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ABSTRACT

With the advent of microcomputers during the 1970's, foreign countries have been trying to introduce some form of computer literacy into the school curriculum. This paper presents the efforts of the Department of Education of the Fiji Islands to introduce computer education into the curriculum and constraints that impede those efforts. Since the creation of the Computer Education Center (CEC), eight procedures have been used by the center to facilitate computer education teaching in the country. Measures include the purchase of computers, training of selected mathematics teachers in the use of the computers, development and distribution of computer software, school visits by CEC officials, development of teacher guides for use in instruction, production of a booklet on computers, and distribution of a computer education newsletter. The following three constraints on further development of the computer education program are identified and discussed: (1) a lack of capital investment to equip computer laboratories; (2) a shortage of qualified computer teachers; and (3) a lack of an integrated policy on the part of the planners. Seven recommendations to alleviate these problems are presented: (1) give priority to developing an integrated, long-term policy for computer education in secondary education; (2) include more units on computer education in teacher preparation; (3) develop textbooks using local content; (4) revise the salary of mathematics and science teachers to retain teachers; (5) train school administrators in non-teacher use of computers; (6) increase the importance of computer education in form 6 mathematics; and (7) conduct a survey of schools currently offering computer education to identify problems. (MDH)

CONSTRAINTS ON EXPANDING COMPUTER EDUCATION: THE CASE OF THE FIJI ISLANDS

B. S. Prasad Ph.D.

'Computing plays such a crucial role in everyday life and the technical future of this nation that the general public's ignorance of the subject constitutes a national crisis. The ability to use computers is as basic and necessary to a person's functional education as reading, writing and arithmetic.'

- A. Luehrmann, Director of Computer Research,
Lawrence Hall of Science,
University of California,
Berkeley, 1980.

Ever since the advent of the microcomputers in the 1970's, educators in both the developed and the developing countries have tried to introduce some form of computer literacy program at the school level to help prepare its citizens to cope with the new technology. The approach they have adopted at the school level falls broadly into two types. In some countries--particularly in the developed countries--computer studies is offered as an additional subject and takes its place alongside other subjects like mathematics. On the other hand, some countries including many developing ones have introduced computer education as a part of the existing mathematics curriculum rather than crowding the school curriculum with another subject.

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In the Fiji Islands in the South Pacific the Department of Education was quick to recognize the significance of computers* soon after they reached the country in the 1970's. In order to prepare the students to cope with the technology of the future, the Department set up a Computer Education Centre (CEC) early last decade with the purpose of introducing computer education in secondary schools. The aim of introducing computer education, according to the Minister of Education, was :

> "... to help students make better use of computers and thus prepare themselves for the world of work in which computer technology will have an increasing impact with the passage of time " (Pal, 1988).

Computer education was introduced into the secondary schools in 1984. Since then, a considerable amount of work has been done by the CEC to facilitate the teaching of computer education in the country. Generally, the following procedures have been used by the CEC:

a. An initial set of computers was donated to several schools. Each set included three or four 'Commodore' keyboards with monitors, a disk drive, and occasionally a printer for each school. For some remote schools power plants were also donated or their purchase subsidized. By the end of the last decade the computers were expected to be in over 100 secondary schools.

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* In this article 'computers' means 'microcomputers'.

b. Training in the use of these computers was given to selected mathematics teachers by the CEC. The teachers could attend a two-year program in Diploma in Applied Computing and Data Processing or undergo an in-service training lasting a fortnight - both run by the CEC.

c. Some software was developed or adopted from abroad by the CEC and distributed free to the schools.

d. School visits by the CEC officials were undertaken to identify difficulties in implementing computer education. Such visits included running refresher courses (say, half a day) for the teachers at their schools and from the neighbouring schools.

e. The CEC has developed a computer course guideline to help the computer teachers in their teaching. The Computer Awareness 90, as it is called, was developed last year and is aimed at the teachers for Years 10-12. It lists broad objectives for teaching computer education and suggests suitable topics for each of those three years, graded in terms of difficulty, interest level, etc.

f. The CEC encouraged the production of a booklet on computers that could be used as an elementary textbook by the senior school students. Written by A. Pal of the U.S. Peace Corps in Fiji, the 60-page booklet gives a very general introduction to the world of computers, focuses on the operation of the 'Commodore 64' machines, and teaches programming in BASIC. A class set of the booklet is donated by the CEC to each school that teaches computing.

g. The CEC produces and distributes free to the teachers involved in computer education a newsletter to keep them abreast of developments in the field. The newsletter is published twice a year.

h. The form 7 students in the country may do some projects as part of their regular mathematics study. Many do computer work as a part of these projects. Those projects form a part of the internal assessment of mathematics.

Given the recency of the computer education in the country, these broad attempts by the Department of Education at introducing and facilitating computer education in the high schools in the country are praiseworthy - particularly at a time when the economy of the

country (and, hence, the school budget) has been facing a difficult time after the two military coups late last decade.

However, there are several constraints that would militate against any further expansion of the computer education in the secondary schools. Three of those key constraints are discussed below. They are: financial, human, and policy constraints. The framework is Fiji - a small tropical island nation located in the South Pacific near Australia and New Zealand, and forms a part of the developing world with sugar and tourism as the mainstay of the economy. The population is about 750,000, evenly divided between the indigenous Fijians and the Indians - the descendents of the migrants from India who came to develop the sugar economy last century.

Constraint 1: Capital investment

It is extremely expensive in terms of the capital requirement to set up a properly equipped computer laboratory to serve a whole class (Amor and Fairhurst, 1987). The shortage of funds to invest into a properly equipped laboratory with sufficient number of computers in it to serve a whole class is one of the key constraints against expanding computer education in this country.

Each school would need a proper laboratory. The laboratory would need fittings such as power points, fans or air conditioning units, tiles, lino or carpet, curtains, tables or counters, cupboards, white board, etc. (A library

is unsuitable for housing the equipment.) To build a proper laboratory alone calls for several thousands of dollars; such a capital is not likely to be forthcoming in the depressed economic circumstances in the country this decade.

When the Department of Education introduced computer education into the schools last decade, only a few computers - three or four units - were donated to each interested school. These units were to be regarded as 'starter sets' - with the Department hoping that the schools would supplement them by buying some of their own*. That was a hope; the reality, however, is very different. Electronic equipment in Fiji, in general, is very expensive; e.g., a monitor would cost about $800. So most schools cannot afford to buy computers, let alone, build proper laboratories to house them.

For example, the Head of the Mathematics Department at a large secondary school in Suva, the capital city, lamented that his school had only three computers (donated by the CEC) but about 40 students per class. To make matters worse, those computers were housed in a small, old room that could barely hold 15 students (Khan, 1990). He wondered how a class of 40 students could work on only three units. The writer supports the view of Amor and Fairhurst (1987) that for a class to use computers gainfully as part of their education, there should be at least a dozen of them with three to four students sharing one. However, to buy eight or ten computers to make a total of 12 per school would be an enormous burden on most of the schools in the

*The Department of Education has now changed its policy. It will donate two computers if the school buys one.

country in the near future. At the same time, in the near future the classes are likely to become larger, not smaller.

Two other difficulties arising from the financial constraints need to be mentioned briefly. A laboratory would need peripheral items such as floppy disks and computer paper to make the day-to-day learning effective and enjoyable. An item such as computer paper, though not extremely expensive, is consumed rapidly; hence, the cost of providing such paper for large classes of students would run into thousands of dollars each year.

The other difficulty relates to the maintenance of the equipment. In due course, some equipment is likely to break down and would need to be repaired. The repairs to electronic items in the country generally are very expensive largely because there are very few repair firms or electronic technicians in the country. A minor repair could cost well over $100. Once they have paid a large repair bill, the schools would be least interested in spending on further maintenance. Instead, they might consider buying library books as a better investment.

Constraint 2: Human resources

The teachers are the key influence on the success of a computer education program (Thomas and Kobayashi, 1987). Yet their training constitutes a severe problem in both the developed and the developing countries alike (UNESCO, 1987). In Fiji many teachers who graduate with a degree in mathematics/science study a little computing as a part of their degree.

Such able teachers are also the most mobile of the teachers. Since the two military coups in the country in 1987, this mobility has accelerated creating severe difficulties and discontinuities in implementing the computer education program so fervently embarked upon by the Department of Education early last decade.

What happens to the computer teachers? Since virtually all are mathematics/science graduates, their skills are in great demand. Some migrate abroad (particularly to Australia and New Zealand), some transfer to other schools within the country, while others join commercial ventures that offer better pay and better working conditions.

The writer is familiar with the problems of one school in Suva that had six teachers in the Mathematics Department when the school year began in February 1990. After the mid-year examinations four of them left, creating severe difficulties for the Mathematics Department in general. It was crippling to the computer education program since the other two teachers were not familiar with computing and could not carry on until suitable replacements arrived.

Teachers with training in computer education are in short supply in both the developing and the developed countries (Thomas and Kobayashi, 1987). Yet, the demand that computers place on the teachers is great indeed (Wright, 1988). Special training programs have to be mounted. In Fiji the students can obtain a degree or a diploma in computing at the University of the South Pacific through recently-introduced programs, but on graduation most head

for the lucrative concerns such as the banks, insurance, accounting and engineering firms, sugar or electricity corporation, etc., rather than join the teaching service that offers both poor pay and inadequate facilities. Those who studied computing as a part of their mathematics/science degree usually end up teaching computing at schools. However, in their overall education and training, computing played a very minor role; i.e., these teachers included only a few units of computing in their degree and they may not feel confident enough to teach the material.

Against these realities, the CEC itself has undertaken the role of a trainer. It offers both a short-term and a long-term training program. While its two-week training is too short and cannot in any way be regarded as adequate, its two-year long training program (Diploma in Applied Accounting and Data Processing) is more thorough-going and is designed to put well qualified teachers into the classroom. This reflects the high priority the CEC, like its counterparts in France and in many other countries, has given to the training of computer teachers.

However, given the long time needed for the specialist training, the migration of teachers continues to be a never-ending problem. As the CEC Newsletter (June 1989, p.3) lamented:

> 'A problem that is presently beyond our means to control is the loss of trained computer teachers in schools that have computers. This is often due to teacher transfers. In such cases, we request that the principals of the school concerned immediately let us know so that arrangements can be made for the training of at least one other teacher from the same school for this purpose.'

Not only does the training of the teachers constitute a problem, the training of the school principals themselves accentuates the problem. Most of the principals in the country are generally over 40 years and, by and large, are social science or language graduates and are not oriented to mathematics or science. They have not studied computing or computer education and sadly lack any familiarity with the new technology. These factors may help explain their poor attitudes toward computers and computer education in general.

Constraint 3: Required policy

In addition to the financial and the human resources needed, there is a third important constraint on the expansion of computer education in the secondary schools in the country. This is the problem of a lack of an integrated policy on the part of the planners. It is the most important of the three constraints discussed here since it contributes both directly and indirectly to the other two constraints discussed earlier.

The CEC policy decisions are too vague and are not specific enough or integrated enough for a long-term planning and expansion of the computer education at the secondary school level. The writer was not able to find a comprehensive statement of the policy. The writer believes that the time has come when the CEC should formulate a comprehensive policy statement on computer education with specific priorities. It needs to define precisely the direction of computer education with respect to the thrusts that the secondary schools should

take. Such a policy is essential not only in helping to reduce the present problems in the field but also in planning the future of such a rapidly expanding area over the next two decades or so.

It is important that any policy developed be based on some research done locally and should draw on foreign experiences as well. The policy would be a tremendous help to the schools, the students, the University of the South Pacific, and other training agencies including the CEC itself. It would have important implications for various aspects of computer education such as the following:

a. Mathematics curriculum, teaching/learning of mathematics and mathematics examinations.

b. Training of computing, mathematics and science graduates intending to be teachers.

c. Mathematics and computer education syllabuses and the writing of computer textbooks.

d. Capital investment into the laboratory, hardware and the development of software.

e. Role of the University of the South Pacific in addition to the training of the teachers.

f. Orientations of the principals, the non-computing teachers such as the geography teachers and the career teachers.

g. An annual budget for each of the schools involved in computer education - as distinct from their school budgets.

h. A wider use of the computer equipment; e.g., the administration could use the computers for the admission of the students, processing of their examination results and preparation of their school reports, etc. Vocationally-oriented girls could study word processing.

i. Catering to the needs of the schools that cannot afford a computer laboratory, etc.; perhaps a few vans equipped with computers could be mobilized.

The above has been a discussion of the three major constraints that are certain to create difficulties in expanding the computer education in the high schools in the country this decade. Based on the above discussion, the following major recommendations can now be made.

1. Priority should be given to developing an integrated long-term policy for the computer education in secondary schools.

2. The pre-service teachers for mathematics/science should include more computing units into their degree programs than they do at present. A certain minimum number of units needs to be made mandatory for them.

3. Textbooks with local content need to be written. Pal's book (1988), if revised and expanded, could be used as a junior text.

4. The salary for the mathematics/science teachers, most of whom are also computing teachers, needs to be revised to halt the loss of skilled manpower from the profession.

5. The school administration personnel should be trained in the non-teaching use of the computers; e.g., processing of students' admission.

6. Computer education should be given a greater weight in form 6 mathematics. It should be made examinable in the form 6 external mathematics examination and should carry a weight of not less than 25% of the total mathematics examination. The present form 6 syllabus would need to be modified accordingly; e.g., "flow-charting" could replace "matrix and transformations".

7. A nation-wide survey of schools offering computer education needs to be made to identify current problems and the findings used for planning. A consultant with extensive experience in computer education from abroad could be hired to help examine current problems and formulate a comprehensive, well-integrated policy outlining specific priorities. It would be immensely helpful to the CEC in implementing computer education program over the next 15-20 years.

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