appreciated the advantages of a computer in compiling his famous dictionary, the first in the English language. He was perceptive beyond his time, even in non-literary matters. Let us therefore leave him with the last word. "Sir", he is reputed to have observed, "Nothing amuses more harmlessly than computation, and nothing is oftener more applicable to real business or speculative enquiries. A

thousand stories which the ignorant tell, and believe, die away at once when the computist takes them in his grip."

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