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ABSTRACT

The Development and Implementation of a District Computer Education, Program conducted at Glasgow High School, Newark, Delaware, was designed to model full utilization of computer services in a public high school. The phases of the project included: (1) development of goals and objectives at the district level; (2) workshops for teacher training; (3) minicourses for students; (4) developing courses ior the 1975--76 school year; and (5) establishing a long-range computer services plan for the district. This report discusses the historical development of the project, summarizes events in each phase, provides results of an evaluation including numerous documents and exhibits illustrating the activities which took place during the project. (EMH)

The Development and Implementation of a District Computer Education Program

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Submitted in partial fulfillment of the requirement for
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1 Abstract

The practicum, "The Development and Implementation of a District Computer Education Program," was designed for the purpose of insuring full utilization of an in-house computer system in a high school. A second purpose was to establish goals, objectives, and directions for computer education on a District-wide basis. Phases conducted to accomplish these goals consisted of staff training student training, and the preparation of a District Computer Education Curriculum Guide.

All phases were completed satisfactorily. Outcome measures indicate that there is a significantly higher number of teachers and students involved in computer education in the District in 1975–76 than in 1974–75. Significant, also, is the number of non-mathematics teachers involved. Finally, a District-wide Curriculum Guide was produced, which will provide the guidance necessary for the expansion of computer education in the other two high schools in the District.

2 Preface

A wide array of scientific, economic, social, and technical factors are reshaping our world and, with it, the course of modern education. One such technological development is the computer, which is being utilized extensively and is playing a pervasive role in modern society. Banking, business, transportation, engineering, medicine, and social and scientific research are only a few of the many areas which are increasingly dependent upon the computer's speed in problem solving and its capacity for handling vast amounts of data. In addition, the computer is fast becoming a significant tool in the administrative and instructional, processes of education.

The President's Science Advisory Committee stated that, since the computer is such a valuable and versatile tool in society, students attending school in the 1970's who have not been exposed to knowledge about computers will be poorly prepared for the world of the 1980's and 1990's. Although most school students will not be computer technologists, the influence of the computer an their future is so important that they should be made aware of its nature and function.

The influence of the computer will be felt by students in many ways. These include career selection, leisure activities, and management of personal

finances. Moreover, the constitutional rights and the depersonalization of each individual can be affected.

"The Development and Implementation of a District Computer Education Program" attempts to formalize and pilot the necessary steps to bring this needed computer awareness to the students and staff in ore school district. Although the direction taken was heavily influenced by such local factors as availability of hardware and funds, it is possible that this project could become a model for other school districts to emulate.

Whatever effectiveness this presentation might have results to a considerable extent from the interest, cooperation, and assistance provided by various personnel of the Newark School District. The assistance of Mr. John Brandt, Principal, Mr. Thomas Comer, Associate Principal, and Mr. Darrell Pelley, all of Glasgow High School, was particularly valuable. The insights and encouragement constantly extended by Superintendent Dr. George V. Kirk, and by Deputy Superintendent Dr. John E. Allen helped make the gathering of data and the writing of this practicum a rewarding experience.

3 Introduction

"The Development and Implementation of a District Computer Education Program" is a multi-phased project designed to solve the problem of utilizing fully the computer System at Glasgow High School located in the Newark School District in the State of Delaware.

Briefly, the Newark School District is a K–12 District consisting of thirteen elementary schools, four middle schools, and three high schools. There are 16,900 pupils in the District. Elementary schools contain grades K–5, middle schools contain grades 6–8, and high schools contain grades 9–12. In addition, a state school for the hearing impaired is located in, and administered by, the District. There is also a vocational school under construction (scheduled to open in September, 1976) which will serve several districts but will be administered by the Newark District. In addition to Glasgow High School, the other two high schools are Christiana and Newark. Each of these high schools has approximately 1600 students enrolled.

The population of the Newark School District contains people representing all socio-economic backgrounds. While largely suburban middle class, all strata of society are represented. In short, its population looks more like a miniature cross section of the nation. This, then, is the setting in which this

practicum was carried out.

The various phases of the project consisted of the developing of goals and objectives at the District level for computer education, the instituting of workshops for teacher training, the conducting of mini courses for students, the developing of courses for the 1975–76 school year, and the establishing of a long range plan for the District. In addition, a library of textbooks and programs currently in use was gathered and a bibliography of pertinent articles and publications was compiled.

The success of previous attempts to establish computer education has been minimal largely because computer education was regarded as the domain of the mathematics department. To overcome this problem, teachers from many disciplines were involved in the preparation of the District-wide goals and objectives and were also included in the teacher training sessions.

Active student involvement was also considered a necessary condition for the success of the project. Thus, students were given the opportunity to participate in mini-courses during the spring of 1975. In addition, a formal course was offered through the District's extended year program during the summer of 1975. The students who attended the summer course were given the opportunity to react to the District-wide goals and objectives as these were being formulated.

Although the major emphasis for implementation was to be in one school, efforts were made to include the sister high schools and the area vocational high school in the development of District plans. One result of the District-wide involvement has been a unified approach to the implementation of computer education. Subsequently, when the decision was reached during the course of the practicum to install in-house equipment in the sister high schools, many of the problems which Glasgow High School faced had already been solved, or at least considered.

While all phases of the practicum have been conducted, several have been expanded or modified as the situation warranted. Moreover, several, additional activities related to the practicum were carried out. Where applicable, a discussion of these will be included later in the body of this report.

4 Historical Background

For practical purposes, the use of computers in Delaware Public School Districts and, more specifically, in the Newark District, began in the summer of

1966. The initial thrust was aimed largely at the administrative functions of business applications, student-scheduling, and student reporting procedures. Minimal attempts were made to use the computer for instructional purposes.

Basically, three different organizations made, and are continuing to make, contributions to effective utilization of the computer in education. The first of these was an ESEA Title III ploject entitled Educational Development through Technology (EDTECH). The second is a project sponsored by the Delaware Schools Auxiliary Association (DSAA)[1] which came to be known in 1971 as Delaware's Total Approach to Computer Knowledge, more commonly called Project DELTA. The third organization is the Data Information Center for Education (DICE) which is a data processing installation funded wholly by a consortium of local school districts and devoted exclusively to serving school districts. A brief description of the activities of each of these organizations follows.

4.1 EDTECH

EDTECH was conceived, written, and originally funded through the Capital and the Marshallton School Districts in the State of Delaware under the ESEA Title III Act.

The major goal of this project was to integrate the computer into the everyday activities of education through a single statewide program. In addition to the sponsoring districts, cooperating agencies included the school districts of Wilmington, Newark, and Dickinson-McKean; the Delaware Department of Public Instruction; and the University of Delaware. The project was funded at $150,000 for the 1966–67 school year.

During that summer, several activities were initiated. The first was a six-hour titled *Educational Data Systems* which was designed to acquaint administrators with the potential uses of the computer in education and to emphasize administrative functions.

A similar seminar devoted to computer-assisted instruction (CAI) was offered. Participants investigated the psychological implications of this type of instruction as well as an introduction to writing CAI programs in Coursewriter I (an IBM CAI language).

[1]DSSA is a private, non-profit organization which derives its funds from school districts by providing a building plan inspection service. These monies are then to be used to fund pilot experimental projects in education.

Another activity was the computer scheduling of three schools: Wilmington, Dover, and Christiana High Schools.

In order to carry out the administrative functions during the pilot year, funds Were budgeted to secure computer services. Through an agreement with the University of Delaware in which each agreed to cover 50% of the costs, an IBM 1401 computer was installed in August, 1966, at the University's Computing Center.

During the school year of 1966–67, a major activity of the project consisted of implementing administrative functions such as report card printing. Meetings were held for administrators and teachers to acquaint them with these various functions. A minimal attempt was made during the year to pilot Computer Assisted Instruction (CAI) and Math Instruction Program (MIP) techniques. However, since only 7% of the budget was devoted to this phase, these activities were minimal.

For various reasons, mainly political, the EDTECH project was not funded during the 1967–68 school year. Because the second year's proposed budget was approximately $500,000, this one project would have tied up all the Title III funds in the state. This was not popular with those who were submitting other proposals. There was also a question about which district would assume the leadership role for the project.

The project was funded for a second year in April, 1968. This caused an awkward financial situation in as much as the project's fiscal year was not concurrent with the fiscal year of the rest of the state. The funding level for the second year was approximately $225,000, less than the half the amount originally requested. Major cuts were made in the administrative application aspects of the project. The net result was a project which was 20% devoted to administrative functions of the computer and 80% devoted to MIP and CAI.

The summer's activities included many seminars conducted through the University of Delaware to acquaint and train teachers and administrators in various aspects of the computer in education. The course originally taught relating to the administrative aspects was repeated. In cooperation with DSAA, math and science teachers were trained in writing Fortran programs and in the use of terminals. Non-math-oriented teachers received training in writing basic programs, in the use of simulations, and in terminal operations. Still other teachers were being instructed in CAI and were writing programs which would eventually be used on the Philadelphia system, with which a cooperative venture had been established. The majority of the teachers

trained were from the Newark, Marshallton and Capital School Districts.

During the 1968–69 school year, three major activities were conducted. The first, called COMDET, was a joint venture between EDTECH and IBM in which touch-tone telephones were used to enable fifth grade students to interact with a computer for mathematics drill and practice. The materials used were adapted from the work of Dr. Patrick Suppes of Stanford University. The telephones, 12 each, were located in three elementary schools. Students would dial the computer which was located in Yorktown Heights, New York. After recognizing the student, she computer would verbally present a series of drill problems, the level of which was based on the student's previous successes or failures. The computer had a limited vocabulary, but it was sufficient to present problems and respond to students. The computer recorded the student's results and supplied the teacher with a daily summary. A statistical study showed no significant difference between this method and the traditional paper and pencil drill and practice method employed by control groups.

The second major activity involved three middle schools using computer-assisted instruction in reading. Two teletype terminals and one CRT terminal with a light pen response were utilized. Although the program was essentially adapted from the one used in the Philadelphia School System, some locally written material was also used.

The third major activity was called the Math Instruction Program (MIP). Under this phase, each high school in Newark (2) and Dover (1) was equipped with a terminal for time-sharing. Students Were taught programming in various ways: through formal computer education courses; through informal courses before and after school; and through the existing math and science courses. Computer time was purchased from the Philco Ford Company, Valley Forge, Pennsylvania, and the Computer Sciences Corporation, Bala Cynwyd, Pennsylvania. As the utilization of the on-line terminal increased, additional equipment was added. The first configuration included one on-line teletype terminal, three off-line teletypes for tape preparation, and one Demex card reader attached to the teletype for card input. (Card preparation could be carried out on key punches located in the business department of each school.)

Under MIP, a portable teletype was available for time-sharing in the middle schools. For periods from two to four weeks each, the middle schools had the terminal available for computer instruction. Such instruction was directed toward the goal of increasing the students' (and the teachers') com-

puter literacy under the MIP concept.

The funding for the third year was drastically reduced from that of the second year to $50,000. Again, state level politics played a significant role in the amount finally granted.

The only activity conducted during the summer of 1969, and the following school year was devoted to MIP. A single terminal was supplied to each of the three high schools. The time-sharing service was provided by in IBM 1130 computer housed at the University of Delaware and funded jointly by EDTECH and DSAA. During this year, the two projects conducted essentially the same activities, sharing costs and personnel alike. After the sophistication of the equipment utilized the previous year, the three EDTECH high schools were generally dissatisfied with the service. Since it was their first time-sharing experience, however, the schools sponsored through the DSAA project were generally satisfied. The EDTECH project officially was terminated in June, 1970.

4.2 DSAA and Project DELTA

The original DSAA projects started in the summer of 1966. It was designed to train high school mathematics and science teachers to teach computer programming to two or three high-ability seniors in each school during the 1966–67 school year. During the first year, the project was limited to eight public and private high schools located in New Castle County, Delaware.

The teachers chosen to participate attended a summer workshop in programming at the University Of Delaware. The language taught was Fortran, and the machine used was an IBM 1620 housed at the University of Delaware. Participating teachers had direct access to the computer.

During the school, year the teachers instructed their students before or after school. On alternate Saturdays they accompanied their students to the University of Delaware's computing center. On these days, the students had the opportunity to run the programs they had written during the previous two weeks. In order to give the students maximum "hands on" computer time on the 1620, key punches were provided in each school for card preparation. The teachers were reimbursed for their time and the cost for computer time and key punches was absorbed by DSAA.

During the 1967–68 year, the project continued much the same as it had the first year. Contact was established between DSAA and EDTECH about the possibility of combining efforts should the EDTECH project better

funded.

During the summer of 1968, DSAA sponsored the training of additional teachers to expand their project. The training was conducted in cooperation with the EDTECH project. Furthermore, the goals were revised to reflect more student involvement during the school year. Teachers were now encouraged to involve a class of students instead of merely the brightest two or three. The result was that the DSAA project and the EDTECH project were now operating along similar lines in the area of MIP.

The next school year's activities proceeded as in the previous year, but with increased student involvement, reflecting the change in philosophy. Plans were finalized for the joint funding of the IBM 1130 time-sharing system with the EDTECH project for the 1969–70 school year, with the result that DSAA's activities were essentially the same as EDTECH's.

During 1970–71, DSAA continued to grant minimal support to schools to provide time-sharing to high schools. This service was supplied through the University of Delaware's expanded computer center utilizing a Burroughs B5500. However, this arrangement proved less than satisfactory. Plans were formulated by DSAA from which the project known as Delaware's Total Approach to Computer Knowledge. (DELTA) emerged. A project director was employed on a half-time basis; the other half of his time was spent working for the Data Information Center for Education (DICE). This sharing arrangement continued through the 1971–72 school year. In succeeding years, a full-time director has been employed.

For the spring of 1971, a Digital Equipment Corporation (DEC) PDP-8/L was installed as an interim machine for the schools to use for time-sharing. In 1971–72, the PDP-8/L was replaced by a PDP-11/20. During this period, the machines were housed at DICE. In 1972, the project moved to the University of Delaware campus to facilities located in the College of Engineering. (It is interesting to note that they remain as a separate entity from the University of Delaware Computer Center.) In 1973, a PDP-11/45 was installed to complement the PDP-11/20. Currently, a PDP-10 is being installed for the 1975–76 school year.

These machines were purchased by DSAA with financial support for operations received from the participating schools. Each school pays a flat rate which covers the teletype terminal, telephone charges, and computer service. Over the years, the school rate has been increasing to facilitate their gradual assumption of the total operating costs.

According to Project DELTA literature, its announced goals were to sup-

ply time-sharing services for high schools in Delaware; to break the prejudice that computer knowledge is for "math-oriented students;" to explore how computer knowledge could become a learnable or a teachable concept; and to make clear to teachers the difference between CAI and computer knowledge.

In addition to these, several new objectives were added in 1974. These are:

- To provide stability and continuity for at least three years so that rational decisions can be made about computer education;
- To work with the University of Delaware in the development of teaching methods and courses in the many disciplines utilizing a computer;
- To determine a feasible way whereby all students, K through 12, can eventually gain computer knowledge;
- To establish DELTA at the University as a research installation to provide all schools with a resource center constantly improving computer technology and curricula for the instruction of students on HUC (How to Use the Computer) and to support teachers' ever-increasing knowledge and interest in computer utilizations and applications.

In addition to offering time-sharing to teach programming, DELTA has an extensive program library available and various simulation packages including the Huntington Project materials. A guidance package taken from the Dartmouth Project (EXPRESS) data base has been offered, but this is being replaced by the package marketed by Time Share Corporation.

Seventeen schools were originally affiliated with DELTA in 1971. Currently, about 50% of the high schools in the state are affiliated with DELTA.

Plans are for Project DELTA to be funded for three more years by DSAA, with a gradual phasing out of their support as the schools assume a greater proportion of the operating costs.

4.3 DICE

The Data Information Center for Education (DICE) is a data processing installation which was formed by a consortium of school districts in 1965. Previous to 1965, several districts maintained their own punch card shops.

For the first two years, DICE continued as a punch card shop and utilized the EDTECH sponsored computer in 1966–67.

Originally, three school districts, Newark, Marshallton, and Dickinson-McKean, were supporting the system. Over the years other school districts have joined this consortium. At present, seven school districts serving approximately 50,000 students are full-member districts.

In 1967–68, DICE installed an IBM 1401 4K card system. This machine was supplemented by purchasing time on larger machines as needed for functions such as scheduling. In July, 1973, the 1401 system was replaced with an IBM 360 Mode1 22 computer.

Initially, DICE provided business and student accounting functions. In 1966, prescheduling data preparation services were provided to the schools using external computer scheduling packages. For instance, two high schools, Dickinson High School and McKean High School, started using the Stanford 4-S Program in 1966. DICE prepared the necessary cards for their scheduling runs. This resulted in a savings to them when they were actually sent to Stanford for their scheduling run. For the schools who had a more traditional schedule, the IBM 360 scheduler package was utilized. (This package has been modified extensively to reflect local needs and to utilize the DICE computer.) Currently, the IBM EPIC Socrates Package is being utilized on the DICE machine.

In 1971, test scoring and analysis were added as regular services. For the first two years, the analysis was conducted on a contract basis by DELTA. In 1973, test scoring became an in-house function utilizing the IBM EPIC Fast Package. Extensive modifications to the package were made to reflect local needs.

Over the years, DICE has remained devoted to serving the administrative needs of the school districts, preferring to leave the educational computer applications to others.

4.4 Newark District Involvement

Through the years, the Newark District involvement in computer applications and computer education has been extensive. The District has contributed personnel and space to each of the three projects previously discussed.

Currently, all business functions, student accounting including secondary report cards, and test scoring are computerized through the services of DICE. The Newark District has had extensive influence on the addition of services

by DICE since it was one of the original members of the consortium and because it is the largest District in the State.

Through DSAA and EDTECH, many teachers were trained in programming techniques and the utilization of computers in the instructional process. Time-sharing facilities which continue to be supported in the secondary schools are utilized primarily by mathematics and science teachers for teaching computer programming. However, some science and social studies teachers are using simulation packages as an integral part of their instructional program.

Continuous support to computer-re1ated activities has been given by the Newark District administration. The use of the computer for administrative functions has been firmly established, but the degree of instructional utilization has fluctuated. However, in 1974, the opportunity to install in-house equipment in the District's newest high school became a reality. An outgrowth of this hardware acquisition was this practicum, resulting in a commitment to establish a complete computer education program in the high schools of the Newark District.

In summary, the preceding is by no means a complete history of organizations and events affecting computer education in the State of Delaware and the Newark School District. In fact, the purpose of this historical development is merely to establish the level of computer utilization at the start of this practicum. Some of the recent activities have been mentioned and, where necessary, will be discussed in greater detail.

5 The Development of Goals and Objectives and a Long-Range Plan for Implementation

The first major phase undertaken in this project was the development of a set of preliminary goals and objectives and a long-range District plan for computer education. Initial planning called for the development of each of these documents by separate committees. However, the two tasks appeared to be so completely interrelated that one committee divided into two subcommittees was formed to accomplish both tasks concurrently.

5.1 Computer Education Workshop, Phase I, is Formed

For obvious reasons, meetings held at the conclusion of the school day are seldom productive. Thus, a proposal (Appendix - A1) was submitted to the Newark School District for the purpose of conducting a workshop for the committee during school hours. The site chosen was Glasgow High School. Following approval of the proposal, potential participants were identified and invited to the workshop. Concurrently, a second proposal (Appendix - A2) for a summer workshop was submitted for the purpose of preparing a formal computer education curriculum guide for the District.

In addition to insuring that committee members would be fresh and alert, holding the meetings during the school day enabled other interested staff members to participate. Also, the committee members could solicit student input immediately when it was needed. In all, four sessions were held during February, March, and April, 1975. Each was a full day session.

The committee consisted of twelve regular members. Included were four members of the Christiana High School staff, three members of the Newark High School staff, four members of the Glasgow High School staff, and the District Supervisor of Mathematics. Departments represented were business education, mathematics, science, and social studies. Others in attendance at various meetings included district administrators, a University of Delaware professor, and the principal-elect of the district vocational school (Appendix - A3).

Prior to the first full day session, participants were asked to bring any materials which might be pertinent to the tasks of the committee. Letters requesting information relating to computer education at the secondary level were sent to schools and organizations which had been identified as having some type of involvement with computer-related activities. These potential sources were identified from ERIC documents and bibliographies included in various articles and books. A sample letter, a sample response, and a list of the organizations contacted are included in Appendix A4. The response to these inquiries was disappointing. Many schools and organizations have implemented computer education programs at the secondary level, but the vast majority do not have formal goals and objectives established. However, during the course of the workshop, additional letters of inquiry were sent as additional sources were identified, in the hope that a well-defined set of goals and objectives could be obtained. None were received. Thus, for practical purposes, the committee started at point zero.

The first full day meeting was spent discussing the possible directions the Districts might take to establish a workable computer education program, to indicate what hardware needs would be necessary to carry out such a program, and to determine how the program would affect the curriculum as a whole. Subsequent meetings were devoted to discussing the specific needs of students and teachers and to formulating the long-range District plan and a preliminary set of goals and objectives. A copy of each of these, is included in Appendix A5. In addition, the problem of incorporating these goals and objectives into the curriculum was considered.

At the, conclusion of the workshop, the preliminary goals and objectives produced were distributed (Appendix - A6) to approximately 60 secondary teachers for their reaction and comments. A long-range plan (Appendix - A7) was include, as part of the yearly report on computer activities and was forwarded to the Deputy Superintendent for his information and possible action.

All materials gathered, the preliminary goals and objectives, and the comments received from the teachers were subsequently used as input for the summer workshop.

5.2 Computer Education Workshop,' Phase II, Proceeds on Schedule

The summer workshop was held during June and July, 1975, and was three weeks in duration. Many of the staff members who served on the original committee participated in the summer workshop. (See Appendix - A8) It was felt that this would help make the task at hand easier since less time would be required for orienting people to what had taken place during the first workshop.

In order to facilitate the writing of the final curriculum guide, three members of the workshop worked full-time while the remainder participated only in the afternoons. The three working in the mornings devoted their time to the "hard" writing; the full group reacted to these efforts in the afternoons. In this way, more people were available for brainstorming and reactions to drafts which were generated at a faster rate by fewer people. The composition of the summer workshop was similar to that of the spring workshop. The total number of participants was less, but the same departments were represented.

Concurrent with the summer workshop, two other activities were held at Glasgow High School. One Was a one-week teacher training workshop and the second was a seven-week summer school class for high school students. Each of these activities will be discussed later in greater detail. However, it is necessary to mention them at this point, because input for the curriculum guide was solicited from the students and teachers participating in them.

By the conclusion of the workshop, a curriculum guide for the District had been prepared. (See Appendix - A9) The guide is student-oriented, and it attempts to overcome the pervasive idea that computer education is the sole responsibility of the mathematics teachers.

In addition to goals and objectives, two appendices were included in the guide. The first is a list of films which can be used to meet some of the objectives in the guide. The second is a list of computer programs available in the District.

Approximately 200 copies of the guide have been prepared and have been circulated to teachers in the secondary schools. The guide is called an interim draft and will be revised as necessary after the. 1975–76 school year However, to date it has been well received by the teachers and should serve the purpose for which it was written.

6 Staff Development

The second major phase of this project was directed toward staff development. A major objective of this phase was to introduce as many of the secondary teachers as possible to the computer. To accomplish this, several school and District level workshops were conducted. In addition, one District staff member was sent to a workshop conducted by Wang Laboraturies, Inc.

6.1 Staff Member Attends In-Depth Training Session

With the installation of the computer system at Glasgow High School in the fall of 1974, it quickly became evident that there was a need for at last one person to have in-depth training on the system. This was especially crucial if the hardware was to be used effectively within the school. Thus, when funds became available, (Appendix- B1) one person, Mr. Darrell Pelley, Mathematics Department Chairman of Glasgow High School, was chosen to attend a five-day in-depth training school at Wang Laboratories, located in

Tewksbury, Massachusetts. The reasons for choosing Mr. Pelley were his previous computer knowledge and his ability to work constructively with other staff members.

Mr. Pelley attended the school during the week of February 3, 1975. This particular week was chosen in order that his training would be accomplished prior to the first District-wide inservice day. This was necessary because he was scheduled to conduct a workshop on computer education on those days.

Mr. Pelley's reaction to the school was extremely positive. He related that the class size was limited eight participants. Also, an attempt was made to create a group with different backgrounds and varied application interest areas. Thus, he was the only educator in his group and had an opportunity to interact with people involved in military, medical, industrial, and construction applications.

The training Mr. Pelley received was very valuable for him personally. In addition, his expertise has been tapped by having him Conduct workshops and by employing him as a leader of the workshop which developed the final goals and objectives for the District. Thus, the funds (Appendix - B2) used to send him were considered well spent, especially since similar hardware is being installed in the other high schools of the District for the 1975–76 school year.

6.2 Spring Computer Inservice Workshop Conducted

Each year three days during the second semester are designated as District-wide inservice days in the Newark School District for which the Office of Instructional Services is responsible. In recent years, the trend has been to offer mini-courses for teachers designed to provide staff members with concrete experiences which can be later used in the performance of their jobs. Staff members are free either to choose any of the offerings provided by the District, or to submit an independent proposal for consideration.

One such course offered at the District level was designed to provide teachers with an exposure to computers in general, and to equipment at Glasgow High School in particular. The workshop was aimed at, but not limited to, the members of The Glasgow High School staff. Twenty-seven staff members (Appendix - B3) elected to take the course. Although some elementary and middle school teachers participated, the majority of the participants were from the high schools of the District.

Two sets of objectives (Appendix - B4) were identified: The first set

for participants who knew little or nothing about the computers and the BASIC language, and a second set for participants who knew BASIC and were already familiar with a computer system. The participants were divided into these two groups, and the "beginners" were further subdivided into groups of three.

Following a short overview by the workshop leader, the instructional approach used for the "experts" was to turn them loose on a machine assisted by a staff member who had already mastered the machine. Half of the "beginners" groups were gathered into a lecture section, where they were given a short presentation of about 15 minutes and then given an assignment (from the assignment sheet, Appendix - B5), on the hardware. The second half of the beginners were then given the same presentation followed by the "hands on" assignment. In this way, the lecture groups and-the "hands on" groups were rotated in order that the amount of knowledge to be handled was not excessive and to insure that immediate reinforcement via the hardware was accomplished.

Throughout the three-day workshop, an informal atmosphere was maintained. The advantages and disadvantages of the Glasgow hardware were pointed out to the participants, and efforts were made to provide the participants with examples of applications of the computer within their existing programs.

In summary, the participants rated the workshop extremely successful. This was significant when considering the fact that on the morning of the first day of the workshop, a,vote was taken which authorized a state-wide strike, and teachers were highly agitated.

6.3 Informational Meetings Held

Following the District inservice workshop, a series of two-hour informational workshops ware held for District personnel. Invitations (Appendix- B6) were sent to the secondary schools in the District inviting staff members to see and try the computer facilities at Glasgow High School.

Three such meetings were held, with approximately twenty staff members attending each. The participants were given a short presentation about the equipment, and G1asgow High School's plans for utilizing it. Following the presentation, the participants Were given an opportunity to interact with the hardware, using canned simulation and game programs.

The purposes for holding these meetings were to acquaint District personnel with the equipment and also to instill a more positive feeling about the use of computers in education. It appeared that these purposes were achieved, since many participants stayed for longer than two hours interacting with the equipment and discussing its possible applications.

6.4 Summer Computer Workshop Conducted

A proposal (Appendix - B7) for a slimmer workshop for training teachers in the use of computers was quickly submitted in April, 1975, when it became apparent that the installation of computer systems in Christiana High and Newark High Schools was a distinct possibility. Following approval of the workshop proposal in May, 1975, a memorandum (Appendix - B8) Was sent to the principals of the three District high schools requesting that they select ten participants for the workshop. They were encouraged to send teachers representing as many departments as possible, and in particular, the business education department.

Following receipt of the names of potential participants from the principals, letters of invitation (Appendix - B9) were sent. In all, thirty teachers representing many departments attended the workshop. (See Appendix - B10) Departments represented were English, social studies, science, business education, mathematics, industrial arts, and physical education.

The workshop which was held during the week of June 23, 1975, was similar in format to that of the spring workshop. Activities (Appendix - B11) included a brief survey of the historical development of computers and the growth of the historical development (educational and administrative) in the Newark School District. The participants were then given instructions on the use of the Wang 2200 computer. Following machine familiarization, the participants were introduced to the BASIC computer language and were given an opportunity to write programs. Finally, the participants were made aware of the canned programs available and were given an opportunity to try several for their reactions.

Throughout, the workshop was conducted informally. As in the spring workshop, the usual method of instruction was for half the participants to be working independently on the machines while the instructor was working more formally with the remaining half. In this way, hands-on time was maximized.

In general, the workshop appeared to meet its objectives. The partici-

pants rated the leader excellent, and except for the length (too short) and the number of participants (too many), they rated the workshop above average.

6.5 School Level Workshops Conducted

Two related school-level workshops were also conducted during August, 1975. The first was a one-week workshop (Appendix - B12) held by the mathematics staff of Glasgow High School for the purpose of finalizing their 12th grade mathematics program. In addition, two of their objectives were to finalize the plans for the Computers I and Computers II courses and to write computer programs for use in mathematics courses.

The second workshop was a one-week workshop (Appendix - B13) held by the mathematics staff of Christiana High School for the purpose of introducing the mathematics staff to the computer hardware which was installed in September, 1975. Activities included instruction on this hardware and identifying and writing canned programs which can be used in the current mathematics classes. Each of these workshops was planned to supplement work being done at the District level on computer education.

7 Student Involvement

7.1 Glasgow High School Mini-Courses Held

Although teacher involvement is a necessary condition, it is not sufficient for successfully implementing computer education in the district. A second necessary condition is active student involvement. Thus, in order to make students aware of the capabilities of the computer system and the exciting activities that can be carried out with it, several mini-courses were conducted during the third quarter of the 1974–75 school year at Glasgow High School. Originally, the plan was to offer two such courses, but the student demand and the structure of the existing master schedule necessitated that six such courses be formed.

In order to generate student interest in the mini-courses, several methods were utilized. These included: placing an article in the student newspaper (Appendix - C1); presenting daily announcements over the school intercom; and making announcements by the mathematics teachers to each of their classes. Efforts were made to encourage students of all levels to participate,

and each student who indicated an interest was invited to attend the classes. Since the course was computer-oriented, student invitations were printed on the computer (Appendix - C2). Thus, when the classes were actually initiated, forty-three students (Appendix - C3) representing all grade levels and all ability levels were enrolled.

Classes for instruction consisted of the students meeting with the District Supervisor of Mathematics on a formal basis one, two, or three periods a week. The students then spent several additional periods per week working independently. The instructor (the Supervisor of Mathematics) was available on Tuesday and Friday mornings and on Wednesday afternoons for this formal instruction. During the periods when the instructor was not available, several members of the mathematics department donated their time to assist the students. Even with this additional help, there were certain periods when there was no adult supervision. However, the students were still encouraged to utilize the equipment during these periods if they were free. It was gratifying to note that no acts of vandalism took place during the unsupervised time.

Topics covered during the formal instructional periods included: machine operation, including use of the machine in the immediate mode, tape loading, and execution of canned programs; elements of the BASIC language; diagnosing of program errors; and simple, computer programming (See Appendix - C4 for sample student materials). For the students who quickly mastered these topics, individual programming problems were assigned. These problems were chosen on the basis of the students' current curriculum. For instance, a business education student would be assigned a problem to write a program which would generate compound interest while a college preparatory student could be assigned a problem to write a program which would find the factors of a quadratic equation.

Evaluation of students was conducted on an individual basis. Since no credit was being awarded, formal letter grades were not kept. Rather, a record of task completion was compiled. Each student completed the competency tasks in the presence of the instructor when the student felt he was ready. For example, when a student mastered the handling of the cassette tapes, he requested a competency check-out. He would then perform the tasks on the Tape Cassette Checkout List (Appendix - C5) in a random order designated by the instructor. If the student did not successfully complete the taks, no failure was recorded. Similar check-out lists (Appendix - C6) were used for other tasks. Only successful completions were recorded.

In addition to the students who formally signed up for this course, many others participated informally. Students who dropped in to see what was going on were encouraged to play game on the computer or use a canned program. The formal participants were eager to assist these drop-ins by helping them use the games and canned programs and by explaining what they were currently working on. (See Appendix - C7 for examples of student-generated programs) Many of these drop-ins were business education students who were encouraged to participate in this manner by their teachers.

Although the courses were scheduled only for the third quarter, many students requested that the program be continued into the fourth quarter. However, because of time constraints, the instructor was available on Tuesdays only. Although less formal instruction was now available, the program continued because there were now many students knowledgeable enough to answer the questions that the new participants would raise.

Overall, the program was considered a successful one. Students signed up knowing they would not receive credit. They continued to participate even though it meant giving up their free time. Further, many of these students elected to take the credit courses established for the 1975–76 school year.

7.2 Extrided Year Program Computer Course Established

Each summer, the Newark School District conducts an extended-year program as part of the regular summer school program. The courses included in this program are designed to give students experiences they could not obtain during the regular school year. The courses are free and credit is given for the ones designated high school level.

For the summer of 1974, an attempt was made to initiate a course called "Mathematics Through the Computer." For several reasons (the main one being lack of publicity) the course did not "make." However, since it was felt that the course had merit, plans were made to implement a similar one in the summer of 1975.

In 1974, the only computer service was through a single terminal. Thus, it was necessary to revise the course guide for the summer of 1975, to reflect the installation of the in-house equipment. The revision of the course guide (Appendix - C8) was contracted to the potential instructor, Mr. Carl Jacobson, of Glasgow High School. In addition to a brief description (Appendix -

C9) in the summer school catalog, a flyer (Appendix - C10) was distributed to the secondary schools of the District to publicize the course.

Because the majority of the summer school courses are conducted at Newark High School, a problem relating to the transporting of students arose. This problem was solved by establishing a shuttle run from Newark High School to supplement the regular bus routes. However, the length of the course then needed to be extended to seven weeks to make up the time lost for transporting students in order that a credit could be awarded. Thus, the course met for seven weeks instead of the regular six weeks.

Initially, twelve students (Appendix - C11) enrolled in the summer course, eleven boys and one girl. Ten students attend Glasgow High School and two attend Newark High School. Nine of the twelve completed the course satisfactorily. Several other students who originally indicated an interest the course gave as their reasons for not enrolling the transportation problem and the need for extending the class to seven weeks. There was also a communication problem in that one high school (Christiana) and the four District middle schools did not receive the special flyers describing the course. Thus, a sizeable potential population was missed.

Four of the students who completed the course are currently in eleventh grade while the remaining five are tenth graders. Three levels of students were represented: honors level; regular college preparatory level; and technical track level. On the basis of his experiences in the simmer course, one student has changed his math course from the technical level (Elementary Geometry) to the college preparatory level (Geometry I).

Many materials were used in the course. These included technical manuals supplied by Wang Laboratories, a text by Neal Golden (*Computer Programming in the BASIC Language*), a text by Rudd Crawford and David Copp (*Introduction to Computer Programming*), and a wide array of regular mathematics textbooks.

Because of the limited enrollment and the varied backgrounds of the students an individualized instructional approach was desirable and, in fact, necessary. Following an introduction to the hardware and minimal instruction in elementary computer programming each student was assigned specific programs to write. The student's program assignment was chosen on the basis of his mathematical background. However, instead of choosing topics which had been covered in his previous course, the topics were chosen from the course he would be entering. Thus, the student was not only responsible for a programming assignment, he was also responsible for determining and

then learning the necessary mathematics needed to complete the program. By using this approach, the student assumed the role of programmer analyst as opposed to being merely a programmer.

The benefits of this approach were three-fold. The student had the opportunity not only to learn and practice programming skills, but to learn additional mathematical content. The third benefit was the skill, that the students developed concerning the use of mathematics textbooks as references. Initially, the students were extremely reluctant to investigate a mathematical topic on their own. However, as the course progressed, the students became less dependent upon the teacher and relied more heavily on their own ability to interpret material found in the texts.

Because credit was offered for the course, a more formal evaluation procedure was necessary. Students were given grades based on the number and degree of sophistication of the programs written. (See Appendix - C12 for a list of the more sophisticated programs generated by the students.) In addition, a final exam was administered which covered a11 aspects of programming. Final grades awarded consisted of two A's, four B's, and three C's. It might have been expected that the grades would closely correspond with the level of the course which the student, would be entering, but this was not necessarily the case. There was a correspondence, but it was weak, at best.

Overall, the summer course was successful. At the end of the course the student exhibited a knowledge of programming skills which should be useful to them in future years. Although the enrollment was somewhat disappointing, the course will be offered again next summer.

Plans are being made to overcome the enrollment problems and, should these be successful, it is expected that many additional students will take advantage of the benefits of the course.

8 Related Activites

Before and during the course of this practicum, several activities took place whick had a direct bearing on, or were an outgrowth of, the practicum. Some were local in nature, while others have State-wide implications.

8.1 State-Wide Council for Computer Education Formed

In 1973, a State-wide council for Computer Education was formed by the State Supervisor of Mathematics (Appendix - D1). The council consists of members from education, business, and industry and its purpose is to advise the State Department of Public Instruction on matters relating to computer education. This author has been a member of the council since its inception.

Each year, one of the recommendations of the council has been for State support for computer education. In 1975, this recommendation was adopted by the State Board and included in the State budget, with the result that districts could apply for matching funds for the 1975–76 school year. A total of $48,000 was allocated by the State for this purpose. These funds can be used for terminal rental, computer maintenance, or purchasing computer hardware. The amount budgeted for 1975–76 is minimal ($1,506 per high school, to be matched by the local district), but it is a step in the right direction. To date, the Newark School District has received State funds totaling $4,500 (Appendix - D2), and is scheduled to receive an additional $2,200.

The council has also engaged in other activities. These include sponsoring informational meetings (Appendix - D3) and computer education courses at the University of Delaware, such as the one designed to acquaint mathematics teachers with the Colorado Algebra through the Computer, Project.

8.2 State-Wide Computer Task Force Formed

A second State-wide effort in which this author is involved is the State Computer Task Force which is charged with the responsibility of creating a State-wide plan for computer utilization in education. The task force initially met in July, 1975, and expects to complete its work by February 1976, (Appendix - D4). The plan will encompass both educational and administrative uses of the computer. Many of the members of this task force are also members of the State Council for Computer Education; thus, the task force will be generating a plan very much in line with the thoughts of the advisory committee.

8.3 H.B. 509 Proposal Submitted

Shortly after this practicum was started, a conversation with the District Supervisor of Occupational and Vocational Education precipitated a proposal (Appendix - D5) for House Bill 509 funds. Briefly, H.B. 509 provides State support for teachers, and operational funds for approved occupational-vocational programs conducted in the comprehensive or vocational schools, grades 7–12. The proposal was submitted and initially rejected. However, after meeting with State officials, minor modifications were made, the project was resubmitted, and approval was granted in May, 1975.

The approval of this proposal at Level 3 funding means that three times the normal operating funds will be available to Glasgow High School for their Computers I and Computers II courses.

8.4 Newark School Board Supports Computer Education

Another item of interest which has been an outgrowth of this practicum is the complete support of the Newark School District Board of Education to computer education. On May 20, 1975, the Board unanimously passed a motion (Appendix - D6) to amend the budget by $80,000 for the purpose of installing in-house computer equipment in the District's ether two high schools (Newark and Christiana), and to add a time-sharing terminal at Glasgow High School, which only had in-house equipment.

The major presentation to gain support for this motion was made by a student at Glasgow High School. Supportive data were supplied by a teacher and the associate principal at Glasgow High School. Thus, through,the unselfish efforts of the people at Glasgow High School, the two sister schools gained immensely.

After the approval of the budget amendment, bids (Appendix - D7) were solicited for computer systems for Newark and Christiana High Schools. The low bidder was Wang Laboratories, Inc. The bid was awarded to them by the Board in July, 1975, (Appendix - D8) and systems similar to the Glasgow in-house system were installed in September, 1975.

Concurrently, time-sharing terminals were ordered (Appendix - D9) for all three high schools for the 1975–76 school year; one each for Glasgow and Newark High Schools, and two for Christiana High School. The decision was made to place two at Christiana High School because of the physical nature

of the plant. The school consists of two buildings, with the mathematics and guidance departments housed in one, and the science and social studies departments housed in the other. Placing an extra terminal at Christiana High School seemed to be the logical direction to take because of the heavy utilization by the departments previously mentioned.

Computer service is supplied by Project DELTA's system on a twenty-four hour basis. In addition to providing computer time and a library of canned programs, for the first time this year the system is providing a guidance package supported by State funds. The guidance package is the one marketed by Time Share Corporation, and provides information on both college and vocational choices open to students.

Heavy utilization of the guidance package is expected in each of the three high schools. Guidance counselors have been given instruction on how to use the package. Each school has instituted a system utilizing student aides. These aides assist other students who need help accessing the package. In this manner, the schools expect to acquaint each junior and senior with the system.

Mass utilization of the guidance package is now possible because of the installation of in-house computer equipment in each school. This enables students who are learning programming to do their work on the in-house machines, thus leaving the time-sharing terminal free for utilization of the special packages.

9 Activities Planned for 1975–76

9.1 Computer Offerings (1975–76)

For the 1975–76 school year, two courses, Computers I and Computers II, are being implemented at Glasgow High School. Computers I is a nine-week course, while Computers II is an eighteen-week course. In addition, an independent study course, Computers III, will be implemented during the 1976–77 school year.

Seventy-two students have enrolled in Computers I, while thirty-seven students have enrolled in Computers II. The majority of the students who elected these courses are juniors and seniors. In future years, it is hoped that more freshmen and sophomores will be able to elect the courses. This will enable them to use the computer knowledge in subsequent studies.

To insure that all business students will have an exposure to computers, a one-week block of the Typing I class will be devoted to the subject. This subject was chosen because it is the only class in which all business students are enrolled. It is anticipated that the same plan will be utilized at the sister high schools (Newark and Christiana) either this year or next.

As schedules had already been established before the decision to install in-house equipment had been made, computer offerings at Newark and Christiana High Schools are limited Co a single eight-week course in each school. This course is comparable to Computers II offered at Glasgow High School. Eighteen students are enrolled at Christiana High School, and twenty-one students are enrolled at Newark High School. Plans are being made to expand these offerings for the 1976–77 school year, and the meeting of certain objectives in existing courses (especially social studies) will be accomplished during the 1975–76 school year. In addition, both Newark High School and Christiana High School are planning to offer Computers III (the independent study course) for a few students this year.

Thus, course offerings in computer education have been expanded at Glasgow High School for the 1975–76 school year, and will be expanded at Christiana and Newark High Schools for the 1976–77 school year.

9.2 A Night School Class is Planned

Plans have been formulated to offer an introductory computer education course in the Newark School District Adult Evening School. The course will be offered during the spring of 1976, and will be open to anyone who is interested, including students who might not be able to schedule a computer course during the regular school day.

Because funds for computer time are no longer necessary, the tuition will be minimal. (It has tentatively been set at $16 for the ten-week course.) The course can be conducted at any one of the District high schools.

9.3 Computer-Related Activities are Planned for In-service Days

Several computer-related activities were planned for the secondary half-day inservice sessions. The first was a school-wide program, held on October 21, 1975, at Glasgow High School, where the personnel of each department were

shown the canned programs available and given an opportunity to evaluate them. Informational meetings for the business education and social studies departments of Christiana and Newark High Schools were planned for November, 1975, and a "swap" session for all three high schools is to be held in December, 1975. Additional sessions will be held as the need arises.

10 Evaluation

10.1 Introduction

Because the overall goal of this practicum was to provide a curriculum in computer education for students, and thus utilize the existing computer system at Glasgow High School, the overall success of-the implementation phase was to be evaluated on the basis of the degree of student and teacher involvement in computer education at the school in September, 1975. However, as the practicum progressed, sufficient involvement of students and teachers from Newark High School and Christiana High School has necessitated that data on their involvement also be included.

In addition, an attempt was made at the completion of the practicum to conduct a goal-free evaluation. That is, what was happening in computer education in the District when the practicum started was compared to what is happening now.

Throughout the practicum, formative evaluations were carried out based on task completion, evaluation of workshops by participants, the evaluation of workshop participants, and the evaluation of student performance.

10.2 Participants Evaluate Workshops

Newark District policy dictates that participants are to be given the opportunity to evaluate inservice programs and workshops. Thus, at the conclusion of the computer education inservice courses, each participant was asked to complete the District's *Inservice and Workshop Opinion Survey.* Using this form, participants can rate the various aspects of the program on one to five scale where one is low and five is high. In addition, they are asked to list any strengths and/or weaknesses they observed during the workshop.

Twenty of the twenty-seven participants in the spring computer inservice program returned a completed form. The vast majority of the participants

rated the eleven items on the form above average. That is, they were given a four or five rating. Comments listed under strengths of the workshop included the instructor's knowledge, and sufficient equipment for hands-on experiences. Comments noted under weaknesses included too many participants, and mixing "experts" with people who "know nothing."

Twenty-eight of the thirty participants of the summer workshop returned a completed, form. The responses were similar to those obtained from the spring workshop. The majority of the participants gave nearly all items on the survey sheet a rating of four or five. The single exception was the length of the workshop. A second item which was not rated as high by this group as the spring group was the one asking about "take home" plans. One possible reason for these lower ratings was the composition of the classes. The spring class contained a significant number of mathematics teachers while the summer class did not.

In summary, the overall impression of the workshops by the participants was highly satisfactory, and plans are being made to provide similar offerings during the 1975–76 school year. The complete results of these surveys are contained in Appendix - E1.

10.3 Workshop Participants are Evaluated

During each workshop, each participant was tested to determine his knowledge of hardware utilization and of the BASIC computer language. Testing was conducted by having each participant demonstrate to the instructor, or his designee (usually a participant who had already mastered the skill), his ability to carry out the task. The following is a list of the tasks and the percentage of participants completing each task satisfactorily.

		% Completed	
	Task	*Spring*	*Summer*
1.	Initialize the computer	100%	100%
2.	Use the machine in the immediate mode	100%	100%
3.	Load a program from tape	100%	100%
4.	Save a program on tape		
5.	Write a simple program without branching	100%	100%
6.	Write a simple program with unconditional branching	100%	100%
7.	Write a simple program with conditional branching	100%	100%
8.	Write a simple program with a loop	100%	100%
9.	Write a program which utilizes array variables	78%	63%
10.	Write a program which utilizes string variables	52%	43%
11.	Write a program which utilizes hex codes	37%	33%

Thus, based on the observations made by the instructor, every participant was able to initialize the computer, use it in the immediate mode, load computer programs from tape, save computer programs on tape, and successfully write simple programs in BASIC at the conclusion of the workshop. In addition, many participants, could use more complex commands, and were starting to prepare a computer program which could be used in their own courses. In short, the majority of the participants met the objectives of the workshop.

10.4 Composition of Workshop Participation is Evaluated

One of the implied goals of this practicum was to involve as many people as possible on a District-wide basis. To determine if this goal was accomplished, background data on workshop participants was compiled. Tables 1, 2 and 3 summarize this effort.

Workshop	*M*	%	*F*	%
Spring Computer Inservice	16	59	11	41
Summer Computer Workshop	18	60	12	40
Computer Education Workshop - Phase I	10	83	2	17
Computer Education Workshop - Phase II	11	92	1	8
Glasgow High School Workshop	6	75	2	25
Christiana High School Workshop	5	62	3	37
TOTALS	66	68	31	32

Table 1: Composition of Workshops by Sex

	CHS		GHS		NHS		Other*	
Workshop	#	%	#	%	#	%	#	%
Spring Computer Inservice	5	18	9	33	6	22	7	26
Summer Computer	9	30	11	37	10	33	–	–
Computer Education - Phase I	4	33	4	33	2	25	1	8
Computer Education - Phase II	4	33	4	42	2	17	1	8
Glasgow High School	–	–	8	100	–	–	–	–
Christiana High School	8	100	–	–	–	–	–	–
TOTALS	30	31	37	38	21	22	9	9

* Includes participants from middle schools, elementary schools, Central Administration, and Sterck School.

Table 2: Composition of Workshops by School

Workshop	Bus. Ed. #	Bus. Ed. %	Lang. Arts #	Lang. Arts %	Math #	Math %	Sci. #	Sci. %	Soc. Stud. #	Soc. Stud. %	Other* #	Other* %
Spring Computer Inservice	1	4	1	4	16	59	2	7	2	7	5	19
Summer Computer	3	10	7	23	3	10	3	10	10	33	4	13
Computer Education - Phase I	2	17	–	–	5	42	2	17	1	8	2	17
Computer Education - Phase II	1	8	–	–	7	58	2	17	1	8	1	8
Glasgow High School	–	–	–	–	8	100	–	–	–	–	–	–
Christiana High School	–	–	–	–	8	100	–	–	–	–	–	–
TOTALS	7	7	8	8	48	49	9	9	14	14	10	10

* Includes physical education, administration, industrial arts, elementary education, and foreign language.

Table 3: Composition of Workshops by Subject Area

It can be seen from the preceding tables that members from all three high schools were involved in the training workshops,and in the preparation of the curriculum guide. Further, it can be seen that a significant number of persons representing areas other than mathematics participated. The number of females participating was also encouraging.

Success was not achieved in the attempts made to involve the members of the Hodgson Vocational-Technical High School. This was probably due to the fact that only two staff members (principal and curriculum coordinator) have been appointed to date. With construction problems foremost in their minds, they have little time available to devote to matters pertaining to curriculum. Contact has been maintained, and several teachers who participated in the development of the District Computer Curriculum Guide will be involved when Hodgson's computer curriculum is established.

Thus, while there is still a tendency for computer education activities to be dominated by males and mathematics teachers (especially in the development of the computer curriculum guide), inroads have been made to dispel the thinking that computers should be controlled by males and are only for the mathematics department.

10.5 A Follow-Up Survey of Workshop Participants is Conducted

In order to determine if the computer education workshops made an impact on the participants, a survey was conducted in October, 1975. Each person who attended one of the workshops and who has access to an in-house computer was asked to complete the follow-up survey form. Sixty-four forms were sent out and fifty-seven (eighty-nine percent) were returned.

Questions included in the survey were generally directed toward personal knowledge, instructional applications, and other applications. The majority of the participants who returned the survey indicated they thought they could operate the in-house equipment, explain to another person how to operate the equipment, and write a simple program in BASIC; however, only about fifty percent have actually done so.

In the area of instructional applications, thirty-three percent of the respondents indicated one or more classroom applications were being used. An additional thirty-four percent indicated they were planning to make use of computer applications in the future. Thus, sixty-seven percent have made use, or are planning to make use, of computer applications in their classroom. In addition, sixty-five percent indicated they have discussed computers and their uses in their classrooms, and an additional twenty-four percent indicated they plan to do so.

The number of people indicating they developed computer applications in non-instructional areas was the same as the number indicating instructional uses; however, the applications were less varied, with the majority being grading applications.

In summary, sixty-five percent of the respondents discussed computers in their classroom; thirty-three percent have implemented computer applications in their classrooms; and thirty-three percent have developed non-instructional uses. If the respondents who have indicated they are planning to discuss or use computers follow through, a significant number of workshop participants will have utilized information gained from one of the workshops. (See Appendix - E2 for a summary of survey results.)

10.6 Students in Mini-Courses are Evaluated

As was done with teachers who participated in workshops, students who participated in the mini-course were tested to determine their knowledge of

hardware utilization and of the BASIC computer language. Testing was carried out by having each student demonstrate his ability to carry out the task. The following is a list of the tasks and the number and percentage of participants completing each task satisfactorily.

	Task	*Number*	*%*
1.	Initialize the computer	43	100%
2.	Use the machine in the immediate mode	43	100%
3.	Load a program from tape	43	100%
4.	Save a program on tape	42	98%
5.	Write a simple program without branching	42	98%
6.	Write a simple program with unconditional branching	38	88%
7.	Write a simple program with conditional branching	29	67%
8.	Write a simple program with a loop	36	84%
9.	Write a program which utilizes array variables	12	28%
10.	Write a program which utilizes string variables	14%	33%
11.	Write a program which utilizes hex codes	19%	44%

As can be seen from the list, all students demonstrated the ability to initialize the computer, use it in the immediate mode, and load specific programs. The majority of the students also demonstrated the ability to write and execute simple programs.

Students were less successful when the more sophisticated commands were presented; however, this Was probably due to their inadequate mathematical background. This was particularly noticeable in their inability to easily master the ideas behind array variables. More success was seen with the use of hex codes. The novelty of being able to control the curser on the cathode ray screen may possibly have contributed to this.

Overall, however, the mini-courses served their initial purposes. Students were made aware of the capabilities of the computer system, and they

demonstrated the skills necessary to utilize it.

10.7 A Follow-Up Student Survey is Conducted

Students who participated in the mini-courses, and those who completed the summer course, were surveyed in October, 1975, to determine if they were utilizing the knowledge acquired. The survey was conducted by inspecting the class lists for Computers I and Computers II at Glasgow High School to see how many had signed up for a formal course, talking with the students, and contacting staff members who might be utilizing their services.

The class lists indicated that twelve of the forty-three students had signed up for Computers I and/or Computers II: Four had signed up for Computers I only; two had signed up for both courses; and ,six had signed up for Computers II. In addition, nine students have indicated they intend to sign up for one of the courses next year. One student who participated in the mini-course also completed the summer course. Thus, thirteen students, or thirty percent of the mini-course participants, are participating in formal courses, and twenty-one percent have indicated they plan to do so in the future.

Three summer participants and two mini-course participants are acting as student aides to the guidance counselors responsible for introducing students to the guidance package on the time-sharing terminal. Two of the summer participants are at Newark High School, while the two Glasgow High School mini-course participants are also among those who have signed up for formal courses this year.

Five students (two who were previously included as participating in a formal course this year) are currently working on a project for two social studies teachers in which they are attempting to analyze data for an economics class. Three others are preparing demonstration programs for four science teachers who are team teaching an introductory science survey course. In addition, nearly all the students who are currently enrolled in a mathematics course indicated that they are doing some programming in these courses.

Thus, of the fifty-one students who participated in a mini-course and/or the summer course, eighteen, or thirty-five percent, are actively engaged in a formal course and/or an assistant role. In addition, others have indicated they plan to participate at a later date, or are currently using their knowledge in their current mathematics courses. Therefore, it seems safe to conclude that a group of knowledgeable and interested students now exists.

10.8 A Computer Curriculum Guide is Produced and Accepted

One of the major goals of this practicum was to produce a District Computer Curriculum Guide. As indicated previously, this was completed in July, 1975. The guide has been endorsed by the Director of Instruction of the Newark School District as indicated by his signature on the Foreword, and has been distributed to all members of the business education, mathematics, science, and social studies departments of each-high school. In addition, administrators and members of other departments who participated in computer education workshops also received a copy.

10.9 Action is Taken on Recommendations and Long-Range Plans

The recommendations and long-range hardware implementation plans generated by the committee working in the spring were well received and action has already been taken on many of them. One measure of success in this area is the amount of money spent by the Newark School District for computer-related activities: $7,300 has been spent for workshops; $12,000 for time-sharing terminals; and $71,000 for in-house computers, for a total of $90,300. In addition, $35,000 was previously spent for the in-house computers at Glasgow High School.

Thus, with the hardware on hand, recommendations are being accepted relative to establishing courses and involving computers in the curriculum. School level personnel now view computer education as being here and now, and not something which would be "nice for the future."

10.10 A Summary of "What is Happening Now" at Glagow High School Is Conducted

In the curse of determining what effect the mini-courses and workshops had on students and teachers at Glasgow High school, an attempt was also made to ascertain the scope of current computer-related activities. In October, 1975, two days were scheduled for an on-site school visitation to accomplish this task. During the visitation, conversations with administrators, teachers, and Students produced the following composite list of current activities:

1. Three sections of Computers I with an enrollment of seventy-two;
2. Two sections of Computers II with an enrollment of thirty-seven;
3. Five students serving as aides to the guidance counselor responsible for introducing students to the computerized guidance package;
4. Eleven teachers using a computerized grading system. Several others indicated they are going to convert to a computerized system.
5. Three mathematics teachers using the computers for tutorial drills in the basic skills classes. These same teachers also use the computerized games as a reward for students who satisfactorily complete their work.
6. One mathematics teacher teaching computer programming to a basic mathematics skills class as an enrichment topic.
7. The baseball coach utilizing a program which updates-the team statistics after each game.
8. The agriculture teacher using the computer for CAI and testing in the area of plant identification.
9. The German teacher and the French teacher each corking on a CAI program for the study of vocabulary and sentence structure.
10. Physics students using the computer as a problem-solving tool.
11. Biology students utilizing statistics programs in connection with yeast growing experiments in two biology classes.
12. Mathematics students (all levels), using the computer as a problem-solving tool.
13. Social studies students preparing computerized simulations for a project.
14. Business education students in the Business Machines course being exposed to the computer.

In addition, many staff members and students indicated that they are planning additional activities; however, these were'not included in the previous list as the intent was to determine what, was actually happening. Thus, it seems reasonable to conclude that many computer activities are, being carried out and the in-house equipment is being utilized extensively.

10.11 Comparison of the Past to the Present

From 1968 until 1974, the Use of computers for instructional purposes, with one exception, was limited to a single time-sharing terminal in each high school. The exception was during the 1968–69 school year, when additional back-up equipment was installed in the high schools, and some CAI activities took place in one middle school and one elementary school when Federal funding was available. During this period, the student-terminal ratio was approximately 1800 to 1.

During the 1974–75 school year, four in-house computers were installed in Glasgow High School, and terminals were maintained in the other two high schools In 1975, Christiana High School and Newark High School each received four in-house computers, and two additional time-sharing terminals were installed. Thus, the present student-terminal ratio is approximately 300 to 1. The literature indicates a maximum ratio of 500 to 1 to successfully implement a computer education program, and it is anticipated that the program initiated during the course of this practicum car be maintained. Further, since the financial effort has largely been at the local level, the problem of program curtailment due to the expiration of external funding has been by-passed.

A comparison of the numbers and types of persons involved, over the years also indicates that computer education has become firmly established. Before 1974, the use of computers was basically limited to applications made by mathematics and science teachers, and limited to high school students. During the past year, this has been expanded to include students of all abilities and teachers of many disciplines. Thus, through hardware acquisition and student and staff training, the Newark School District has reached the point where a meaningful computer education program can be maintained.

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. . . giant step has been taken, and the transition will be smoother and more orderly as the District moves toward a more refined program of computer education.