THE UNIVERSITY OF MANITOBA

The Effect of Microcomputer Literacy Instruction on Teacher Attitudes Towards Microcomputers in Secondary Schools in Kenya

by

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A thesis submitted to the Faculty of Graduate Studies
in partial fulfillment of the requirements for the
degree of Master of Education

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DEDICATION

This study is dedicated to Charlie and Achieng, my two children, for their trust and confidence even during trying moments.

ACKNOWLEDGEMENT

Several people and organizations made this study possible. First and foremost the Kenya Directorate of Personnel Management awarded me the scholarship that made it possible for me to pursue graduate studies in Canada. Second, I am grateful to members of my thesis committee: Dr. Eric McPherson guided me through critical moments of writing the thesis proposal; Dr. Tony Riffel gave me valuable feedback; and, above all Dr. George Porozny, my advisor, gave me encouragement and guidance throughout the writing of this thesis. To all I say 'hasante sana.'

ABSTRACT

The purpose of this study was to investigate the effect of microcomputer literacy instruction on teacher attitudes towards microcomputers in secondary schools in Kenya. The study consisted of two groups of teachers, with the first group having undergone a program of computer literacy and the second having no prior computer experience.

The instrument used, Computer Attitude Scale, measures attitudes on four sub-scales: (a) computer anxiety, consisting of anxiety toward or fear of computers, (b) computer confidence, related to confidence in ability to learn about or use computers, (c) computer liking, meaning enjoyment or liking of computers, and (d) perception of usefulness, consisting of the perception of computers as helpful in one's future work.

Results indicated that the two groups of teachers differed significantly in their computer anxiety, computer confidence, and computer liking. However, and contrary to the literature, the two groups of teachers in this study did not significantly differ in their perception of usefulness of computers.

CHAPTER I

INTRODUCTION

This chapter is divided into two sections. The first section outlines the objectives of the study, the statement of the problem, the research questions, the significance of the study and the definition of terms used in the study. The second section provides background information on Kenya, a general discussion of computers in the country and a discussion of the Aga Khan Computers in Education Project. The acronym, CEPAK, is used often in this study instead of the full name of the Computers in Education Project of the Aga Khan Foundation.

The Objectives of the Study

The main purpose of this study was to examine empirically the basic computer attitudes among high school teachers involved in the Aga Khan Computers in Education Project in Kenya and the extent to which these attitudes are influenced by the computer literacy instruction each of the teachers in the project received. This study also examined the extent to which variables such as teaching and computer

experience affect computer attitudes and the use of computers.

Data were also collected that related to uses of microcomputer technology in the educational system, integration of computer technology in the classroom, related costs, general knowledge of microcomputer capabilities among teachers not in project, and informed views of future of technology in the Kenya setting.

Statement of the Problem

The problem in this study was to investigate the effect of microcomputer literacy instruction on teacher attitudes towards microcomputers in secondary schools in Kenya.

Justification of Study

Implementing a microcomputer based curriculum is curtailed by two kinds of problems as Moursund (1979) points out. First are hardware, software and courseware problems. The other depends upon knowledge of and attitudes of individual teacher or school administrator. In this study, the focus was on teacher knowledge of, and attitudes towards microcomputers. These constraints were considered more critical than hardware, software and courseware considerations since:

> Without knowledgeable teachers and supportive administrators, progress will be painfully slow. With them, progress is rapid, even in light of inadequate hardware, software and courseware (Moursund, 1979, p. 39).

This study was an attempt to understand the relationships, if any, between teacher attitudes, microcomputer literacy instruction, and usage of microcomputers among high school teachers in Kenya.

The issue of teachers was seen to be critical since they serve as the link between policy and students. The strength of this link and the subsequent mass dissemination of information technology would to a large extent depend on the level at which teachers have been prepared. Preparation here not only comprises acquisition of skills and knowledge related to the technology but also acquisition of the right attitudes.

Four types of attitudes were considered:

1. Computer anxiety, consisting of anxiety toward or fear of computers;
2. Computer confidence, related to confidence in the ability to learn about or use computers;
3. Computer liking, meaning enjoyment or liking of computers; and
4. Computer usefulness, consisting of the perception of computers as helpful in one's future work.

Other factors related to attitudes such as amount of experience in using microcomputers, type of training received, and general teaching experience were also studied.

It has been recognized that computer literacy is necessary for society if it is to reap the benefits of science driven industries (Fary, 1983; Commonwealth Secretariat, 1987). As such it is critical that citizens become informed of capabilities of computers. Naturally, development of this awareness should begin with students. This implies that teachers in these schools should be in a position to provide this new literacy to students. The teachers themselves must become computer literate. However, before an effective computer literacy program can be developed, a study of the way teachers feel or think about the use of microcomputers need to be undertaken, more so, in a third world country such as Kenya. A thorough understanding of teacher attitudes will help policy makers and those seeking to implement a microcomputer-based curriculum to be more effective.

It was felt that teacher input in the decision making process was not only important, but also necessary for the successful implementation of the microcomputer in the classroom. As microcomputer literacy and use became more important in the educational process, the attitudes of teachers would play an important role in the successful implementa-

tion of computer related components in the curriculum. Since educational change depends on, among other things, what teachers think (Fullan, 1982), positive attitudes increase the prospects of successful implementation and adoption of technology in the school setting.

The Research Questions

The study gathered data that would help to answer the following research questions:

1. Do teachers who have had instruction in the use of microcomputers differ in anxiety about computers from teachers who have not?
2. Do teachers who have had instruction in the use of microcomputers differ in confidence concerning using computers from teachers who have not?
3. Do teachers who have received instruction in the use of microcomputers differ in liking for computers from teachers who have not?
4. Do teachers who have received instruction in the use of microcomputers differ in perception of the usefulness of computers from teachers who have not?

In this study therefore, the main issue of concern was to measure those variables, other than hardware and software considerations that would act as barriers to successful

implementation and adoption of computer technology within the Kenya high school setting. These variables were identified as teacher anxiety, confidence, liking and perception of usefulness of microcomputer technology.

Definition of Terms

Several terminologies whose meaning may be either ambiguous, or only clear to someone who is intimate with the situation in Kenya, are defined in this section.

Computer literacy

The term computer literacy is seen as a changing concept because of rapid developments in the field (Fary, 1983). As a result, there is no consistent definition in the literature. On one extreme, computer literacy may be considered as involving establishing a certain degree of comfort with computer related technology (Klassen, 1983). To the extreme of this are those who equate computer literacy with computer programming (Johnson, 1980).

In order to provide a comprehensive definition of computer literacy, a task force was set up by the Minnesota Educational Computing Consortium (MECC). The aim of this task force was to define computer literacy in terms of cognitive and affective domains. Consequently, six areas that would comprise computer literacy were found: (a) hardware,

(b) programming and algorithms, (c) software and data processing, (d) application, (e) impact, and (f) attitudes, values and motivation. According to this view, computer literacy is:

> comprised of knowledge and higher level cognitive abilities with regard to computer hardware, computer programming and algorithms, software and data processing, computer application and computer impacts. Computer literacy would also include attitudes, values and motivation as mediating components of and supplements to cognitive skills and abilities, without which acquisition of computer literacy would be difficult if not impossible (Randhawa & Hunt, 1984, p. 2).

This definition and the list developed by MECC require both a knowledge of programming and use of computers. While it may be argued that a computer literate person does not need to program a computer but rather be able to use it effectively (Randhawa & Hunt, 1984), a limited knowledge of the relationship between user, software and hardware and how software "talks" to hardware may be necessary to "demystify" the computer to those being introduced to the technology (Fary, 1983).

For the purposes of this study, the following definition was considered appropriate:

> Whatever understanding, skills and attitudes one needs to function effectively within a given role that directly or indirectly involves computers (Fary, 1983 p. 3).

Approved teachers

These are high school teachers, in Kenya, who lack professional teacher qualifications but are still regarded as professionals. Most hold B.A./ B.Sc. degrees without teaching qualifications. After long and productive service, often ten years or more they become approved as professionals.

Before a teacher can be "approved" they are known as "untrained teachers" since they lack professional teacher qualifications. The teaching certificates they receive remain temporary and must be renewed after a stipulated time period, usually five years.

Trained teachers

These are teachers who have professional designations such as B.Ed. or B.A./ B.Sc. with professional teacher training certificate such as Diploma in Education.

Tertiary education

There are three levels of education in Kenya. These are primary, secondary and tertiary. Primary is the equivalent of grades one to eight; secondary or high school is the equivalent of grades nine to twelve. Tertiary education is considered the third level of education which range from universities to other institutions offering general or professional qualifications.

Secondary schools

These are equivalent to grades nine to twelve. The term secondary school is used interchangeably with the term high school.

Government universities

Kenya has four government universities. The universities operate as autonomous institutions under separate Universities Act of Parliament. Most of the funds come from the government treasury with a revolving fund established to provide student loans. Some funds come from private donors. All other private universities operate under special charters.

Country of Kenya

Background information

Kenya occupies a total of 583,000 square kilometers. Over two-thirds of the country to the north east is arid or semi-arid and therefore sparsely populated. Two-thirds of the Kenyan population lives in the country's central, western and coastal regions. The current population is about 25 million, and with a birth rate of almost 4% it is projected to reach 35 million by the year 2000.

Kenya is divided into eight administrative provinces. These are Coast, Central, Rift Valley, North Eastern, Nyanza, Western, Eastern and Nairobi provinces. Out of these, Rift Valley and North Eastern occupy two-thirds of the country; yet are home to less than one-half of the population. This means that some of the provinces, relatively speaking are small and densely populated, thus making the provision of services easier.

During the colonial period, the economic organization of Kenyan society involved extensive farming by Europeans. This system produced exports, foreign exchange and tax revenues for the colonial government and incomes for the European settlers. Others benefited from the European settler-oriented development as tradesmen and shopkeepers (Asians) and as unskilled labourers (Africans). This socio-economic organization, with its implied division of labour along racial lines, was jealously protected through discriminatory legislation and a host of institutions. A stratified and unequal school system based largely on race, reinforced the occupational division of labour and the distribution of income. Further colonial practice was to keep rural wages low, while at the same time offering relatively higher urban wages. Greater emphasis was also put on the development of urban areas such as Nairobi and other large towns.

The end result of this development pattern was great geographical inequalities and an urban economy geared to meet the consumption patterns of the Europeans. This process created a dual economy - a formal sector characterized by capital intensive and relatively large scale production of goods and services for the high income groups (mostly Europeans), and informal sectors characterized by reliance upon indigenous resources and small scale production of goods and services consumed largely by low income groups (the majority being Africans).

The most disturbing feature of this dualism was that by independence, it had established the model life style to which all who acquired certain academic qualifications could aspire. At the time of independence in Kenya, as in most other African countries, it was the possession of the necessary educational credentials that tended to determine and justify selection to the elitist position left vacant in public and private sectors by departing European administrators.

This pattern of development provided a system of rewards and incentives that buttressed the existing structure of education and acted as an extremely powerful catalyst for its expansion. Education and even more education became the route to the jobs and incomes of the formal sector. This was illustrated by the massive increase in school

enrollments after independence, a rational response by peasants to endow their children with an education through which they could exploit the opportunities presented by the growth of the economy and the process of Africanization.

Formal education structure

Despite receiving independence from Britain in 1963, Kenya's educational system still retains some of its colonial inheritance. English remains the official medium of instruction from grade three onwards. Even though there has been some local adaptation of curriculum, especially in lower levels, a lot of colonial inheritance can still be seen in areas such as school administration, teacher-student relationship, student discipline, and use of external exams for promotion of the individual from one level to another.

Enrollment figures and number of institutions have greatly expanded. In primary schools enrollment has significantly risen from less than one million in 1963 to nearly five million in 1985 and is projected to rise to over seven million by the year 2000. Secondary schools have been expanded from about 150 in 1963 to 2,500 in 1985. While there was no government university in 1963, there are now four government universities with a 1990 projected enrollment of almost 40,000 students.

Kenya has phased out the 7-4-2-3 (7 years of primary, 4 of junior secondary, 2 of senior secondary and minimum of 3 years for university) structure and replaced it with the 8-4-4 cycle of education. At the end of both the primary and secondary levels students sit for compulsory national certificate examinations. This restructuring of the educational system was completed at the end of 1989.

Education is controlled by the ministry of education. The Minister for Education is responsible for all policy matters concerning the ministry. It is the responsibility of central government officers to control and inspect all educational institutions to ensure that quality education is being offered.

Growing demand for schooling

Several factors are considered to be related to the explosive demand of education in varying measures. Foremost is Kenya's rapid population growth rate (approx. 4.0%), due to a high birth rate and increased life expectancy. This has resulted in high land pressure, land fragmentation, and underemployment and unemployment in the rural areas. Many rural families see schooling as the only alternative to economic sufficiency.

A second factor is unemployment. The growing unemployment among high school graduates has led to a 'diploma dis-

ease.' A situation has been created where academically overqualified people compete for jobs previously considered too low for them. There is a continuing and growing demand for higher qualification and certification.

Third, commercialization of the economy which has penetrated into formerly traditional subsistence economies. Modern schooling has become necessary and essential for modern life styles. Coins and notes have replaced cows and goats for bride price; bottled beer has replaced the traditional 'busaa' (local brew made from cereals).

Fourth, the declaration of primary education as a basic right. This demand led to the Kenya government's endorsement of Universal Primary Education in 1980. At the same time, and in order to attract more children to school, the government has continued to provide free school milk to all primary school children as an additional incentive.

Another factor is colonial restriction and political rhetoric. The restrictive colonial system left many people illiterate who now populate the adult education classes. Also the struggle for political independence had heightened the people's expectation for more and better educational facilities, as fruits of 'Uhuru' (Kiswahili word for independence).

Lastly the acceptance of education and development as a tier syndrome. It has been strongly and emphatically argued that, for a a nation to develop faster, it must equip people with the necessary knowledge and skills. Education is thus seen as a key to growth and development.

By all standards, schooling in Kenya is a growth industry. There are large enrollments at all levels. It is the largest government department in terms of teaching staff, auxiliary, back-up personnel, and administrators. The number of pupils and students engaged in schooling form a very significant proportion of the total population. In schools, congestion has become common. The teacher-student ratio in many schools approaches 1:50 or more.

The Ministry of Education is one of the largest consumers of government expenditure. For example, in 1982 the education sector took about 20.5% of current government expenditure (UNESCO, 1984). Most of these funds are spent on primary education. According to the UNESCO figures, 63.8% of the Ministry of Education's budget in 1982 was apportioned to primary level. Over 70% of this amount goes to supporting recurrent expenditure like teachers salaries. It is within these contexts that the Computers in Education Project of the Aga Khan Foundation (CEPAK) was conceived in 1984.

Computers in Kenya: a local context

Computers were introduced in Kenya in the early 1960's with the arrival of main frames machines with microcomputers appearing in the 1980's. Evidence of this arrival and use is illustrated by two events. First, the existence of a monthly, privately published journal devoted entirely to the subject, and second, the local assembling of microcomputers by various locally based companies. The emergence of this industry has however not been completely welcomed as can be seen in an article in the Nairobi weekly news magazine, the Weekly Review of May 11, 1990:

> The absence of a well articulated policy on informatics has led to a situation whereby the local computer industry has been invaded by the many vending firms (The "Weekly Review" May 11, 1990 p. 30).

The insinuation here is that a situation is arising where many firms are moving into the computer industry in order to cash in on its potential. Left without guidance and coordination, the average user will be in difficulty in making hardware and software purchase decisions. Also in a country where all imports are purchased in convertible currency, effective resource allocation becomes critical. This may only be possible where some broad guidelines are in effect to control hardware and software imports.

It should be noted that computers remain part of the modern sector of the economy, mainly in urban areas. Most of rural Kenya, where more than 80% of the population live has yet to experience the computer. Also, because of the high costs of the technology, most people in urban areas are yet to be exposed to it. In terms of diffusion and dissemination of ideas on the computer potential in education, the majority of Kenyans are still ignorant and even mystified by the technology. Lack of awareness of the technology's potential is an important consideration in any attempt to introduce computers in schools.

The small number of schools with computers is in great contrast to the country's 13,000 primary schools and over 2,500 secondary schools, with a student enrollment of over five million (see Table 1). When compared to the developed world, Kenya is at a very young age as far as computers are concerned.

A close examination of institutions having microcomputers raises a number of issues (Makau, 1988). First, in almost all institutions (including government ones) the equipment has been supplied and is maintained through donations and other private funds.

Table 1

Number of Kenya educational institutions using microcomputers in 1987

Level of Ed.	Govt.	Private	Total
Primary	-	5	5
Primary & Sec.	-	3	3
Secondary	7	10	17
Tertiary	3	6	8
Total	10	20	33

Source: Makau, B. M (1988) p. 8

Secondly, these computers consist of 25 different makes in 35 different models. This factor becomes significant when considering organized maintenance and possibility of pooling software. Third, import duty and sales tax make the cost of computers in the Kenya market almost thrice the list price in Europe and North America.

The Aga Khan Computers in Education Project (CEPAK)

Objectives and goals.

In the early 1980's the Aga Khan Education Service in Kenya proposed that microcomputers be introduced into one of its schools as a pilot project. If the project proved to be successful, it was anticipated that it could serve as a mod-

el for future innovation both inside its own school system and for other interested parties in developing countries (Makau & Wray, 1987).

When the project was finally approved, a consultant was recruited to oversee Phase I of the project. The project's objective was stated to be:

> To use the microcomputer in the schools to improve the level of instruction, to give teachers a new challenge in order to revitalize them, and give children an experience of a tool which would affect their lives (Makau & Wray, 1987).

After further consideration, mostly pertaining to hardware and software, Phase I was set to begin with 4 Apple microcomputers with disk drives, monochrome monitors and a printer. The site of Phase I was a privately owned school, the Aga Khan Academy in Nairobi.

Before the project was implemented the professional development of teachers was recognized as a key issue. If the teachers were to have a central role in the classroom, "the innovatory process should concentrate on them" (p. 573). It was thus hoped that the teachers would be able to master the new equipment and to use it in their own teaching. A sixty hour computer literacy program was offered during the initial workshop (Makau, 1987).

After the initial workshop, the teachers were expected to have some understanding of microcomputer application in

the classroom and to use microcomputers on their own. A consultant was also appointed to give further guidance and help teachers develop a liberal approach not only when using microcomputers but also in non-computer lessons.

At the end of 2 years the program was considered successful. Teachers were not only using microcomputers, but were also willing to try new ways of using them in order to improve their approach to teaching (Makau & Wray, 1987).

With these encouraging results, Phase II, which is the subject of this study, was approved in 1986. It was funded by the Aga Khan Foundation and Apple Computer Inc. through a generous donation of hardware and software. Phase II called for the introduction of at least five microcomputers in each of five selected schools. Table 2 shows the particulars of the schools in Phase II of CEPAK.

Table 2

Particulars of schools in Phase II of the Aga Khan Computers Project (CEPAK) in 1987

Name	No. of students	Gender	No. of teachers	City
Aga Khan Academy	430	co-ed.	38	Nairobi
Aga Khan Sec.	420	co-ed.	28	Mombasa
Coast Girls	760	female	46	Mombasa
Ofafa Jericho High Sch.	440	co-ed.	38	Nairobi
State House Girls High Sch.	500	female	35	Nairobi

Source: Makau, B. M. (1988)

The objective of Phase II which covers 185 teachers and about 2,500 students, was to replicate the pilot project at the Aga Khan Academy. The objectives were:

1. To improve the quality of teaching by in-service teacher education using the microcomputer as a catalyst.
2. To use microcomputers as a teaching resource in appropriate school subject topics.
3. To provide the pupils with a basic knowledge of new information technologies, both to aid them in their studies and to make them aware of their technological environment.

4. To improve the quality of the practice of school administration through the use of appropriate information technology.

A three-tier implementation strategy was adopted. The first stage was to develop a core team of teachers through in-service activities who will act as initiators within the schools. During these start-up workshops teachers were given 60 hours "hands-on" experience. Teachers were allowed to experiment with various software that relate to their teaching areas. The goal of this activity was to provide full freedom to the teachers to discover for themselves how best they can use this technology. Many discovered that integrating the microcomputer in their lessons would result in a change of teaching styles and methods of class control. These teachers acted as catalysts by creating an atmosphere where views on the innovation could be freely discussed with project co-ordinators.

In addition a programming language, called PILOT, was taught. This allowed some of the teachers especially in mathematics and other natural sciences to develop programs in their respective teaching subjects for use in their classes. This was followed by specialized workshops for school managers, administrators and subject teachers. Specific microcomputer applications in word processing, spreadsheets and data-base management were taught during this time.

In the second stage, the director visited each project school to offer technical support and hold professional discussion with teachers. The third stage, the use of the technology with students, has been left entirely to decision by the head teachers or individual teachers.

CHAPTER II

LITERATURE

This chapter inclues the following areas: (a) a review of studies done on the Computers in Education Project of the Aga Khan Foundation (CEPAK), (b) a theoretical framework for educational change and instructional technology, (c) the implementation of a microcomputer-based curriculum, (d) teacher attitudes towards a microcomputer-based curriculum, and (e) hypotheses of the study.

Review of CEPAK Project

The International Development Research Centre (I.D.R.C.) and the Rockefeller foundation with the cooperation of the Aga Khan Foundation funded a systematic study of CEPAK (Makau,1988). The purpose of the study was to analyze the extent of changes associated with the introduction of computer technology. The research team was also expected to make suggestions on how the educational processes in Kenya could be improved by limited use of the new technology.

The research was conducted on 2 levels (Makau, 1988). The first consisted of re-analysis of data previously collected during Phase I of the project, conducting a survey of teachers and students in Phase II and interviews with key personnel.

This first level of research provided the research team with basic information from which to operate. Subsequent research activity consisted of:

1. Observation of and interviews at CEPAK organized workshops.
2. Observation of and interviews in the six schools between March and October 1987.
3. Observation at meetings of school computer clubs.
4. Examination of school records on the use of computers.
5. Examination of CEPAK's library records and evaluation of software.
6. Interaction with program director.

Results of the study indicated that students were motivated to learn because of computers. In addition the technology was found to enhance peer interaction among students. It was also being used in the schools management in varying degrees. Some teachers had integrated various computer applications like word-processing of reports into their sub-

ject areas. Overall, the technology helped some teachers to develop new perceptions of their jobs (Makau, 1988).

The study also had some negative findings. These are that use of microcomputers had negatively affected the learning environment by making some students passive. In some lessons, use of microcomputers was observed to be detrimental to learning as a focused activity. There was also ambivalence in systematically integrating the technology in teaching schemes.

In four of the new schools it was found that the number of teachers attempting to master the technology or to use it with students actually declined during 1987. In mid July, 32% of these teachers reported as users of technology, but by mid October of the same year, this had dropped to 14%. The professional staff in these schools mentioned four reasons for this decline of use of the innovation: (a) lack of time, (b) inadequate mastery of the technology, (c) inadequate and/ or inappropriate software, (d) small number of computers in relation to large classes.

In a draft report to headteachers in October 1988, the program director identified and raised a few issues. First how the project was affecting school life; second, staff turnover and third, staff competence (Wray, 1988). He observed that, in general, CEPAK had a positive effect on

the schools. Many schools found that use of microcomputers resulted in time savings. In terms of teacher/ pupil relationships there was greater mutual respect and understanding. However, he noticed that most project schools had a turnover rate of almost 50%. This meant that the project could not build on previous expertise gained during the initial workshops. It was felt that schools should organize their own professional development programs for new teachers to make up for the high turnover. Staff competence was best in the applications of word-processing, spreadsheets and graphics.

Educational Change and Instructional Technology

Fullan (1982) attempted to study systematically the problem of educational change. He pointed out that while it is right to assume that educational change is usually desired because of benefits they are thought to bring, "closer examination reveals that innovation can be adopted for symbolic, political or personal reasons (p.22)".

The meaning of educational change may be dichotomous, either subjective or objective (Fullan, 1982). Subjective meaning often occurs when proposals for change are defined according to only one person's or group's reality. The extent to which this is done is the extent to which problems in implementation are met. Maintaining this view of change

therefore presents a major barrier or constraint to successful implementation.

Meaning of educational change can only be objective when there is consensus on the desired outcomes. When perceived in this manner, educational change will be seen to have several dimensions to it. Lack of knowledge of these dimensions or components provide reasons why innovations are accepted before full understanding: "Why some aspects of a change are implemented and others are not (p. 29)."

There are several implications of what Fullan (1982) calls the subjective and objective realities of change which should address: (a) The soundness of the proposed changes, (b) understanding the failures of well intentioned change, (c) guidelines for understanding the nature and feasibility of particular changes, (d) implications for planning, (e) realities of status quo, and (f) deepness of change, and the question of valuing.

Once change has been decided upon, there are three broad phases associated with adoption and process of change. First is the process which leads up to the decision to go on with the change. Second, is the first experiences, normally 2-3 years, of trying to place the program into practice. Third, the uncertainty of direction of change - whether adopted or whether it disappears. Fullan (1982) maintains

that, to a large extent, the following factors will be responsible for success of any intended changes: (a) Existence and quality innovation, (b) access to information, (c) advocacy from central control, and (d) teacher pressure or support.

On examining the available literature one gets the distinct impression that there is a tendency for teachers to resist any kind of innovation in the classroom. Daniel (1985) reviewed why various instructional technologies have not persisted in North American schools. He attributed this failure to the fact that the teacher as an instructional leader in the classroom has been largely ignored. He says categorically that:

> Nowhere in the literature can I find good, solid research on the importance of a teacher as a person. In my opinion, the importance of the teacher is second only to the importance of the student attributes, and both are far above teaching methods or technology (p.5).

An implication of Daniel's (1985) finding which was also pointed out by Fullan (1982) is that success in the utilization of instructional technology like microcomputers in the classrooms is dependant upon what teachers think about them. The attitudes of the teachers should therefore be taken into account in the planning stages before implementation takes place. Teachers must be willing to make use of the media before its use is made a policy.

According to Armsay & Dahl (1973), there are four main reasons why teachers resist technology in the classroom. Three are discussed here. The first is that education as an establishment is conservative in nature. Teachers tend to identify with traditional systems. Needham (1986) adds that technologies have the potential of upsetting traditional power relationships where teachers have traditionally held authority and control. Cuban (1986) further suggests that:

> Teachers selection, training, and experience and the beliefs teachers hold combine to produce a deep seated conservatism, a reluctance to alter prevailing practices and use mechanical devices in classrooms. Recruitment and selection, then, bring into the profession people who tend to reaffirm, rather than challenge, the role of schools, thereby tipping the balance towards stability rather than change (p.59).

Here Cuban (1986) implies that training of teachers should be changed to reflect the technological aspects of instruction beyond the "occasional course in audio visual aids that includes the conventional array of films, overhead projectors, television and microcomputers" (p.26).

The second reason discussed by Armsay & Dahl (1973) and also supported by Anderson & others (1986), lies in the teacher's fear that technology may replace them rather than supplement their efforts. They fear an invasion of their authority in the classroom, and a possible loss of autonomy and professional privacy, separation from students, and

subsequently, downgraded position, loss of recognition and prestige, and reduced rewards. This view is also given by Plomp & Ely (1982), who maintain that:

> The role of media and technology and a more contemporary one, is that of replacement. An instructional medium can perform certain functions without the physical presence of the teacher. Replacement means that teaching procedures can be handled by media [stress mine] (p.74).

On the other hand Anderson & others (1986) state that:

> It is a mistake to think that the replacement of teachers is the goal of computer education. It should be emphasized that the teacher, if anything, becomes more important in getting the most out of the investment in computers (p.16).

The third reason for teachers's resistance to the technology of instruction is that frequently they have been assigned a secondary role or no role at all in its planning and use. Armsay and Dahl (1973) state that:

> Not only is the teacher ignored in the planning, curriculum designing and decision making, but training in the use of the new media is either inadequate or non-existent. Hence, aloofness, hostility or active opposition (p.29).

As a result of teachers being ignored in planning, some of the technological media have failed to achieve the intended results. Kauffmann (1987) points out:

> Usually it is not technology which is at fault. It is normal defective planning. In fact, most of our ... results from applying technology have been disappointing. And 'technology' gets blamed when the real culprit is lousy planning and analysis...we have to put people (teachers) in the centre of our planning and objectives, if we are to be successful (p.72).

Florio (1987) seems to agree with Kauffmann (1987) when he says that:

> This computer 'revolution' was launched in the manner of a typical education fad. It was pushed from the outside with little time for planning, few opportunities to integrate the innovation with school programs, or adapt it to local situations, and little or no teacher input into the selection of equipment or material (p.21).

Implicit in both Kauffmann's (1987) and Florio's (1987) statements is that proper planning involving teachers is a must for successful implementation of technology in the classroom.

Microcomputer-based Curriculum

It has already been pointed out elsewhere that computer literacy is necessary for the modern society. Since to a large extent, the shape of society is determined by the kind of education given in its schools, provision of a microcomputer-based curriculum will depend on whether the teachers, who as agents of society, are willing and ready to take such a role.

Moursund (1979) identified barriers to full implementation of a microcomputer based curriculum to be: (a) lack of sufficient and adequate computer hardware, (b) appropriate software, (c) appropriate courseware, (d) adequately trained school administrators, and (e) adequate support from school boards, parents and tax payers.

Given funding, the first three are easy to overcome. Adequate support from society as represented by school boards, parents and tax payers is often available. An illustration of this can be seen in the more developed countries of Europe, Asia and North America where the computer has permeated all aspects of life. In these countries community organizations and PTA's have been involved in "computer literacy" programs where working adults register in and learn how to use microcomputers for various applications. The general public in these countries have therefore considerable information about microcomputers. In Britain for example, public information was initially provided by way of BBC-TV's "The Computer Program" and later by other sections of the media (Makau & Wray, 1987).

In these countries, therefore, there was a natural development in which parents and various pressure groups sought to have microcomputers introduced in schools. Still, as it has been pointed out, any attempt to disseminate microcomputer-based curriculum into the educational system must first deal with the part teachers must play in the process. Adequately trained teachers and administrators will be required to carry out the wishes of society as far as a microcomputer-based curriculum is concerned (Pappagiannis, Klees & Bickel, 1982), since:

> Without teachers adequately prepared to use computer-based technology, the best available soft-

> ware and the most up-to-date computing equipment will remain unused. Teachers will continue with teaching practices they have found in the past or, if pressurized make token gestures (Anderson & others, 1987 p.89).

Wedman & Heller (1984) maintain that there has been little impact of microcomputer technology because "teachers lack the ability and the commitment necessary to alter their instructional techniques to accommodate the computer (p.29)." On the other hand Aquila & Parish (1989) while agreeing that microcomputer technology will eventually revolutionize educational service, still concede that the near term picture is far less bright. They attribute this to inappropriate decision making compounded by teacher fear, general mistrust and the mistaken stress on classroom computer literacy programs.

Aquila & Parish (1989) further suggest that lack of use occurs mainly because teachers are artisans with a craft orientation rather than technology-oriented technocrats. As such, schools are craft cultured with certain qualities that make them different from technological systems. Strategies and information relating to cultural change may therefore be more appropriate to generate cultural change than are instructional technologies and that any school change is cultural change.

Nevertheless, teachers should actively be involved in the development of professional development programs relating to microcomputer-based curriculum:

> Allowing teachers to have input in determining the contents of an inservice activity is common practice. However, the input frequently is limited to helping decide what ideas and/or skills are to be learned. Very seldom is there a concerted effort to take into account the affective needs of teachers. When affective needs have been considered, the concern has usually been limited to a desire to change attitudes rather than to use the present attitudes as clues to determine what inservice activities are appropriate (Wedman & Heller, 1984, p.33).

Fary (1984) suggested a staff development program comprising three phases in order to develop a core of microcomputer literate teachers. Phase one calls for obtaining support from administrators without whom the introduction of the innovation would fail. Phase two would involve training a computer resource people within the educational community with the purpose of: (a) conducting professional growth workshops in computer literacy, (b) developing effective software selection criteria, (c) making hardware selection and co-ordinating the development of microcomputer-based curriculum, and (d) teaching microcomputer related courses. In the last phase, this core team will develop and conduct 18 contact hour computer literacy programs to interested teachers.

Teacher Attitudes Towards Microcomputers

Several studies which I now turn to have attempted to empirically study problems associated with the implementation of microcomputer-based curriculum. Studies cited examined problems relating to attitudes and perceptions of teachers.

A study by Wedman & Heller (1984) is first examined. Their purpose was to examine the level of concern of teachers about microcomputers. To do so they administered the Stages of Concern Questionnaire (SoCQ). This instrument was developed as a means of measuring attitudes of individuals towards a particular innovation. The model hypothesizes that individuals move through different stages of concern as they gain more experience with an innovation. The subjects were 87 inservice teachers enrolled in a microcomputer education course. The instrument has seven scales to it as follows:

Scale (Level)	Concern
0 - Awareness	Unconcerned about the innovation.
1 - Information	Concerned about the general characterestics of the innovation.
2 - Personal	Concerned about the relationship between one's role and the demands of the innovation.
3 - Management	Concerned about the time, organization and management of the innovation
4 - Consequences	Concerned about the impact of the innovation on student outcomes.

5 - Collaboration	Concerned about working with others using the innovation.
6 - Refocussing	Concerned about something better than the innovation.

Results showed that most teachers were at 0, 1 and 2 levels. These findings had implications for those inservice planners who may be designing programs appropriate for teachers at varying levels of concern. For example, it would be highly inappropriate to design a program based on level 4 (consequences) while the target teachers are at level 1 (information). This example further emphasizes the need for planners and those seeking to implement a microcomputer-based curriculum to be aware of teacher attitudes and to integrate the attitudes in designing appropriate staff development and inservice programs.

In an unrelated study done in England, Chandra (1984) also investigated teacher attitudes and perceptions of a microcomputer-based curriculum. His findings which were similar to those of Wedman and Heller (1984), can be summarized under three main headings.

Teacher Perception About Computers in General

Chandra (1984) found that while there was an overall tendency to think positively about computers, over half of the teachers he studied had reservations of one kind or another. Some had quite deeply rooted worries or criticisms. He states that:

> These worries had to do firstly with the possible abuse of power that computers afford as a result of its capabilities of storing and accessing large quantities of personal data; and secondly with the feelings of inadequacy that arose because of an ignorance about computers and the terminology used. The criticism the teachers had, included the views that the use of computers would demand a greater level and commitment that would be required of them (p.27).

Some teachers who were unfavorable towards the use of computers associated them only with mathematical and statistical disciplines. Others were antagonistic, perceiving the use of computers as encouraging lazy thinking or even worse, as "brainwashing instruments."

Teachers Perception About Computers in Teaching

The majority of teachers saw the computer as a teaching aid or resource. Those favourable saw computers as useful, quick and permitting the use of dynamic visual displays for difficult concepts as statistics and as a means of reinforcing learning through visual displays.

Some critical of computers viewed them as "marvelous motivational tools" but had reservations about the quality of educational software. They saw the danger of computers encouraging nothing but game playing. Others saw them as not suitable for work, as poor instruments of storage and information retrieval.

There were also teachers who were indifferent to the use of computers. They saw computers as just another type of audio-visual aid or as an aid of teaching programming. All of these teachers were opposed to the use of computers in teaching.

Teachers Perceptions About Their Role

Teachers in this study perceived their role as changing, first in relation to the authority of the computer. They perceived that the computer might be in control, and were concerned for classroom organization and particularly discipline and control. Teachers also expressed the fear that pupils might tamper with or damage the computers.

The second way they perceived their role as changing related to their own authority. The majority of teachers in the study had unfavourable views about themselves as an authority. They saw it as important to be familiar with computers and not ignorant or inefficient in the use of them. But they expressed the feelings they felt as "old",

"inadequate" and "not-practical" in acquiring the necessary skills and knowledge to use computers.

The last way they perceived their role as changing was in their teaching with respect to such matters as group size and in the transmission of knowledge. The majority of teachers saw these possible changes in their teaching situation as unfavourable.

In another study, Harmon (1986), investigated teacher attitude towards the use of microcomputers in business education. He constructed a Teachers' Attitude Survey Instrument containing 27 items. The survey was conducted by mail, and 68% or a total of 267 teachers responded.

Results showed that the overall attitude of business education teachers towards microcomputers was positive. However none of the teachers agreed with the statement that: "Microcomputers software programs could effectively replace business education teachers." All teachers indicated a positive attitude towards the future of teachers in business education.

Generally, the study found that teachers were apprehensive about incorporating microcomputers into the curriculum. They agreed that they were not comfortable working with computers, but felt this could be reduced with additional knowledge on how to use the computer effectively. It was

evident that their attitude decreased as the statements became more restrictive in wording by using the verbs "will" instead of "should."

Ingersoll, Smith & Elliot (1983) also investigated teacher attitudes towards the microcomputer as an instructional tool. In this study, a questionnaire was sent to 4,200 teachers representing a cross-section of elementary through secondary school teachers. The response rate, 38.92%, was considered low. The questions examined in the study and which are of concern to this study are: "What are teacher attitudes towards microcomputers as an instructional tool?" and "How do the teachers perceive their role ?"

Results showed that teachers were positive in their attitude towards the computer. Respondents in the study are reported to have been enthusiastic about the prospects of the new technology in their classrooms. This favourable attitude was reported at all teaching levels. Despite this enthusiasm, some misgivings were still expressed:

> A few teachers voiced suspicions that the computer may reduce opportunities for employment, and concerns about the lack of human contact between teacher and pupil. Teachers felt that human interaction is at the heart of school learning and that increased use of computers could reduce that interaction. Teachers acknowledged that they would need extensive training before they could take advantage of this new technology (p.31).

Madsen & Sebastiani (1987) conducted a study to measure the changes of inservice teachers in knowledge of and attitudes toward computers. The experimental design of this study was a prettest-posttest control group design. The subjects were 60 secondary school teachers randomly selected from a sampling frame of 90 secondary schools. Thirty teachers were randomly assigned to the treatment group who received no formal or informal computer literacy training. The remaining 30 went through a 15 hour computer literacy course based on an approved program.

The instrument selected for this study was the Minnesota Computer Literacy and Awareness Assessment (MCLAA). This instrument has both cognitive and affective components. The results for this study showed that the attitude of teachers toward computers was significantly improved by their participation in an inservice computer literacy course. There was no reported significant shift in attitude among the control group.

In two other studies, Battista & Krockover (1984) and Robinson, Mikkelsen & Ellermeyer (1987), also used the Minnesota Computer Literacy and Awareness Assessment (MCLAA) as their instrument. They sought to investigate the effects of computer use upon the computer literacy and attitudes of preservice elementary and early childhood teachers.

The conclusions drawn were that an effective method for improving preservice elementary teachers' computer literacy and attitudes toward the computer was to involve them in computer assisted instruction (Battista & Krockover, 1984) or provide training on the uses of computers in instruction (Robinson, Mikkelsen & Ellermeyer, 1987).

According to Morrisey (1980), problems in implementation brought about by teacher attitude "is not necessarily significant if addressed properly in introductory teacher training in CAI"(p.50). He outlined four principles which he was confident that if followed, would influence teacher attitude towards the microcomputer. These are:

1. Teach the teachers to think of the computer as a general purpose machine, not a brain.
2. Provide successful introductory experiences.
3. Emphasize the importance of good instructional design in effective CAI.
4. Avoid programming at the beginning (p.50).

Morrisey (1980) used these principles to teach an introductory course on computers at a teacher training college. At the end of the course, he asked the students to complete an anonymous ten-question attitude survey. The answers were on a five-point Likert-type scale graded from less positive to more positive. The study reported an overall positive shift in attitudes about CAI from the beginning of the course to the end.

In order to examine the effect of gender, and amount of computer experience on computer attitudes, Loyd and Gressard (1986a) designed a study of 112 teachers enrolled in a staff development program. Each participant in this study was administered the Computer Attitude Scale at the beginning and at the end of the staff development courses [This instrument was validated in two separate studies also reported by Loyd & Gressard (1986b)]. Results indicated that the main effects for both computer experience and gender were statistically significant. Males were significantly less anxious and more confident than the females. Those teachers with between six months and one year of computer experience and those with more than one year perceived computers to be more useful than those teachers who had no previous computer experience.

These results are consistent with other results obtained by Marshall & Bannon (1986). They designed a study to determine the relations between computer attitudes, computer knowledge, age and gender of both teachers and students. An interesting finding in this study and which was not investigated by Loyd & Gressard (1986a) was that relating to age. Their results showed that the older the respondents, the more positive attitudes they had towards computers.

Summary of chapter

The following are highlights of this chapter:

1. Instructional innovation can be adopted for symbolic, political or personal reasons as opposed to educational benefits they bring.
2. There is a general tendency for teachers to resist any kind of innovation in the classroom. Several factors are considered responsible for this: (a) teacher attitudes and fears, (b) teacher selection, training and experiences, and (c) lack of teacher input in planning processes.
3. Barriers to full implementation of a microcomputer-based curriculum are of two kinds: (a) hardware, software and courseware considerations, and (b) organizational factors. Organizational factors like teacher and administrative preparedness are critical to success of any such programs.
4. Teachers generally have positive attitudes towards microcomputers.
5. Carefully planned inservice and/ or staff development programs are necessary to improve teacher attitudes and acceptance of a microcomputer-based curriculum.
6. Teachers who get involved in computer literacy programs generally have positive shifts in attitudes towards computers.

7. Teachers who have microcomputer experiences of 3 months and over perceived computers to be more useful than those teachers without any previous microcomputer experience.
8. Teachers who have been involved in a computer literacy program usually like computers more, are less anxious and more confident about computers than teachers who have not been involved in a computer literacy program.

Hypotheses

Consequently, as a result of this literature review, the following hypotheses were formulated:

1. There is no difference in anxiety levels between teachers who have had computer literacy instruction and those who have not.
2. There is no difference in computer confidence between teachers who have had computer literacy instruction and those who have not.
3. There is no difference in computer liking between teachers who have had computer literacy instruction and those who have not.
4. There is no difference in perception of usefulness of computers between teachers who have had computer literacy instruction and those who have not.

5. There is no difference in computer attitudes between teachers who have had computer literacy instruction and those who have not.

CHAPTER III

METHODOLOGY

This chapter presents a description of study sites, the research design of this study, the nature of data collected, the data collection procedures, the samples studied, and the limitations and delimitations of the study.

The Study Sites

The study was conducted in two districts in Kenya, namely, Nairobi and Mombasa. These cities are similar in many ways. Nairobi is the capital and the largest city in the country, while Mombasa is the second largest. The soci-o-economic contexts of these two cities are similar.

After setting up necessary appointments with respondent schools, the investigator administered the instrument between May and June 1989. Since the schools are confined within two distinct geographical regions, travel was reduced to a minimum.

Data was first collected from Nairobi schools in the CEPAK project; followed by control schools (those not in

project but matched on other variables). The same strategy was employed with schools in Mombasa.

These locations were selected in advance by Computers in Education Project of The Aga Khan Foundation (CEPAK). Of the five schools in this study, three are in Nairobi and the remaining two in Mombasa.

The Research Design

The study consisted of 2 groups of 5 schools each. Subjects in Group 1 received formal computer literacy instruction. The second group acted as a control for the first group, they were therefore matched on all major characterestics except the treatment. The design called for measuring and comparing scores of the two groups on four categories of the dependent variable: computer attitudes.

The five schools in the Phase II project are: Aga Khan High School, State House Girls High School, Ofafa Jericho (all in Nairobi), Aga Khan Secondary School, and Coast Girls (both in Mombasa). The control group consisted of 5 schools, three in Nairobi and two in Mombasa. All the schools in the study are known as government schools. These are schools whose major operating expenses are paid for by the government through the Ministry of Education.

The matching was done in terms of school size, number of members on teaching staff, and whether co-educational, girls-only or boys-only institutions. Teachers in Group 1 had experience on a wide range of educational software, and evaluation of such software in the classroom. Group 2 teachers did not have any such experience.

Types of Data Collected

Data critical to the study were: (a) computer experience, (b) teaching experience, (c) computer literacy instruction, (d) computer use, (e) and attitudes as measured by: anxiety, confidence, liking, and perception of usefulness.

Subjects

This study involved two groups of teachers in selected Kenya secondary schools. Even though each group was supposed to have a sample of 100; it was only possible to collect data from 71 in Group 1 and 69 in Group 2. It is felt that a response rate of 71% and 69%, for groups 1 and 2 respectively, is sufficient for this kind of study.

Group 1 consisted of teachers selected from a population of 185 teachers distributed from five schools who had participated in the Aga Khan Computers Project. The inves-

tigator did not use any random means to select subjects in this group. In most cases twenty questionnaires were issued to participants on behalf of the investigator by the teacher in charge of the project in each particular school. Since most of the teachers in project schools had participated in the computer literacy program, any teacher was eligible to take part in the study.

In Group 2 the headteachers in each school distributed twenty questionnaires to selected teachers. The main difference between the groups was that Group 1 teachers had undergone a computer literacy program while Group 2 teachers had not.

Instrument

The main instrument for this study was the Computer Attitude Scale (Loyd & Gressard, 1986a). In addition, a questionnaire developed for this study was administered to obtain other relevant data, specifically on level of use of computers, teaching experience and academic qualifications of respondents. The questionnaire did not require any validation since the items required responses that are matters of fact such as teaching experience and academic qualifications. Validation studies for the Computer Attitude Scale was done by Loyd & Gressard in a 1986 study. Results of the validation study showed that the scale is a reliable and

valid measure of computer attitudes and that it can be used effectively in research and program evaluation contexts.

The Computer Attitude Scale (Appendix A) provides scores on four subscales: computer anxiety, computer liking, computer confidence and perception of usefulness. Each subscale consists of 10 items which are distributed alternately throughout the instrument. For this study, the format of the instrument was modified to provide easy scoring of responses. First, the modified version had response scale of 1-5 instead of 1-4. On the scale, 1 was equated to "Strongly disagree", 2 to "disagree", 3 to "neither", 4 to "agree", and 5 to "strongly agree." The original version did not have "neither" as a response. Second, some statements were stated in reverse form, for example, the item, "working with a computer does not make me nervous" appeared in the modified version as "working with a computer makes me nervous." The purpose of this was to facilitate scoring in such a way that low scores would represent high anxieties, low confidence, low liking, and low perception of usefulness - all meaning negative attitudes. And high scores would represent low anxieties, high confidence, much liking and high perception of usefulness - all meaning positive attitudes.

Each subscale of the instrument has a minimum score of 10 and maximum of 50 with a midpoint of 30. A three tier

interpretation (arbitrary) of scores was applied in such a way that for anxiety, scores of between 10-30 represented high anxiety, 31-40 moderate anxiety and 41-50 low anxiety levels. For confidence, liking and perception of usefulness, scores of 10-30 were regarded as low, 31-40 moderate and 41-50 high. This interpretation system was used only for the purposes of this study.

Taken then that minimum score in each level or subscale is 10 and maximum 50 and that the variable had 4 subscales in all; the minimum and maximum score for attitudes would therefore be 40 and 200 respectively (i.e minimum 10 x 4 subscales and maximum 50 x 4 subscales). And since the mid-point section between 40 and 200 is 120, scores falling below it would represent negative attitudes and those falling above it represented positive attitudes. Negative attitudes (scores under 120) meant high anxieties, low confidence, low perception of usefulness and dislike of computers. Positive attitudes (scores above 120) on the other hand meant low to moderate anxiety, moderate to high confidence, moderate to high perception, and moderate to high liking. Table 3 summarizes how data should be interpreted.

Table 3

Group Raw Score Interpretation for Each Subscale of Attitudes

	Anxiety	Confidence	Liking	Usefulness
Low	41-50	10-30	10-30	10-30
Moderate	31-40	31-40	31-40	31-40
High	10-30	41-50	41-50	41-50

Note 1: All figures represent scores on the scale, e.g High Liking is represented by scores between 41-50.

Note 2: Attitude scores are obtained by getting the totals of the 4 subscales. Scores below 120 represented negative attitudes, between 120 and 160, low positive attitudes, and over 160, high positive attitudes.

Data Analysis

Means and frequencies for both dependant and independent variables were analyzed to allow for descriptive analysis of data. To determine whether the two groups in the study were significantly different in their computer attitudes, t-tests were carried out for each research question. Though the scores on the scale may not have been independent, it was felt that it was justifiable to act as if it were in this kind of exploratory study. Given that the sample sizes were large and almost of the same size, it seemed unlikely that there are any threats to the conclusions.

Limitation and Delimitations of Study

Two limitations have been identified. First, since the investigator did not assign teachers randomly to the treatment groups, observed differences between the groups could be attributable to other variables not controlled in the study. Second, results of the study should be viewed from a Third World point of view thus caution should be taken in generalizing the results to a different setting.

Teachers participating in the study's control group did not have any prior microcomputer literacy instruction and all teachers in the experimental group had a minimum of 60 hours of microcomputer literacy instruction. However, it cannot be ruled out that there was systematic bias in those who participated in the study, especially in Group 1, with those favourable towards microcomputers participating and those unfavorable declining to participate in the study. Still, given that the sample sizes were large, it was hoped that the conclusions were valid.

While some studies reviewed indicated the possibility of relationships between gender, age and computer attitudes, this study deliberately did not collect any data to facilitate their testing. This was because the investigator did not see any educational significance of such information.

CHAPTER IV

FINDINGS

This chapter presents the descriptive and inferential analysis of the data collected for the study. The descriptive analysis are discussed to give an overall perspective of findings. Results of inferential analysis (t-tests) are presented to test the research hypotheses.

Details of the descriptive analysis

This section presents the descriptive overview of both the independent and dependent variables. Independent variables included teachers academic qualifications, professional qualifications, teaching experience and computer experience. The four subscales of the dependent variable were: (a) anxiety, (b) confidence, (c) liking, and (d) perception of usefulness. Data relating to microcomputer use among teachers in the study are also tabulated. Frequencies, means, maximum and minimum scores are tabled to aid in analysis.

Details of the descriptive analysis

Table 4 shows the frequencies and categories of academic qualifications for teachers in both groups. It can be seen that teacher qualification in each group are closely matched. For example, 38 teachers (53.5%) in Group 1 and 36 teachers (52.2%) in Group 2 had B.Ed. qualifications.

Table 4

Academic Qualifications of Teachers in the Study

Type	Group 1 No.	Group 1 %	Group 2 No.	Group 2 %
B.Ed.	38	53.5	36	52.2
B.A/ B.Sc.	11	15.5	13	18.8
M.A/ M.Ed.	3	4.2	1	1.4
Dip. Ed.	19	26.8	19	27.5
Total	71	100.0	69	100.0

In Kenya, a B.Ed. is considered to be both an academic and professional minimum qualification for teaching at the high school level. While those with other qualifications such as B.A or B.Sc. may be employed as teachers, their certification is only for a temporary period pending formal teacher qualification such as Dip. Ed. A Diploma in Educa-

tion is a distinct program for those with or without degrees who wish to join the teaching profession.

Table 5 shows that 49 of the teachers (69%) in Groups 1 and 46 (66.7%) in Group 2 were "trained teachers." These figures indicate that professional qualifications of teachers in the two groups are comparable. Only a small number of teachers in each group (item: Graduate untrained) may be regarded as non professionals since they lack formal teacher training.

Table 5

Professional Qualifications of Teachers in the Study

Type	Group 1 No.	Group 1 %	Group 2 No.	Group 2 %
Graduate trained	49	69.0	46.0	66.7
Graduate untrained	4	5.6	6.0	8.7
Approved	3	4.2	4.0	5.8
Dip. Ed.	15	21.1	13.0	18.8
Total	71	100.0	69	100.0

Table 6 shows teaching experience of teachers in the study. Almost 82% of teachers in Group 1 had teaching experiences of more than 3 years. This is slightly less for teachers in Group 2 (62.3%). Taken together, 93% of teachers in Group 1 have teaching experiences of 2 or more years. This figure is considerably lower for group 2 teachers at 68%.

Table 6

Teaching Experience of Teachers in the Study

Length	Group 1 No.	Group 1 %	Group 2 No.	Group 2 %
< 1 year	2	2.8	8	11.6
Between 1 and 2 yrs.	3	4.2	14	20.3
Between 2 and 3 yrs.	8	11.3	4	5.8
> 3 years	58	81.7	43	62.3
Total	71	100.0	69	100.0

While Group 2 teachers were chosen on the basis of no microcomputer experience and no microcomputer use (Tables 7 and 8); the length of microcomputer experience in Group 1 teachers varied from none (4 teachers), less than six months (26 teachers); between six months and one year (14 teachers) and over one year (27 teachers). Those teachers who after the initial computer literacy workshop did not again use the microcomputers were considered as having no computer experience.

Table 7

Computer Experience beyond introductory Microcomputer Workshop of Teachers in the Study

Length	Group 1 No.	Group 1 %	Group 2 No.	Group 2 %
Non	4	5.6	69	100.0
< 6 months	26	36.6	-	-
6 months - 1 year	14	19.7	-	-
> 1 year	27	38.0	-	-
Total	71	100.0	69	100.0

Results of computer use are presented in Table 8. Computer use was regarded as actual use of a microcomputer for some defined purpose other than playing of games. It can be seen that almost 82% of teachers in Group 1 used computers at least once per week.

Table 8

Average no. of times per week that Teachers in the Study used Microcomputers

	Group 1		Group 2	
	No.	%	No.	%
Non	7	9.9	69	100.0
1-3 times/ week	58	81.7	-	-
> 4 times/ week	6	8.5	-	-
Total	71	100.0	69	100.0

Table 9 shows anxiety scores for all teachers in this study. Two teachers in Group 1 and 20 teachers in Group 2 had high anxiety towards computers. Eighteen teachers in Group 1 and 46 teachers in Group 2 had moderate anxiety.

Table 9

Computer Anxiety Scores for Teachers in the Study

Scale	Level	Group 1 No.	Group 1 %	Group 2 No.	Group 2 %
10 - 25	High	2	2.8	20	29.0
26 - 30	High	5	7.1	35	50.7
Total	High	7	9.9	55	79.7
31 - 35	Moderate	13	18.3	11	16.0
36 - 40	Moderate	35	49.3	3	4.3
Total	Moderate	48	67.6	14	20.3
41 - 45	Low	11	11.5	-	-
46 - 50	Low	5	7.0	-	-
Total	Low	16	18.5	-	-
Total		71	100.0	69	100.0
Maximum Score		50		38	
Minimum Score		22		15	
Means		37.45		27.28	

While no teacher in Group 2 had low anxiety scores, 16 or 8.5% of teachers in Group 1 had them. The mean anxiety score for Group 1 was 37.5 (moderate) for Group 2 this was 27.3 (high).

Table 10 shows computer confidence scores of teachers in this study. Results show that 14 teachers in Group 1 had low confidence. This sharply contrasts with results of Group 2 where 64 (93%) reported low confidence in using computers. Again, while no teacher in Group 2 had high confidence, 12 teachers in Group 1 reported high confidence. The mean confidence level for Group 1 was moderate (35.6) and low for Group 2 (25.9).

Table 10

Results Showing Scores on Computer Confidence of Teachers in the Study

Scale	Level	Group 1 No.	Group 1 %	Group 2 No.	Group 2 %
10 - 25	Low	3	4.2	23	33.4
26 - 30	Low	11	15.5	41	59.5
Total	Low	14	19.7	64	92.9
31 - 35	Moderate	17	24.0	4	5.7
36 - 40	Moderate	28	39.4	1	1.4
Total	Moderate	45	63.4	5	7.1
41 - 45	High	9	12.7	-	-
46 - 50	High	3	4.2	-	-
Total	High	12	16.9	-	-
Total		71	100.0	69	100.0
Max. Score		48		37	
Min. Score		18		11	
Means		35.55		25.91	

No teacher in Group 2 expressed a strong dislike for computers (see Table 11). However, in Group 1, 2 teachers scored very low when it came to liking computers. Forty three teachers in Group 1 and 45 teachers in Group 2 had a moderate liking for computers. Sixteen teachers in Group 1 and 2 in Group 2 expressed a strong liking. The mean liking scores were 37 (moderate) and 34 (moderate) for Group 1 and 2 respectively.

Table 11

Scores of Computer Liking for Teachers in the Study

Scale	Level	Group 1 No.	Group 1 %	Group 2 No.	Group 2 %
10 - 25	Low	2	2.8	-	-
26 - 30	Low	10	14.1	14	20.3
Total	Low	12	16.9	14	20.3
31 - 35	Moderate	12	16.9	31	44.9
36 - 40	Moderate	31	43.7	22	31.9
Total	Moderate	43	60.6	53	76.8
41 - 45	High	13	18.3	2	2.9
46 - 50	High	3	4.2	-	-
Total	Moderate	16	22.5	2	2.9
Total		71	100.0	69	100.0
Max. Scores		48		42	
Min. Scores		22		27	
Means		36.54		34.06	

Scores for perception of usefulness for both groups were nearly the same as can be seen in Table 12. The mean score for Group 1 was 37.62 (moderate) and for Group 2 was 36.80 (moderate).

Table 12

Scores of Perception of Usefulness of Computers among Teachers in the Study

Scale	Level	Group 1 No.	Group 1 %	Group 2 No.	Group 2 %
10 - 25	Low	3	4.2	-	-
26 - 30	Low	6	8.5	5	7.2
Total	Low	9	12.7	5	7.2
31 - 35	Moderate	11	15.5	24	34.8
36 - 40	Moderate	27	38.0	26	37.7
Total	Moderate	38	53.5	50	72.5
41 - 45	High	20	28.2	10	14.5
46 - 50	High	4	5.6	4	5.8
Total	High	24	33.8	14	20.3
Total		71	100.0	69	100.0
Max. Scores		49		47	
Min. Scores		17		27	
Means		37.62		36.80	

After all the scores were totaled to provide attitude scores (Table 13), it was found that 5 teachers (8%) in Group 1 had negative attitudes towards computers (Scores of 120 or less on the scale). In Group 2, 27 teachers or nearly 40% reported negative attitudes. While no teacher in Group 2 had a high positive attitude (scores above 160 on the scale), 16 teachers or nearly 23% in Group 1 had high positive attitudes towards computers.

Despite this, the average scores for attitudes for each group was low positive (scores between 120-160) with Group 2 having a mean score of 124.20 and Group 2 having a mean score of 146.89.

Table 13

Total Scores of Computer
Attitudes of Teachers in the Study

Scale	Level	Group 1 No.	Group 1 %	Group 2 No.	Group 2 %
40 - 100	Negative	2	2.8	2	2.9
101 - 120	Negative	3	4.2	25	36.2
Total	Negative	5	7.0	27	39.1
121 - 140	Low Positive	18	25.4	35	50.8
141 - 160	Low Positive	32	45.1	7	10.1
Total	Low Positive	50	70.5	42	60.8
161 - 180	High +ve	13	18.3	-	-
181 - 200	High +ve	3	4.2	-	-
Total	High +ve	16	22.5	-	-
Total		71	100.0	69	100.0
Max. Scores		189		151	
Min. Scores		91		90	
Means		146.89		124.20	

Results of Inferential Statistics

Tables 14-18 present results of t-test procedures. These are organized under separate headings for each of the dependent variables.

Table 14 shows the t-test results for the dependent variable, computer anxiety. According to this result there is a significant difference in anxiety between the two groups. Given the earlier noted limitation in this kind of exploratory study, the null hypothesis that there was no difference in anxiety between the 2 groups was rejected at $P< 0.05$ with degrees of freedom 70 and 68.

Table 14

Results of t-test analysis of
Computer Anxiety for Teachers in the Study

Group	N	Mean	Std. Dev.	Std. Error	t
1	71	37.45	5.19	0.62	12.58*
2	69	27.28	4.36	0.52	

*P< 0.05 df 70 and 68
significant at alpha=0.05

The t-test results for confidence (Table 15) also show a significant difference between the two groups on this variable at alpha=0.05. The null hypothesis that there was no difference between the two groups in anxiety was therefore rejected at P< 0.05 with 70 and 68 degrees of freedom.

Table 15

Results of t-test analysis of
Computer Confidence for Teachers in the Study

Group	N	Mean	Std. Dev.	Std. Error	t
1	71	35.55	5.50	0.65	11.44*
2	69	25.91	4.42	0.53	

* P< 0.05 df 70 and 68
Significant at alpha=0.05

While the mean difference for computer liking between Group 1 and Group 2 was so small (less than 3) significance was found at alpha=0.05. This meant that the groups differed significantly in their liking for computers (see Table 16). The null hypothesis that there was no difference in liking between the two groups was therefore rejected at P< 0.05 with 70 and 68 degrees of freedom.

Table 16

Results of t-test analysis of
Computer Liking among Teachers in the Study

Group	N	Mean	Std. Dev.	Std. Error	t
1	71	36.53	5.32	0.63	3.21*
2	69	34.0	3.62	0.43	

* P< 0.05 df 70 and 68
Significant at alpha=0.05

Table 17 shows t-test results of the variable, Perception of Usefulness. This result meant that the groups did not differ significantly in their perception of usefulness of computers. The null hypothesis that there was no difference in perception of usefulness between the two groups at P< 0.05 with 70 and 69 degrees of freedom was retained.

Table 17

Results of t-test analysis of
Perception of Usefulness of
Computers among Teachers in the Study

Group	N	Mean	Std. Dev.	Std. Error	t
1	71	37.62	6.10	0.72	0.89*
2	69	36.80	4.70	0.56	

* P> 0.05 df 70 and 68
Not significant at alpha=0.05

When comparing total computer attitudes (Table 18) the investigator found the mean difference was large at 22.69. Despite the mean scores all falling under the level of "low positive attitude," (i.e scores between 120-160 on the scale), the groups differed significantly in their attitudes towards computers at alpha=0.05. The null hypothesis that there was no difference in attitudes between the 2 groups was therefore rejected at P <0.05 with 70 and 68 degrees of freedom.

Table 18

Results of t-test analysis of
Computer Attitudes for Teachers in the Study

Group	N	Mean	Std. Dev.	Std. Error	t
1	71	146.89	18.99	2.25	8.49*
2	69	124.20	11.93	1.44	

* P< 0.05 df 70 and 68
Significant at alpha=0.05

CHAPTER V

DISCUSSION AND RECOMMENDATIONS

This chapter presents the summary of the findings, discusses the educational implications of these findings, and gives recommendations for educational improvement and suggestions for further research.

Summary of the Findings

The major hypothesis for this study was that there is no difference in attitudes between teachers who have had microcomputer literacy instruction and those who have not received such instruction. This study showed that there indeed are differences in attitudes between the two groups of teachers.

Operational definition of attitudes made it necessary for its subdivision into 4 subscales namely: (a) anxiety towards computers, (b) confidence in using computers, (c) liking of computers, and (d) perception of usefulness of microcomputers in educational systems. Null hypotheses were

formulated for each of the subscales. Each subscale thus measured a component of attitudes, with sum of all subscales providing measurements for attitudes. Hypotheses for subscales were that:

1. There is no difference in anxiety between teachers who have had microcomputer literacy instruction and those who have not received such instruction
2. There is no difference in confidence between teachers who have had microcomputer literacy instruction and those who have not received such instruction.
3. There is no difference in liking for computers between teachers who have had microcomputer literacy instruction and those who have not received such instruction.
4. There is no difference in perception of usefulness between teachers who have had microcomputer literacy instruction and those who have not received such instruction.

The first three null hypotheses were all rejected at $P< 0.05$. These results indicated that indeed there were differences in anxiety, confidence, and liking as they related to microcomputers. This study found no sufficient grounds to reject the null hypothesis that there was no difference between the two groups in their perception of usefulness of microcomputers in the educational systems.

After total scores were obtained and analyzed, it was found that the 2 groups of teachers differed significantly in their total attitudes towards computers. The null hypothesis that there were no differences in attitudes was therefore rejected at $P< 0.05$.

Educational Implications

Attitude differences between the groups

Even though results showed that there were significant differences in attitudes between the groups, both groups reported positive attitudes. This is consistent with the literature that teachers generally have positive attitudes towards microcomputers.

Significant differences in attitudes were attributed to the fact that one group of teachers was involved in a formal microcomputer literacy program which probably resulted into a positive shift in their attitudes. This finding agrees with the literature notably, Madsen & Sebastian (1987); Battista & Krockover (1984); Robinson, Mikkelsen & Ellermeyer (1987), among others.

Findings of significant differences in attitude subscales of computer anxiety, confidence and liking were also consistent with literature. However, contrary to what Loyd & Gressard (1986a) found in their study that teachers with

some computer experience (6 months, 1 year and over 1 year) perceived computers to be more useful than those who had no previous computer experience, this study found no evidence to support this. Instead, it was found that there were no differences in perception of usefulness of microcomputers between teachers with no experience and those with 3 months, 6 months or even 1 year experience. Whereas microcomputer literacy instruction with subsequent experience seemed responsible for differences in anxiety, confidence, and liking, it had no bearing on perception of its usefulness.

It is reasonable to suggest that anxiety, confidence and liking of a technological innovation such as a microcomputer, indeed anything that requires some level of expertise, will be affected by prior training in its use and subsequent exposure to it. This may not, on the other hand, be true for perception of usefulness as results in this study indicated.

A more likely factor would be level of education. This may have played a larger part in influencing perception of usefulness. Given that on average, teachers are well educated people, most with university degrees and diplomas, it will not be surprising that their exposure to information through the media, for example, would shape the way they perceive things. Unfortunately, data obtained in this study could not produce conclusive evidence about this, since teachers in both groups had comparable levels of education.

Recommendations

Even though this study only investigated the effect of teacher attitudes towards microcomputers, the study as a whole has implications for the future of information technology in Kenya. Recommendations will not just deal with changing or improving teacher attitudes, but the larger field of information technology in the country.

Proceeding on the assumption that future socio-economic development of a country will, to a large extent, depend on the degree to which its information technology has been developed, it is hoped that the following suggestions if followed through will: (a) Increase public awareness of computer technology, its usefulness and capabilities; (b) Result into many schools/ colleges offering programs on microcomputer technology/ applications; (c) Increase availability and accessibility of hardware and software to a larger section of the community. The investigator came up with five recommendations on how the dissemination of information technology could be improved within the Kenya setting:

RECOMMENDATION ONE

Kenya secondary school teacher training should include a course in microcomputer applications in education.

Once teacher trainees are exposed to this technology while still at university, they will learn to view microcomputers as useful education tools. They will begin to depend on them to accomplish various tasks. Passing on these attitudes and skills to other learners will therefore be only part of the total learning strategy which they have been trained in.

While spending large sums of money on the CEPAK pilot project may be useful in some ways, long term benefits are questionable. Research on the project has already shown that there is a large staff turnover (Wray, 1988). This would not be the case if all teachers had exposure to the technology while at college. However, it should be conceded that for this to succeed there must be policy guidelines set out by the government.

RECOMMENDATION TWO

The Ministry of Education should come forward with a clear policy on information technology in the education system.

Whereas Kenya, as a member of the Commonwealth, was a signatory to the 1987 policy guideline on information technology by the Commonwealth Secretariat, nothing seems to have been done locally to provide guidelines. The current high school curriculum is so extensive that little time is left for other activities other than those specified. A

comprehensive policy statement from the ministry will not only provide guidelines on issues such as hardware and software, but also ensure that time is made available, within the high school curriculum, for the dissemination of appropriate skills and knowledge as far as information technology is concerned.

RECOMMENDATION THREE

Microcomputers should be promoted as a useful tool to the general public.

The government of Kenya should promote use of microcomputers as a useful tool to the general public. It was seen in this study that apart from schools in the CEPAK project and some private schools, microcomputers have not been a feature in the Kenyan society. It is a totally "foreign" innovation whose use is restricted to a few in business and industry. Public education will therefore serve the purpose of dispelling some of the fears associated with such technology, and also aid in demystifying the technology to the majority.

RECOMMENDATION FOUR

The government should consider reducing the high sales tax and duties currently imposed on imported computer hardware and software.

This will reduce the cost to users, whether individuals or schools. This will also go along way to ensure that hardware and software is affordable even by the poorest schools.

RECOMMENDATION FIVE

The Ministry of Education should establish a Kenyan Microcomputer Information Centre.

Such a facility, which should have a consultant, will serve several purposes such as: (a) providing information on computers to those who are interested, (b) organizing workshops, and conferences on information technology, (c) consulting with Kenya Institute of Education in planning and developing a microcomputer-based curriculum for the educational system and in the preparation of instructional materials on the technology.

Suggestions for Further Research

These suggestions are made on the assumption that the Kenya government does adopt a comprehensive policy guideline on information technology in the country. A policy guideline will ensure that Kenya is not left behind in the development of a society that is not only computer literate but also knowledgeable and skilled in the general area of information technology.

If a program on microcomputer application is to be offered to all secondary school teacher trainees, a study should be carried out by the relevant authorities to determine the kind of program and the implications of implementing it in terms of finances and man power needs. In addition, the Kenya Institute of Education, which has the sole responsibility of curriculum development should carry out a study to see how best microcomputers can be integrated in the secondary school curriculum.

APPENDIX

(i) Questionnaire

1. Name of School _____

Please check (/) whichever is applicable:

2. Gender:

(1) Male ( )

(2) Female ( )

3. To which age group do you belong?

(3) 20-30 ( )

(4) 31-40 ( )

(5) 41-50 ( )

(6) over 50 ( )

4. Your academic qualifications:

(7) B.Ed ( )

(8) B.A/B.Sc. ( )

(9) M.A/M.Ed. ( )

(10) Other ( ). Please indicate_____

_____

5. Your professional qualifications:

(11) Graduate trained ( )

(12) Graduate untrained ( )

(14) Approved teacher status ( )

(15) S.1 ( )

(16) Other ( ). Please indicate _____

_____

6. No of years you have been teaching:

(17) Less than 1 year ( )

(18) 1-2 years ( )

(19) 2-3 years ( )

(20) >3 years ( )

7. Indicate which subjects you teach:

(i) _____ (ii)_____ (iii)_____

8. Have you ever attended workshops on computer literacy?

(21) Yes ( )

(22) No ( )

If your answer to question 8 above is Yes, answer questions 9 and 10. If No go to question 11.

9. List seminars or workshops you have attended on computer literacy in the spaces below.

	Seminar/Workshop	Approx. Dates
(i)	_____	_____
(ii)	_____	_____

(iii) _____ _____

(iv) _____ _____

10. Indicate whether the seminar and/or workshop covered the following:

    (a) Familiarization with general capabilities of microcomputers: Yes ( ) No ( )

    (b) Providing a "hands-on" experience on microcomputers: Yes ( ) No ( )

    (c) Specific applications of microcomputers to your subject area:
    Yes ( ) No ( )

    (d) Developing software/ courseware for your own subject area:
    Yes ( ) No ( )

11. Your experience with microcomputers is:

    (23) No experience ( )
    (24) Less than 6 months ( )
    (25) 6 months to 1 year ( )
    (26) 1 year and over ( )

12. How often do you use microcomputers?

    (27) Never ( )
    (28) 1-3 times a week ( )

(29) 4 and more times a week ( )

(ii) COMPUTER ATTITUDE SCALE

In the following section, rate yourself on the 1-5 scale by circling the score that best describes the extent to which you agree or disagree with each statement.

On this scale:

1. implies you strongly disagree,
2. implies you disagree,
3. implies you neither disagree nor agree,
4. implies you agree, and
5. implies you strongly agree.

1. Computers do not scare me at all:	1	2	3	4	5
2. I am good with computers:	1	2	3	4	5
3. I would like working with computers:	1	2	3	4	5
4. I will use computers many ways in my life:	1	2	3	4	5
5. Working with a computer does not make me nervous:	1	2	3	4	5
6. Generally, I would feel O.K. about trying a new Problem on the computer:	1	2	3	4	5
7. The challenge of solving problems with computers appeals to me:	1	2	3	4	5
8. Learning about computers is not a waste of time:	1	2	3	4	5
9. I do not feel threatened					

when others talk about computers:	1	2	3	4	5
10. I think I would do advanced computer work:	1	2	3	4	5
11. I think working with computers would be enjoyable and stimulating:	1	2	3	4	5
12. Learning about computers is worthwhile:	1	2	3	4	5
13. I feel attracted toward computers:	1	2	3	4	5
14. I am sure I could do work with computers:	1	2	3	4	5
15. Figuring out computer problems appeals to me:	1	2	3	4	5
16. I will need a firm mastery of computers for my future work:	1	2	3	4	5
17. It wouldn't bother me at all to take computer courses:	1	2	3	4	5
18. I am the type to do well with computers:	1	2	3	4	5
19. When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer:	1	2	3	4	5
20. I expect to have much use for computers in my daily life:	1	2	3	4	5
21. Computers make me feel comfortable:	1	2	3	4	5
22. I am sure I could learn a computer language:	1	2	3	4	5
23. I understand how some people can spend so much time working with comput-					

ers and seem to enjoy it:	1	2	3	4	5
24. I can think of many ways of using computers in my career:	1	2	3	4	5
25. I would feel at ease in a computer class:	1	2	3	4	5
26. I think using a computer would be very easy for me:	1	2	3	4	5
27. Once I start to work with the computer, I would find it hard to stop:	1	2	3	4	5
28. Knowing how to use computers will enhance my career aspirations:	1	2	3	4	5
29. I get a good feeling when I think of trying to use a computer:	1	2	3	4	5
30. I could get good grades in computer courses:	1	2	3	4	5
31. I will do as much work with computers as possible:	1	2	3	4	5
32. There are many things which I can't do but the computer can:	1	2	3	4	5
33. I would feel comfortable working with a computer:	1	2	3	4	5
34. I do think I could handle a computer course:	1	2	3	4	5
35. If a problem is left unsolved in a computer, I would continue to think about it afterward:	1	2	3	4	5
36. It is important to me to do well in computer class:	1	2	3	4	5

37. Computers make me feel

good and confident: 1 2 3 4 5

38. I have a lot of self-confidence when it comes to working with computers: 1 2 3 4 5

39. I do enjoy talking with others about computers: 1 2 3 4 5

40. Working with computers will be important to me in my life's work: 1 2 3 4 5

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