A STUDY ON THE COMPUTER EDUCATION IN THE HIGH SCHOOLS OF SELECTED STATES OF NORTH-EAST INDIA

A THESIS
SUBMITTED FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN
EDUCATION

By

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To

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1994

CERTIFICATE

I certify that the thesis entitled **"A Study on the Computer Education in the High Schools of Selected States of North-East India"** submitted by **Sri. Parijat Chakrabarty** for the **Degree of Doctor of Philosophy** of the North-Eastern Hill university, Shillong, embodies the record of original investigation carried out by him. He has been duly registered and the thesis presented is worthy of being considered for the award of the **Ph.D. Degree.** This work has not been submitted for any Degree of any other University.

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ACKNOWLEDGEMENT

First of all I like to avail the opportunity to express profound gratitude and indebtedness to my Teacher cum Guide **Dr.(Mrs.)M.S.Padma**, Professor, Department of Education, NEHU, Shillong, for her assistance, guidance and providing with valuable ideas and constructive criticism, without which the present study would not have been completed. Inspite of her busy schedule, she extended full cooperation.

I wish to convey my sincere gratitude to the Principals of the various schools who have permitted me to collect data in their respective institutions. I also like to express thanks to the **Computer Education Teachers** and **Students** of **Class X** belonging to four different places namely, **Guwahati, Shillong, Aizawl** and **Kohima** for their active cooperation and help rendered to me while conducting this study. I express my sincere thanks to the Computer Personnel of Private Computer Institutes for their suggestion and cooperation.

I am indebted to **Dr.Y.S.T.Rao**, Professor, Department of Physics, NEHU, Shillong whose comments and

suggestion have made me thoughtful.

I like to register my profound thanks to **Women's College Governing Body, ex-Principal (Dr.S.B.Nandi)** and the present **Principal (SriD.Chowdhury)** for granting me permission to carry out the work. I also appreciate my colleagues of **Women's College, Shillong** for their cooperation.

The cooperation of the office staff of the Education Department, NEHU, Shillong is thankfully acknowledged.

In completion of this work I appreciate the effort and inspiration put on by my **sisters, brother** and **cousin sister.**

Finally, I express my deepest gratitude to my **parents** who have been a constant source of inspiration and confidence.

SHILLONG

DATED : THE 24th OCTOBER 1994

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INTRODUCTION

INTRODUCTION

1.1.0. INTRODUCTION TO COMPUTER EDUCATION

Human progress, as understood in the modern world, is associated with the phenomenal development in science and technology. It is also well-known that since the days of unrecorded history of human existence, man has been engaged in technological development to fulfil his needs for food, shelter, safety, comfort and many other aspects of social and cultural life. Large scale exploration of nature and utilization of vast natural resources using technological tools have direct bearing on man and his life. Rockets and space vehicles are used for the exploration of space as also for collection of purposeful data by meterologists and other scientists. Extensive utilization of computers are being made not only for scientific investigation, information storage and retrieval, control and guidance, data transmission and processing and many more scientific applications, but also for almost all areas of our life, including management, banking, traffic control, language transmission, data cataloguing and recording in libraries, education and many other fields. Our technology[1] has moved us into an information society. Whether it be in securing or utilising knowledge, or in acquiring

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1 Implies whole collection of ways in which the members of a society provide themselves with the material tools and goods of their society. The collection of artifacts and concepts used to create an advanced socio politico-economic structure (Alcron, 1986).

skill, information of the right kind at the right time in the right dose is essential. The world of information is an intellectual wealth that mankind has accumulated troughout its existence in various forms like language, printing, mass-media computer, etc. Information serves its purpose only if it materializes in technology and cultural values, in human knowledge and experience, in the forms of their communication as a matter of fact, in the entire system[1] of social relations. It thus falls to the sphere of education to evaluate this useful information. Though the term education is as old as civilisation, its role, content and importance in society have undergone major changes. In the agricultural civilisation, education was an ornament, an enrichment and a leisure time pursuit. It became a tool for economic development in the industrial civilisation. In the high technology era of today, it has become a resource, perhaps the most precious of all resources.

With the advent of electronics, computers, micro-processors, etc., the traditional concept of education is changing rapidly. Rapid development of technology is turning all traditional disciplines into inter-disciplinary divisions. Each new technology introduced in the society brings in change

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1 A system is an aggregate of two or more physical components and a set of disciplines or procedures by means of which they interact (Alcron, 1986).

in attitude and interest towards education among the individuals. Also, new technology brigs with it new methods and new opportunities in the field of education. Computer is one such recent technology which has entered in every walk of human activity including education sector.

Entire educational system is experiencing transformation with the introduction of this modern technology, that is, computer. "We are having access to an unprecedented technology upon which to build educational systems that distinguish between the transmission of past heritage, and the eliciting of new understanding" (Dwyer, 1974). Parents, teachers, children and school managements are interested in introducing computer awareness in schools, but, clear cut guidelines are not available for the schools on suitable computer courses, infrastructure, hardware and software materials and the objectives. It is essential to grow awareness among the children about computer and its application at the school level so that they can cope up with the practical applications of computer and its further development effectively. The goal, is not to create a better world of computers, but to create a better world for man to live in (Hunt and Shelley, 1980).

The impact of computers is felt everywhere because of its speedy and effecient information processing ability. In this

socially conscious and highly developed technological society the role of computer is quite effective. Increasing amount of information in government, public and private establishments lead to development of adequate form of handling information. The problem of information handling system could be performed easily with the help of computers because of its ability to analyse information, to retain, up-date, reproduce and the ability of presenting the information in various forms. Computer saves labour, increases effeciency, minimises wastage and helps in bringing desired quality of output.

Hunt and Shelley (1980) stated that "Society is already more computerised than many people may imagine and because of the implications of this, hence, it is clearly important that people become aware of the potentialities so that they can seek to influence future use. Awareness hinges on education and this is growing and must continue to expand - hopefully at the same fast pace at which the youthful, vigorous computer industry is itself expanding".

The statement clearly suggests that education has a vital role to play in making full use of the potentialities and abilities of computers. People need to become aware, knowledgeable and specialised on this technology to make the society effective and productive. Education helps in bringing awareness, developing knowledge and becoming specialised in any field. Therefore, computer education is essential right from the school level.

At the first instance, let us know what is a computer.

1.1.1 DEFINITIONS OF COMPUTER

Computer is an electronic device which helps in solving complex problems.

Computer is "a data processor that can perform substantial computation, including numerous arithmetic or logic operations, without intervention by a human operator during the run" , (American National Standard Vocabulary for Information Processing, X 3.12-1970).

According to Encyclopaedia of Micro Computers Terminology (Christie and Christie, 1985), computer is "a mechanism capable of manipulating data".

"Computer is a device capable of solving problems or manipulating data by accepting data, performing prescribed operations (mathematical or logical) on the data, and supplying the ressults of these operations" (Malik and Kotwal, 1985).

According to Lav Gupta (1987), a computer is "an information processing system".

Thus, a computer may be defined as an electronic device that manipulates symbols self-directedly but algorithmically for executing programs and process data with an amazing speed and accuracy. Defining, computer in technical way, a computer is a high speed, automatic, electronic, digital data processing machine.

1.2.0. MAN-COMPUTER INTERACTION

Today, human beings are increasingly dependent on families of machines, irrespective of size, shape and capabilities. Computer is one of the finest examples of such families. Inter-relationship between man and computer has been nicely illustrated by Licklider (1970), as shown in Table 1.

Table 1. Man-Computer Interrelationship

Man	Computer
Sets goals, supplies motivation	Converts hypotheses into models, tests models against data
Formulates hypotheses, asks questions	Answers questions
Conceives models, mechanisms, procedures	Simulates mechanisms and models carries out procedures
Defines criteria, evaluates performance	Displays results
Handles low-probability events	Interpolates, extrapolates, transforms, plots data in various alternatives. Converts static equations into dynamic models

Contd...

Table 1. Contd.....

Man	Computer
	Makes elementary probabilistic evaluations Performs some diagnosis, pattern matching, relevance recognizing.

In the man-computer interaction situation one needs to consider the following aspects, the nature of a man, the nature of a computer, the interface from a man to a computer, the interface from a computer to a man, and the interaction between man and the computer through these interfaces. Here, man refers to children and adults of both the sexes. In the children-computer interaction, the most important factors associated are the environment and motivation of the children. The environment comprises people, objects, and events. A child is mainly characterised with respect to age, sex and potentiality. Parents, siblings and teachers are considered as people ; computers and educational materials are referred to as objects ; the cultural and social systems surrounding are referred to as events. All combined together influence the learning of the children. Learning and motivation get influenced by child's age, sex, ability and interests. Children-computer interaction aims at familiarisation of the basic things of computer technology to children. There is a need to study the extent of interrelationship generated between the children and the computer.

1.3.0 IMPACT OF COMPUTERS ON THE SOCIETY

Technology is a major stimulus for change and has become synonymous with economic progress. Technology has been responsible for bringing about major changes in agriculture, health, transportation, communication, education and general industrial development in varying degrees. Sheingold, Kane and Endreweitz (1983) state that "The computer does not have a simple impact on an organisation or the people in it. Its implementation and use are embedded in a compiled matrix of social and political relationships. At all levels of implementation and use, it is essential to consider the interaction of the computer with the social system that surrounds it, for, this interaction should be viewed over time, as computing activities influence the social system and the social system shapes the influence of the technology". Computers, which originated in the most advanced countries of the world, have today made themselves felt in almost all nations of the world. They have pervaded in various walks of life like business, administration, documentation, recreation, etc. In fact, computers are bringing about revolution in aiding man's thinking process and decision-making ability (Simon, 1960). If one looks back at the human history, it may be noted that three major developments have altered man's living conditions, his concept of society and his understanding of human existence.

These developments are : (i) the scientific revolution in the 16th and 17th centuries ; (ii) the late 18th century industrial revolution ; and (iii) the scientific-technological-industrial revolution after the Second World War. Computer, as put forth by Simon (1960), is the fourth revolution in this direction.

1.4.0. EVOLUTION OF COMPUTERS

Computers have been evolved over a peeriod of time, the genesis of its basic principles getting traced to the Circa B.C.. The progress of this evolution is presented briefly in Table 2.

Table 2. Evolution of Computers

Period	Device	Generation
1	2	3
Circa B.C.	The first mathematical device	Abacus
16th Century	John Napier produced Logarithms for calculation	Logarithmic tables
1620	William Oughtred formulated the analog device	Slide Rule
1642	Blaise Pascal invented the first mechanical calculator	Pascal's machine
1671	Gottfried Leibnitz devised a calculating machine	Modified Calculator
1801	Joseph Marie Jacquard devised first automated machine	Punching Cards

Table 2. Contd....

1	2	3
1822	Charles Babbage designed the first mechanical Computer	Difference Engine
1833	Charles Babbage designed a machine based on five units - Store, Mill, Control, Input and Output	Analytical Engine
1872	George Boole developed two state algebra came to be known as Boolean Algebra based on which the theory of modern Computer was formulated	Electro - Mechanical Computer
1890	Herman Hollerith devised electrically activated computer cards or Punch Card Machines. He established the largest manufacturing multinational company known as International Business Machines (IBM)	Hollerith Cards
1920	Leonardo Torres devised a digital calculating machine	Digital Calculator
1936-50	Konard Zuse developed four computers	Z - 1, Z-2 Z-3, Z-4
1944	Howard Aiken designed the first electro mechanical computer	Automatic Sequence Controlled Calculator or Mark 1

Contd....

Table 2. Contd....

1	2	3
1946	J.Prosper Eckert and John Mauchly devised first electronic computer using Vacuum tubes known as ENIAC (Electronic Numerator Integrator and Calculator)	Electronic Computer
1946	John Von Neumann gave the concept of stored program computer	
1949	EDSAC (Electronic Delayed Storage Automatic Computer) is the first stored program electronic computer	First Generation of Computers
1952	EDVAC (Electronic Discrete Variable Automatic Computer) Computer was developed using stored programs concept	Examples - IBM 650, IBM 702, UNIVAC - 1 and E 101
1959	Computers are devised using transistors	Second Generation Computers
1959	Random access devices	Discs
1964	Integrated Circuits (ICs)	
1965	Computers using ICs	Third Generation Computers
1969	Large Scale Integrated (LSI) circuits	

Contd...

Table 2. Contd...

1	2	3
1971	Computers using LSI circuits	Fourth Generation Computers
1972	Microprocessors - computer on a single silicon chip	
1976	First Microcomputer	Apple Computer
Since 1985	Concept of "Artificial Intelligence" knowledge Information Processing Systems evolved - Very Large Integrated Circuits (VLSI) are in use.	Fifth Generation Computers

Note : Based on - (i) Jaggi and Jain (1988)
(ii) Rajaraman and Rajaraman (1988),
(iii) Bhatnagar and Ramani (1990).

Computers were originally designed to calculate easily and speedily. Then, they were used to perform repetitive clerical calculations. This was followed by information processing to generate management information systems. At present the computers help in a wide variety of activities of our civilisation.

1.5.0. SOME HIGHLIGHTS ABOUT COMPUTERS

Below are highlighted some fundamental ideas about computers.

Components of a Computer -

The basic configuration of a computer is given in Figure 1.

A computer has an Input, an Output and a Central Processing Unit.

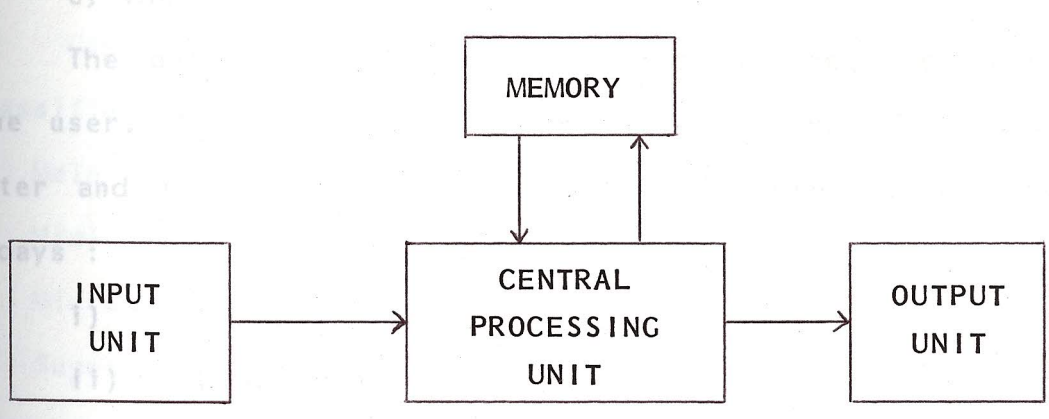

Figure 1. Components of a Computer

a) The input unit -

The input unit reads instructions and data into a computer's memory. There are two devices which assist in feeding data in this unit, namely ;

i) Keyboard

ii) Video Display Unit

b) Central Processing Unit -

Instructions and data fed into the input unit needs to be executed and this function is done by the Central Processing Unit (CPU). The CPU consists of the following sub units:

i) Memory - Main memory or Primary Storage and Secondary Storage

ii) Control Unit

iii) Arithmetic Logic Unit

c) The Output Unit -

The output unit provides results or required information to the user. Output unit is a communication or link between the computer and the user. A number of output devices are available nowadays :

i) Character Printer

ii) Line Printer

iii) Dot Matrix Printer

iv) Visual Display Unit

v) Laser Printer

Types of Computers -

There are three types of computers, namely, digital, analog and hybrid.

a) Digital Computers -

Digital computers are based on the binary system (0 and 1). A digital computer can perform only one operation, namely, addition.

b) Analog computers -

An analog computer works on supply of continuous electrical signals and displays output continuously, for example, speedometer of an automobile.

c) Hybrid Computers -

A hybrid computer combines the features of analog and digital computers.

Classification of Computers -

Computers belonging to third and fourth generation can be classified as :

i) Main Frame computers

ii) Mini computers

iii) Micro computers (e.g., Personal Computers)

iv) Super computers

Characteristics of a Computer -

The main characteristics of a computer are :

i) High Speed

ii) Reliability and Accuracy

iii) Large and Perfect memory

iv) Capability of Logical Decisions

v) Versatility

vi) Automation

vii) Diligence

Computer Languages--

A computer can understand the binary language, the

language of 0 and 1, also called Machine Language. Computer, being an electronic machine, only understands the language of electric pulses, the presence of an electric pulse being denoted by 1 and its absence by 0. Languages used for computer purpose are categorised into three forms namely :

a) Machine Language

b) Assembly Language

c) High Level Language

Machine Language -

Binary language (the language of 0's and 1's) is the machine language. Machine language was in use in the past for making programs but today its use is very much restricted.

Assembly Language -

Assembly language (or Symbolic Programming Languages) was developed in 1950. This language is written in mnemonic (alphabetic, symbolic) codes and not in numeric codes.

High Level Languages -

High level languages are quite easy to learn and use. This language is also known as Procedure Oriented Language. Some of the commonly used high level languages are provided in Table 3.

Table 3. Commonly used High Level Languages

Language	Full Name	Development and Use
FORTRAN	Formula - Translation	Developed by IBM in 1957. Used for scientific purpose.
ALGOL	Algorithmic - Language	Developed in 1960. Used for scientific and numerical work.
COBOL	Common - Business - Oriented - Language	Designed by CODASYL (Conference of Data System Languages) in the year 1960. Used for commercial and business purposes.
BASIC	Beginner's All Purpose Symbolic Instruction Code	Designed by John Kemeny and Thomas Kurtz in around mid 1960's. Widely used in business, science, education, and in other areas.
PASCAL	Named after the famous French Scientist, Blasie Pascal	Developed by Niklaus Wirth. Used for general purpose and for computer scientists.

(Note :- Adopted from Jaggi and Jain (1988)).

Special Purpose Languages -

There are some high level languages which are developed for use in solving particular class of problems. They are known as Special Purpose Languages. These are

i) LOGO

ii) LOTUS

iii) dBASE III

1.6.0. DEVELOPMENT OF COMPUTERS AND THEIR APPLICATIONS IN INDIA

Because of the immense utility and efficiency, computers have made great impact on the development of mankind all over the world, India being no exception. India is under the process of major social, economic and educational revolution with the introduction and adaptation of computers. The Indian computer industry is still in its developmental stage as compared to the developed countries, but progressing very fast. In this section a brief picture is presented, of the technical growth and applications of computers in India, and also of the demands in the society of persons having a working knowledge of computers.

History of computer in India dates back to 1954 when a decision to design a general purpose computer was started at Tata Institute of Fundamental Research (TIFR), Bombay and the project was completed in 1956. The computer developed was

named TIFRAC.

Development of a second generation computer was started with a joint effort of Indian Statistical Institute, Calcutta and Jadavpur University, Calcutta in 1963. The computer, named ISIJU - 1 came into operation in 1966. Inspite of these bold attempts, productive output was not much. In the fifties and mid-sixties, activities concerning computers were very much limited with the help of a few imported computers namely, IBM[1](1401) and ICL[2](1901). In 1969, the Government based Electronic Corporation of India Ltd. (ECIL), Hyderabad, in collaboration with Bhaba Atomic Research Centre (BARC), Trombay built the computer TDC 12 (Trombay Digital Computer 12) followed by upgraded versions - TDC 316 and TDC 32. The number of computer installations rose to 120 by the early seventies. The process of computerisation of libraries in India started in 1964. Planning Commission of India are using computers since 1968.

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1 International Business Machines, USA

2 International Computers Ltd., UK

During the early part of the seventies the CDC 3600 at the TIFR and the IBM 7044 at Indian Institute of Technology (ITT), Kanpur were the two most powerful computers. In the early seventies computers were used in the fields such as structural engineering, power systems analysis, ballastics, nuclear physics, cryptography, demographic research, agricultural statistics and in other areas. The use of computers in the Universities and technological institutions was only ten per cent. In 1971, Numerical Weather Prediction forecasts were carried out with the help of computers. For the first time, 1971 Census data were processed through computer. During 1970's, Regional Computer Centres were set up at Calcutta, Pune, Chandigarh and Kanpur for catalysing the development of various computer applications. As the technical advancement of computers got progressed, the computers paved their way for use in various sectors in the country. Balasubramaniam (1985) has given an analysis of the same as shown in Table 4.

Table 4 Sector-wise Growth of Computers in India during 1960's and 1970's

Sector	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Total
Utilities	–	–	–	–	–	–	2	–	–	–	2	–	–	–	–	–	–	–	4
Engineering/ Manufacturing	1	–	–	–	2	5	6	10	9	6	13	16	6	10	12	4	7	–	107
Insurance and Banking	–	–	–	–	2	1	–	1	–	–	–	–	–	–	–	2	1	–	7
Transport	–	–	–	–	1	3	4	4	2	1	2	4	–	–	–	1	–	–	22
Petroleum & process industries/ steel	–	–	–	–	2	–	2	2	2	2	2	1	2	2	3	2	2	--	24
Educational Institutions	–	–	2	3	2	1	2	2	1	2	8	1	5	2	11	10	12	5	69
Consulting and Service Bureau's	–	–	–	–	–	1	3	2	–	2	2	2	1	3	5	5	6	4	36
Government	–	–	–	–	1	–	2	1	1	–	1	1	2	3	5	6	7	4	34
Defence	–	–	1	–	–	–	–	1	1	1	–	3	–	3	5	4	5	3	27
Research and Scientific Organisations	–	–	–	6	2	3	–	2	–	–	3	4	2	6	23	14	15	9	89
Total	1	–	3	9	12	14	21	25	16	14	33	32	18	29	64	45	57	26	419

Source :- Balasubramaniam (1985)

Further is provided the estimated demand projection for computers during the Eighth Five Year Plan (Table 5).

Table 5 Estimated demand for Computers during the Eighth Five Year Plan

Sector	Super	Large	Mini	Micro
Government	2	270	2,100	1,60,000
Defence	4	50	500	12,000
Space and Atomic Energy	2	6	100	3,000
Railways	-	20	180	21,000
Communications	-	20	86	16,000
Banking and Finance	-	85	850	52,000
Education	5	50	1,000	50,000
Research and Development	10	40	500	20,000
Total (Rounded off)	23	541	5,316	2,74,000
Total Cost (in Rs. Crores)	184	1,082	1,329	13,700

Note :- The average cost of computer systems for different categories are taken to be as follows :

Supercomputers - Rs.8 Crores ; Large Computer - Rs.2 Crores ; Minis - Rs.25 Lakhs ; Micros - Rs.50,000.

Source : Ghosh (1989).

Thus, it may be seen that computers are entering into our society in a large way. Though the figures indicated are large, yet there is tremendous potential for further increase in this field. This becomes evident when a comparative picture of the number of computers in relation to the population of different countries are seen. Table 6 gives a brief picture of the same.

Table 6 The Computer Scape

Country	Computers per 1,000 people
U.S.A.	184.0
U.K.	104.0
Canada	96.0
Norway	87.0
Japan	87.0
Ireland	84.0
Singapore	79.0
Switzerland	77.0
Denmark	74.0
Sweden	73.0
India	0.6

Source :- "The World View", Masterfile, Computers Today, Vol.8, No.89, July 1992.

Alongwith the demand for computers there is a heavy requirement of people to work with computers in various capacities. As reported by Aparna Aachar (1991), the DoE

(Department of Electronics) study team stated that the manpower requirement in the country for the next five years - over 255 at the doctorate level, 14,500 at M.Tech. level, 24,000 at B.Tech. level, 40,000 at Graduate level, 99,000 Diploma holders and additional 18,500 at the diploma in the computer engineering category. It is further reported that the formal institutes can produce hardly 1,85,000 skilled manpower vis-a-vis, the above requirements. Let us look into the manpower demand versus supply scenario for the Seventh and Eighth Five Year Plans as estimated by DoE (Table 7).

Table 7 Manpower : Demand Versus Supply in the field of Computer Technology

Particulars	Manpower : Demand Vs. Supply (DoE Estimates)				
	Seventh Plan		Eighth Plan		
	Requirement	Supply	Requirement	Supply	Gap
Ph.D.	105	65	255	240	15
M.Tech.	1,650	1,850	14,355	2,500	11,845
B.Tech.	1,762	11,500	23,945	7,000	16,945
M.C.A.	2,892	2,000	40,040	18,000	22,000
D.C.A.	13,632	12,100	98,880	80,000	18,880
Others	17,476	-	18,340	7,000	11,000
Total	37,517	27,515	1,95,815	1,14,740	80,685

Source :- Aiyer (1992)

Thus, it is quite evident that there is a great demand for computer manpower. An effective programme of computer education is needed for partial fulfillment of this demand.

1.7.0. COMPUTER EDUCATION

Walker (1984) states that the term "Computer Education" may be used in two connotations ; one to refer it as a means of instruction, and the other as an object of instruction. Carnoy, Daley and Loop (1987) explain as "Computer education (as a means of instruction and object of instruction) is part and parcel of the new technology, and, at the same time it represents access to understanding computers and participating in different kinds of work involving computers".

Thus, it may be stated that computer education refers to the acquisition of knowledge about computers and participating in different kinds of work involving computers. Knowledge about computers refers to computer literacy. Participation in different kinds of work involving computers refers to the effective use of computer as a tool, for example, in Computer Assisted Instruction. Referring to Carnoy, Daley and Loop (1987) again, they have explained and distinguished the two connotations in the following way "Computer as a means of instruction includes drill and practice sessions that exercise a student's skills usually in a subject other than computing ; intelligent tutorial and diagnosis systems that teach new subject matter and/or

identify gaps in student knowledge ; simulations and games that provide activities to supplement traditional classroom instruction in a subject ; and finally, problem solving or logical thinking skills development wherein the computer and software serve as a laboratory for exercising a student's reasoning power. Computer as an object of instruction includes word processing and data base management as well as computer programming in a variety of computer languages and computer literacy".

In the present study, the term 'Computer Education' has been used as an object of instruction[1].

1

(i) According to Lorin W. Anderson and Robert B.Burns in **Research in Classrooms** (Pergamon Press, 1989) the concept of instruction as defined by various educators, is provided as follows :- Gump (1967) includes five components of instruction : concern (e.g., academic, social and recreational), teacher leadership pattern, group quality (defined in terms of the group configuration in the classroom), pupil activity (that is, the behavioural and/or academic demands of the activity) and action sequencing (that is pacing). Weil and Murphy (1982) defined instruction ("instruction processes") as "duration, source, group size, nature of the instructional activities, and specific teacher or studentbehaviours". Barr and Dreeben (1983) suggest, instruction consists of "patterns of interaction,

On a close look into the programme of computer education in the schools in the North-Eastern Region of India, computer education is considered as an object of instruction covering computer programming (which to some extent covers word processing[1]) and computer literacy. These two terms are explained further.

Computer Programming -

Computer Programming has been defined by Bork (1985) and Bozeman (1985) as the "communication activity by which th

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aspects of class organisation, curriculum content, and the intellectual and social demands made by the nature of the school-work itself". Stodolsky (1988) used eleven dimensions to conceptualise instruction : instructional format, teacher leadership role, cognitive level, task options, options when done, expected student interaction, feedback, pacing, student location, student behaviour, and student involvement.

(ii) "Instruction may be considered as a process of providing a controlled environment consisting of various components with which an individual interact and gain experience, leading to their attaining certain prespecified learning outcomes" (Instruction in Higher Education, ES-302, Block 1, IGNOU, New Delhi, 1991).

1 Word Processing refers to computer facility that allows users to create, edit, store, reformat, and print letters, reports and other documents (DCO-01, Block 3, IGNOU, New Delhi, 1991).

person specifies what the computer is to do in a manner which enables the computer system to perform the specified task".

"Computer Program is a set of sequenced instructions to cause a computer to perform a particular operation" and "a programming language consists of the vocabulary and the set of rules, designed for precise description of computer programs" (Office Environment and Data Processing, DCO-01, Block 3, IGNOU, New Delhi, 1991).

Making it explicit, it may be said that the steps involved in feeding data into a computer and based on which the computer will perform the required task to get desired result is computer programming. The steps essential for feeding data inside a computer includes flowcharting and writing sequential steps from the flowchart for a particular computer language.

Computer Literacy -

Computer literacy is considered as a talking-level-of-knowledge. This includes knowing some computer history ; knowing definitions of computer-related words ; knowing some applications of computers in business, government and industry knowing about social and ethical issues and so on. Many of these objectives are stated, "the student is aware of ....." (Carey and Carey, 1984 as quoted in Ricardo Nemirovsky, 1987).

According to Carnoy and Loop (1986), learning of skills with which to use the computer, is referred as, "computer literacy" and this term can be given a broad definition so as to include not just detailed use of the computer in various situations, but a general knowledge of the roles of computers in society and in the broader sense it is known as "informatics".

Wagner (1987) states, "the advent and increasing use of microcomputers has led many educators and policy makers to consider the need for individual comptencies in dealing with computer languages and manipulation of microcomputer software, commonly grouped under the term Computer Literacy".

While highlighting the importance of computer literacy, Mallick and Kotwal (1985) express as, "Computer Literacy is the non-technical study of the computer and its effect upon society. It is an important area in Computer Education as it provides the student with some of the knowledge, tools and understanding necessary to live in a society which is going to be dominated by Computers".

Thus, it may be concluded that computer literacy includes computer structure, programming and the impact of

computers in different fields in society. The main objective of the computer literacy is to meet a cultural objective which is generally a part of a broader base, that is, to prepare students for an "informatics future" by developing an awareness of computers and their working.

1.8.0. COMPUTER EDUCATION IN INDIA

The importance and growth of applications of computers are highlighted by Ershov (1990). To quote him "By the eve of the third millennium, the developed industrial countries will be close to completing the second industrial revolution connected with the automation of information processing. We may term this concluding stage the "full Computerization of society, which means the situation where all information needed by men will originate, be stored and circulated in society on machine carriers, and its entire processing, both internal and in interaction with man, will be performed by computers and computer software". In India, the application of computers in various fields are getting extended in a fast rate. This has resulted in an increasing demand for computer manpower. To meet this demand, attempts are made by both the Government and private organisations by imparting necessary computer education to people at different levels. The computer education imparted in the educational institutions may be considered at post school level and school level. Each of these levels are briefly discussed further.

1.8.1. COMPUTER EDUCATION AT POST-SCHOOL LEVEL

According to Khanna (1992), by 1991, there were about 108 Universities and 1,216 Colleges equipped with computer facilities assisted by University Grants Commission (UGC). An Educational Network (EDUNET) is being set up to connect IITs (Indian Institute of Technology) and the Tata Institute of Social Sciences, Bombay. In the Eighth Five Year Plan (1992-97) there is a proposal to link various libraries in India through Satellite Network known as INFLIBNET (Information Library Network), (Goel and Jaiswal, 1992).

There are a number of higher educational institutions imparting computer education courses in collaboration with the Department of Electronics (DoE) throughout India as illustrated in Table 8. Apart from it, the DoE, in cooperation with the UGC, MHRD (Ministry of Human Resource Development, Government of India), Directorate General of Employment and Training, and State Governments, has initiated a number of courses and other projects in various educational institutions and Universities to produce highly skilled and trained manpower required for the computer industry.

According to the Manufacturer's Association for Information Technology (MAIT) there were 700 private Computer Institutes during 1990-91. Computer Policy of 1986, states

that, private computer training institutes must have due recognition from the All India Council of Technical Education - Department of Electronics (AICTE-DoE).

Table 8 Number of Institutions offering Computer Education courses at the Higher Education level

Courses	No. of Institutions
Bachelor of Technology (B.Tech.)	23
Master of Computer Applications (M.C.A.)	60
Post Graduate Diploma in Computer Applications (P.G.D.C.A.)	63
Diploma in Computer Engineering	18
Post Polytechnic Diploma in Computer Applications	47
Diploma in Computer Applications (Teachers' Training Programme)	11
Master of Computer Applications (Teachers' Training Programme)	8
Post Graduate Diploma in Computer Applications in Hindi	9

Source : Which Course ? ; Special Report, Computers Today, 7 (76), june 1991.

By June 1991, about 47 institutes have been provided provisional recognition out of 270 institutions applied for ("Shifting the Chaff", 1991).

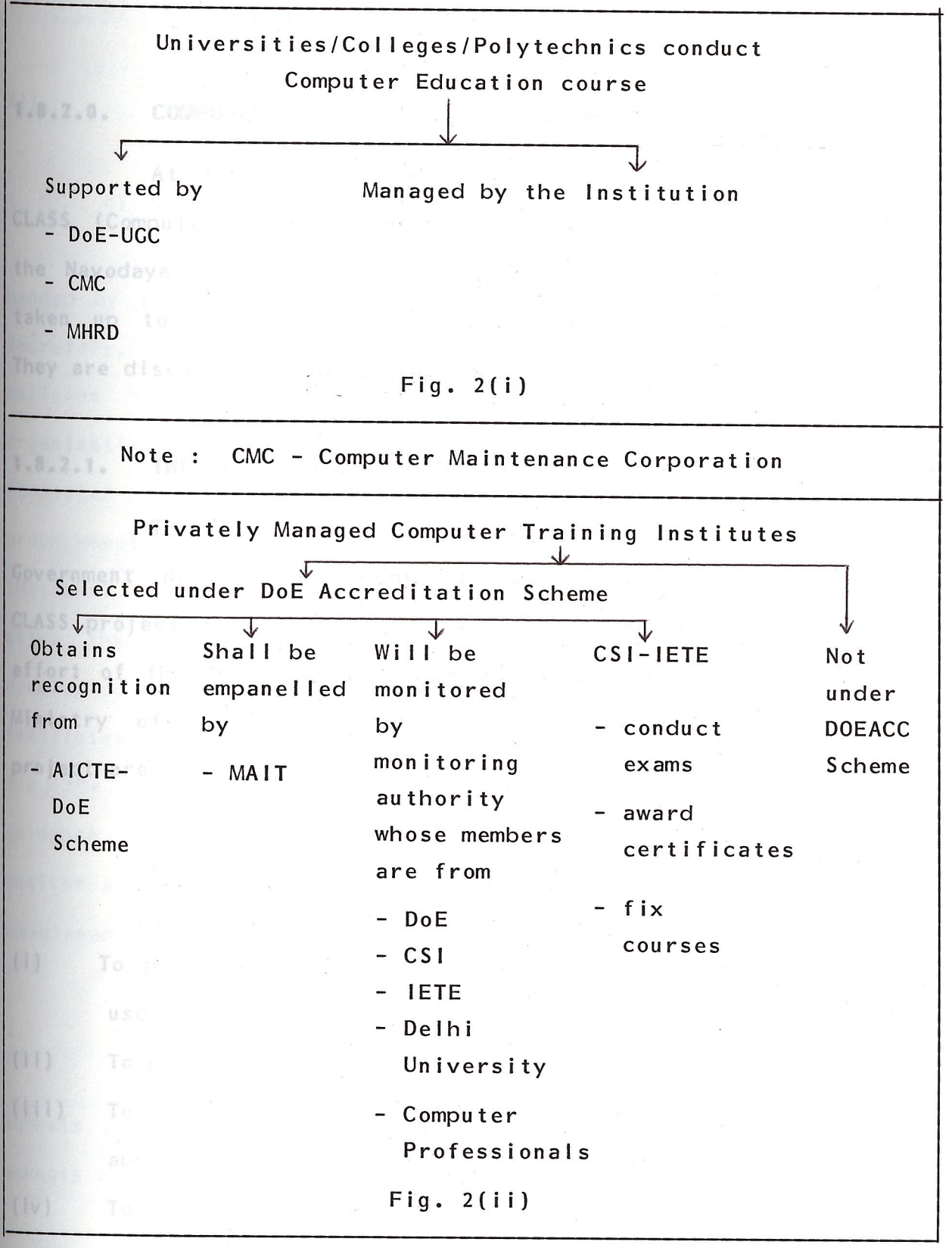
In 1991, National Working Group under the Chairmanship of Prof. S.Sampath was set up to look into the problems associated with computer training and education for producing the required computer manpower. In consequence to its observations and recommendations, the DoE has launched a scheme known as DOEACC (Department of Electronics Accreditation) scheme. The objective with which the scheme is formulated is for "building a meaningful, organised and responsible computer training industry". According to Vittal (1991), Secretary, DoE, "DoE is implementing this scheme to generate qualified manpower in information technology by utilising the facilities and expertise available in the private sector". Under the DOEACC scheme there are four levels of examinations The DOEACC scheme is depicted in Table 9.

Table 9 DOEACC Scheme

Level	Description	Minimum Eligibility	Duration
O	Foundation course (Program Assistant Level)	10 + 2	1 year
A	Advanced Diploma course (Programme Level)	Level O and one year professional experience/ polytechnic diploma/ graduate	11/2 years
B	Graduate Level course (Systems Analyst/ Software Engineer Level)	Level A or three years relevant professional experience or DCA (post graduate polytechnic) with three years experience	3 years
C	Master's Level course (Systems Manager Level)	Level 'B' or B.Tech. (Computer Science) or MCA, M.Sc. (Computer Science or equivalent) with one and a half years professional experience	11/2 years

Further is provided the present system of structural functioning of various computer educational institutions as shown in Figures 2(i) and 2(ii). From the figures it may be seen that there are several agencies managing the computer training facilities in the country.

Figure 2 Organisational Structure of Computer Educational Institutions



Note : IETE - Institution of Electronics and Telecommunication Engineers

CSI - - Computer Society of India

1.8.2.0. COMPUTER EDUCATION AT SCHOOL LEVEL

At the school level two major schemes, namely, the CLASS (Computer Literacy and Studies in Schools) Project and the Navodaya Vidyalaya Commputer Education Scheme (NVCES) were taken up to promote Computer Education in schools in India. They are discussed in brief further.

1.8.2.1. THE CLASS PROJECT

The year 1983-84 ushered in a new era when the Government of India launched a project known as CLASS. The CLASS project was implemented as a pilot project with the joint effort of the Ministry of Human Resource Development (then the Ministry of Education) and DoE. The details of the CLASS project are provided further.

a) Objectives of the CLASS project -

The objectives of the CLASS project are :

(i) To provide a broad understanding of computers and their use ;

(ii) To provide a hands on experience ;

(iii) To familiarise students with the range of computer applications ; and

(iv) To demystify computers and develop a degree of ease

and familiarity with the computers.

b) Target groups -

School students studying in classes IX, X, XI and XII.

c) Management of CLASS Project -

The CLASS project comprises of a Steering Committee headed by the Secretary, Department of Education, MHRD and the Secretary, DoE. They are responsible for formulating plans and policies related to the project. There are a number of organisations involved in managing the CLASS project. CMC (Computer Maintenance Corporation) is entrusted for procurement, installation and maintenance of hardware. NCERT (National Council of Educational Research and Training) looks after the academic matters like academic planning, software development, teacher training and monitoring the project. Institutes such as technological institutions or Universities are the resource centres whose functions are to provide guidance and supervise the schools, provide teacher training, monitor and report, and take care of installation and maintenance of hardware in coordination with CMC.

d) Coverage of Schools -

CLASS project became operational in selected schools in 1984/85. The schools selected were either government schools or government funded schools located in urban areas.

Most of the schools selected were Central schools (Kendriya Vidyalayas). The number of schools covered under the project were increased over the years. Table 10 shows the number of schools covered under the CLASS project. The number of schools included under the CLASS project from 1984-85 to 1989-90 were 2,598.

Table 10 Number of Schools covered under the CLASS project

Years	Number of Schools in the first Year	Additional Schools over the previous Year					Total number of schools
1984-85	248						
1985-86		501					749
1986-87			500				1,249
1987-88				700			1,949
1988-89					378		2,327
1989-90						271	2,598

Source : Vittal, (1992)

During the first year of operation of the CLASS project, 42 resource centres were established in various technological institutions and Universities distributed all over India. The number of resource centres rose to 60 during 1991-92. In the first year of its implementation following

facilities were provided to the selected schools.

(i) Two eight-bit BBC microcomputers per school. Capacity of the microcomputer is of 32 Kilobyte RAM[1] and 32 Kilobyte ROM[2] and has resolution graphics

(ii) Two 5 1/4 inch floppy disk drives

(iii) One 80-column dot-matrix printer

(iv) One cassette recorder

(v) Two 12 inch monochrome/colour VDUs (Visual Display Unit)

(vi) Investment made on hardware is Rs 60,000 per school

(vii) Twentyfive software packages per school

e) Teacher Training -

Schools selected for the CLASS project are required to send three teachers for training to the nearest resource centre for a period of three weeks. Teachers having received the training are expected to devote five and a half hours per week with computers mostly after school hours and

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[1] RAM (Random Access Memory) is the main memory of the computer that is fabricated on a semiconductor chip. Information can be read from and written to by the user and therefore it is also called read/write memory.

[2] ROM (Read Only Memory) is the main memory of the computer that is fabricated as the random access memory but the contents of this memory are fixed during manufacture and cannot be modified.

during vacation. A total of 3,180 teachers received training from 1984 to 1987. Following aspects are dealt upon in the teacher training programme

(i) computer awareness and literacy ;

(ii) interaction with computers ;

(iii) programming ;

(iv) computer arithmetic and logic ; and

(v) social objectives.

The training programme consisted of lectures on computers, writing basic programming and operating computers.

f) Effectiveness of CLASS Project -

CLASS project has now been in operation for several years. Vittal (1992) refers to a review, made by a Working Group set up the Government of India in 1986-87, of the CLASS project. As stated, the review indicates that,

(i) Such a project is the first major initiative for computer education at school level

(ii) Awareness is generated and demand for computer education among the school students is increasing

(iii) Objectives of demystification and familiarisation are partially achieved

The Working Group's recommendations for the improvement of the CLASS project after the review are

(i) Originally stated objectives are to be retained

(ii) CLASS may be at + 2 stage covering all senior secondary schools by 1990

(iii) Periodical evaluation of hardware must be carried out

(iv) Depending on the strength of the students number of computers are to be increased to 5-8 per school

(v) Maximum utilisation of Indian languages are to be made

(vi) Greater stress has to be laid on software development

(vii) Resource support to school is to be made available at district level

(viii) NCERT will be nodal agency for academic matters

National Policy on Education (NPE), 1986 and Programme of Action (POA), 1986 emphasised that computer literacy programme to be made available on a wide scale and that adequate coverage to be provided to all senior secondary schools by 1990.

The CLASS project will be continued in a modified form and is expected to cover 15,000 higher secondary schools by 1997. The project will be implemented in collaboration with private computer institutes. This modified form of CLASS project shall be introduced only in those selected schools which are equipped with requisite physical facilities and characteristics.

1.8.2.2. NAVODAYA VIDYALAYAS COMPUTER EDUCATION SCHEME (NVCES)

Navodaya Vidyalayas (NV) were set up throughout India to impart education specifically for the rural talented children managed by the Navodaya Vidayalaya Samiti (NVS). The NVS decided to go for computer education since January, 1991. A sum up of the NVCES is putforth.

a) Objectives of NVCES -

The objectives of NVCES are to

(i) strengthen creativity and discovery learning ability

(ii) develop problem solving skills

(iii) develop procedural thinking abilities

(iv) develop intuitive thinking and estimating skills

(v) develop computer programming concepts

b) Target Groups -

Computer education course in NVs is meant for students studying in Classes VI, VII, VIII, IX, X, XI, and XII.

c) Management of NVCES -

The NVS launched the Computer Education Scheme or Computer Literacy Programme with the assistance of Private Computer Agencies, namely ; Computel Systems and Services (CSS) and Informatics Computer Systems (ICS). An agreement is signed between NVS and CSS under which there are several terms and

conditions. Some of the terms and conditions of agreement are

(i) CSS will supply four IBM PC Compatible Computers (256 KB memory and 360 KB capacity single disk drive) ; one Printer (80 column), one Stabiliser, Floppies, Text books, etc. alongwith one computer teacher

(ii) The contract period lasts for four years starting from 1st July 1991 to 30th June 1995. After completion of the contract period NVS may extend the contract for another term

(iii) Educational Software must be provided by the Agency

(iv) At the end of the contract period (1991 to 1995), computers and other materials provided by the agency shall be the property of NV.

NVS is responsible for financing the Private Computer Agency. The Samiti is the approval authority for implementing the CLP in all the NVs of India. Regional offices located at various centres of India shall monitor the NVs of the respective regions and report to the NVs. NVs will implement the CLP and submit quarterly progress report to the Navodaya Vidyalaya Regional Offices and to the NVs. NVs has taken a step since 1992 to acquaint and make aware of the CLP to the Principals of the NVs during vacations. In the year 1992, about 30 Principals of NVs were provided training in relation to CLP. Only those NV Principals are eligible to receive training in the CLP where the CLP is being implemented.

d) Coverage of NVs -

The CLP was first started in 73 NVs throughout India in the year 1991. During the second year that is in 1992 the CLP was extended to 30 more NVs, thus making the total of implemented schools as 103. Implementation of the CLP in different States/Union Territories (UTs) of India is presented in Table 11. Out of a total of 275 NVs spread all over India the CLP is going on 1n 103 NVs. Maximum number of NVs where CLP is implemented is in the State of Uttar Pradesh.

Table 11 CLP undergoing in NVs in various States/UTs of India

State/UT	Number of NVs where theCLP is being implemented			Place where the NVs are located
	1991	1992	Total	
Andaman & Nicobar Islands	1	-	1	South Andaman
Andhra Pradesh	7	1	8	Visakhapatnam, Medak, Nalgonda, Rangareddy, Chittor, Nizamabad, Karimnagar, Anantapur
Arunachal Pradesh	-	1	1	Mahadevpur
Bihar	6	1	7	Nalanda, Gumla, West Champaran, Ranchi, Samastipur, Bhojpur, Nawada

Table 11 Contd.....

State/UT	Number of NVs where the CLP is being implemented			Place where the NVs are located
	1991	1992	Total	
Dadra & Nagar Haveli	1	-	1	Sili
Delhi	1	-	1	Katewara
Diu & Daman	-	1	1	Diu
Goa	1	-	1	South Goa
Gujarat	3	2	5	Jalna, Kheda, Junagarh, Surat, Bharuch
Harayana	4	1	5	Jind, Hissar, Sonepat, Rohtak, Sirsa
Himachal Pradesh	3	1	4	Mandi, Sirmour, Shimla, Una
Jammu & Kashmir	2	1	3	Jammu, Kathua, Udhampur
Karnataka	5	2	7	Belgaum, Bangalore, Raichur, Kolar, Mandya, Shimoga, Chikmangalur
Kerala	4	1	5	Eranakulam, Idukki, Cannore, Pathanamthitta, Kasargod
Madhya Pradesh	5	3	8	Bilaspur, Shahdol, Raipur, Narsingpur, Hoshangabad, Tikamgarh, Jabalpur, Panna

Table 11 Contd.....

State/UT	Number of NVs where the CLP is being implemented			Place where the NVs are located
	1991	1992	Total	
Maharastra	6	1	7	Buldana, Latur, Nagpur, Ahmednagar, Amravati, Nasik, Osamanabad
Manipur	1	-	1	Bishnupur
Meghalaya	-	2	2	Williamnagar, Baghmara
Orissa	3	1	4	Cuttack, Bolangir, Keonjhar, Dhenkanal
Pondicherry	1	1	2	Karaikal, Kalapet
Punjab	4	2	6	Kapurthala, Amritsar, Ropar, Sangrur, Ludhiana, Faridkot,
Rajasthan	5	3	8	Bhilwara, Chittorgarh, Sikar, Churu, Jaipur, Ajmer, Udaipur, Jaisalmer
Sikkim	-	1	1	Rothak
Uttar Pradesh	10	4	14	Merrut, Kanpur, Rai, Bareilly, Nainital, Jaunpur, Jhansi, Sultanpur, Sitapur, Gorakpur, Mirzapur, Gonda, Bahraich, Bulandshahr
Total	73	30	103	

Source : Navodaya Vidyalaya, Regional Office, NER, Shillong (Obtained during June 1993).

There is a proposal on the part of the NVs to introduce Computer Science as a Vocational course in the NVs for XIth and XIIth standards. The scheme that is NVVEC (Navodaya Vidyalaya Vocational Education Courses) is expected to be implemented from 1993.

e) Textbooks and Softwares -

Under the agreement between the NVS and the computer agencies, necessary textbooks and softwares shall be provided to the NVs by the agencies. The following are the text books which are recommended and supplied by ICS for the CLP in different classes.

Class	Name of the books for CLP
VI	Computers for Children
VII	Basics of BSIC
VIII	Basics of BASIC
IX	Basics of BASIC
X	Introductory Computer Science
XI	Textbook on Computer Science
XII	Textbook on Computer Science

The ICS has also supplied the Systems Software for CLP which is used for the programme alongwith the textbooks.

f) Expectations -

Following are the expectations of the NVS through the CLP

(i) By the end of the four year period, every child in the school (NV) be able to operate and programme on computers. The knowledge gained would help the child not only to find employability in the fast growing computer industry, but, would even help to improve his employment prospects in any organisation that use computers.

(ii) By involving an expert agency, NVS can look forward to the introduction of a sophisticated hi-tech subject in the schools through a simple and proven mechanism

(iii) In each school 4 teachers will be trained in the use of computers

(iv) Enabling more sophisticated classroom instruction

(v) Computer for school office use.

g) Effectiveness of the CLP -

Since, the contract period between the NVS and computer agencies is from 1991 to 1995, no evaluation is carried out, so far, to know the effectiveness of the ongoing CLP, according to the available information.

1.8.2.3. COMPUTER EDUCATION SCENARIO IN SCHOOLS : AN OVERVIEW

The CLASS project and the NVCES are the two major steps taken so far in introducing computer education in the schools. Alongwith the students, a number of teachers are trained and made aware of the modern technology. Apart from the CLASS project and the NVCES, many schools have taken up on their own to provide computer education to their students.

The computer revolution which is taking place in our schools is changing the outlook of both urban and rural students markedly. Demand for computer education at the school level is increasing day by day all over India. "It is estimated that there are more than 3,500 educational institutions in India with computer facilities. This number is likely to increase to about 15,000 in another few years with the implementation of policy directives passed by the Parliament in March, 1988" (Mukhopadhyay, 1988). Emphasising the role of computers in the educational process, the Programme of Action formulated by the Ministry of Human Resource Development to implement the National Policy on Education (NPE), maintains that "Computers can play an important role in enhancing the efficiency of the teaching learning process, to make children more creative and provide them with the individualised learning environment. Computer Literacy will be crucial in preparing children to cope with the microcomputer explosion, which has the same potential for social change as the industrial

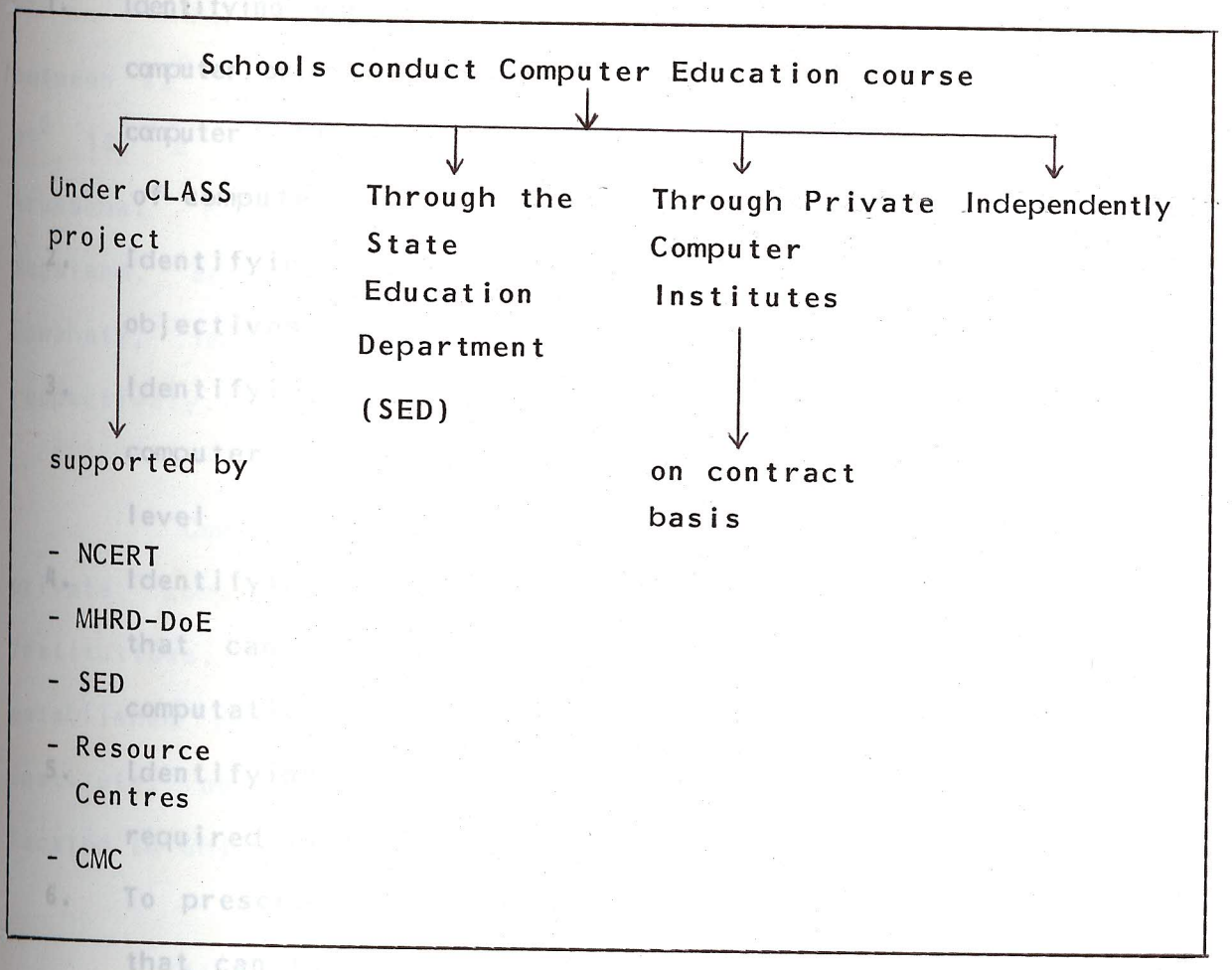
revolution. The demands for equity, therefore, require that Computer Literacy programmes be progressively integrated with the school curriculum at the lower secondary and elementary levels" (Ministry of Education, Government of India, 1986).

The action plan of the NPE, 1986 envisaged extension of the computer awareness programme to 10,000 higher secondary schools and their progressive integration with the school curriculum at the lower secondary level in the Seventh Five Year Plan (1985-90). According to the Fifth-All India Educational Survey (1986), Computer Science as a subject is introduced in 94 Higher Secondary Schools (3 in Haryana, 88 in Tamil Nadu and 3 in Delhi) out of a total of 15,498 Higher Secondary schools in India.

There are thousands of private computer education institutes which are helping in promotion of computer education in schools by providing trained computer teachers, and computer sets as necessary inputs. Probably, the massive spread of computer education in schools became possible within a very short period because of the private computer education institutes.

An attempt is made to represent the present system of structural functioning of computer education in schools as shown in Figure 3.

Figure 3 Management Structure of Computer Education in Schools of India



Thrimurthy (1993) has made valuable suggestion which needs mentioning -

"It is the need of the hour to workout different strands of computer orientation, their functions, tools that provide such functions and to assign such tools to different levels of school education, in the Indian context.

To start with, we need to work out and accomplish the following, while keeping open to the new thoughts.

1. Identifying various objectives and functions at each strand of computer orientation, which may include procedures, using programs, computer fundamentals, computer application, impact of computer usage, writing computer programs
2. Identifying the computer software tools to achieve these objectives
3. Identifying management methodologies to introduce computer orientation at different standards of school level
4. Identifying the Hardware Platforms and Software tools that can be adopted in Indian Schools, to meet the computational and training requirement at each standard
5. Identifying gray areas where software development is required indigenously to help the school education
6. To prescribe and recommend the specific software tools that can be used for Teaching by assigning them to each level from Kindergarten to 10th Class
7. List out the guidelines on infrastructure to introduce the courses for helping the management
8. Suggest the effective management methods of handling tools (for example, school library cannot be an ideal place to keep track of school software and catalog them)

It is also necessary to identify the suitable time slot to offer computer curriculum by adjusting it in the regular school schedule".

1.9.0. COMPUTER EDUCATION IN THE NORTH EASTERN REGION OF INDIA

The North Eastern Region (NER) of India extends between 22^0 19' N to 28^0 16' N Longitude and 89^0 42' E to 97^0 12' E Latitude, comprising of seven States, namely, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura whose capital towns are Itanagar, Guwahati, Imphal, Shillong, Aizawl, Kohima and Agartala, respectively.

Computer education is offered in the NER both by private computer institutes and by formal educational institutions. Most of the private computer institutions are established in the State capitals. Only one private computer institute, namely, Informatics Computer Institute which is located in Shillong, is accredited under the DOEACC scheme.

At the higher education level, beginning has been made by the different Universities to offer computer education in one way or the other. To quote some, North Eastern Hill University has provisions for a Diploma/Certificate course in computers; Regional Science Centre at Guwahati, Gauhati University, and Manipur University also offer diploma courses in computer applications. Certain selected Colleges (St. Edmund's College, St. Anthony's College and Lady Keane College

located in Shillong ; Cotton College, Arya Vidyapeeth College, Handique College situated in Guwahati) of the North Eastern States have introduced computer courses at the degree level.

At the Secondary education level, several schools have introduced computer education as a part of their curricular programme. Some Navodaya Vidyalayas in NER have already come under the Navodaya Vidyalaya Computer Education Scheme. The CLASS project also covers many secondary schools in various States of North East.

The CLASS project or Computer Literacy Programme (CLP) in short, is in operation since 1984-85 in the States of Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. The number of schools which have opted for the CLP in the various States of NER are given in Table 12.

Table 12 Schools covered under the CLP in the NER as in 1992

State	Number of Schools
Assam	104
Manipur	4
Meghalaya	6
Mizoram	11
Nagaland	11
Tripura	11
Total	147

In Assam, the CLP is in operation in more than hundred high and higher secondary schools. The Resource Centre for Manipur, Meghalaya and Mizoram and a part of Assam is the Regional Engineering College, Silchar (situated in Assam). The Resource Centre for Nagaland and a part of Assam is Guwahati Engineering College, Guwahati. The State Institute of Education at Jorhat in Assam started functioning since 1991 as yet another Resource Centre in this region. The Tripura Engineering College serves as the Resource Centre for Tripura.

Teachers from these 147 schools covered under the CLP are sent in batches to get training on the computers for a period of three weeks. A casual discussion with the heads and teachers of some of these schools revealed the following as the reasons for not getting the benefit of the programme to the fullest extent - irregular electricity supply ; defective computer ssets ; insufficient training imparted to the teachers; lack of coordination between the National Council of Educational Research and Training, State Education Department, Resource Centre and School ; lack of motivation and interest among the trained teachers in CLP ; and improper communication facility. But, the picture gets brightened a little to notice that students from Central Schools of Guwahati took part and won prizes at the national level quiz competition on Computers.

Apart from the formal educational institutions, various private agencies in the form of private computer

institutes are serving the region quite effectively in promoting computer education particularly among the student population.

Students from certain schools of the NER participated in a Computer Fair held at Calcutta in the year 1991. At the first instance, Statewise district level competition was organised and the selected students from the district level participated in North East region competition held at Regional Science Centre situated at Guwahati. From the North East, the students of Don Bosco School and St. Mary's School both from Guwahati and Assam Rifles Public School and Auxilium School located at Shillong were selected to participate in the Inter-State Computer Fair, held at the Birla Industrial and Technological Museum, Calcutta. In the Fair, St. Mary's School of Guwahati bagged the Best-School team award and Special and token prizes for Quiz, Essay writing and software development competition.

1.10.0. NEED FOR THE STUDY

Walker (1983) proposes that computers enhance education by providing the following : more active learning, more varied sensory and conceptual modes, less mental drudgery, learning nearer the speed of thought, learning better tailored to individuals, more independent learning,

and better aid to abstraction. The proposed statement by Walker requires validation through research. Today, computers are playing a vital role in our life because of its multifarious utilities. The rapid rise in the number of organisations, industries and institutions possessing computers is a clear indication of the pivotal role played by them. Computer technology is undergoing a total change. The future computers pioneered by Japanese, known as Knowledge Information Processing Systems, will open a new era in computing.

The developed countries introduced computer education at the school level with the intention to improve students' performance to prepare young people for changing job demands in the workplace, and to bring in change in students' learning. Developed countries were able to succeed in achieving the set goals to a great extent as they were technologically and economically well advanced. Developing countries on the other hand, had to delay in introducing computer education at the school level due to varied economic, resource, technological, social and such other constraints.

Though computer technology in India is in use since mid-fifties, yet its entry at the school level was only in the early eighties. Computer education at the school level commenced with the launching of the CLASS project. After that, sudden introduction of computer education in the schools began

throughout India, either with the help of private computer institutes or through their own initiative. Rapid expansion of computer education specially through the private computer institutes in private schools and the ever increasing demand for computer manpower in various sectors forced the government to incorporate computer education as a subject of study in government funded schools, to prepare the individuals for the information society. The demand for computer education in the schools is spelt out by parents and elders and this is perhaps one of the significant demands expressed by the society in the history of Indian schools. The manner in which the schools introduced and the desirability shown by the parents in introducing computer education calls for attention in this direction.

Carnoy, Daley and Loop (1987) in "Education and Computers : Vision and Reality" reviewed the status of computer education in various countries of the world, and revealed that, in an increasingly computerised society introduction of computers in schools is essential in order to develop positive and efficacious attitudes toward the technology ; and research evidence suggested that motivational (positive and efficacious attitudes) outcomes can be produced by modelling influences available from parents and peers. They have further indicated that limited research work had been carried out regarding the motivational consequences of computer use. They have also highlighted the importance of research in this area reasoning out that the

computer technology is becoming an integral part of daily life in many societies.

Realising the importance of computers in our day to day activities, computer education gained due priority in schools, in India. Introduction of computer education ocurred in Indian schools a decade ago. Most decisions to introduce computer education have been made without having due research knowledge about the implications of this technology on the psychological and pedagogical aspects.

Policy-makers, curriculum developers, educators and parents are all faced with the following challenge : on the one hand, they want to provide computer experiences for children in the classroom but, on the other, so far they have no conclusive evidence of a general nature that the computer is a positive educational force (Carnoy, Daley and Loop, 1987).

As the case is there with the rest of India, computer education is there in the schools of NER of India also, since a decade. Though NER of India is not industrially advanced compared to the other parts, yet, the impact of computers can be seen in the region.

Introduction of computer education in schools in the NER of India in general and making it a compulsory aspect of

curriculum by some in particular is a bold step. Realising the demand of computer education in the schools of NER of India and the non-existence of any indepth research work in this area, it becomes worthwhile to study certain aspects like the attitude of students towards computer education, how the teachers and students view the programme, the performance of students in the course, and basic to all, the existing status of the operational aspects like the machines, teachers and curriculum. The present investigation is an attempt in this direction.

1.11.0. STATEMENT OF THE PROBLEM

The problem under investigation reads as **"A Study on the Computer Education in the High Schools of Selected States of North-East India".**

The study attempts to find out the facilities available for computer education course in High Schools, views of teachers towards certain aspects of computer education, views of students about certain aspects of the computer education course, performance of students in the computer education course, relationship between the performance of students in the computer education course and their performance in other school subjects, and attitude of students towards computer education course.

As has already put forth (refer caption 1.7.0.) the term **'computer education'** is considered as an object of instruction covering computer literacy and computer programming (which to some extent covers word processing).

The **'performance of students'** in this study refers to the marks obtained by the students in the **'Computer Studies'** paper in their Class X examinations.

The term **'attitude'** (for a discussion of the term refer caption 3.4.1.1.) indicates the degree of positive or negative affect associated with some psychological object (here it being computer education). Operationally, the term refers to the score obtained by an individual on the Attitude Scale developed by the investigator for the purpose of the present study.

1.12.0. OBJECTIVES

The following were the objectives of the present study :

i) To find out the facilities provided for the computer education course in high schools

ii) To study the computer education curriculum followed in the high schools

iii) To find out the views of teachers towards certain

aspects of computer education

iv) To find out the views of students about certain aspects of the computer education course

v) To find out the performance of students in the computer education course

vi) To find out the relationship between the performance of students in the computer education course and their performance in other school subjects

vii) To find out the attitude of students towards computer education course.

1.13.0. DELIMITATIONS OF THE STUDY

a) The present study is confined to four States, namely; Assam, Meghalaya, Mizoram and Nagaland

b) Since introduction of computers is of recent times in the region, the study was restricted to only the capital towns of the four States, Guwahati, Shillong, Aizawl and Kohima, respectively. (Figure 4 shows the four States and the capital towns which were considered for the study).

c) Since, at present, the Indian Certificate of School Education (ICSE) system alone conducts the final examination in 'Computer Studies' for Class X, only such schools offering ICSE syllabus were considered for collecting data on the performance of students (refer objectives v and vi under caption 1.12.0.)

d) As it was felt that to give any reaction or to develop any attitude, the school should have exposed the course to the students and teachers for a considerable time, the study included only those high schools which had introduced the course prior to 1991.

The next Chapter presents a review of related literature.