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The integration of computers at Pinelands High School:

A case study

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SAMEVATTING

Integrasie van rekenaars te Pinelands High School: ‘n Gevallestudie

‘n Skripsie deur

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Hierdie projek ondersoek die integrasie van rekenaargesteunde onderwys te Pinelands High School. ‘n Literatuurondersoek is uitgevoer oor die definisie van, die infrastruktuur vir en die modelle van die integrasie van rekenaargesteunde onderwys. ‘n Nuwe model, die Ewolusiemodel, vir die fases van rekenaargesteunde onderwys is ontwikkel.

Rekenaargesteunde onderwys te Pinelands High School word gemeet in terme van die nodige infrastruktuur en die vyf fases van die Ewolusiemodel. Die skool het rekenaargesteunde onderwys geïntegreer en baie van die onderwysers is betrokke by die tweede fase van die Ewolusiemodel. In die integrasie van rekenaargesteunde onderwys gee die personeel van Rekenaar- en Wiskundedepartemente die pas aan.

Aanbevelings vir verder integrasie en verbeterde infrastruktuur word gemaak.

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ABSTRACT

The integration of computers at Pinelands High School: A case study

This project investigated the integration of computer-assisted education at Pinelands High School. A literature search was done on the definition of, the infrastructure for and models of, the integration of computer-assisted education. A new model, the Evolutionary Model, of computer-assisted education was developed,.

Computer-assisted education at Pinelands High School was measured in terms of the necessary infrastructure and the five phases of the Evolutionary Model. The school has integrated computer-assisted education and many of the teachers are involved at the second phase of the Evolutionary Model. The staff of the Computer and Mathematics departments are ahead of the general staff in the integration of computer-assisted education.

Recommendations for further integration and improved infrastructure were made.

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CHAPTER 1

INTRODUCTION

Pinelands High School purchased its first computer, a BBC, in 1983. By 1996 the computer room had 21 networked computers. The school, like many other schools, is proud of its computer department supported mainly by the school's own funds.

Parents at Pinelands High School and parents elsewhere ask how many computers a school has, not what is done with them. Schools report to their parent bodies the number of computers they own (Rieber, 1994, p.4) but rarely how the computer is integrated into and supports learning.

Schools have finite resources and cannot afford to squander those resources through poor management or utilisation. Planning for the effective use of computer-assisted education is crucial if scarce resources are to be used effectively (Department of Education, 1996a, p.57).

In the light of the uncertainty within education, the resources of staff and funds must be well utilised. Funders of education in general, and of education at Pinelands High School, wish to see their funds being well used, especially in an 'expensive' resource such as computer-assisted education.

1 Research question

As a result of the funding and staffing factors the necessity arose to investigate the main research topic successful computer integration particularly to answer the question:

How effectively is Pinelands High School integrating computer-assisted education and what infrastructure is required?

This question can be refined by the following subquestions:

1. What is computer-assisted education?
2. What models exist to describe the integration of computer-assisted education?
3. What infrastructure is necessary to support computer-assisted education?
4. Where is Pinelands High School on the model of the integration of computer-assisted education?

2 Research plan

Numerous sources were consulted on the topics of defining computer-assisted education, information about the necessary infrastructure for computer-assisted education and models on the integration of computer-assisted education.

Print material in the form of journal articles, electronic mail postings to the Internet mailing lists of *Kidsphere, Ednet, Edtech* and *ITForum*, the World Wide Web and books were consulted in the literature search for material on defining computer-assisted education, the prerequisite infrastructure and models on the integration of computer-assisted education.

A quantitative perspective to the research topic of the integration of computer-assisted education at Pinelands High School was necessary. A questionnaire was devised to measure the use of the computer in teaching and lesson preparation, ownership, training and decision-making policies, i.e. anything which could support or detract from computer-assisted education and the level of computer usage at Pinelands High School. Data was collected by interviews and observation to supplement data from questionnaires. The method of data collection is tabulated in Table 1.1.

The research is of a mixed qualitative and quantitative nature where the quantitative data is used to support observations. The subjects of the study are the teaching staff at Pinelands High School and the infrastructure of the school and the computer department. The data is reported by means of tables, charts and text. The opinions of leading stakeholders in computer-assisted education at Pinelands High School were canvassed to assist in the triangulation of data. The data collection took place at Pinelands High School during August and September 1996.

Table 1. 1 Data collection method

QUESTION	PRINT	INTER-VIEW	QUESTION-NAIRE	OBSER-VATION
1. What is computer-assisted education?	✓	✓		✓
2. What models exist to describe the integration of computer-assisted education?	✓			
3. What infrastructure is necessary to support computer-assisted education?	✓	✓		✓
4. How does the infrastructure to support computer-assisted education at Pinelands High School compare with the literature?	✓	✓		✓
5. Where is Pinelands High School on the model of the integration of computer-assisted education?		✓	✓	✓

3 Organisation

This mini-thesis is organised into six chapters.

Table 1. 2 Organisation of the thesis

CHAPTER	CONTENTS
1. Introduction	Introduction and statement of the problem
2. Literature review	Defining computer-assisted education and the infrastructure necessary for the integration of computer-assisted education, and developing a model for describing the integration of computer-assisted education based on the literature.
3. Research methodology	Description of research instruments
4. Findings	Description of the integration of computer-assisted education at Pinelands High School
5. Synthesis	Synthesis of the model of the integration of computer-assisted education and the findings at Pinelands High School
6. Conclusion	Summary of project and recommendations for further research

4 Value of the research

Pinelands High School has managed to reach a certain level of integration of computer-assisted education with the finite staff and monetary resources at its disposal. This study is a snapshot of computer-assisted education at the school towards the end of 1996.

With even further education staffing and monetary limitations envisaged from 1997 in South African education it is vital to note what infrastructure is necessary for the integration of computer-assisted education, and at what phases of the integration. It will be valuable to examine the situation at Pinelands High School and note the infrastructure at that school and its level on the model of the integration of computer-assisted education.

CHAPTER 2

LITERATURE REVIEW

The aim of this literature survey is to give an overview of the literature in the field of the integration of computer-assisted education. A synthesis of the literature is done to develop a model against which the integration of computer-assisted education at Pinelands High School can be measured.

1 Integration of computer-assisted education

1.1 Introduction

When computers are used in education they are more than just another medium of teaching, such as a chalkboard. The integration of computers changes the whole ecology of a school, for example, funding, teaching methodology, evaluation, curricula and timetables (Lippert, 1993, p.5). The integration of computer-assisted education is a development which influences all the stakeholders in education (Anderson, 1996; McKinsey, 1996). As computers are introduced, certain supporting factors contribute to specific outcomes which impact on other sustaining factors. The integration of computer-assisted education will produce an effect on all the stakeholders at different phases of the process of integration.

1.2 Defining the integration of computer-assisted education

Integrating the computer in education means using the power and ability of the computer to aid learning in every subject area within the school (Dudley, 1980, quoted in IFIP, p.14). The integration of computer-assisted education means using the computer as a tool to teach subject matter, and to promote problem-solving and higher-order thinking skills (IFIP, 1993, p.14). The power of the computer is applied

to facilitate decision-making, to amplify concepts and to support synthesizing of information (IFIP, 1993, p.14).

The integration of computer-assisted education is neither computer literacy nor computer awareness. It means using the computer where it is the best medium to support the learning goal (Anderson, 1996; Apple Computer, Inc., 1992, p.3). It involves changes in a school. The entire school community of students, parents, teachers and administrators has to accept that computers are a part of everyday school life (Kearsley, 1992, p.iii).

Integrating computer-assisted education implies a move towards a different kind of teaching, a whole-school awareness which looks at the following (IFIP, 1993, p.15):

- aims of general secondary education
- meeting new demands of society in students skills
- reforming the curricula
- training teachers in new skills
- internal school organisation
- hardware provision and maintenance
- stabilizing of funding policies
- support by technical staff
- equity of access for all students
- software development and provision
- development and provision of complementary materials
- copyright policies for software

Thus, if one accepts that integration represents the means to combine the above-mentioned factors into a whole and to make it part of a larger unit, then it implies that there has to be consensus between the stakeholders. All the stakeholders in education have to reach basic consensus regarding the organisation and setting of goals. In order to reach this consensus, the criteria for integration and organisation have to be agreed upon and followed by the stakeholders. In order to integrate technology, schools have to exploit that technology for the betterment of themselves and their students (Mecklenburger, 1989, p.6) and computers form a part of that technology.

Successful integration takes place when technology becomes invisible or transparent and both the teacher and students can concentrate on the content of the course, thus making it possible for students to use computers in the natural flow of classroom activities (Brunner, 1990, p.12; Partee, 1996, p.79; Rieber, 1994, p.17; Smith, 1995, p.8). The impact that computers make in the classroom depends on their availability and upon the ways in which they are used (Morrison, 1989, p.4). In other words, the impact of the computer depends on the developmental level of the school in respect of computers.

2 Models of the integration of computer-assisted education

2.1 Introduction

Any model for integrating computer-assisted education at school level must take cognisance of the form of education of the school, for example: the method of teaching being group work or lecture; exam orientated or continuous assessment; goals and remuneration.

The author uses three developmental models of integrating computer-assisted education to develop a single standard from which to discuss the integration of computer-assisted education and the resulting changes at Pinelands High School. These three models describe the different phases of the introduction of computer-assisted education. The outcome and the support factors which contribute to development differ in each phase of the models.

The models differ because they have different goals:

- In the **Apple Classrooms of Tomorrow (ACOT) Model** the goal is to provide insights into how technology would affect teaching and learning (Fisher, 1996, p.2).
- In the **CAMI Mathematics Model** the goal is to introduce computers gradually into the school, taking cognisance of the educational task to be performed and

the teachers' capabilities at each stage, matching the hardware with the software deployed at each stage (Vorster, 1996).

- In the **Make It Happen! (MIH) Model** the goal is to integrate technology into the curriculum to meet the needs of all students.

2.2 Apple Classrooms of Tomorrow Model

A widely noted model (Dwyer, 1991, p.49; Kearsley, 1992, p.150) is the **Apple Classrooms of Tomorrow (ACOT)** project illustrated in Table 2.1. This project involved thirty-two teachers and 650 students working in technology-rich **ACOT** K-12 (from grade school to matriculation) classrooms in the United States of America. The project documented the course of instructional change in those classrooms from 1985 to 1990 when it began publishing its findings. An aim of the project was to document how learning and teaching change in technology-rich environments, what factors inhibit the changes and what support is needed to effect fundamental and sustainable change (Apple Computer, Inc., 1992, p.4).

The **ACOT Model** was selected as it is a model for which there is a large data collection. It follows the changes which take place when the students and staff have constant access to the relevant technology. There does not appear to have been any deliberate direction except to provide technology and to note what happens in the class.

The **ACOT Model** involved parents, students, teachers, administrators and volunteers. This project has produced an evolutionary model of the integration of technology-intensive classrooms divided into five phases, i.e. Entry, Adoption, Adaptation, Appropriation and Invention (Dwyer, 1991, p.49) illustrated in Table 2.1.

The first phase in the **ACOT Model** is the Entry Phase where computers are installed and teachers start using the technology. The staff are initially unsure of the technology and, when they have confidence, mainly use the computers for text-based work. The method of teaching remains what it was in a traditional school, mainly lecture, recitation and seatwork instruction.

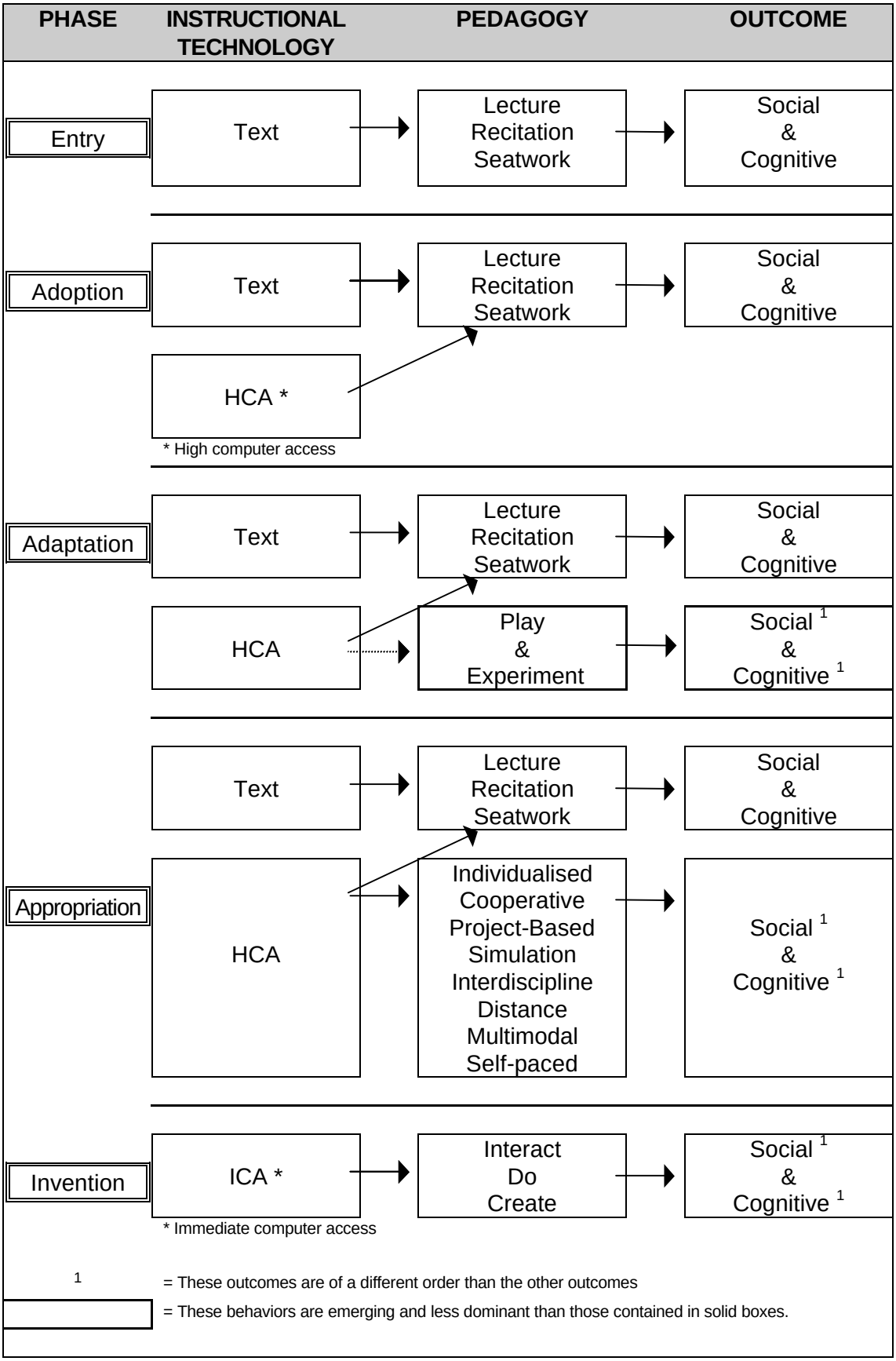
During Phase 2 of the **ACOT Model**, Adoption, the computer is used to support traditional text-based instruction using drill-and-practice or word processing applications. There is high computer access but the students receive whole group instruction via lectures, recitation and seatwork.

In Phase 3, Adaptation, the computer has been integrated into classroom teaching. There is high computer access in the form of word processor, database, spreadsheet and graphics applications. Classroom teaching is still in the form of lecture, recitation and seatwork instruction. There has been a change in the social and cognitive outcome of classroom instruction. Students use the computer for play and experimentation. This phase continues the lecture, recitation and seatwork mode of instruction. The computer is used to support classroom instruction but the students are encouraged to be creative.

The Appropriation or Phase 4 of the **ACOT Model** is a continuation of the previous three phases. The changes hinge on the teachers' mastery of the computer technology. High computer access supports lecture, recitation and seatwork instruction but the teachers' computer experience facilitates creative activities in collaborative work. Cooperative interdisciplinary projects are created, as well as multimodal, self-paced and individualised work. The school timetable is changed to accommodate enthusiastic teachers. Social interaction changes from that of the first phase.

In the final Phase 5, Invention, of the **ACOT** instructional evolutionary model the students have intensive computer access. Learning is something the students create or do. There is much interaction between the students and teachers who collaborate in the construction of knowledge. The type of learning has totally changed from that in the first Entry Phase.

Table 2. 1 ACOT instructional evolution in technology-intensive classrooms (from Dwyer, 1991, p.49)



2.3 CAMI Mathematics Model

Vorster (1995) of **CAMI Mathematics** has a different developmental model. The model is divided into three phases: Knowledge Retention, Knowledge Processing and Knowledge Expansion, illustrated in Table 2.1. This model was based on the running of a commercial computerised mathematics school since 1984 and the implementation of software and methodology in more than 200 schools by 1996 (Vorster, 1996).

This model was selected as it is South African where the educational emphasis has been the retention of information. The focus of this model is not on technology as in the **ACOT Model**, but on teachers, hardware, software and examination results. In this model there is individualised seat-based learning in the initial phase with the emphasis on improving the retention of knowledge, as is found in most South African schools.

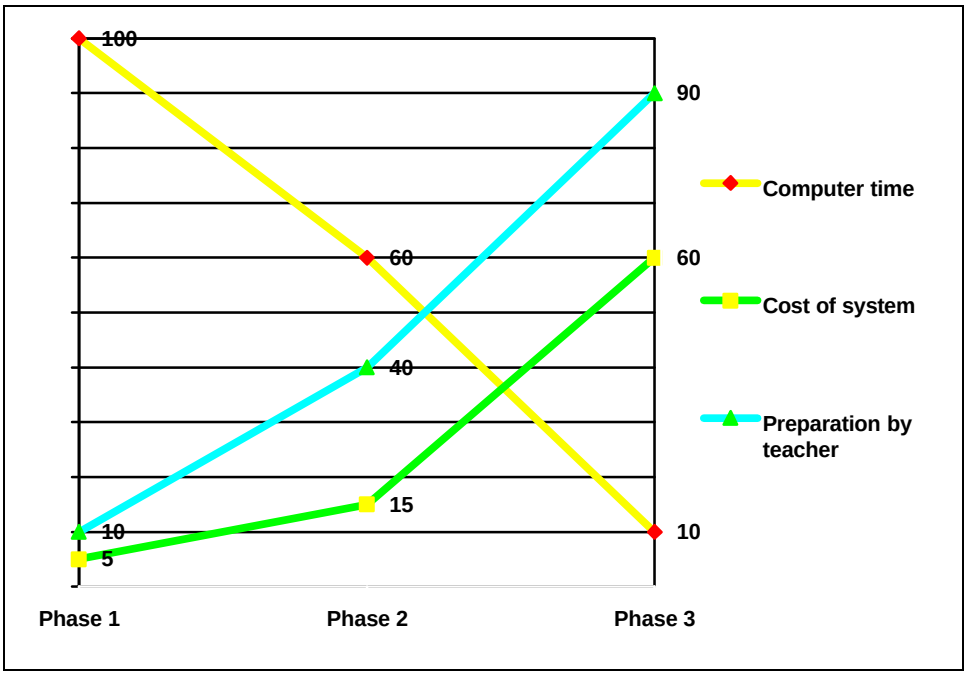
According to Vorster (1996) all three phases of the **CAMI Mathematics Model** must be covered before you have a fully computerised school. Phase 1 is concerned with Knowledge Retention and does not require sophisticated hardware or software. The work done is mainly of a drill-and-practice nature which does not require much computer knowledge on the part of the teacher. Phase 2, concerned with Knowledge Processing, requires hardware sufficient to run a number of packages such as word processors, spreadsheets and databases. That hardware could be of the level used in the preceding phase. Planning as well as preparation would be required from the teacher. Computer application knowledge would be essential, although it could be of a basic level. Phase 3, Knowledge Expansion, would require more technology, hardware and software, and greater teacher computer skills than the previous two phases. The teacher would also require greater planning, organisational, technical and application knowledge.

Table 2. 2 CAMI Mathematics Model of the integration of computer-assisted education

PHASE	USE MADE OF COMPUTER	TYPE OF HARDWARE AND SOFTWARE	ROLE OF TEACHER
1. Knowledge Retention	Cements recently taught subject matter using • drill-and-practice	Needs • mono screen monitor • 1 MB of RAM • one dot-matrix printer • networked system • drill-and-practice program, for example *CAMI Mathematics*	Needs little • involvement • supervision • computer knowledge
2. Knowledge Processing	Takes existing knowledge and reprocesses it using • word processor • databases • spreadsheets	Same as above with addition of • ink-jet printer • suite such as *MSWorks for DOS* • DOS based desktop publisher • testing program such as *Study Aid*	Needs • planning • preparation • teaching tasks using existing applications • computer application knowledge
3. Knowledge Expansion	Exposes students to new and unknown topics using • CD-ROM • multimedia • new technologies	As above plus • at least one multimedia computer with CD-ROM in each computer room	Needs • lesson preparation • planning and organisational skills for cooperative learning groups • technical computer knowledge • computer application knowledge

As a school is always getting new students and new teachers the first phase must continue simultaneously alongside phases two and three,. The first phase of Knowledge Retention must *also* simultaneously be used for drill-and-practice and assisting students to retain information (Vorster, 1996). There must be sufficient venues and computers for all three phases to take place simultaneously. The three phases have different hardware, software, time and usage requirements as illustrated in Figure 2.1

Figure 2. 1 Graph to depict access time of the student, the effort required by the teacher in preparation of course material and overall cost of the system through the three phases of computerisation (from Vorster, 1996)



The **CAMI Mathematics Model** as seen in Table 2.2 focuses mainly on the teacher's capabilities, hardware and software requirements for each phase of the model and providing effective time for a large number of students on the computers (Vorster, 1996). Figure 2.1 depicts the relationship between computer time, the cost of the computer system and the preparation by the teacher in the different phases of the integration of computer-assisted education using the **CAMI Mathematics Model**. In the **CAMI Mathematics Model** the development of integrating computer-assisted education can be halted by not purchasing the hardware and software necessary for the next phase.

2.4 Make It Happen! Model

The **Make It Happen! (MIH) Model** focuses on the curriculum and the integration of technology to promote school change by developing a positive attitude towards learning; and by implementing a curriculum which supports inquiry-based learning.

According to the model the school aims to move forward to collaborative planning and teaching that fosters higher-order thinking in adolescents. The goals set in the model (Zorfass, 1991, p.69) are for

- interdisciplinary teams of teachers to design, implement and evaluate a curriculum that uses computers to support inquiry-based learning;
- adolescents to expand their critical thinking abilities, cooperative learning behaviours and positive attitudes towards learning by engaging in the curriculum which would have been developed above; and
- principals and school-based management teams to create a supportive context that facilitates computer integration.

The **Make It Happen! Model** was selected as technology is deliberately integrated into the curriculum. This has happened in selected subject departments at Pinelands High School.

Table 2. 3 Make It Happen! Model of the integration of technology into the curriculum

Step 1 (1st Year)	**Theme: Build a strong foundation for innovation** **Curriculum component** Teachers and administrators • evaluate school's curriculum goals • begin a process of curriculum revision • select topics which could be studied in an interdisciplinary inquiry based unit which integrates computers • begin to form a shared vision of successful technology integration **Teacher development component** Teachers • learn about software that can enhance inquiry-based learning • evaluate software • receive training with applications suitable for potential use **School-based facilitation component** Principal • identifies participants for the MIH team
Step 2 (1st and 2nd Year)	**Theme: Initiate with a small group of pioneer teachers** • work continues as in 1st Year • MIH team meets regularly to discuss problems, plan and make decisions
Step 3 (2nd Year)	**Theme: Expand to whole school** • pioneer team continues to design, implement and evaluate curriculum units • more teams of teachers follow pioneer group's example • pioneer teachers mentor members of expansion teams • MIH team changes composition to give representation to expansion team

The model has three components - the curriculum, the teacher development and the school-based facilitation components. The model is implemented over a two year period in three steps, starting with a small group of teachers who pioneer the innovation in their school and draw in other teams, as illustrated in Table 2.3.

In Step 1 teachers and administrators evaluate the school's curriculum goals and begin a process of curriculum revision. They select topics which could be studied in an interdisciplinary inquiry-based unit which integrates computers and begin to form a shared vision of successful technology integration. Teachers learn about software that can enhance inquiry-based learning, evaluate software and receive training to become fluent with applications suitable for potential use. The principal identifies participants for the **Make It Happen!** team.

In Step 2 of the **Make It Happen! Model** the work initiated with a small group of pioneer teachers in the first year continues with the pioneer team meeting regularly to discuss problems, plan and make decisions.

In Step 3 of the **Make It Happen! Model** the pioneer team continues to design, implement and evaluate curriculum units; more teams of teachers follow the pioneer group's example and the pioneer teachers mentor members of expansion teams. The **Make It Happen!** team changes its composition to give representation to an expanded team.

3 Models synthesized

The three models selected have different features which are of relevance to the investigation of computer-assisted education at Pinelands High School.

Reasons for selection as a model:

- The **ACOT Model** was selected for the investigation as Pinelands High School seemed to have all the software and hardware it needed. Unlike the teachers in South Africa, the **ACOT** teachers appeared to have freedom of teaching material and methodology. The most compelling reason for selecting this model was that technology was not forced on the **ACOT** schools nor was it forced on the

Pinelands High School staff. The integration of computer-assisted education *evolved* in both situations.

- The **CAMI Mathematics Model** was selected as it emphasises results as do many South Africa schools. In addition to the results-focus the model *slowly* integrates computer technology as improved hardware and software are obtained and teachers develop expertise. It was thought that that was what was happening at Pinelands High School.
- The **Make It Happen! Model** was selected for the investigation as in this model teams expand, bringing in other departments/teams as the original team gains confidence. This appeared to be happening at Pinelands High School.

3.1 Synthesis of the three models into one integrated model, the Evolutionary Model

The author has synthesized the three models into one new **Evolutionary Model** to facilitate the examination of computer-assisted education at Pinelands High School. All three models were selected as each has aspects which are valid for an investigation into the integration of computer-assisted education at the school. They have been synthesized as each has a dominant feature common to the situation at Pinelands High School.

3.2 Prerequisite infrastructure of the Evolutionary Model

The support infrastructure below forms the foundation of the new **Evolutionary Model** of the integration of computer-assisted education and contributes to its success (Apple Computer, Inc., 1990-1992; Becker, 1993, p.7; Brunner, 1990, p.14; Dyrli, 1994; Kearsley, 1992; Stager, 1995, pp.80, 81; Vorster, 1995; Zorfass, 1991, 1993; correspondents from the mailing list *Kidsphere* and the newsgroup *za.school*). They do not fit into any particular part of the **Evolutionary Model** but underpin the whole development.

The staff should be

- able to practise using the computer out of class;

- enabled to use the computer as a personal tool;
- given time in school for training and research;
- involved and play an active role from the design and planning stage to the evaluation stage (Anderson, 1996; Carl, 1995, p.244);
- financially assisted to purchase their own computers to use at home;
- financially assisted to purchase the same software as that being used at school;
- provided with access to program-expertise when necessary;
- provided with loaned computers for home usage; and
- encouraged to share enthusiasm and celebrate initiative.

The school should

- allocate resources prudently - it should initially focus on a few successful classrooms, teachers or subjects (Lippert, 1993, p.5);
- eliminate technical obstacles with technical staffing and enough financial planning;
- involve the principal, school management team and support staff as well as teachers (De Klerk, 1995);
- practice what it preaches with regard to learning theory, i.e. train the staff in the method/theory being used in the classroom;
- make technology and computers part of their overall planning to increase student learning (Morrison, 1996);
- introduce a system of ‘buddies’ where enthusiastic staff are partnered with those who are reluctant to use technology (Frers, 1996);
- provide adequate resources for the desired outcomes;
- take cognisance of the school’s dominant teaching/learning style, for example, whether it uses the traditional ‘factory’ approach or cooperative group work (De Klerk, 1995);
- provide time for joint decision-making and planning (Carl, 1995, p.244);
- select software with broad usage; and
- share the vision and goals of computer-assisted education (O’Neil, 1995b, p.11).

Community involvement and private sector support can be a useful help factor (De Klerk, 1995) which can be gained

- by means of communicating success and problems; and by

- offering training sessions using the school's facilities (Carter, 1996, p.29) on current market applications.

The **Evolutionary Model** was divided into five phases in the successful introduction of computer-assisted education, i.e. Introduction, Entry, Intermediate, Penultimate and Creation. The outcomes in each phase of the development and the infrastructure supporting those outcomes, were noted. Supporting factors are complementary to and sustain these outcomes. The outcomes and supporting infrastructure listed in Tables 2.4 to 2.8 are those of the **Classrooms of Tomorrow Project (ACOT)** (Apple Computer, Inc., 1990-1992), **CAMI Mathematics** (Vorster, 1995, 1996) and **Make It Happen!** (Zorfass, 1991, 1993) models, unless otherwise specified.

The different phases of the **Evolutionary Model** do not have a particular time limit and individuals will be at different phases in their personal computer-assisted integration development (Carter, 1996, p.32). This development takes time because it involves people, skills, attitudes, beliefs (Lippert, 1993, p.5), organisation and finance.

4 Development phases in the integration of computer-assisted education in the Evolutionary Model

4.1 Phase 1: Introduction

In the first of the five phases of the successful introduction of computer-assisted education, the technology is introduced into the school, for example, computers, network system and modems are installed. Time is spent checking if they work and how they work. Plans are drawn up and training begins. Teachers may spend time trying to teach with the computer by doing simple work.

Table 2. 4 Outcomes and infrastructure which contribute to the successful integration of computer-assisted education in Phase 1: Introduction

OUTCOMES
Instructional activity • Computer use replicates traditional instructional and learning activities **Teacher interaction** • Identification of a steering or organising committee • Training of the teachers begins with word processing **General school** • Installation of the computers and complimentary technology, such as network systems, modems and telephone lines
SUPPORT INFRASTRUCTURE
Technical assistance • in the installation of the computers and complimentary equipment **Time to** • define the purpose of integration of computer-assisted education • develop shared vision with non-participant colleagues • plan in task teams • share frustrations and successes • train **Training** • in word processing

The most crucial supporting factors here are the communication of enthusiasm and sharing the vision of a different kind of education or methodology. In this phase tabulated in Table 2.4, the planning and sharing of the vision are prerequisites which contribute to the successful integration of computer-assisted education (Knoetze, 1996). This phase may appear to be time-consuming but it is the foundation on which the integration rests.

4.2 Phase 2: Entry

In Phase 2 of the five phases of the integration of computer-assisted education, teachers start using the equipment. The computer is used mainly to support classroom instruction by means of drill-and-practice instruction or text-based work (Apple Computer, Inc., 1990-1992; Vorster, 1995). If a teacher needs support it is mainly of a technical nature whilst doing simple computer tasks.

During this phase, while completing simple computer tasks with the aid of technical support, the teachers lose their fear of the technology. In both **ACOT**'s evolutionary

model and that of **CAMI Mathematics** the computer is used mainly in whole-class instruction and individualised seat-work (Apple Computer, Inc., 1992; Vorster, 1995) as tabulated in Tables 2.1 and 2.2. There is little change in classroom layout. Computer lesson work supports a predominantly behaviouristic approach to learning. The teacher needs to develop discipline strategies appropriate for the new classroom dynamics. Table 2.5 tabulates the support infrastructure which facilitates relatively stress-free and successful outcomes in the integration of computer-assisted education in Phase 2.

Table 2. 5 Outcomes and infrastructure which contribute to the successful integration of computer-assisted education in Phase 2: Entry

OUTCOMES
CURRENT OUTCOMES **Instructional activity** • Computers are used mainly in drill-and-practice or text-based work • Established teaching methods and activities are supported by computer technology **acher interaction** • Stress levels of teachers are kept low with basic skill computer work • Teacher interactions are mainly of a technical nature • Technical assistance is given to teachers • Training of educators begins initially in word processing **NEW OUTCOMES** **Instructional activity** • Technical assistance is given to students
SUPPORT INFRASTRUCTURE
CURRENT SUPPORT INFRASTRUCTURE **Time to** • share frustrations and successes • train **Training** • in word processing **NEW SUPPORT INFRASTRUCTURE** **Technical assistance to** • develop teachers' confidence • develop teachers' use of hardware • facilitate students' use of computers **Time to** • evaluate outcomes (Kearsley, 1992, p.153) • share vision and enthusiasm **Training in** • word processing in subject area

4.3 Phase 3: Intermediate

In Phase 3 of the integration of computer-assisted education, teachers and students use the computer as a tool. The word processor, database and spreadsheet are the main packages used. The students' computer work is completed more quickly than previously and the quality improves.

The role of the teacher changes to become more of a facilitator as opposed to being the focus of the instruction. Classroom interaction with students changes from technical assistance to sharing instructional strategies. Teachers move beyond drill-and-practice and text-based work to work of a more creative nature as they develop expertise in the medium. Teachers experiment with different computer applications. They investigate teaching strategies for problem-solving and higher-order learning. Physical classroom arrangements are made to optimise classroom space. There is a desire by teachers for more sophisticated hardware.

Table 2. 6 Outcomes and infrastructure which contribute to the successful integration of computer-assisted education in Phase 3: Intermediate

OUTCOMES
NEW OUTCOMES **Instructional activity** • Role of teacher gradually changes from instructor to facilitator • Students' work is done more quickly and quality improves • Students are motivated • Students peer tutor • There is a move from text-based instruction and drill-and-practice to word processors, databases, spreadsheets and graphics **Teacher interaction** • Collaboration on instructional topics between teachers • Teachers observe fellow teachers' classes **General school** • Curriculum is modified to make use of the different technologies • There is a desire for new technology (Musco, 1995, p.68)
SUPPORT INFRASTRUCTURE

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SUPPORT INFRASTRUCTURE
CURRENT SUPPORT INFRASTRUCTURE **Technical assistance to** • develop teachers' confidence • develop teachers' use of hardware • facilitate students' use of computers **Time to** • evaluate outcomes • share frustrations and successes • share vision and enthusiasm • train **Training in** • team teaching • word processing in subject area **NEW SUPPORT INFRASTRUCTURE** **Time to** • discuss instructional strategies • permit mentoring between teachers (Lyndes, 1995) • permit peer observation • permit team teaching **Training in** • databases, spreadsheets and graphics in subject area

4.4 Phase 4: Penultimate

Many changes in instructional strategies occur during the Penultimate phase of the integration of computer-assisted education tabulated in Table 2.7. Team teaching develops as a result of peer observation. Collaboration occurs as teachers share new instructional patterns and methods. The school timetable is juggled in order to accommodate team teaching. The teachers' organisational skills have to be well developed for the newly formed student groups. Much computer knowledge is needed from the teacher, i.e. technical and application skills. The teacher's role in the learning process is one of facilitator or collaborator rather than instructor.

Students get involved in collaborative and creative project work. Cooperative and group learning takes place. Many different packages are used during collaborative and creative project work rather than single computer packages. The computer packages are used as knowledge-building tools to support a growing constructivist approach to learning. With the constructivist approach to learning student grouping changes from homogeneous grouping to heterogeneous grouping or mixed ability grouping. New and better technology is required by the teaching staff.

Table 2. 7 Outcomes and infrastructure which contribute to the successful integration of computer-assisted education in Phase 4: Penultimate

OUTCOMES

CURRENT OUTCOMES

General school

- Curriculum is modified to make use of the different technologies
- Desire for new technology and better technology
- Students are motivated
- Students peer tutor

NEW OUTCOMES

Instructional activity

- Constructivist approach to learning replaces the behaviourist approach
- Different computer applications are used in learning
- Experimentation with student grouping
- Role of teacher gradually changes from facilitator to collaborator
- Students are actively involved in knowledge construction
- Students involved in collaborative and creative project work

Teacher interaction

- Experimental collaboration between teachers in interdisciplinary project-based learning

General school

- School timetable is rescheduled for team teaching

SUPPORT INFRASTRUCTURE

CURRENT SUPPORT INFRASTRUCTURE

Technical assistance to

- develop teachers' confidence
- develop teachers' use of hardware
- facilitate students' use of computers

Time to

- discuss instructional strategies
- evaluate outcomes
- permit peer observation
- share frustrations and successes
- share vision and enthusiasm
- team teach
- train

Training in

- team teaching
- word processing, databases, spreadsheets and graphics in subject area

NEW SUPPORT INFRASTRUCTURE

Time to

- attend conferences and presentations
- reflect on evaluation

Training in

- other computer packages in subject area
- teaching with student groups

4.5 Phase 5: Creation

The Creation phase in the development of computer-assisted education is never complete but is an ongoing process as new technologies are constantly being developed. Schools have to decide which new technologies best suit their instructional needs and adapt accordingly. Few schools have attained this 'Nirvana' (Vorster, 1995) owing to the costs and skills required. When schools reach this stage they realise what forces were unleashed by the integration of computer-assisted education, how so much in the learning/teaching process/system has changed.

The main feature of this last phase is that staff work in collaborative teams. Timetables are adjusted to allow team teaching and collaborative work. Teachers question their methods of teaching and evaluation. Much training has to be done as new teachers enter the teaching system but their movement through the preceding four phases is fairly quick as there is a knowledge and skill base in the school.

Students use the computer and other technology to create knowledge in the form of web pages, multimedia documents and multimedia presentations. Much of the learning is done in the constructivist mode. Students are motivated and keen to learn. Student verbal interaction is purposeful. The technology at the school will be inadequate most of the time, with demands ever spiralling. The phase has been tabulated in Table 2.8.

Table 2. 8 Outcomes and infrastructure which contribute to the successful integration of computer-assisted education in Phase 5: Creation

OUTCOMES
CURRENT OUTCOMES **Instructional activity** • Active involvement of students in knowledge construction • Assessment is either portfolio or authentic assessment • Constructivist approach to learning replaces behaviourist approach • Many different computer packages used in learning • Students involved in collaborative and creative project work • Students motivated • Students peer tutor **Teacher interaction** • Interdisciplinary project-based learning • Team teaching **General school** • Desire for new technology and better technology • Modification of the curriculum to make use of the different facilities • School timetable rescheduled for team teaching **NEW OUTCOMES** **Instructional activity** • Accommodation of more learning styles, individual needs and individual preferences (Kinnaman, 1994, p.74) • Balance between direct and project-based teaching • Knowledge creation • Multimedia programs used • Teacher acts as a collaborator in the learning process (O'Neil, 1995a, p.9) • Use of new technologies (O'Neil, 1995b, p.10)
SUPPORT INFRASTRUCTURE

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SUPPORT INFRASTRUCTURE
CURRENT SUPPORT INFRASTRUCTURE **Technical assistance to** • develop teachers' confidence • develop teachers' use of hardware • facilitate students' use of computers **Time to** • attend conferences and presentations • evaluate outcomes • permit peer observation • reflect on evaluation • share frustrations and successes • share vision and enthusiasm • team teach • train **aining in** • teaching with groups of students • team teaching • other computer packages in subject area **NEW SUPPORT INFRASTRUCTURE** **Technical assistance to** • select and source suitable hardware • select and source suitable software **Time to** • act as a mentor • do research on effective ways of teaching • publish teaching experiences • question the whole methodology of teaching **Training in** • new and innovative technologies

5 Summary

The integration of computer-assisted education has been discussed and defined. Three models of the development of computer-assisted education, the **Apple Classrooms of Tomorrow (ACOT), CAMI Mathematics** and the **Make It Happen! (MIH)** models were discussed and integrated into one new **Evolutionary Model**. This new **Evolutionary Model** was divided into five phases that include expected outcomes and the infrastructure necessary to sustain them.

The integration of computer-assisted education is more than just using computers. It changes the school organisation, finances, evaluation, method of teaching, type of

learning and student work attitude. All the staff of a school are influenced by the integration of computer-assisted education.

The **Apple Classrooms of Tomorrow (ACOT) Model** is an open-ended look at technology-rich schools (Tierney, 1996, p.171). The changes in those classes were documented and are divided into five phases of Entry, Adoption, Adaptation, Appropriation and Invention. Each phase was described noting the outcomes and what was necessary to achieve those outcomes.

The **CAMI Mathematics Model** was described. The difference between the **CAMI Mathematics Model** and that of **ACOT** was that the **CAMI Mathematics Model** was about the gradual integration of computer hardware, software, financial resources and teacher skills. The hardware, software, financial resources and teacher skills are noted and the expected outcomes with the addition of more of the above.

The **Make It Happen! (MIH) Model** was discussed where a team of teachers deliberately focus on a curriculum and the integration of computer-assisted education, was discussed. This plan occurs over two or three years and the changes and actions in each step are noted.

The three models had common features which were synthesised into one **Evolutionary Model**. This model describes the five phases in the integration of computer-assisted education: Introduction, Entry, Intermediate, Penultimate and Creation. The outcome in each phase and what infrastructure supported that outcome is described. In the five phases it is found that in teaching the

- number of computer applications used changes from one to many;
- role of the teacher changes from facilitator to collaborator;
- methods change whereby the students becomes actively involved in their own learning;
- type of computer application changes from the information processor, the word processor, to the information creator, multimedia; and the
- type of learning changes from a behaviouristic mode to a constructivistic mode.

The teacher interaction changes whereby

- interdisciplinary work begins;
- verbal computer-related interaction changes from technical to collaborative;

- team teaching begins; and
- training in applications changes from technical use of the application to use of the application as a tool.

Within the school the

- curriculum is modified to integrate computers; and
- timetable is rescheduled.

The **Evolutionary Model** describes the changes which take place within a school while the support foundation of the **Evolutionary Model** describes the infrastructure necessary for the integration of computer-assisted education to take place. The infrastructure necessary for the integration of computer-assisted education were listed under the headings of staff, school and community involvement.

6 Conclusion

This chapter has looked at four models which describe the integration of computer-assisted education and the infrastructure necessary for the integration of computer-assisted education. Chapter 3 will describe the method used to investigate the integration of computer-assisted education at Pinelands High School. Chapter 4 will describe the findings of computer-assisted education at Pinelands High School. In Chapter 5 the findings of the integration of computer-assisted education at Pinelands High School will be synthesised with the phases of the **Evolutionary Model** and its necessary infrastructure.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter will discuss the research instruments, namely the questionnaires, interviews and observation used to collect the information, and the methods used to validate the findings of the research project.

1 Investigation instruments and subjects

The information about computer-assisted education at Pinelands High School has to be seen in context so information about the school as a part of the town were gained by interviews and observation.

For the purposes of this research project, staff who had *taught* at the school for more than one year were consulted. At the time of the investigation, August/September 1996, a number of staff were on leave. Substitute staff were not included in the survey. The total teaching staff surveyed was 40, including two members of the computer department who are not officially teachers but who teach Computer Literacy in addition to their administrative duties. In the survey the total number of staff involved in teaching the subject Computer Literacy numbered seven.

1.1 Questionnaires

1.1.1 Purpose of the questionnaires

Objective data, able to be corroborated by facts and figures and statistically illustrated, was required on the infrastructure to support computer-assisted education and the integration of computer-assisted education at Pinelands High School. These questionnaires had the purpose of collecting information on those topics at Pinelands High School in August/September 1996.

Two questionnaires were given to the staff. The first questionnaire was given to all the staff members surveyed, Appendix A. The second questionnaire was given to those staff members who used the computer in teaching, Appendix B.

1.1.1.1 First questionnaire given to all teaching staff surveyed

The questionnaire given to *all* staff members in the survey was accompanied by the letter shown below.

Figure 3. 1 Letter accompanying the first questionnaire for all teaching staff

THE INTEGRATION OF COMPUTERS AT PINELANDS HIGH SCHOOL: A CASE STUDY

Hi

This questionnaire is part of an investigation into the efficient use of the computer at PHS and will, I hope, make life easier for all of us once the results have been evaluated. All of the questions relate to PHS and not time spent at another school.

I realise it will take some time out of your already busy day, but in the long term I think it will help all of us to be better teachers and communicators.

May I fetch the results tomorrow. Please drop the results in my pigeon hole.

Thanks in advance
Pam Miller

The questionnaire for all teaching staff covered personal details, their infrastructure for computer use and their use of the computer. A copy of the letter and questionnaire are attached in the Appendix A. The topics asked are listed and the information gleaned can be divided into the fields shown below:

Table 3. 1 Topics covered in the first questionnaire given to all teaching staff

TOPIC	TYPE OF INFORMATION
Years of teaching	Personal details
Years of teaching at Pinelands High School	Personal details
Subjects taught	Personal details
Use of the computer at home	Personal details, Integration
Other computer training	Personal details, Support infrastructure
Computer ownership	Personal details, Support infrastructure
Financial assistance to purchase computer	Support infrastructure
In-house/in-service computer training	Support infrastructure
Financial assistance for computer training	Support infrastructure
Decision-making	Support infrastructure
Technical advice	Support infrastructure
Involvement with team teaching	Support infrastructure, Integration
Use of group work	Support infrastructure, Integration
Subject department software	Support infrastructure, Integration
Access to computer applications	Support infrastructure, Integration
Use of the computer at school	Integration
Use of the computer in teaching	Integration

1.1.1.2 Second questionnaire given to the 19 staff members who use the computer in teaching

The second letter and questionnaire was given to those teachers who indicated that they had used the computer in teaching in 1996. Both the letter and questionnaire can be found in Appendix B. The questionnaire below was given to 19 staff members who had used the computer in teaching in 1996. They were also given enough of the questionnaire for each of the subjects they teach, altogether nine subjects. There were a total of 29 subject-classes-and-teachers.

The aim of the second questionnaire was to note the computer-related infrastructure of these staff members and see how they had integrated computer-assisted education.

Table 3. 2 Second questionnaire given to the 19 teachers who use the computer in teaching and the frequencies of the 29 subject-classes-and-teachers

QUESTION	*Yes*	*No*	*f* Yes / A	*f* No / B
1. Have you used any computer package(s) in the teaching of a lesson at PHS? If NO, no more questions. Thanks!	*Yes*	*No*	29	0
2. Have you shared information (printed or verbal) about a computer-related lesson with ...				
a) teachers in your department?	*Yes*	*No*	24	3
b) other adults in the school?	*Yes*	*No*	14	10
c) teachers not from PHS?	*Yes*	*No*	19	8
3. Have you published anything about (a) computer-related lesson(s)? If YES, please specify titles of publications.	*Yes*	*No*	3	26
4. Have you mentored any person in a computer-related lesson this year?	*Yes*	*No*	6	23
5. Were you mentored by anyone in a computer-related lesson this year?	*Yes*	*No*	8	21
6. In general, in your computer classes, ...				
a) do the students work in (A) pairs/groups or (B) on their own?	*(A)*	*(B)*	16	11
b) would you prefer the students to work in (A) pairs/groups or (B) on their own?	*(A)*	*(B)*	12	14
c) do you act as a (A) facilitator or (B) focus?	*(A)*	*(B)*	29	0
7. What computer applications have you used in teaching during the last year? (Please list)				
8. Which of the applications which you use in teaching do you have access to at home? Please indicate on the list above.				
9. In general, in your computer classes, is the material of the work syllabus related?	*Yes*	*No*	25	3
10. In general, in your computer classes, do the students use the package(s) below for ... (select a maximum of 3)				
a) the purpose of learning a specific skill e.g. typing.	*Yes*	*No*	7	
b) the specific purpose of learning the package.	*Yes*	*No*	13	
c) retaining information e.g. drill-and-practice.	*Yes*	*No*	8	
d) processing information by typing/drawing e.g. word processing, graphics or tables.	*Yes*	*No*	14	
e) communicating with someone e.g. e-mail.	*Yes*	*No*	9	
f) finding information and possibly drawing conclusions e.g. Orbits, PCGlobe.	*Yes*	*No*	14	
g) creating new knowledge e.g. multimedia presentations, web pages or multimedia documents.	*Yes*	*No*	2	
h) (your own wording)	*Yes*	*No*	6	

Table 3. 3 Topics covered in the second questionnaire given to the 19 teachers who use the computer in teaching

TOPIC	TYPE OF INFORMATION
1. Have you used any computer package(s) in the teaching of a lesson at PHS? If NO, no more questions. Thanks!	Integration
2. Have you shared information (printed or verbal) about a computer-related lesson with ...	
a) teachers in your department?	Support infrastructure
b) other adults in the school?	Support infrastructure
c) teachers not from PHS?	Support infrastructure
3. Have you published anything about (a) computer-related lesson(s)? If YES, please specify titles of publications.	Support infrastructure
4. Have you mentored any person in a computer-related lesson this year?	Support infrastructure
5. Were you mentored by anyone in a computer-related lesson this year?	Support infrastructure
6. In general, in your computer classes, ...	
a) do the students work in (A) pairs/groups or (B) on their own?	Integration
b) would you prefer the students to work in (A) pairs/groups or (B) on their own?	Integration
c) do you act as a (A) facilitator or (B) focus?	Integration
7. What computer applications have you used in teaching during the last year? (Please list)	
8. Which of the applications which you use in teaching do you have access to at home? Please indicate on the list above.	
9. In general, in your computer classes, is the material of the work syllabus related?	Integration
10. In general, in your computer classes, do the students use the package(s) below for ... (select a maximum of 3)	
a) the purpose of learning a specific skill e.g. typing.	Integration
b) the specific purpose of learning the package.	Integration
c) retaining information e.g. drill-and-practice.	Integration
d) processing information by typing/drawing e.g. word processing, graphics or tables.	Integration
e) communicating with someone e.g. e-mail.	Integration
f) finding information and possibly drawing conclusions e.g. Orbits, PCGlobe.	Integration
g) creating new knowledge e.g. multimedia presentations, web pages or multimedia documents.	Integration
h) (your own wording)	Integration

1.1.2 Design of the questionnaires

In designing the questionnaires the purpose was to obtain the required information with as little stress to the teachers as possible. The author was aware that at the time of the data collection there was discussion of cutting staff numbers and that there could have been a negative attitude towards any extra work. Therefore the questionnaires had to be simple, relevant and quick to complete. The questions had to be clear so that all the respondents could answer in the same way and results standardised. As some teachers would wish to complete the questionnaires at home, the questions had to be designed so that there was little need for interaction with the researcher.

Length was not considered in drawing up the questionnaires, rather covering the required topics. One respondent did not complete the first questionnaire and handed it in incomplete. It was given to her for completion but never returned to the author. Therefore one can assume that the first questionnaire was too long for one member of staff.

The type of questions in the questionnaires were mainly of the closed type. There was only one open question, question 10 in the second questionnaire for teachers who used the computer in teaching, Table 3.2.

A flaw in the first questionnaires was that the teachers did not know what the different applications were although examples of most were given. Where there seemed to be incorrect answers, Shannon Paul, head of computers, was consulted and then the staff members themselves, where necessary for clarification.

1.1.3 Method of distribution and collection of the questionnaires

An introductory letter, Figure 3.1, the first questionnaire and a token reward in the form of a roll of sweets were put in 41 teachers' pigeon holes. The staff were not verbally asked by the author or anyone in authority to complete the questionnaire. The author was on leave and not present to prompt the staff to complete the questionnaires. The letter and questionnaire were printed on brightly coloured paper in order not to get lost in the teachers' plethora of exam and other papers.

Two days after the initial distribution of the first questionnaire the author collected the completed forms. The teachers' names were on their questionnaires and so the author was able to verify who had the missing questionnaires. The persons who had not completed their questionnaires were given another token reward but no printed reminder. Two days later the author had all the completed questionnaires bar one, 40 out of a possible 41, a 97.56% response rate.

The second letter and questionnaire, Table 3.2, also printed on brightly coloured paper, were given to those teachers who had indicated in the first questionnaire, that they used the computer in teaching. It was given to 23 teachers and 19 answers were returned, an 82.6% response rate. Each of these 23 teachers was given enough questionnaire sheets for each of the subjects taught. The summary of the response to the questionnaire is seen in Table 3.4.

Table 3. 4 Summary of distributed and returned questionnaires

QUESTIONNAIRES	DISTRIBUTED	RETURNED	RESPONSE RATE
First questionnaire to all 41 teachers in the survey	41	40	97.56%
Second questionnaire to 23 teachers who use the computer in teaching	23	19	82.6%

From the teachers' response to the questionnaires it can be seen that they have a positive response to computers and computer-assisted education at Pinelands High School. Perhaps the reason for the full cooperation of the staff is that this is the first time a comprehensive report is being done on the computer department at Pinelands High School, or the questionnaires were a novelty.

1.2 Interviews

The purpose of each of the interviews was to obtain specific information about computer-assisted education at Pinelands High School or about the town of Pinelands. All of the people interviewed are referenced in the text and listed in the

Reference List. Most of the interviews started with unstructured questions which allowed the author to let the interview go in the direction appropriate for the subject.

Interviews were also held with the head of computers at the school, specifically to corroborate information in the questionnaires. Strange responses were confirmed with the head of computers and then, if necessary, with the teacher concerned. These interviews assisted in triangulating the data.

1.3 Observation

The author has taught at the school for six years in the capacity of school librarian, Computer Literacy and History teacher and has had an opportunity over those six years to observe the computer department and its growth in the field of computer-assisted education. Information gleaned from the questionnaires could be corroborated by years of unobtrusive observation. Over the years any chance of the subjects changing their behaviour when being observed (McMillan, 1993, p. 257) was nullified by familiarity with the researcher. The observations assisted in triangulating the data.

2 Triangulation of data

2.1 Triangulation based on corroborating questionnaires, interviews and observation

In order to triangulate the data, *interviews* based on the data from the two *questionnaires* and *observations,* were held with the head of computers. In addition, a number of the sections in the questionnaires supported each other.

A summary of the Findings was given to the following people to read with regard to content and interpretation, so that the information could be further triangulated:

- Brian Ingpen - Principal
- Dave Arguile - Senior deputy principal and new principal from January 1997
- Shannon Paul - Head of computers

As a further measure to check the interpretation of computer-assisted education at Pinelands High School, a draft copy of the manuscript was given to:

- John Gilmour - Deputy principal

2.2 Confirmation of data and interpretation

In specific cases the following were confirmed:

- Data about the decision-making policies of the school and the unexpected results of the first questionnaire were shown to the principal. He noted the wording of the questions and suggested reasons. In hindsight perhaps the question of 'Have you had any input into the ... long term plans of the school as a whole?' should have read 'Have you had any opportunity for input into ... long term plans of the school as a whole?' (Ingpen, 1996) as the staff do have opportunities for input into school management decision-making policies.
- The senior deputy principal read the chapter on Findings as did the principal.
- Information about funding was shown to and discussed with the head of computers.
- Information about donations from the Pinelands High School Continuing Education Programme for adults and its community computer classes were checked by its head.
- Information about the schools' student statistics were confirmed by the school statistician.

3 Summary

Questionnaires were given to the teaching staff at Pinelands High School in order to obtain information of a quantitative nature about computer-assisted education at Pinelands High School. The purpose, design, method of distribution and return of the questionnaires were discussed. Data obtained by interviews and observations were used to support data obtained from the questionnaires.

The information was triangulated by data from questionnaires from the 40 teaching staff, questionnaires from the 19 teachers who used the computer in teaching, and

corroborated and supplemented by interviews and observation. Further checking of interpretation was achieved by having a draft copy of the manuscript checked by the chief stakeholders.

4 Conclusion

The information in Chapter 4, Findings about computer-assisted education at Pinelands High School, was obtained by the methods described in this chapter.

CHAPTER 4

FINDINGS

This chapter will look at the community of Pinelands, students and staff of Pinelands High, the infrastructure they have in place for computer-assisted education and then how computers have been integrated into education at the school.

1 Objects of the research project

Pinelands High School is in Pinelands on the Cape Peninsula. It is largely a community school but also accommodates students from further afield. In its web page on the Internet it declares (Pinelands, 1996):

> "We pride ourselves on our record of excellence; our concern for the needs of the individual; and our endeavour to instill in our pupils the values and skills that will equip them to become thinking, capable, balanced adults ready to cope with the demands of life and the changing employment market."

1.1. Pinelands

Pinelands is a suburb of the provincial capital city of Cape Town which is in the Western Cape, a province of South Africa. In 1994 the total adult population of Pinelands was 11 000. The 1994 demographic details (Retail Data Library, 1994) in Tables 4.1 to 4.3 below indicate that the average adult in Pinelands is employed, well educated, of a mature age, lives in a house, speaks English and earns a good salary. It is a traditional 'White' suburb of middle to upper class inhabitants but is slowly changing to represent the different cultural groups found in South African society.

Table 4. 1 Gender, age groups and language of adults in Pinelands (Retail Data Library, 1994)

GENDER	1000s
Male	5
Female	6
AGE GROUPS	**1000s**
18-24	2
25-34	2
35-49	3
50+	5
LANGUAGE	**1000s**
English/Other	10
Afrikaans/Bilingual	1

Table 4. 2 Education levels and occupations of adults in Pinelands (Retail Data Library, 1994)

EDUCATION	1000s
Up to primary completed	0
Some high school	1
High school completed/Matric	4
Post matric	6
OCCUPATIONS	**1000s**
Working	6
Housewife	1
Student	1
Retired	2
Unemployed	0

Table 4. 3 Housing and household income in Pinelands (Retail Data Library, 1994)

HOUSING	1000s
Live in a house	9
Live in a flat	2
Live in a townhouse cluster	0
Other	0
INCOME (per month)	**1000s**
R6000+	6
R2500-R5999	4
R800-R2499	1
Less than R799	0

1.2 Pinelands High School

The school opened in 1952. It is a co-educational school and at the time of the survey, August/September 1996, has 963 students from standard six (grade eight) to standard 10 (grade 12).

1.2.1 Students

At the beginning of 1996 the total number of students from standards six to 10 at the school was 963. The majority of high school students in Pinelands attend Pinelands High School. In addition to Pinelands, the feeder areas for the school are

- Thornton, a neighbouring suburb with 'down market' housing compared to Pinelands, which does not have its own high school;
- Kensington and Athlone, medium to lower income traditional Coloured areas; and
- Langa, a traditional Black, low income Xhosa-speaking township.

According to the senior deputy principal, Pinelands High School is generally seen to offer 'better' schooling than the schools zoned for the above areas (Arguile, 1996).

Besides being a co-educational school, Pinelands High attempts to be multi-cultural, recognising each individual group's traditions, rather than assimilating minor cultures (Arguile, 1996). The school population is becoming increasingly heterogeneous.

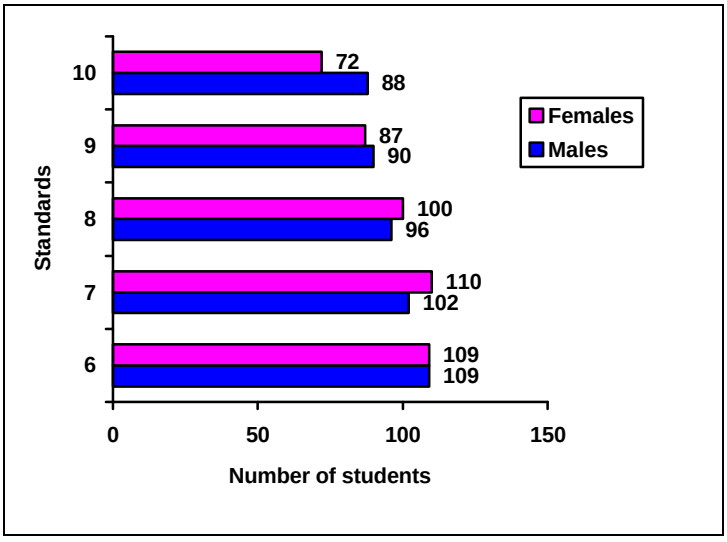
1.2.1.1 Standards and gender of students

Table 4. 4 Standards and gender of students

GENDER	STD 6	STD 7	STD 8	STD 9	STD 10	TOTAL
Males	109	102	96	90	88	485
Females	109	110	100	87	72	478
Total	218	212	196	177	160	963

The standard and gender groupings of the students at Pinelands High School in 1996 are shown in the table above and figure below. The numbers of students in each standard decreases towards standard 10. The gender balance is almost the same in each standard.

Figure 4. 1 Standards and gender of students



1.2.1.2 Home languages and gender of students

Table 4. 5 Home languages of female students

LANGUAGE	STD 6	STD 7	STD 8	STD 9	STD 10	TOTAL
Afrikaans	2	2	2	2	1	9
English	101	97	87	80	64	429
Sotho				1	1	2
Xhosa	6	7	9	3	3	28
Zulu				1	1	2
Other		4	2		2	8
	109	110	100	87	72	478

Table 4. 6 Home languages of male students

LANGUAGE	STD 6	STD 7	STD 8	STD 9	STD 10	TOTAL
Afrikaans	6	0	1	1	2	10
English	94	89	88	83	75	429
Sotho		1				1
Xhosa	7	9	6	6	8	36
Zulu		1			1	2
Other	2	2	1		2	7
	109	102	96	90	88	485

From the two tables below it can be noted that the majority of the students are English speaking. According to the school statistician, many students come from homes where more than one language is spoken but the official statistics do not make provision for two or more home languages (Rundle, 1996b).

Ranked the home languages of Pinelands High School students are:

1. English with 858
2. Xhosa with 64
3. Afrikaans with 19
4. Zulu with 4
5. Sotho with 3
6. Other languages account for 15

1.2.1.3 Age and gender of students

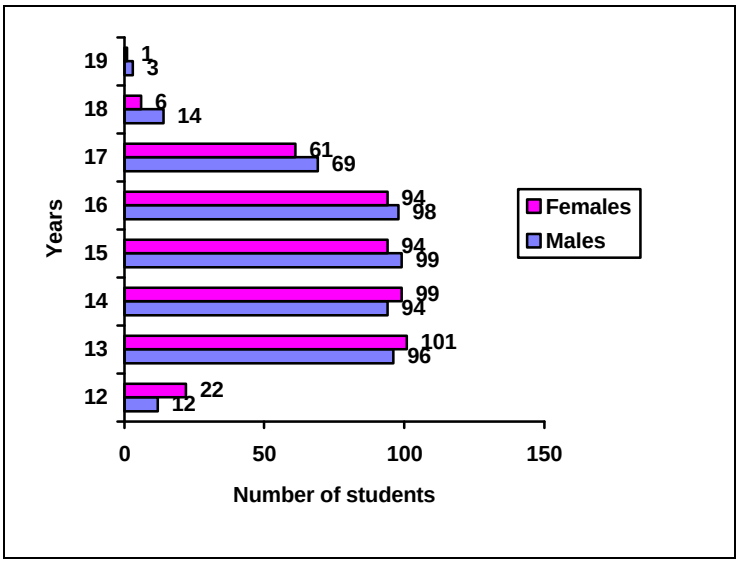
Table 4. 7 Ages of male students

YEARS	STD 6	STD 7	STD 8	STD 9	STD 10	TOTAL
12 years	12					12
13 years	79	17				96
14 years	17	64	13			94
15 years	1	20	65	13		99
16 years		1	17	63	17	98
17 years			1	12	56	69
18 years				2	12	14
19 years					3	3
Total	109	102	96	90	88	485

Table 4. 8 Ages of female students

YEARS	STD 6	STD 7	STD 8	STD 9	STD 10	TOTAL
12 years	22					22
13 years	76	25				101
14 years	11	68	20			99
15 years		14	57	23		94
16 years		3	22	57	12	94
17 years			1	7	53	61
18 years					6	6
19 years					1	1
Total	109	110	100	87	72	478

Figure 4. 2 Age and gender of students



From the two tables and graph above it can be noted that the students are mainly in the 13 to 16 age group, and almost evenly spread between males and females.

Figure 4. 3 Scenes from school-life

1.2.1.4 Student computer ownership

In June 1996 a survey was conducted with 98 standard six students in three classes and with 104 students in standard seven in three classes to determine computer home ownership and whether the students had used computers in primary school.

Table 4. 9 Computers at home and school

STANDARD	HOME OWNERSHIP	PRIMARY SCHOOL USE
Standard 6	66%	79%
Standard 7	71%	79%

The table above indicates that a large percentage of the students have computers at home. In the table above it is also indicated that a large percentage of the students come from primary schools where they use computers.

1.2.2 Staff

The teaching staff of Pinelands High School in 1996 comprises the principal, one senior deputy principal, two deputy principals, and 44 heads of departments and teachers, totalling 48. All of the 48 teach classes. These 48 persons are responsible for teaching 963 students in 1996 in:

- six standard 6 classes
- six standard 7 classes
- six standard 8 classes
- six standard 9 classes
- six standard 10 classes

There are 11 administrative staff members who include one laboratory assistant, one caterer, one bookroom administrator, one media assistant, one bursar, one data capturer, one network administrator, one receptionist, two secretaries and one computer administrator. There is one grounds manager, one janitor and one caretaker. There are five members of the grounds staff and two female cleaners. According to the deputy principal, Pam Broster, in 1996 the teaching staff : student ratio is 1 : 22 (Broster, 1996).

For the survey all teachers who had been at the school for more than one year were included. Of the Computer Literacy teachers the network administrator and one teacher were excluded as they had been at the school less than one year.

1.2.2.1 Staff marital status and gender

Table 4. 10 Marital status and gender of teaching staff

MARITAL STATUS	FEMALE	MALE	TOTAL
Divorced	3	0	3
Married	9	9	18
Single	11	8	19
Total	23	17	40

The above table indicates the gender of the staff. Female teachers are 23 (57%) members of the staff complement of 40 in the survey.

Table 4. 11 Marital status and gender of computer department teaching staff

MARITAL STATUS	FEMALE	MALE	TOTAL
Divorced	1	0	1
Married	2	1	3
Single	1	2	3
Total	4	3	7

As can be seen from the table above, the number of male to female computer department teaching staff is almost equal, thus the students do not have a gender stereotype of a computer expert.

1.2.2.2 Staff years of teaching experience

Table 4. 12 Total years of teaching experience of staff

YEARS OF EXPERIENCE IN TOTAL	FEMALE	MALE	TOTAL
10 or more	17	9	26
less than 10	6	8	14
Total	23	17	40

The table above indicates that 26 (65%) members of staff have more than 10 years of teaching experience. The staff who have less than 10 years of experience number 14 (35%). The average length of teaching experience is 13.2 years.

Table 4. 13 Years of teaching experience of staff at Pinelands High School

YEARS OF EXPERIENCE AT PHS	FEMALE	MALE	TOTAL
10 or more	5	8	13
less than 10	15	12	27
Total	20	20	40

The table above indicates that 13 (32%) members of staff in the survey have more than 10 years of teaching experience at Pinelands High School. The staff have an average of eight years of teaching experience at the School.

1.2.2.3 Computer department staff

The computer department staff of seven have had many years of teaching experience in general as well as in the subject of Computer Literacy. On average the computer department teaching staff

- have taught for 14.3 years;
- have taught at Pinelands High for 8.71 years; and
- have taught Computer Literacy at Pinelands High for 5.8 years.

Table 4. 14 Average years of teaching experience

AVERAGE TEACHING YEARS	GENERAL TEACHING STAFF	COMPUTER DEPARTMENT STAFF
Years experience in total	13.2	14.3
Years experience at PHS	8.0	8.71

From the table above it can be seen that the computer department teaching staff on average have slightly more years' teaching experience than the general teaching staff. It can also be seen that the computer department teaching staff on average have slightly more year's teaching experience at Pinelands High School than the general teaching staff at Pinelands High School.

The six standard six classes are taught Computer Literacy twice a cycle by

- one teacher who teaches two classes;
- one teacher who teaches one class;
- one network administrator who teaches two classes; and
- one computer administrator who teaches one class.

The six standard seven classes are taught Computer Literacy once a cycle by

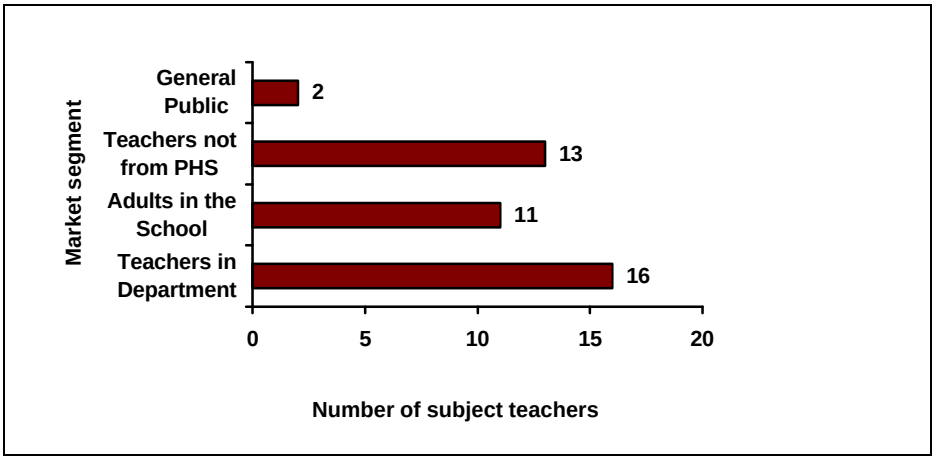
- four teachers who teach four classes; and
- one teacher who teaches two classes.

2 Support infrastructure

2.1 Sharing of skills

2.1.1 Sharing of information about classroom computer use

Figure 4. 4 Sharing of information, skills and enthusiasm by teachers who use computer-assisted education



Of the 40 staff members who took part in the survey 23 have used the computer in their teaching of Pinelands High School at *some* time. It was found that 19 teachers have used the computer in teaching in 1996 and took part in the survey. Data about sharing information in relation to their computer-related lessons was obtained from 18 of those teachers. The Computer Literacy, Geography and Mathematics subject departments have shared their computer teaching experiences with colleagues in

their departments but not with other adults in the school. Teachers from the English department have shared their computer teaching experiences with teachers from other schools. Findings or experiences about computer-assisted education at Pinelands High School have been published by two teachers.

Of the seven teachers who teach Computer Literacy

- one teaches Accounting;
- one teaches Business Economics;
- one teaches Library;
- one teaches Mathematics;
- one teaches Typing;
- two teach Graphics;
- two teach History;
- two teach Science; and
- two teach Environmental Science.

Where a teacher teaches Computer Literacy and another subject, the other department is also drawn into using computer-assisted education. The departments of Environmental Science, Graphics, History, Mathematics, Science and Typing have teachers who also teach Computer Literacy.

The teachers of the subjects Computer Literacy, Geography, Graphics and Mathematics share information with those in their subject departments. Based on the data in the figure above, sharing with colleagues in the school is not really taking place. The figure above shows the sharing by the 18 of the 19 surveyed teachers who have used computer-assisted education at Pinelands High School in 1996.

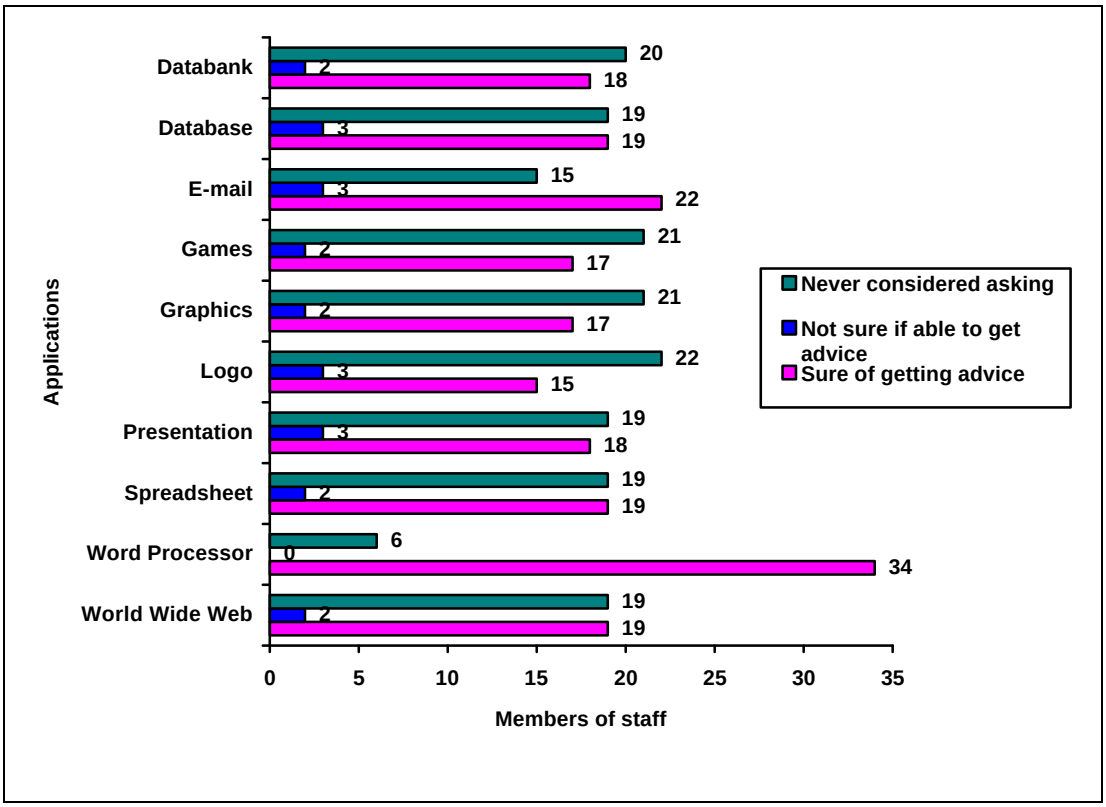
2.1.2 Mentoring of teachers using the computer in the classroom

Mentorship by an experienced teacher is taking place with regard to computer-assisted education. Six teachers in the Computer Literacy, English, Graphics and Mathematics subject departments were mentored by someone in computer-related teaching. Three teachers mentored other teachers in the Computer Literacy, Environmental Science and Graphics subject departments.

In the Computer Literacy and Graphics departments mentoring is taking place between staff who have been teaching Computer Literacy for a long time and teachers new to using the computer.

2.1.3 Providing of advice by the computer department

Figure 4. 5 Perceived availability of advice from the computer department



From the above figure it is clear that staff members believe they are able to get advice from the computer department, when they need it using the applications listed in the figure. A number of staff members have not considered asking for advice on using these applications. Pinelands High School has staff in the computer department who, from the figure above, are believed to have the program-knowledge. This knowledge would give the staff confidence in using the applications.

2.2 Decision-making policy

2.2.1 School decision-making policy

Pinelands High School has, in many fields, an open decision-making policy. For example, during 1995 and 1996 all teaching staff were involved in planning for rationalisation. Quality Circles, comprised of students, teachers and parents,

discuss key aspects of school life regarding discipline, public relations, communication, academics, arts, sport and buildings; and make recommendations to the appropriate governance structures. The principal follows an open door policy and staff are always able to discuss matters with him. This information has been corroborated by his secretary and the author's experience.

Staff have input in their subject departments. The answers below to questions on the questionnaire (see Appendix A, number 15) indicate the open policy of the school and that of the subject departments.

Table 4. 15 Decision-making within the school by all surveyed teachers

HAVE YOU HAD ANY INPUT INTO THE ...	YES %	DO NOT KNOW %	NO %
1. long term plans of the school as a whole?	75	7	18
2. methodology of teaching in your department?	95	0	5
3. evaluation methods in your departments?	95	0	5
4. content of courses in your department?	98	2	0

The data above indicates that should staff wish to make changes within their departments they are able to do so. Should they wish to add a computer component to their subjects there would be no problem as they do have input into the subject area as shown above. The subject departments are able to take decisions concerning the methodology, evaluation and contents in their departments. Computer-assisted education has been integrated into specific subject departments because the subject departments concerned took the decision.

2.2.2 Computer department decision-making policy

2.2.2.1 Computer department decision-making policy and the computer committee

The Computer Committee meets once a term. It is comprised of three members of the Board of Governors, the principal, the senior deputy principal and three members of the computer department. Requests for the computer department budget are discussed with this committee before presentation to the full Board of

Governors. The committee acts in an advisory capacity, mainly in the field of capital expenditure (Ingpen, 1996; Paul, 1996).

2.2.2.2 Computer department decision-making policy and computer department teaching staff

Table 4. 16 Decision-making by computer department teaching staff with regard to the computer department

HAVE YOU HAD ANY INPUT INTO ...	YES %	NO %
1. decisions with regard to who teaches the subject Computer Literacy?	100	0
2. decisions with regard to the purchase of computer hardware?	100	0
3. decisions with regard to purchasing of computer software?	100	0
4. discipline code of the computer room?	100	0
5. physical design of the computer room?	28	72
6. hours of the computer room?	72	28
7. long-term plans for the computer room?	100	0

The questions above were asked of the teaching staff of the computer department and shared decision-making is indicated in most aspects.

2.2.2.3 Computer department decision-making policy and general teaching staff

When asked about input into decision-making with regard to computers the results listed in the table below indicate that the staff of the school as a whole have little part in the vision of computer-assisted education at Pinelands High School.

Table 4. 17 Decision-making by all surveyed staff with regard to the computer department

HAVE YOU HAD ANY INPUT INTO ...	YES %	NO %
1. decisions with regard to who teaches the subject Computer Literacy?	18	82
2. decisions with regard to the purchase of computer hardware?	23	77
3. decisions with regard to purchasing of computer software?	40	60
4. discipline code of the computer room?	30	70
5. physical design of the computer room?	10	90
6. hours of the computer room?	13	87
7. long-term plans for the computer room?	23	77

The data above concerning the staff input into the computer department at Pinelands High School indicates that there is not much input and the vision has not been shared with the staff of the school.

2.2.2.4 Computer department decision-making policy and software

Each subject department within the school is free to make suggestions with regard to software and make provision for it within their budget (Paul, 1996). From point 3 of the table above, there are indications that, in general, the staff are not aware that they are able to select and purchase software. However, the Mathematics department recently bought the package, *Geometer's Sketchpad,* on the recommendation of its members.

2.3 Computer department teaching facilities

The computer facility was established in 1984 with two BBC computers. It has developed into a fully-fledged computer department with nine staff involved with teaching Computer Literacy and 21 networked computers. Since its inception at the school in 1984, the subject, Computer Literacy, has changed. Initially the subject taught was programming, but now they are taught computer communication and concepts (Paul, 1996).

2.3.1 Computer department hardware for teaching purposes

The computer room has 19 x 386 computers with four MB of RAM, two x 486 computers with eight MB of RAM and one Hewlett Packard 4L laser printer. For demonstration purposes there is a large 51 cm television screen and Creative Lab CTV-coder. The system runs on *Novell Netware 4.1* with a 50-user licence. Each student is allocated two MB of space on their account.

The computer department at Pinelands High School is highly regarded in comparison with schools in the neighbourhood. All the computers used in the school for computer-assisted education are found in this computer room. The classes which use the computers the most are standards six and seven and they have an average of 36.3 and 35.3 students respectively. This means that there are more students than the 21 computers available in the computer room.

Figure 4. 6 View of the computer room

Figure 4. 7 Plan of the computer room

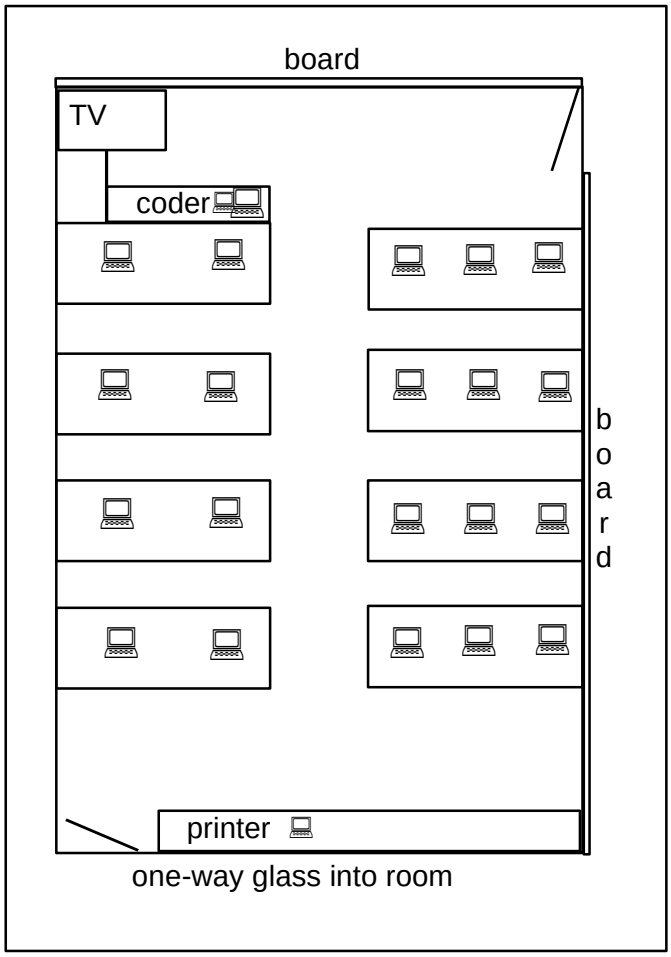
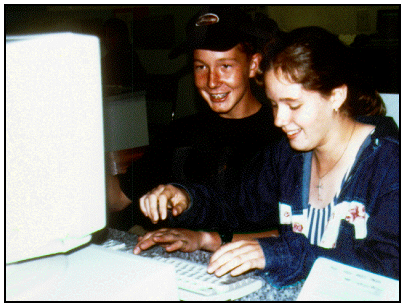


Figure 4. 8 Students in the computer room



2.3.2 Computer department software for teaching purposes

The school has a number of applications for teaching purposes available on the network listed in the table below. The programs listed below are the ones currently being used, although the school has bought numerous applications since 1984.

Table 4. 18 Content-free applications available for teaching purposes

APPLICATION	PRODUCER	LICENCES	SUBJECT	TYPE OF PACKAGE
Pegasus Mail	David Harris	Freeware	multipurpose	communication
Geometer's Sketchpad	Key Curriculum Press	site licence	Mathematics	mathematical drawing
Logo	Harvard Associates	site licence	Mathematics	programming language
MSWord for Windows	Microsoft	21 licences	multipurpose	word processor

Table 4. 19 Applications available for teaching purposes

APPLICATION	PRODUCER	LICENCES	SUBJECT	TYPE OF PACKAGE
PCGlobe	PCGlobe, Inc.	21 licences	Geography	databank
Knowledge Adventure	Knowledge Adventure, Inc.	1 licence	multipurpose	databank
Orbits	Software Marketing Corporation	21 licences	Sciences	databank
Guido	University of Delaware Academic Computer Instructional Technology	3 licences	Music	drill and practice
Simcity	Maxis	1 licence	Geography	game
Zip Zap Map World	National Geographic	site licence	Geography	game
Windows 3.1	Microsoft	21 licences	multipurpose	operating system

Where there are not enough licences for the whole class, usage is limited. The content-free software includes a word processing, communications and graphics package but there are no spreadsheet, database or presentation applications. The databank programs, *Orbits*, *PCGlobe* and *Knowledge Adventure* are content-rich

programs available for use as information resources. The single drill and practice package of *Guido* is used by Music students only.

In 1991 a project was initiated by the Cape Education Department where teacher training in packages such as *Lotus 123* and *MSWorks* was begun (Kratzenstein, 1994, p.26). Pinelands High School started teaching the application *MSWorks* during Computer Literacy classes at that time. The replacement of *MSWorks* with *MSWord for Windows* is a possible reason for the current use of the content-free application and so few curriculum-specific applications. According to the heads of Science and Mathematics respectively, the school does not have or use any drill and practice applications in their departments as they have not found any suitable for their needs (Jacoby, 1996; Rundle, 1996a).

2.4 Finance

2.4.1 Computer department finance for teaching purposes

Should members of a subject department find an application they would like, they are required to make provision for it in their departmental budget and it is then purchased and added to those available on the network. *Logo* and *Geometer's Sketchpad* were purchased by the Mathematics department in 1996. The English department is currently discussing buying *Plato 2000* for its academic development department. According to the head of computers, there is little to prevent any department from obtaining the software it requires (Paul, 1996).

At the school the standard six and seven students are currently required to pay R10 a year to cover the cost of paper and ink used in printing. Therefore there are no real limits to their printer usage. The costs of computers at the school are borne by general school fees, and donations from the Continuing Education Programme.

The computer department is responsible for budgeting for maintenance and upgrading of the computer system. The costs of the computer department change from year to year, depending on whether the room is being expanded or systems upgraded (Paul, 1996). The department has to motivate their requirements when

presenting their budget. There has not been any major cut in funding and this factor as well as careful planning has enabled Pinelands High to continue to purchase new applications and do upgrades.

2.4.2 Staff computer purchase and ownership

Currently 29 of the 40 teaching staff members surveyed have a computer at home. Fourteen teaching staff members have made use of the school's scheme of providing low cost loans at 8.8% for the purchase of computers and printers. Of these 14 teachers, 11 (78%) use computers in their teaching. The technical staff member of the computer department provided advice to 17 staff members when they purchased or up-graded their computers of whom 13 (76%) use the computer in teaching. These figures do not include those who use the computer in lesson preparation.

The salaries of the 40 staff members who took part in the survey are tabulated in the table below (Department of Education, 1996, p.30). The majority of the teachers are at Post Level 1. At the highest of the salary range of Post Level 1 they would have a gross monthly remuneration of R5921.25. This gross monthly salary is less than the cost of a multi media personal computer in 1996, let alone software or a printer.

Table 4. 20 Salaries of surveyed teaching staff

POST LEVEL	GROSS ANNUAL SALARY RANGE IN RAND	NUMBER OF STAFF
Administrative staff	Not available	2
Level 1	23526 - 71055	25
Level 2	32988 - 92661	10
Level 3	40836 - 98463	1
Level 4	53487 - 106941	1

2.4.3 Staff software ownership for lesson preparation

Most of the staff who use computer-assisted education have the software applications they use in teaching on their computers at home as tabulated in the table below. The school does not provide assistance to purchase the software.

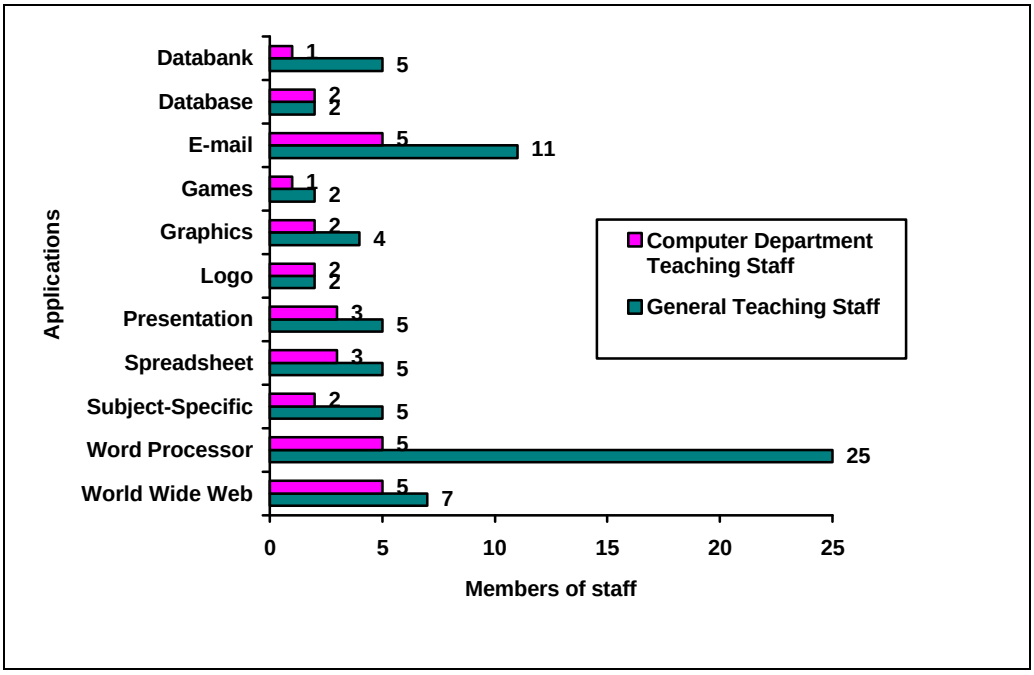
Table 4. 21 Staff usage of and ownership of software

APPLICATION	STAFF WHO TEACH WITH APPLICATION	STAFF WHO HAVE APPLICATION AT HOME	STAFF WHO HAVE APPLICATION AT HOME AND USE IT IN TEACHING
Geometer's Sketchpad	3	3	100%
Logo	5	2	40%
MSWord	10	6	60%
Orbits	9	6	66%
PCGlobe	5	4	80%
Pegasus Mail	7	5	71%
Zip Zap Map World	2	1	50%

2.5 Staff training in the use of computers

2.5.1 In-house computer training

Figure 4. 9 Staff in-house computer training during the day



The figure above indicates the large number of staff who have attended in-house training courses during the day particularly in word processing and e-mail. A large number of the computer department teaching staff (total seven) in comparison to the general teaching staff (total 40), have had in-service training. From the data it appears that in-service training classes were small, aimed at those in the computer department, or for those who expressed a desire to know a particular application, apart from word processing and e-mail.

The school offers evening courses, under the auspices of the Continuing Education Programme, where 16 teaching staff members have been able to take free courses in *MSWord* and *Windows 3.1*. Twelve (75%) of the teachers who have attended evening classes use the computer in teaching. Two of the course leaders of the Continuing Education computer classes, are members of the computer department teaching staff.

Pinelands High School has offered classes during the day where 25 (63%) of the staff have received training in word processing, and evening classes where 16 (40%) of the staff have received training in word processing. A total of 25 teaching staff members (62%) have received word processing classes offered by the school during the day or evening.

2.5.2 Extra-mural computer training

Pinelands High School has financially assisted eight staff members, six of whom are members of the computer department teaching staff, attend extra-mural computer courses at teachers' centres, universities, technikons, and conferences. Four members of staff, three of whom are computer department teaching staff, have paid for their own computer training at teachers' centres, universities and a computer school.

2.6 Computer department public relations

2.6.1 Public relations in school

The computer department convenes an annual staff meeting to make its activities known to all the teachers. In the 1995 meeting the head of computers and the data capturer described their visit to Melbourne and the International Education and Research Network (I*EARN) conference and a demonstration of Internet World Wide Web browsing was given.

At parents' meetings the computer room is usually mentioned and is open to view with computer department staff on hand to show them the facilities. When new parents are shown the school, one of the first places they are shown is the computer room where they are able to view material on display. In the normal course of events parents are not able to see how the students work affectively or cognitively in a normal classroom teaching situation.

The teaching staff are not compelled to use the computer facilities at any time, except for entering their examination marks. Their marks are then collated and their reports printed. This measure was introduced in 1994 to force staff members to use the computers a little. Initially staff were fearful but the system is now accepted, especially as the computer administrative staff are always there to assist (Paul, 1996).

Sharing of the vision of computer-assisted education seems to emanate from the teachers of Computer Literacy in the subject departments, other than Computer Literacy, in which they work. The internal public relations of the computer department is handled by a small team of Computer Literacy teachers.

2.6.2 Public relations in community

Information about the Western Cape Schools' Network is often published in the metropolitan newspapers, *Cape Times* and *Argus*, and Pinelands High School is often the school mentioned. The computer activities at the school were highlighted

at the I*EARN conferences in Melbourne in 1995 and Budapest in 1996. As a result of e-mail activities, overseas visitors often visit the school and the computer centre. The local community newspaper often carries reports about computer use at Pinelands High School. The computer department also desktop publishes programmes for concerts involving the school. The school's music department does a great deal of performing; the latest performance being one in the Cape Town City Hall in aid of the Red Cross War Memorial Children's Hospital, a major fund-raising event. The programmes indicate their designers and this helps to make the school's computer facilities known. The school's web page with photographs of some students, is on the Internet.

The school has an adult Continuing Education Programme which offers a variety of courses every quarter. Courses in computers have been offered every term for at least the last 10 years. These courses are open to the public at very reasonable prices and are advertised in Cape Town newspapers. Currently the courses offered are *Windows 3.1* and *MSWord for Windows*.

3 Use of the computer, applications and computer facilities

3.1 Use of the computer in teaching

There are 40 teachers from 25 subject departments at Pinelands High School. The following are the subjects offered in 1996: Accounting, Afrikaans, Art, Biology, Business Economics, Ceramics, Computer Literacy, English, Environmental Science 1, Environmental Science 2, Geography, German, Graphics, History, Home Economics, Latin, Library, Life Skills Junior, Life Skills Senior, Mathematics, Music, Physical Education, Science, Typing, Woodwork and Xhosa. Some teachers work in more than one department.

Table 4. 22 Staff members and number of subjects which they teach

NUMBER OF STAFF MEMBERS	NUMBER OF SUBJECTS EACH TEACH
22	1
13	2
3	3
0	4
2	5

A number of teachers teach more than one subject as illustrated above. Afternoon Sports and Life Skills are not included.

Table 4. 23 Staff members and number of subjects which they teach, and their computer use in the classroom

STAFF MEMBERS	SUBJECTS EACH TEACH	USE COMPUTER IN TEACHING	
NUMBER	NUMBER	NUMBER	%
22	1	7	31
13	2	11	84
3	3	3	100
0	4	0	0
2	5	2	100

From the table above it can be seen that teachers who teach more than one subject use the computer more in teaching, than those who teach just one subject.

3.1.1 Computer use and group work

A large number, 38 of 40 (95%) members of staff, use group work and 28 of 40 (70%) members of staff, use cooperative group work. An educational consultant specialising in cooperative learning ran two afternoon training sessions for all teaching staff during 1995 and 1996. A number of staff members have also attended weekend training sessions with him.

Fifteen staff members representing seven teaching departments, i.e. Computer Literacy, English, Environmental Science 1 and 2, Geography, Graphics, History and Mathematics use group work which involves the computer.

3.1.2 Computer use by subject departments

The departments which have used the computer for teaching in 1996 are Computer Literacy, English, Environmental Science 1 and 2, Geography, Graphics, History, Mathematics, Music, Typing and Xhosa.

Table 4. 24 Subject departments use of computer-assisted education

SUBJECT	SUBJECT TEACHERS	
	NUMBER	%
Computer Literacy	7	100
English	3	50
Environmental Science 1 and 2	7	100
Geography	4	100
Graphics	4	75
History	1	25
Mathematics	2	33
Music	1	50
Typing	1	100
Xhosa	1	100

The departments which have bought applications since 1984 are Environmental Science 1 and 2, Geography, Latin, Mathematics, Music and Typing. The teachers from the Mathematics, Music and Latin departments indicated that they assisted in the selection of the applications. The Mathematics and Music department staff received training on the packages they bought. The departments which purchased software are using the software in teaching.

3.1.3 Computer use and lesson focus

Different subjects use different methods and have different numbers of students which influences their method of teaching and lesson focus when using the computer in education. The questionnaire answered by the staff who have used the computer in teaching at Pinelands High School in 1996, indicates that 28 of the 29 subject-classes-and-teachers regard themselves as the facilitators in the lessons. One teacher indicated that he was a facilitator or a focus of the lesson depending on the type of lesson.

Many of the classes using the computer room are large, with too many students for one-computer-one-student. In 16 of the 29 subject-classes-and-teachers the students work in pairs, but only in 12 of the 29 classes would the teachers prefer the students to work in pairs.

Teaching at Pinelands High School has followed the traditional mode. In this mode, when using the computer for teaching purposes, the teachers require one computer per student. Of the teachers at Pinelands High School, 14 of the 29 subject-classes-and-teachers want one computer per student. Three of the subject-classes-and-teachers do not mind the students working in pairs or alone.

It would appear that the subject-classes-and-teachers who use computers in teaching

- act as facilitators of the lessons;
- are forced to have students working in pairs in 16 of 29 (55%) of the classes because of a lack of work stations; and
- would prefer the students work on their own in 14 of 29 (48%) classes.

3.1.4 Computer use and the curriculum

Computer Literacy is not an examination subject at Pinelands High School. Four of the seven Computer Literacy teachers link the content material of their lessons to an examination subject, i.e. Environmental Science, Graphics, History and Mathematics. Of the teachers who teach Computer Literacy, two of the seven are administrative staff who teach the subject in addition to their other duties. One of these persons manages to relate the lesson content to an examination subject; and

the other teacher relates the lesson content to general matters such as graffiti or the city of Cape Town and the Olympic Games. Two other teachers of Computer Literacy do not relate the content of their work to an examination subject. The other teachers who use the computer facilities are subject teachers who use computer-assisted education in their subjects.

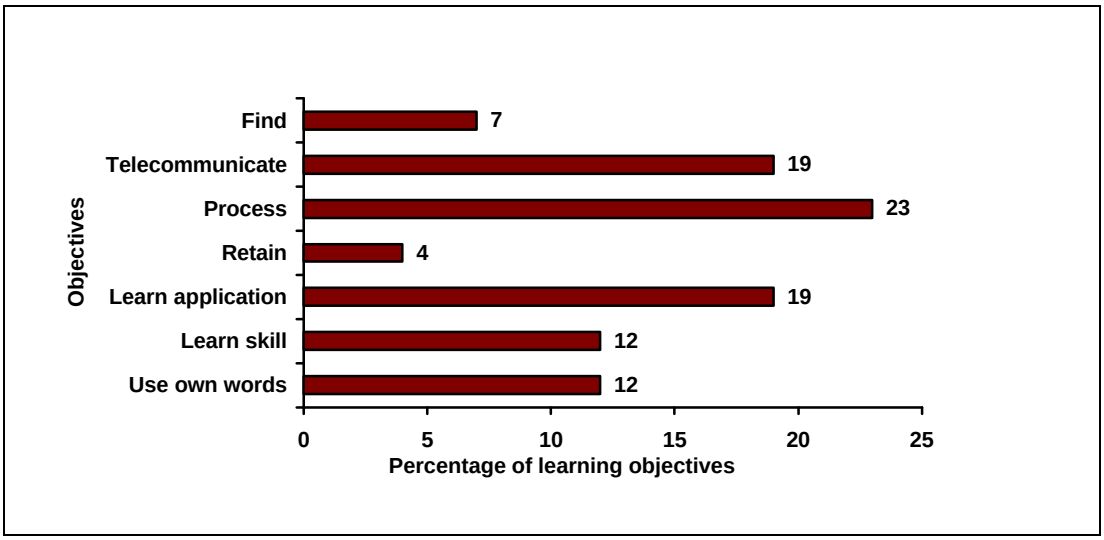
3.1.5 Computer use and lesson objectives

The computer is used for a variety of purposes at Pinelands High School. Based on the objectives of the teachers who have used computer-assisted education in 1996, the computer and its software applications are used to

- find information and possibly draw conclusions using packages such as *PCGlobe* and *Orbits* - 7%;
- telecommunicate using a package such as *Pegasus Mail* - 20%;
- process information by typing/drawing using a package such as *MSWord* or *Paintbrush* - 24%;
- retain information using a package such as *Guido* - 4%;
- learn a specific application using any of the packages on the network - 19%;
- learn a specific skill using any of the packages on the network - 12%; and
- learn concepts which can be applied to whatever package a student uses later using any of the packages on the network; explore relationships in geometrical diagrams; experience and discover in a package such as *Geometer's Sketchpad*; and discover and learn new skills in a package such as *Logo* - 12%.

The objectives of computer-assisted lessons at Pinelands High School during 1996 are illustrated in the figure below.

Figure 4. 10 Objectives of computer-assisted education lessons

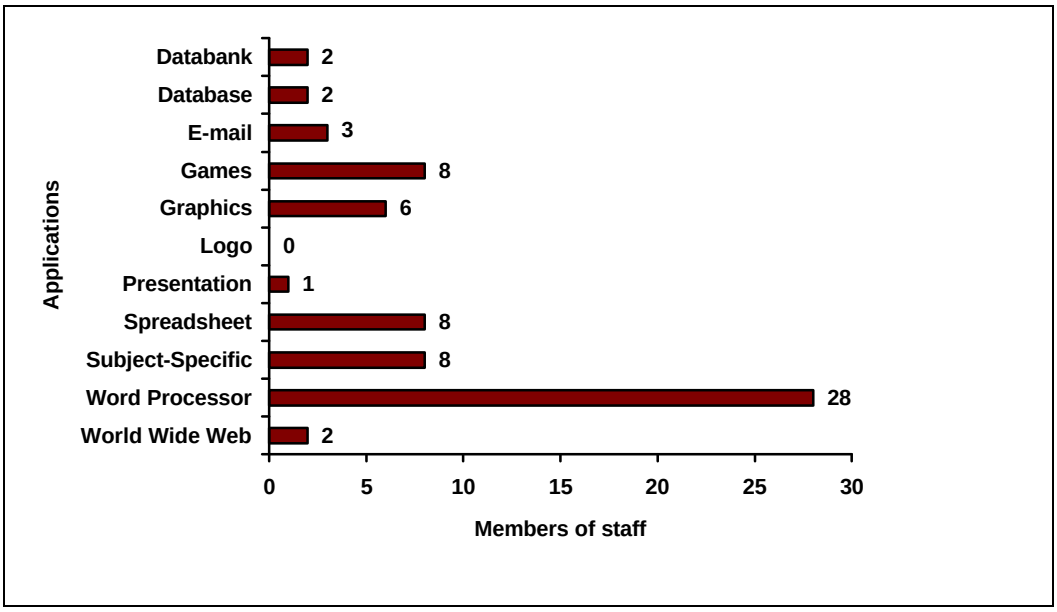


The main objective in the computer-assisted education lessons is the processing of information i.e. the processing of text and pictures using a word processor or graphics package. The second purpose of the computer-assisted education lessons at Pinelands High School is for telecommunications. The range of objectives of the lessons is varied which may indicate various uses to which computer-assisted education is put.

3.2 Use of computer applications

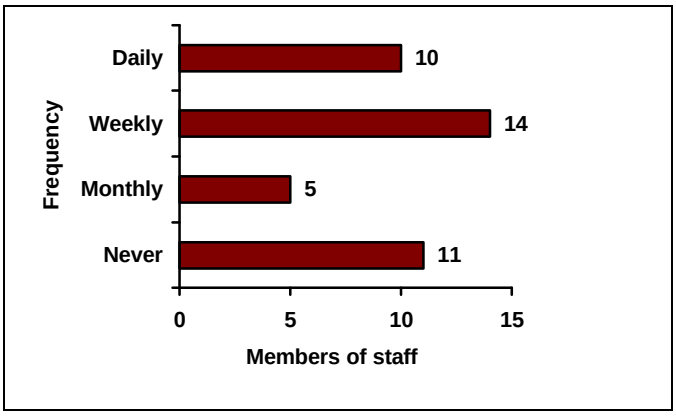
3.2.1 Use of applications at home by teaching staff

Figure 4. 11 Use of computer applications at home by staff



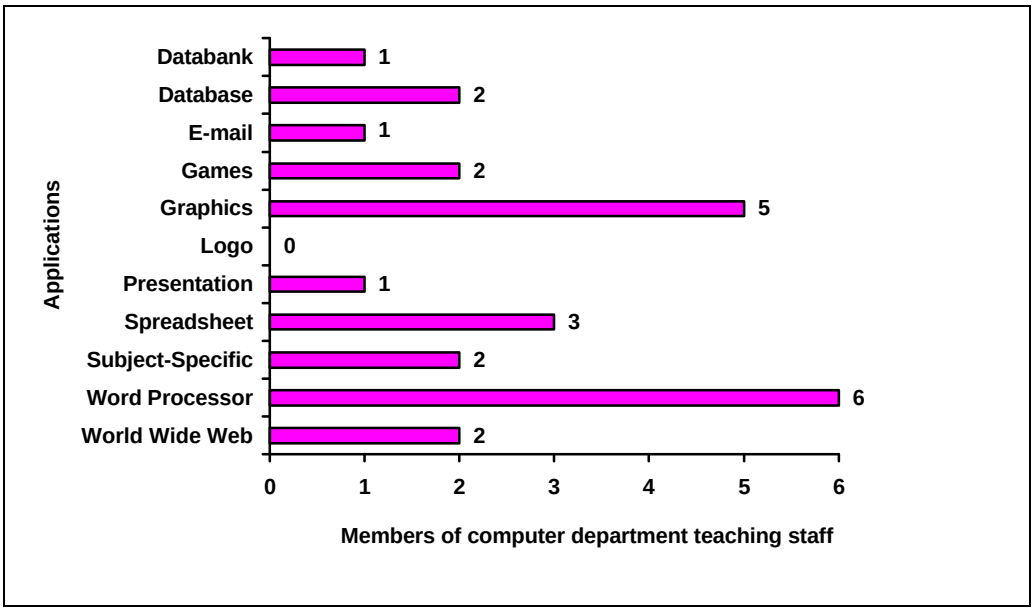
The figure above indicates the use of computer applications at home for lesson preparation or private use by staff members at least *once a month*. From this it can be seen that 28 (70%) of the staff members who completed the questionnaire use a word processor at home at least once a month.

Figure 4. 12 Use of the word processor at home by staff



The figure above indicates the frequency of word processing at home. Fourteen (40%) members of staff use the application on a weekly basis.

Figure 4. 13 Use of computer applications at home by computer department teaching staff

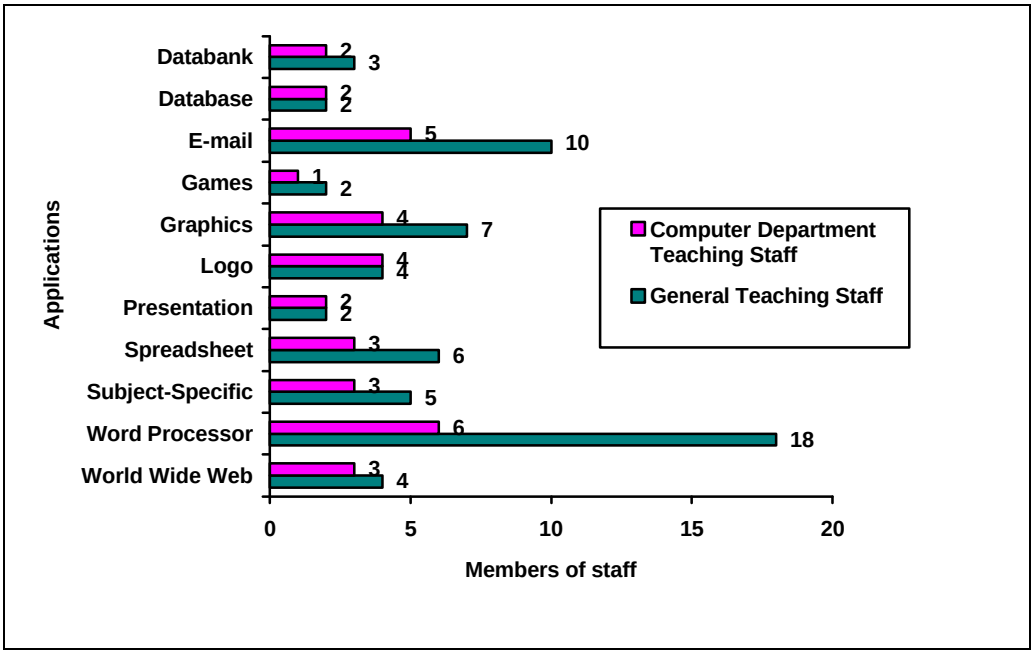


From the above figure it can be seen that a large number of staff from the computer department teaching staff use the computer at home for lesson preparation or private matters, at least once a month. One member of the computer department does not have a computer at home. The illustration indicates that six of the seven department's teaching staff uses the word processor regularly at home. It must be noted that the computer teaching department includes two staff members who are administrative staff who teach Computer Literacy in addition to their administrative duties and thus do not really have to do much lesson preparation at home.

From Figures 4.11, 4.12 and 4.13 it can be deduced that the staff of Pinelands High School use the word processing application more than any other application at home in lesson preparation. The staff of the computer department use the word processor more than other groupings of the staff. The data in Figures 4.11, 4.12 and 4.13 indicate that the computer department team uses the word processor the most in lesson preparation, almost to the exclusion of other applications.

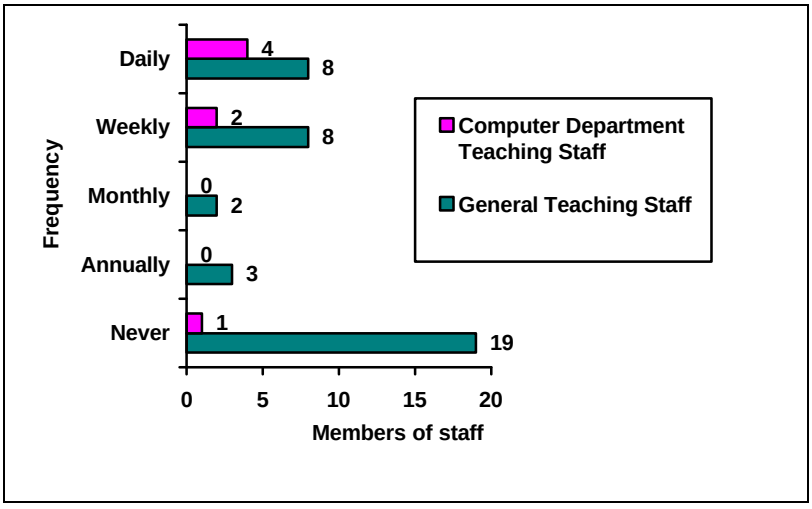
3.2.2 Use of applications at school for lesson preparation

Figure 4. 14 Use of computer applications at school for lesson preparation



The figure above indicates computer use at school for lesson preparation by teaching staff, total 40, at least *once a month*. Note that the word processor is the most commonly used application and that e-mail is also used by a fair number of staff members. The overall use of the computer must be seen against the use made of it by teaching staff from the computer department. It must be noted that the computer teaching department, total seven, includes two staff members who are administrative staff who teach Computer Literacy in addition to their administrative duties.

Figure 4. 15 Use of the word processor at school for lesson preparation



From the figure above it can be noted that most staff do not use the word processor at school for lesson preparation possibly as their lesson preparation is done at home. The staff who do use the computer at school for lesson preparation and use the word processor, are mainly from the computer department.

The word processor is the application used at home the most and is used in the main by the computer department staff. The data in Figures 4.14 and 4.15 indicate that the computer department team uses the word processor in lesson preparation, almost to the exclusion of other applications.

3.2.3 Use of applications at school for teaching purposes

Table 4. 25 Computer use in teaching based on marital status and gender

MARITAL STATUS	FEMALE		MALE		TOTAL	
	NUMBER	%	NUMBER	%	NUMBER	%
Divorced	2	66	0	NA	2	66
Married	5	55	5	55	10	55
Single	6	54	5	62	11	57
Total	13	56	10	43	23	57

From the data above it appears that a greater percentage of female than male members of staff use the computer in teaching in the classroom. The evidence of three divorced staff members is too small to be used to form a judgment regarding their marital status influencing computer use in the classroom for teaching purposes. There is a small difference in computer use in teaching by married and single teachers.

Table 4. 26 Computer use in teaching based on total years of teaching experience

YEARS EXPERIENCE IN TOTAL	FEMALE	MALE	TOTAL
10 or more	10	4	14
less than 10	3	6	9
Total	13	10	23

It was suspected that there may be a correlation between gender, years of teaching experience and use of the computer in teaching. The calculations below were carried out to discover if any pattern could be found.

Table 4. 27 Statistics on computer use in teaching based on total years of teaching experience

TEST	VALUE	p-VALUE
Chi-square (df=1)	3.24	0.0721
Fisher exact p one-tailed		0.0857

The Chi-squared statistic, calculated from a two way table, follows approximately the Chi-squared distribution. The approximation improves as the numbers in the table increase. The numbers given in this table are small and thus the Chi-squared approximation becomes questionable, thus Fisher's exact test has been performed to serve as a check on the Chi-squared p-value. The p-values of both tests are similar suggesting that the Chi-squared approximation is reasonable.

Generally a p-value greater than 0.05 is considered as weak evidence against the null hypothesis that, as far as computer usage is concerned, gender and experience are independent. There is therefore no difference in computer usage between male or female members of staff; less or more than 10 years (Fresen, 1996).

Table 4. 28 Computer use in teaching based on years of teaching experience at Pinelands High School

YEARS EXPERIENCE IN TOTAL	FEMALE	MALE	TOTAL
10 or more	4	1	5
less than 10	9	9	18
Total	13	10	23

It was suspected that there may be a correlation between gender, years of teaching experience at Pinelands High School and use of the computer in teaching. The calculations below were carried out to discover if any pattern could be found.

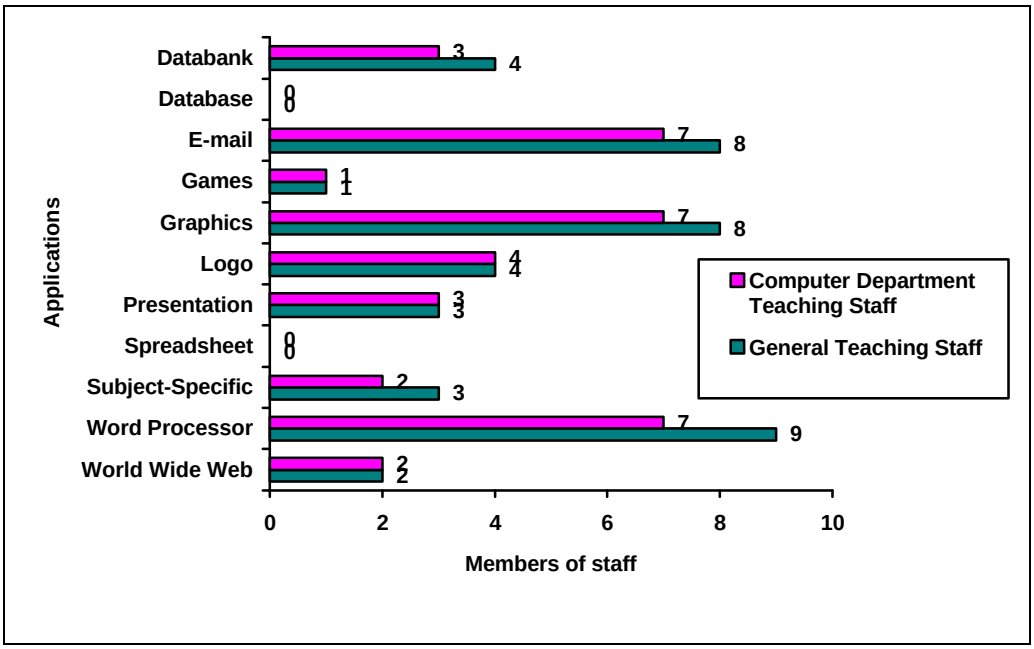
Table 4. 29 Statistics on computer use in teaching based on total years of teaching experience at Pinelands High School

TEST	VALUE	p-VALUE
Chi-Squared (df=1)	1.43	0.2313
Fisher exact p one-tailed		0.2507

The Chi-squared statistic, calculated from a two way table, follows approximately the Chi-squared distribution. The approximation improves as the numbers in the table increase. The numbers given in this table are small and thus the Chi-squared approximation becomes questionable, thus Fisher's exact test has been performed to serve as a check on the Chi-squared p-value. The p-values of both tests are similar suggesting that the Chi-squared approximation is reasonable.

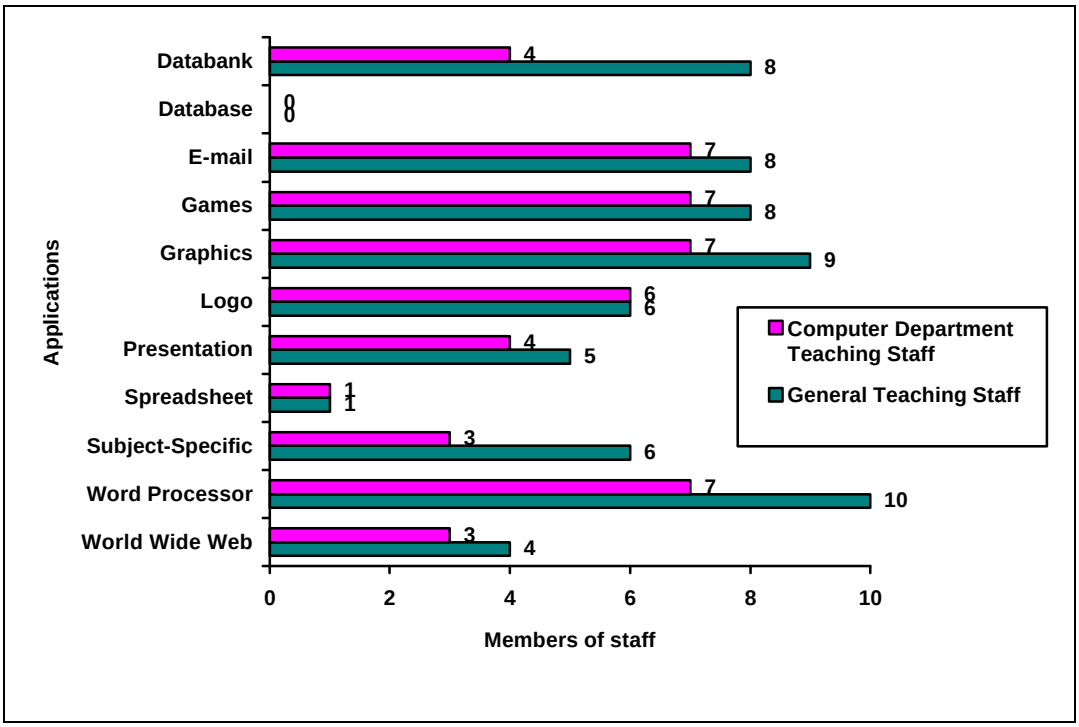
Generally a p-value greater than 0.05 is considered as weak evidence against the null hypothesis that, as far as computer usage is concerned, gender and experience are independent. Therefore there is no difference in computer usage between male or female members of staff; less or more than 10 years (Fresen, 1996).

Figure 4. 16 Use of computer applications at school for teaching purposes at least once a month



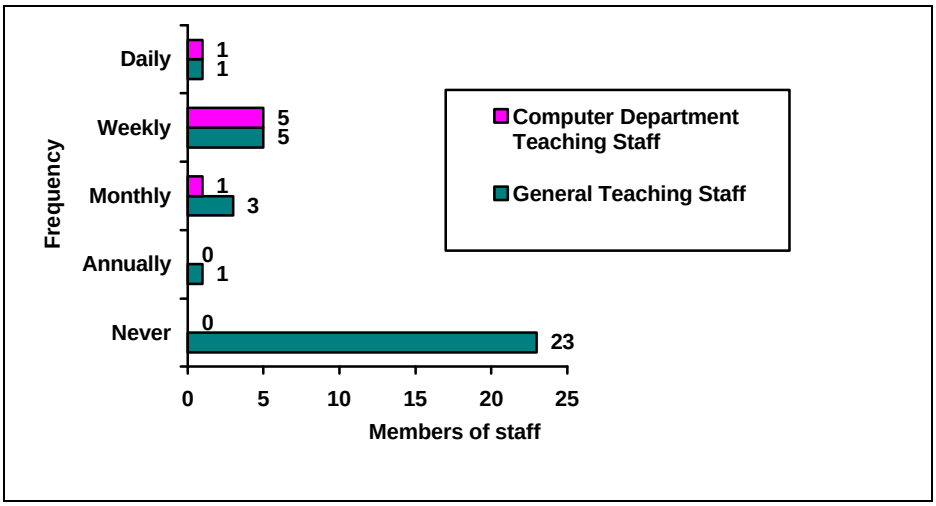
The above figure indicates the use of computer applications for teaching by all teaching staff. The figures above indicate computer use at least *once a month*. Note that the word processor, e-mail and graphics packages are used the most. Also note the correlation between the number of computer department teaching staff, total seven, and general staff, total 40, using the computer for teaching.

Figure 4. 17 Use of computer applications at school for teaching purposes at least once a year



The above figure indicates the use of computer applications for teaching by all teaching staff. The major difference between the Figures 4.16 and 4.17 is that the former illustrates computer use in teaching at least monthly and 4.17 at least annually. It appears that a number of staff, although they use the applications, only use them annually. Note that the word processor, graphics, games, e-mail and databank applications are used the most. Also note the correlation between the number of computer department teaching staff, total seven, and general staff, total 40, using the computer for teaching.

Figure 4. 18 Use of the word processor at school for teaching purposes



From the above figure it can be seen that the word processor is seldom used for teaching purposes by the 40 staff members. When the word processor is used for teaching purposes, the computer department teaching staff are the main users. The word processing package is used relatively seldom although it is one of the most commonly used applications as seen from Figure 4.16 and 4.17. From the data in Figure 4.16 and 4.17 it is apparent that use of word processors, e-mail and graphics applications are the most common. The timetable of the computer room may give an indication as to the reason for lack of use of computer applications.

3.3 Access to computer facilities

3.3.1 Access to computer room

The computer room is timetabled for classes for 68% of the time. The subjects which have timetabled periods are illustrated in the table below. In a two-week cycle the room is only available for 18 out the possible 58 periods for non-timetabled classes. The limited access for other subjects could be a limitation to the use of computer-assisted education at the school. All the teachers who use the room for the timetabled periods are teachers who are also part of the computer department. The timetable has been rescheduled to allow for the Graphics, Mathematics and Typing departments to use the room in addition to that of Computer Literacy.

Table 4. 30 1996 computer room timetable

	Mon A	Tue A	Wed A	Thu A	Fri A	Mon B	Tue B	Wed B	Thu B	Fri B
1	9 Typing			6M CL	6L CL	9 Typing			6LDK Maths	
2	6D CL				7J CL			9 Graphics		7M CL
3	9 Maths	LSJ1		7EMW Maths	LSJ2	9 Graphics	LSJ1		6D CL	LSJ2
4		LSS1	7E CL	8 Graphics	LSS2	6GNM Maths	LSS1	6G CL	7R CL	LSS2
5	6M CL	7T CL	6N CL		6G CL	7RTJ Maths	7W CL	7L CL		6K CL
6		6K CL		6N CL	10 Maths	7EMW Maths			10 Maths	8 Maths

The computer room is used for the periods below as indicated in the table above:

Computer Literacy (CL)

- the six standard 6 classes receive classes twice per cycle
- the six standard 7 classes receive classes once per cycle

Graphics

- the standard 8 Graphics teacher has a period booked on Thursday A
- the standard 9 Graphics teacher has periods booked on Monday B and Wednesday B

Life Skills Junior 1 and 2 (LSJ1 and LSJ2), and Life Skills Senior 1 and 2 (LSS1 and LSS2)

- two mixed groups of standards 6 and 7 students have Life Skills on Tuesday A and B, and Friday A and B
- two mixed groups of standards 8, 9 and 10 students have Life Skills on Tuesday A and B, and Friday A and B

Mathematics (Maths)

- the standard 6 Mathematics teachers who between them have six classes, have two periods booked, Monday B and Thursday B
- the standard 7 Mathematics teachers who between them have six classes, have three periods booked, Thursday A, and Monday B twice
- the standard 8 Mathematics teachers have a period booked on Friday B
- the standard 9 Mathematics teachers have a period booked on Monday A
- the standard 10 Mathematics teachers have a period on Friday A and Thursday B

Typing

- the standard 9 Typing teacher has periods booked on Monday A and Monday B

Table 4. 31 Use of computer room for timetabled subjects and applications

SUBJECT	NUMBER OF PERIODS	%	SOFTWARE APPLICATION
Computer Literacy	18	31	Logo, MSWord, Orbits, Paintbrush, PCGlobe, Pegasus Mail, Windows, Zip Zap Map World
Graphics	3	5	Paintbrush
Life Skills	8	13	Logo, MSWord, Windows,
Mathematics	9	15	Geometer's Sketchpad
Typing	2	3	MSWord

The computer room is used mainly for Computer Literacy, Mathematics and Life Skills classes as indicated in the table above. Access is limited for non-timetabled classes. The software used in the timetabled classes is listed in the table above. The applications are mainly *MSWord* used in three subjects and *Paintbrush* used in two subjects.

Table 4. 32 Use of software in non-timetabled periods

SUBJECT	SOFTWARE APPLICATION
English	MSWord, Pegasus Mail
Environmental Science 1 and 2	MSWord, Orbits, PCGlobe
Geography	PCGlobe, Orbits, Zip Zap Map World
History	MSWord, Paintbrush, PCGlobe
Music	Guido

Subject teachers, apart from the Computer Literacy, Graphics, Mathematics and Typing teachers, endeavour to use the computer room by fitting their classes into the unused periods. The table above lists the subjects which use the computer room and the software used during non-timetabled periods.

3.2.4 Access to computer applications

The physical access to computer applications for lesson preparation or teaching purposes as illustrated below in Figure 4.19 indicates that the staff in general have

not considered access to many applications. At the time of the survey, of the applications listed below, the staff at school only had access to

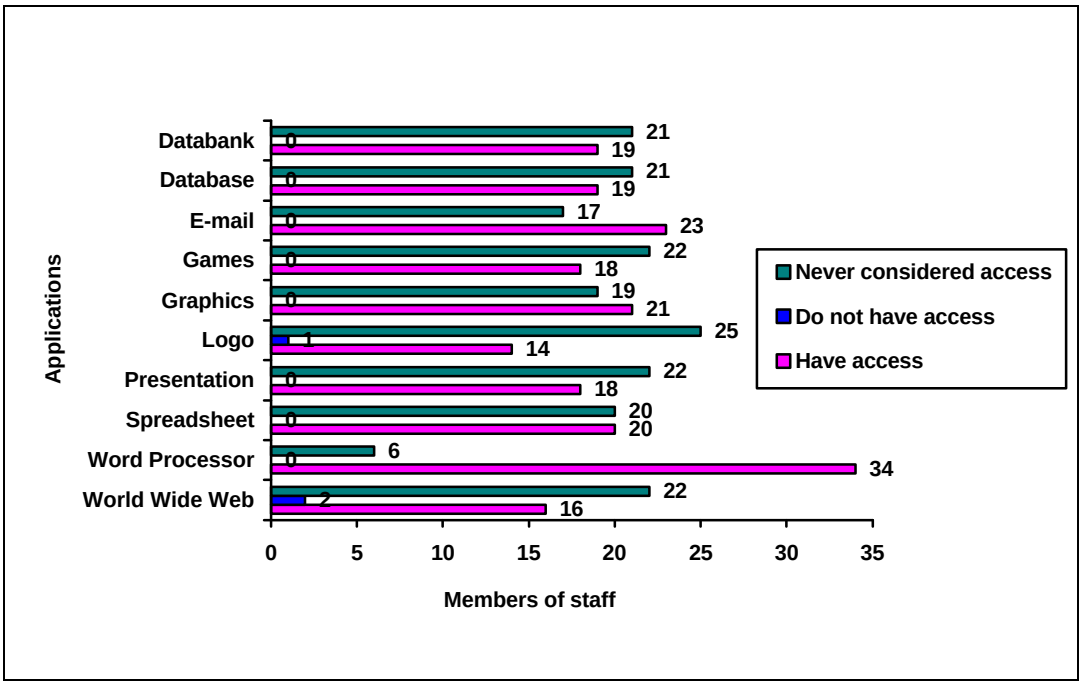
- the World Wide Web on one computer which is not available for teaching use;
- a presentation package, *Powerpoint*, on three computers; and
- a spreadsheet on three computers which had enough RAM.

There was no database for teaching purposes, only administrative purposes, although 19 of the 40 staff *believed* that they had access to a database application.

The staff believed that they had access to the applications. Note, in the following figure, the number of teachers who have neither considered inquiring about access to the following applications nor using them.

In general the staff show a lack of interest in the applications which can only be put down to knowing that they could not get access to the computer room for teaching, or lack of knowledge about the use of the application for teaching purposes.

Figure 4. 19 Physical access to computer applications by staff



4 Summary

The survey of computer-assisted education at Pinelands High School was done in order to be able to compare the integration of computer-assisted education at

Pinelands High School with the **Evolutionary Model** developed in Chapter 2. The following aspects were investigated and discussed.

4.1 Pinelands and Pinelands High School

Pinelands is a middle class town where most of the high school students attend the local high school, Pinelands High School. The school has approximately 960 male and female students drawn from Pinelands itself and neighbouring suburbs. The students mainly speak English. Students come from homes where about 70% of them have computers. The 48 male and female teachers teach 25 subjects in 32 classes from standard six to standard 10.

4.2 Summary of support infrastructure

4.2.1 Sharing of skills

Computer-assisted education has been used by 23 of the 40 teachers surveyed. Teachers from the computer department spread their enthusiasm outwards to the other subject departments in which they work.

Mentoring of some staff members is taking place with novices to computers on a small scale. Apart from sharing the vision of computer-assisted education in their subject departments not much sharing of information, skills and enthusiasm of computer-assisted education takes place at Pinelands High School.

4.2.2 Decision-making policy

The school has a decision-making policy where staff have the opportunity for input in long and short term planning of the school via staff meetings and quality circles. Within subject departments the staff are able to discuss and plan their methods, evaluation and subject content. The vision and enthusiasm of the computer department does not appear to have been shared with the general staff with respect

to software, hardware, plans for the department and day-to-day running of the department. The computer department staff themselves have reached general consensus with regard to their planning and future.

4.2.3 Computer department teaching facilities

The computer room is networked with 21 computers and one printer. All computers for teaching purposes are found in this room. The software comprises a word processing application, a telecommunication application, databanks, a mathematical drawing application, a programming language application, a drill and practice application and games applications, i.e. mainly content-free applications.

4.2.4 Finance

Each subject department is responsible for budgeting for their own computer software to add to those on the network. Finance for the computer department requires discussion in the Computer Committee before presentation to the Board of Governors.

The school has helped staff to purchase computers with low cost loans, and technical advice from the computer department has been utilised by the staff. Many teachers who have bought computers with school assistance use the computer in teaching. An interesting point raised is that the cost of a multimedia computer is more than the monthly salary of 25 of the 40 teachers surveyed, and possibly more.

4.2.5 Staff training in the use of computers

Two-thirds of the staff have attended evening or day-time in-house classes in word processing. Other applications on the school's network have not been taught to more than seven members of staff, apart from e-mail where 11 out of 40 have received training. This would indicate that not much staff training has been done. The staff who have received the most training are teachers who are members of the computer department. The training which has taken place is using an application, and not on how to use the application in teaching. The exception to this is the use

of subject-specific applications where the Music and Mathematics staff have received training on applications they selected.

4.2.6 Computer department public relations

Computers are part of the administration of the school. Computers are usually spoken about at parents' meetings. Computer generated posters are found throughout the school. The computer department office is open for staff to use and advice is readily available from computer department staff. The broader community is offered the opportunity to learn more about computers at evening classes. In respect of computers Pinelands High School is well known and highly regarded.

4.3 Summary of computer use in teaching, applications and facilities

.3.1 Use of the computer in teaching

The staff use group work in their general teaching and have attended a course in group work. Group work is used by 15 of the 23 teachers who have used computer-assisted education. This groupwork has almost been forced on the teachers because of a lack of computer stations and the general traditional method of teaching.

Computer Literacy is not an examination subject at Pinelands High School. Standards six and seven are taught the subject Computer Literacy by a number of teachers some of whom are not official qualified teachers. The Computer Literacy teachers are not required to integrate computer work into the curriculum. The work being done in computer-assisted education is used mainly to support traditional classroom work i.e. mainly processing information using a word processor or graphics application, whether taught by a subject or a Computer Literacy teacher.

4.3.2 Use of computer applications

The computer is being used mainly for word processing, e-mail and graphics. At home the word processor is used by 70% of all staff for lesson preparation or private matters. At school the word processor is used the most by staff in lesson preparation. E-mail is also apparently used in lesson preparation as well. In teaching the common applications used are e-mail, graphics and word processors.

A total of 23 teachers have used the computer in teaching at Pinelands High School but the core teachers are those of the Computer Literacy subject department. In every graph indicating computer usage where the general staff are compared with that of the Computer Literacy subject department, the Computer Literacy subject department are the major users of the computer in teaching, at home and in lesson preparation.

4.3.3 Access to computer facilities

Computer Literacy has been timetabled for standards six and seven, and Graphics, Life Skills, Mathematics and Typing for different groups. The timetable has been adjusted to facilitate these classes and they fill most of the available periods in the computer room. During such lessons content-free applications are used the most.

Many staff members do not know what computer applications are really available at Pinelands High School. The staff believe they are able to get access to normal computer applications, whether they are on the network or not, or have never considered getting access.

5 Conclusion

Chapter 5 comprises an evaluation of the integration of computer-assisted education at Pinelands High School, the infrastructure to support computer-assisted education and its integration based on the **Evolutionary Model.** This evaluation will be done based on the information collated in this chapter.

CHAPTER 5

SYNTHESIS

This investigation is about the integration of computer-assisted education at Pinelands High School. In the literature study there was an investigation into a definition of computer-assisted education and developmental models of the integration of computer-assisted education. A new model of the integration of computer-assisted education was created, the **Evolutionary Model**. In this chapter computer-assisted education at Pinelands High School will be discussed in the light of the definition, infrastructure and model.

1 Evolutionary Model

1.1 Implementation of the prerequisite infrastructure of the Evolutionary Model at Pinelands High School

1.1.1 Staff

In the foundation of the **Evolutionary Model** of the integration of computer-assisted education the staff should be

- able to practise using the computer out of class;
- enabled to use the computer as a personal tool;
- given time in school for training and research;
- play an active role from design and planning to the evaluation stage;
- financially assisted to purchase their own computers to use at home;
- financially assisted to purchase the same software as that used at school;
- provided with access to program-expertise when necessary;
- provided with loaned computers for home usage; and
- encouraged to share enthusiasm and celebrate initiative.

Pinelands High School staff are assisted in practicing to use the computer out of the classroom, at home, by means of the financial assistance given them by the school's low cost loans to purchase hardware. Fourteen of the 40 staff members surveyed have used the school's financial scheme to purchase a computer. In-house computer training using the word processor has been provided and 25 staff members or 62% have received training. Eight staff members, six of whom were from the computer teaching department, have made use of the school's financial assistance to attend a course or conference on computers. In the Mathematics and Music departments there is the necessary training for the integration of computer-assisted education using applications which those departments have bought.

Of the surveyed staff, 75% have had input into the school's long term planning but only 23% have had any input into the plans for the computer department. The staff are not financially assisted to purchase the same software for home use as that used at school. The staff are able to get application expertise from staff in the computer department, or so they believe, as shown in Figure 4.10. Should they wish, to the staff are able to borrow a computer for home use.

Of a surveyed staff of 40, 16 have shared their experiences with teachers in their department, 11 with adults in the school, 13 with teachers not from Pinelands High School and two have published articles relating their experiences using the computer in the class. This data plus the fact that only 23% of the staff have had any input into the computer department decision-making would indicate that the vision, enthusiasm and expertise of computer-assisted education is not being shared with the Pinelands High School staff.

1.1.2 School

In the foundation of the **Evolutionary Model** the school should allocate resources prudently. It should

- initially focus on a few successful classrooms, teachers or subjects;
- eliminate technical obstacles with technical staffing and enough financial planning;
- involve the principal, school management team and support staff as well as teachers;

- practice what it preaches with regard to learning theory, i.e. train the staff in the theory being used in the classroom;
- make technology and computers part of the overall planning to increase student learning;
- introduce a system of 'buddies' where enthusiastic staff are partnered with those who are reluctant to use technology;
- provide adequate resources for the desired outcomes;
- take cognisance of the school's dominant teaching/learning style, for example, whether it is the traditional 'factory' approach or cooperative group work;
- provide time for joint decision making and planning;
- select software with broad usage; and
- share the vision and goals of computer-assisted education.

Pinelands High School has allocated resources prudently in purchasing mainly content-free applications which can be used in a number of subject departments as indicated in Tables 4.15 and 4.16. Funding problems have been eliminated with the involvement of three members of the Board of Governors on the computer committee, hence the school's financial authorities should be aware of the needs of the computer department. The school has endeavoured to eliminate technical obstacles by appointing a network administrator.

Pinelands High School has not managed to involve the principal, management team, support staff and the teachers in the planning and vision of computer-assisted education. Only 23% of the staff surveyed, which included the management team, support staff and teachers, have had input into the long term plans for the computer room. The Computer Literacy subject department has involved most of their teachers in the decision-making of the department as indicated in Table 4.18.

Staff training in computer-assisted education in the **Evolutionary Model** should be conducted in the teaching method employed in the school and in particular in the computer department. Staff *training* in computers at Pinelands High School is done in the traditional 'factory' method with one person per computer although the number of computers available in the computer room prevents *teaching* in the traditional 'factory' method with the majority of classes which use the room. Six teachers in the Computer Literacy, English, Graphics and Mathematics subject departments are being mentored by another teacher in computer-related teaching.

The school should provide adequate resources for the desired outcomes. At the school the outcomes with regard to computer-assisted education have not been specified or published. There is no mission statement in the computer department.

The school has not taken cognisance of its teaching style which is the traditional 'factory' approach where every student requires his own computer station. The average class in standards six or seven is 36.3 students and there are only 21 computers available for class teaching. Staff have received training in cooperative group work but not group work using the computer.

1.1.3 Community involvement

Community involvement and private sector support can be gained by means of communicating the successes and problems of the computer department; and by offering training sessions using the school's facilities in current application packages.

The Continuing Education Department at Pinelands High School offers computer courses to the public using the school's equipment and facilities. Information about using the computers at school is shared with the parents.

1.1.4 Conclusion with regard to the prerequisite infrastructure of the Evolutionary Model

The school has done much to lay a good foundation for the integration of computer-assisted education. A few factors need to be addressed to assist in the process:

- The vision of computer-assisted education must be shared with all staff members.
- Initiative in and enthusiasm for computer-assisted education must be celebrated.
- Training in application use is needed.
- Training in using the computer in the classroom is needed.
- Staff training in computers must be done in the method to be used in teaching with computers.
- More computers are needed to take cognisance of the current teaching method of the school.

1.2 Implementation of the phases of the Evolutionary Model at Pinelands High School

The **Evolutionary Model** is divided into five phases to describe the integration of computer-assisted education in a school. The five phases are Introduction, Entry, Intermediate, Penultimate and Creation.

1.2.1 Phase 1: Introduction

In the Introduction phase of the **Evolutionary Model** computers and complimentary technology are installed, teacher training in using the word processor begun and a steering committee is identified. The computer is used mainly to support traditional teaching methods using drill-and-practice and word processing applications. The use made of the applications and their integration with each other, would indicate their level in the phases of the **Evolutionary Model** of computer-assisted education.

Table 5. 1 Outcomes based on the Evolutionary Model Phase 1: Introduction - Instructional activity

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Computer use replicates traditional instructional and learning activities	Most work uses word processor, graphic or e-mail application	✓✓ ✓✓	Most work uses word processor, graphic or e-mail application	✓✓ ✓✓

Table 5. 2 Outcomes based on the Evolutionary Model Phase 1: Introduction - Teacher interaction

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Identification of steering or organising committee	Computer committee for finances - computer subject department for teaching matters	✓✓ ✓✓	Senior staff involved with financing	✓
Training of teachers begins with word processing	Five of seven staff trained but all nevertheless competent	✓✓ ✓✓	63% of staff have had training	✓✓ ✓

Table 5. 3 Outcomes based on the Evolutionary Model Phase 1: Introduction - General school

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Installation of computers and complimentary technology	Done	✓✓ ✓✓	Done	✓✓ ✓✓

At the school the processing of information is the main activity in this Introductory phase. The use of the graphics, word processors and e-mail applications are the most common applications as seen in Figure 4.14. From Tables 5.1 to 5.3 one can see that Pinelands High School has completed the Introduction Phase 1.

1.2.2 Phase 2: Entry

In this Entry phase of the **Evolutionary Model** teachers start using the computer equipment in their teaching. As in the Introductory phase, the computer is used mainly to support traditional teaching methods using drill-and-practice and word processing applications. Teachers lose their fear of the technology with the aid of technical support.

Table 5. 4 Outcomes based on the Evolutionary Model Phase 2: Entry - Instructional activity

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Computers are used mainly in drill-and-practice or text-based work	Most work uses word processor, graphic or e-mail application	✓✓ ✓✓	Most work uses word processor, graphic or e-mail application	✓✓ ✓✓
Established teaching methods and activities are supported by computer technology	Methods - insufficient computers for each student based on established methods Activities - supported by work using word processor, graphic or e-mail application	✓✓ ✓✓ ✓✓	Methods - insufficient for each student based on established methods Activities - supported by work using word processor, graphic or e-mail application	✓✓ ✓✓ ✓✓
Technical assistance is given to students	Given by network administrator	✓✓ ✓✓	Given by network administrator	✓✓ ✓✓

Table 5. 5 Outcomes based on the Evolutionary Model Phase 2: Entry - Teacher interaction

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Stress levels of teachers is kept low with basic skill computer work	Have been given basic computer skills and believe able to get advice from colleagues in computer department	✓✓ ✓✓	Have been given basic computer skills and believe able to get advice from computer department	✓✓ ✓✓
Teacher interactions are mainly of a technical nature	Staff have moved beyond this point	✓✓ ✓✓	Staff have moved beyond this point	✓✓ ✓✓
Technical assistance is given to teachers	Technical assistance given by network administrator	✓✓ ✓✓	Technical assistance given by network administrator	✓✓ ✓✓
Training of educators begins initially in word processing	Five of seven staff trained but all competent nevertheless	✓✓ ✓✓	63% of staff have had training	✓✓ ✓

Most of the work done in the computer department at Pinelands High School is processing information using the word processor, graphics application or electronic mail as indicated in Figure 4.8. The teaching methods are traditional in many of the classes where students work on their own, each needing a computer. Of the staff who use the computer only 44% of the teachers would like the students to work in pairs. This would indicate that the staff prefer to use individualised traditional teaching methods. Of the total of 23 teachers who have used computer-assisted education, 21 use it for work directly connected to the curriculum.

At Pinelands High School the staff believe they are able to get advice and assistance from the computer department staff and network administrator as tabulated in Table 4.10. Stress levels are kept low because of the support from the staff of the computer department and the staff selecting their own entry level of computer-assisted education work. From Tables 5.4 and 5.5 above, one can note the level of computer-assisted education at Pinelands High School in this Entry Phase 2.

1.2.3 Phase 3: Intermediate

The Intermediate phase is the most dramatic in the **Evolutionary Model** of computer-assisted education. The teachers start using computers as a tool to achieve an educational objective. Content-free applications such as word processors, spreadsheets and databases are used. The role of the teacher changes from the focus of the lesson to facilitator of learning. Interactions with students change from sharing technical information to sharing instructional strategies. Teachers start using the computer in creative ways as they develop expertise in applications. The desire by teachers for additional technology begins to be felt.

Table 5. 6 Outcomes based on the Evolutionary Model Phase 3: Intermediate - Instructional activity

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Move from text-based instruction and drill-and-practice to word processors, databases, spreadsheets and graphics	No spreadsheet or database applications. Use word processor and graphic applications	✓✓	No spreadsheet or database applications. Use word processor and graphic application	✓✓
Role of teacher gradually changes from instructor to facilitator	Computer Literacy teachers call themselves facilitators	✓✓ ✓✓	All but one of the 16 non-Computer Literacy teachers who use the computer regard themselves as facilitators	✓✓ ✓✓
Students peer tutor	Students have to peer tutor while sharing same computer and doing individualised work as not enough computers	✓✓	Students have to peer tutor while sharing same computer and doing individualised work as not enough computers	✓✓

Table 5. 7 Outcomes based on the Evolutionary Model Phase 3: Intermediate - Teacher interaction

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Collaboration on instructional topics between teachers	Computer Literacy teachers discuss and collaborate on lessons	✓✓ ✓✓	Mathematics and Geography teachers collaborate on lessons	✓✓
Teachers observe fellow teachers' classes	Mentoring takes place between four of the Computer Literacy staff	✓✓	In English, Graphics and Mathematics departments mentoring taking place in teaching with computers	✓✓

Table 5. 8 Outcomes based on the Evolutionary Model Phase 3: Intermediate - General school

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Curriculum is modified to make use of the different technologies	Four of the seven Computer Literacy teachers link content of lessons to curriculum	✓✓	English, Environmental Science 1 and 2, Geography, Graphics, History and Mathematics departments deliberately modify their curriculum to integrate computers	✓✓ ✓✓

Tabulated in Tables 5.6 to 5.8 the activities of the teaching staff are described at the Intermediate phase. At Pinelands High School staff use the word processor and graphics applications as there are no spreadsheets or database applications on the network for teaching purposes. Creative use of the word processor and graphics applications is seen in the objectives staff have for their lessons seen in Figure 4.8.

The computer is used by 24% of the staff for objectives which could fall into the early phases of the **Evolutionary Model** but 12% use it for non specified encompassing objectives, illustrated in Figure 4.8, which are the initial stages of creative work using computer-assisted education.

The students have to peer tutor each other while working together as there are insufficient computers for one per child and many of the lessons are for individualised learning. Teachers who use the computer regard themselves as facilitators of learning as opposed to the focus of the lessons.

Collaboration and discussion between teachers is found in the Computer Literacy, Geography and Mathematics subject departments. In subject departments, 16 of the 23 teachers who use computer-assisted education discuss their computer experiences. Although only 16 of the 23 teachers share their experiences within their departments that sharing is mainly extended from the Computer Literacy subject department outwards so that other departments and individual teachers within the school are introduced to using the computer. The curriculum is modified in certain subjects to make use of the computer applications, for example using *Orbits* in Environmental Science 1 and 2, *PCGlobe* in Environmental Science 1 and 2 and *Geometer's Sketchpad* in Mathematics.

1.2.4 Phase 4: Penultimate

In this Penultimate phase of the **Evolutionary Model** the foundation built on over the previous three phases bears fruit. The curriculum is modified to make use of different technologies and the school timetable is rescheduled to allow for team teaching and mentoring. The method of teaching changes from behaviourist to constructivist learning where students are involved with collaborative and creative project work by constructing their own knowledge. The teacher becomes a collaborator as opposed to a facilitator. A number of applications are used in learning.

Table 5. 9 Outcomes based on the Evolutionary Model Phase 4: Penultimate - Instructional activity

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Constructivist approach to learning replaces the behaviourist approach	Not apparent	-	Not asked in questionnaire but ascertained from objectives of lessons it is developing in Mathematics department	✓
Different computer applications are used in learning	Computer Literacy teachers integrating and moving between graphics, word processor and databank applications	✓✓	Use single applications	-
Experimentation with student grouping	Not apparent	-	Not apparent	-
Role of teacher gradually changes from facilitator to collaborator	Not apparent	-	Not apparent	-
Students are actively involved in knowledge construction	Not apparent	-	Found in Mathematics department	✓
Students involved in collaborative and creative project work	Not apparent	-	Not apparent	-

Table 5. 10 Outcomes based on the Evolutionary Model Phase 4: Penultimate - Teacher interaction

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Experimental collaboration between teachers in interdisciplinary project-based learning	Found between Graphics and Computer Literacy teachers	✓	Not apparent	-

Table 5. 11 Outcomes based on the Evolutionary Model Phase 4: Penultimate - General school

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Desire for new technology and better technology	Not apparent	-	Not apparent	-
Modification of curriculum to make use of the different facilities	Deliberately expose students to new technologies	✓✓ ✓✓	Environmental Science 1 and 2, Geography, Graphics, History, Mathematics and Typing deliberately integrate computers into their curriculums	✓✓
School timetable is rescheduled for team teaching	Rescheduled in order for working between Graphics and Computer Literacy teachers	✓	Found in Mathematics department	✓
Students peer tutor	Students have to peer tutor while sharing same computer and doing individualised work as not enough computers	✓✓	Students have to peer tutor while sharing same computer and doing individualised work as not enough computers	✓✓

Tabulated above in Tables 5.9 to 5.11 the activities of the teaching staff are described at the Penultimate phase. At Pinelands High School the curriculum is modified in Environmental Science 1 and 2, Geography, Graphics, History and Mathematics to make use of the computer, and in Computer Literacy. The Mathematics department appears to be moving towards the constructivist approach to teaching in their use of the *Geometer's Sketchpad*. This was apparent when the Mathematics department staff individually wrote different objectives in using the computer in teaching, despite the fact that they had a choice of ready-made objectives from which to choose.

The Computer Literacy teachers use more than one application in their classes often moving between the word processor, graphics application and the databanks of *Orbits* and *PCGlobe*. There is collaboration between the teachers of Graphics and Computer Literacy. The school timetable has been rescheduled to allow for team teaching in Graphics and Mathematics.

The staff do not seem to be aware of other applications which they could use, as illustrated in Figure 4.18 where they were asked if they had access to particular

applications. The school has neither a database nor spreadsheet application on the network. There is not an apparent desire for new technologies. There appears to be an ignorance of what applications the school has in the computer department, as illustrated in Figure 4.19.

1.2.5 Phase 5: Creation

This Creation phase in the integration of computer-assisted education is never completed as new technologies continue to be developed.

In this phase teachers use the technology to adapt to the student's learning styles, needs and preferences. With the new technology, computers and associated technologies, comes a total change in teaching/learning with collaborative learning, teacher mentoring, creation of knowledge, peer tutoring and active involvement of the students. Teachers reassess the system of grading work and the teaching organisation as a whole. The schedule of the school is reorganised to facilitate team teaching. Much of the learning is of a constructivist nature. Many applications are used in class work, a number of which are multimedia applications. Learning is exciting.

Table 5. 12 Outcomes based on the Evolutionary Model Phase 5: Creation - Instructional activity

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Accommodation of more learning styles, individual needs and individual preferences	Not apparent	-	Not apparent	-
Active involvement of students in knowledge construction	Not apparent	-	Found in Mathematics department	✓

continued on next page

continued from previous page

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Assessment is either portfolio or authentic assessment	Not apparent	-	Not apparent	-
Balance between direct and project-based teaching	Not apparent	-	Not apparent	-
Constructivist approach to learning replaces behaviourist approach	Not apparent	-	Ascertained from objectives of lessons it is developing in Mathematics department	✓
Knowledge creation	Not apparent	-	Knowledge creation as method beginning to be applied in Mathematics department	✓
Many different computer packages used in learning	Computer Literacy teachers integrating and moving between word processor, graphics and databank applications	✓✓	Use single applications	-
Multimedia programs used	Have none	-	Have none	-
Students involved in collaborative and creative project work	Not apparent	-	Not apparent	-
Students peer tutor	Students have to peer tutor while sharing same computer and doing individualised work as insufficient computers	✓✓	Students have to peer tutor while sharing same computer and doing individualised work as insufficient computers	✓✓
Teacher acts as a collaborator in the learning process	Not apparent	-	Not apparent	-
Use of new technologies	The newest technology used is e-mail but that is no longer new technology	-	The newest technology used is e-mail but that is no longer new technology	-

Table 5. 13 Outcomes based on the Evolutionary Model Phase 5: Creation - Teacher interaction

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Interdisciplinary project-based learning	Not apparent	-	Not apparent	-
Team teaching	Found between Graphics and Computer Literacy teachers	✓	Found in Mathematics department	✓

Table 5. 14 Outcomes based on the Evolutionary Model Phase 5: Creation - General school

OUTCOME	COMPUTER DEPARTMENT STAFF	✓✓ ✓✓	WHOLE STAFF USING COMPUTERS	✓✓ ✓✓
Desire for new technology and better technology	Not apparent	-	Not apparent	-
Modification of the curriculum to make use of the different facilities	Deliberately expose students to new technologies	✓✓ ✓✓	Environmental Science 1 and 2, Geography, Graphics, History, Mathematics and Typing deliberately integrate computers into their curriculums	✓✓
School timetable rescheduled for team teaching	Rescheduled in order for working between Graphics and Computer Literacy teachers	✓	Found in Mathematics department	✓

In Tables 5.12 to 5.14 above the outcomes of each aspect of the phase are tabulated and indicate how and where they are is found at Pinelands High School. There is almost a lack of any new outcomes in this Creation phase at Pinelands High School.

1.2.3 Conclusion with regard to the phases of the Evolutionary Model

Pinelands High School is at different levels of the integration of computer-assisted education based on the **Evolutionary Model**. The main outcomes from each of the different phases have been listed below showing the level at which they are found at Pinelands High School on the **Evolutionary Model**.

Table 5. 15 Position of the Computer Literacy subject department in the five phases of the Evolutionary Model

OUTCOMES	1	2	3	4	5
Instructional activity outcomes					
Number of applications used increases - from one to many					
Role of teacher changes - from facilitator to collaborator					
Teaching methods change - traditional to active involvement					
Type of applications used changes - wp to multimedia					
Type of learning changes - from behaviourist to constructivist					
Teacher interaction outcomes					
Interdisciplinary teamwork begins	NA	NA	NA	Gr	Gr
Teacher interactions change - from technical to collaborative					
Team teaching begins	NA	NA	Gr	Gr	Gr
Training in applications begun - from application to tool					
General school outcomes					
Curriculum modified to integrate computers	NA	NA			
Rescheduling of timetable	NA	NA	NA		

wp	Word processor	G	Geography
	Found at school	Gr	Graphics
	Found in small amounts	M	Mathematics
NA	Not applicable in this phase	NA	Not apparent

Table 5.15 above indicates the position of the Computer Literacy department in the five phases of the **Evolutionary Model**. Interdisciplinary Interactions are found between the Computer Literacy and Graphics subject departments. The training of the computer staff in the use of applications is still at the Phase 1, Introduction while General School Outcomes would indicate that the school is at Phase 5, Creation. In the section on Instructional Activity Outcomes the Computer Literacy subject department appears to be between Phases 3 and 4.

Table 5. 16 Position of the integration of computer-assisted education at Pinelands High School in the five phases of the Evolutionary Model

OUTCOMES	1	2	3	4	5
Instructional activity outcomes					
Number of applications used increases - from one to many					
Role of teacher changes - from facilitator to collaborator					
Teaching methods change - traditional to active involvement			M	M	
Type of applications used changes - wp to multimedia					
Type of learning changes - from behaviourist to constructivist				M	
Teacher interaction outcomes					
Interdisciplinary teamwork begins	NA	NA	NA		
Teacher interactions change - from technical to collaborative		MG	MG		
Team teaching begins	NA	NA			
Training in applications begun - from application to tool					
General school outcomes					
Curriculum modified to integrate computers	NA	NA			
Rescheduling of timetable	NA	NA	NA		

wp	Word processor	G	Geography
	Found at school	Gr	Graphics
	Found in small amounts	M	Mathematics
NA	Not applicable in this phase	NA	Not apparent

Table 5.16 above indicates the position of Pinelands High School on the **Evolutionary Model**. In the section on Instructional Activity Outcomes the school appears to be between Phases 3 and 4. Teacher Interaction Outcomes appear to be between Phases 1, Introduction, and 3, Intermediate. The training in the use of applications is still at Phase 1, Introduction, while General School Outcomes would indicate that the school is at Phase 5, Creation.

The foundation of the **Evolutionary Model** showed what the school has done to assist in the integration of computer-assisted education and its efforts can be seen in that the Computer Literacy subject department is between Phases 2 to 5. More training and additional software could help bring the Computer Literacy subject department and the general teaching staff of Pinelands High School into Phase 4 or 5.

2 Summary

2.1 Infrastructure to support computer-assisted education at Pinelands High School

Pinelands High School has provided the infrastructure for computer-assisted education in the manner below and has

- adapted the school organisation by timetabling Computer Literacy, Graphics, Mathematics and Typing classes in the computer room;
- endeavoured to meet the new demands of society by introducing the subject Computer Literacy to all standard six and seven students, and the subject Typing on the computer or keyboarding skills to older students;
- prevented gender stereotyping of computer expertise by having almost equal numbers of male and female Computer Literacy teachers;
- provided a certain level of hardware and the finance to maintain that hardware;
- provided sufficient finance for requested software;
- provided opportunities for general staff discussion on reform of the curriculum;
- provided staff computer training;
- stabilised the financing of the computer department; and
- supported computer-assisted education with technical staff in the form of a network administrator.

The foundation or infrastructure to support computer-assisted education at Pinelands High School was discussed in respect of staff, the school and the community. The instances where Pinelands High School was actively supporting computer-assisted education were cited as well as the factors which need to be addressed if the school wishes to make more effective use of its facilities.

2.2 Level of computer-assisted education based on the Evolutionary Model at Pinelands High School

This chapter has examined the level of integration of computer-assisted education at Pinelands High School using the **Evolutionary Model**. The **Evolutionary Model**

was used to determine, in detail, the integration of computer-assisted education at Pinelands High School. The five different phases looked at the Instructional Activity Outcomes, Teacher Interaction Outcomes and General School Outcomes within each phase at Pinelands High School in the computer subject department and the general teaching staff.

Table 5. 17 Level of computer-assisted education at Pinelands High School based on the Evolutionary Model

PHASE	INTEGRATION BASED ON THE EVOLUTIONARY MODEL
1. Introduction	Completed by general and computer teaching staff
2. Entry	Completing by general and computer teaching staff
3. Intermediate	Change is taking place here, especially in the Mathematics and Graphics departments
4. Penultimate	Little evidence
5. Creation	Very little evidence

In the field of computer-assisted education, Pinelands High School, in general, is moving from the Entry to the Intermediate phase. In the field of Instructional Activity Outcomes the general teaching staff and the computer department teaching staff have completed the Introduction and Entry phases and are moving into the Intermediate Phase 3. Of the subject departments the Mathematics department is moving into the Penultimate Phase 4.

The computer subject department is far ahead of the school In the field of Teacher Interaction Outcomes, as a whole, taking the Graphics department with it into the final Creation phase. The school, as a whole, is found in the Phase 2, Entry. In the General School Outcomes the school is reaching the final Phase 5, Creation. The school, as a whole, could be said to be moving from the Phase 2, Entry, to Phase 3, Intermediate, as tabulated in Table 5.17.

3 Conclusion

Chapter 6 will make a final summing up of the project and make recommendations for the further integration of computer-assisted education at the school as well as recommendations for further research.

CHAPTER 6

CONCLUSION

The aim of this research project was to investigate the integration of computer-assisted education at Pinelands High School. This necessitated

- defining computer-assisted education;
- examining the necessary infrastructure to support computer-assisted education;
- developing a model for the integration of computer-assisted education;

and then

- determining the infrastructure which supports computer-assisted education at Pinelands High School; and
- investigating the integration of computer-assisted education at Pinelands High School based on the model of the integration of computer-assisted education.

1 Computer-assisted education

A literature search in journals, books, Internet mailing lists, newsgroups and web sites was completed. Three suitable models of the integration and a number of definitions of computer-assisted education were found. Factors concerning the required infrastructure for the integration of computer-assisted education were found in many sources which included asking the advice of practitioners in the field.

1.1 Definition of computer-assisted education

Rieber and Hooper sum up the integration of computer-assisted education when they state that educational technology, including computers, involves applying ideas from various sources to create the best learning environment possible for students (Rieber, 1995, p.155; 1997). To meet this definition of computer-assisted education

the school has to change in many fields which include, for example, funding, timetables, curriculum, method and assessment.

1.2 Infrastructure to support computer-assisted education

The literature on the infrastructure to support computer-assisted education focused on three aspects: the staff, the school and the community. The stakeholders in education have to work together to integrate computer-assisted education with the funding, planning, training, sharing, communicating, involving and allocating of funds, skills, time, knowledge, enthusiasm and ideas. The integration can take a long time working with the different stakeholders to get consensus. The prerequisite infrastructure changes as the integration takes place.

1.3 Evolutionary Model of the integration of computer-assisted education

Three models of the integration of computer-assisted education were used in the project: the **Apple Classrooms of Tomorrow Project (ACOT)**, **the Make It Happen!** and the **CAMI Mathematics** models each had a major feature which was similar to the situation at Pinelands High School. These three models were synthesized into one **Evolutionary Model** to evaluate the integration of computer-assisted education at the school.

The **Evolutionary Model** was divided into five phases: Introduction, Entry, Intermediate, Penultimate and Creation. Each phase of the **Evolutionary Model** represents a higher type of mental activity, building on and relying on the previous phase. In this the **Evolutionary Model** of the integration of computer-assisted education is similar to Bloom's taxonomy of cognitive learning objectives of knowledge, understanding, application, analysis, synthesis and analysis.

Each of the phases of the model indicates the specific infrastructure necessary at that point which changes with the level or phase of integration. As the required infrastructure is provided the outcomes change with respect to the instructional activity, the teacher interaction and general school outcomes. The specific

infrastructure in each phase is divided into three main fields of activity, namely technical assistance, time and training.

The required infrastructure necessitates more time and funding as one moves from phase to phase in the **Evolutionary Model**. If the required infrastructure is not provided during the integration, computer-assisted education will be halted. Instruction changes in the different phases of the **Evolutionary Model** from traditional knowledge retention to knowledge creation; the social interaction of the students changes from individual seat-based work to collaborative work; and teacher interaction changes to interdisciplinary work and team teaching.

The required infrastructure assists and facilitates the integration of computer-assisted education. Should the education authorities halt funding for new computer hardware or software or fail to maintain the computer system, thus preventing the evolutionary integration, they will halt the integration and change.

2 Computer-assisted education at Pinelands High School

Computer-assisted education has been integrated at Pinelands High School with a very wide base. All standards six and seven students have the opportunity to become confident with the word processor, a graphics package and a telecommunications package in their weekly Computer Literacy classes. Senior students have access to computer facilities to a lesser extent, depending on their choice of subjects. These applications are mainly used in the initial phases of the **Evolutionary Model.** Over half of the staff use the computer in their teaching which is a large number in terms of the limited access to computer facilities.

The computer facilities, financed mainly with school funds, are good up to a point. The school has applications able to run in a *Windows* environment but the selection, used in the initial phases of the **Evolutionary Model**, is limited. The numbers of work stations are satisfactory for use in cooperative learning environments but these are not always used as teachers prefer individual stations.

Training of teachers in use of the computer is mainly limited to the word processor where many staff have been trained, but training in many other applications has been neglected. Teachers are able to attend evening classes at school in using the computer or be financially assisted in attending extra-mural courses. The training offered has been limited to using the application rather than using the application as a tool to enhance learning.

Teachers are able to take part in decision-making within the school and subject departments. Should there be a movement to integrate computer-assisted education within a department that would be possible and it has happened within the Geography and Environmental Science departments, and Mathematics to a large extent. The Computer Literacy department staff are also members of other subject departments and it is in these other departments that computer-assisted education has been integrated into the work. The school has been flexible in permitting and arranging for the junior classes to attend computer literacy classes and to accommodate the integration of computers in the Graphics and Mathematics classes.

The subject departments within the school are able to purchase applications for use, providing the network can accommodate them. The computer department has to budget for its own requirements and expressed satisfaction with its allocation of the total budget.

2.1 Recommedations for further integration

Should Pinelands High School wish to further integrate computer-assisted education the following are recommended:

1. Increase the funding in particular to
    - provide more computer stations;
    - provide more computer venues;
    - increase the number of applications available, in particular provide a spreadsheet and database; and
    - increase the RAM in individual computers so that they are able to use current applications.
2. Provide time to spread the vision of computer-assisted education among all staff

3. Provide training to
    - increase training in application use; and
    - use the computer as a tool to enhance learning.

In conclusion it must be noted that Pinelands High School is integrating computer-assisted education on a broad scale and has reached the second phase in the **Evolutionary Model**. The Computer Literacy subject department staff are mainly responsible for the use of computer-assisted education at the school. Further integration and its different educational outcomes can be reached by implementing the recommendations above.

3 Recommendations for further research

Research on a large scale is necessary to investigate whether the infrastructure and subsequent outcomes recommended in the different phases of the **Evolutionary Model** are valid and generalisable in order to become more effective.

4 Conclusion

This chapter concludes an investigation into how effectively Pinelands High School is integrating computer-assisted education and the required infrastructure.

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APPENDIX A

THE INTEGRATION OF COMPUTERS AT PINELANDS HIGH SCHOOL: A CASE STUDY

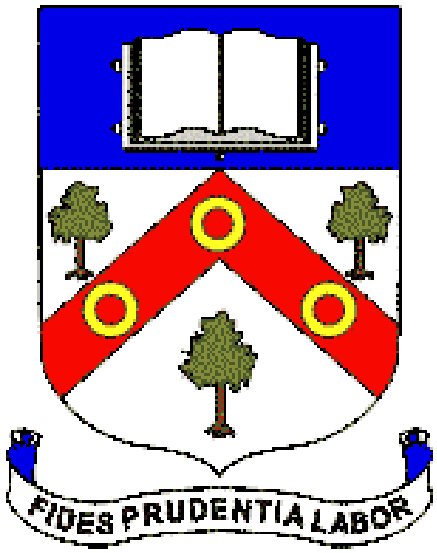
Hi

This questionnaire is part of an investigation into the efficient use of the computer at PHS and will, I hope, make life easier for all of us once the results have been evaluated. All of the questions relate to PHS and not time spent at another school.

I realise it will take some time out of your already busy day, but in the long term I think it will help all of us to be better teachers and communicators.

May I fetch the results tomorrow. Please drop the results in my pigeon hole.

Thanks in advance
Pam Miller



THE INTEGRATION OF COMPUTERS AT PINELANDS HIGH SCHOOL: A CASE STUDY

For office

Please fill in where required or mark your choice with an X.
Thank you in anticipation.

1. Personal details

How many years have you been teaching?

1. in total .....
2. at Pinelands High School .....

1	1.
1	2.

2. Teaching subjects

Do you teach computer literacy?

Yes	No

2	

3. Subjects

1. What subjects do you teach? .....

3	*

4. Team teaching

1. Are you involved in any team-teaching in your department(s)?	Yes	No
2. If YES, are you involved in any team-teaching in a department which involves the computer?	Yes	No

4	1.
4	2.

5. Groupwork

1. Do you use group work in your teaching?	Yes	No
2. If YES, do you use cooperative group work in your teaching (à la Dr Gibbon)?	Yes	No
3. Do you use the computer for cooperative, general group work or both?	Yes	No
4. Have you had training in teaching with cooperative groups or general groups?	Yes	No

5	1.
5	2.
5	3.
5	4.

6. Computer ownership

1. Have you ever borrowed a computer from school?	Yes	No
2. Do you have a computer at home?	Yes	No
If YES, ...		
3. did you buy it before you joined the staff of PHS?	Yes	No
4. did the school assist you financially in purchasing or upgrading the computer?	Yes	No
5. did the school network operator assist you with the purchase or upgrade in any way?	Yes	No

6	1.
6	2.
6	3.
6	4.
6	5.

7. In-service/in-house computer training

Have you ever attended a training session on one of the following at PHS during the day?

1. word processing	Yes	No
2. spreadsheets	Yes	No
3. databases	Yes	No
4. e-mail	Yes	No
5. World Wide Web	Yes	No
6. graphics application	Yes	No
7. presentation application	Yes	No
8. databank e.g. Orbits, PCGlobe	Yes	No
9. subject-specific applications e.g. Turbo Cash	Yes	No
10. games e.g. Simcity, Simearth	Yes	No
11. programming language e.g. Logo	Yes	No

7	1.
7	2.
7	3.
7	4.
7	5.
7	6.
7	7.
7	8.
7	9.
7	10.
7	11.

8. Computer training funded by Pinelands High School

1. Have you ever attended (a) computer training session (s), seminar(s) or conference(s) funded by the	Yes	No
If YES, was that course at a ...		
2. teacher centre?	Yes	No
3. university?	Yes	No
4. technikon?	Yes	No
5. computer school?	Yes	No
6. other? ..... (please specify)	Yes	No

8	1.
8	2.
8	3.
8	4.
8	5.
8	6*.

9. Evening courses

1. Have you ever attended one of the evening courses offered by the Continuing Education Programme at PHS?

Yes	No

9	1.

10. Computer training paid for by yourself after initial teacher training

1. Have you ever attended (a) computer training session(s), seminar(s) or conference(s) funded by	Yes	No
If YES, was that course at a ...		
2. teacher centre?	Yes	No
3. university?	Yes	No
4. technikon?	Yes	No
5. computer school?	Yes	No
6. other? ..... (please specify)	Yes	No

10	1.
10	2.
10	3.
10	4.
10	5.
10	6*.

11. Bought subject software

1. Has your subject department bought a computer	Yes	No
2. If YES, what is it called?		
If YES, ...		
3. did you help decide which subject package	Yes	No
4. have you attended a training session on that	Yes	No
5. have you used that subject package in a lesson with a class?	Yes	No

11	1.
11	2*.
11	3.
11	4.
11	5.

12. Use of the computer at school

How frequently do you use the applications below at school for lesson preparation?

1. games e.g. Simcity	Daily	Weekly	Monthly	Annually	Never
2. word processor	Daily	Weekly	Monthly	Annually	Never
3. database	Daily	Weekly	Monthly	Annually	Never
4. spreadsheet	Daily	Weekly	Monthly	Annually	Never
5. graphics	Daily	Weekly	Monthly	Annually	Never
6. e-mail	Daily	Weekly	Monthly	Annually	Never
7. presentation package	Daily	Weekly	Monthly	Annually	Never
8. World Wide Web	Daily	Weekly	Monthly	Annually	Never
9. databank e.g. PCGlobe,	Daily	Weekly	Monthly	Annually	Never
10. programming language	Daily	Weekly	Monthly	Annually	Never
11. subject-specific package	Daily	Weekly	Monthly	Annually	Never

12	1.
12	2.
12	3.
12	4.
12	5.
12	6.
12	7.
12	8.
12	9.
12	10.
12	11.

13. Use of the computer at home

How often do you use the computer applications below at home for lesson preparation or private matters?

1. games e.g. Simcity	Daily	Weekly	Monthly	Annually	Never
2. word processor	Daily	Weekly	Monthly	Annually	Never
3. database	Daily	Weekly	Monthly	Annually	Never
4. spreadsheet	Daily	Weekly	Monthly	Annually	Never
5. graphics	Daily	Weekly	Monthly	Annually	Never
6. e-mail	Daily	Weekly	Monthly	Annually	Never
7. presentation	Daily	Weekly	Monthly	Annually	Never
8. World Wide Web	Daily	Weekly	Monthly	Annually	Never
9. databank e.g. Orbits	Daily	Weekly	Monthly	Annually	Never
10. subject-specific program e.g. Pastel,	Daily	Weekly	Monthly	Annually	Never
11. programming	Daily	Weekly	Monthly	Annually	Never

13	1.
13	2.
13	3.
13	4.
13	5.
13	6.
13	7.
13	8.
13	9.
13	10.
13	11.

14. Teaching

How often do you use the applications below while teaching?

1. games e.g. Simcity	Daily	Weekly	Monthly	Annually	Never
2. word processor	Daily	Weekly	Monthly	Annually	Never
3. database	Daily	Weekly	Monthly	Annually	Never
4. spreadsheet	Daily	Weekly	Monthly	Annually	Never
5. graphics	Daily	Weekly	Monthly	Annually	Never
6. e-mail	Daily	Weekly	Monthly	Annually	Never
7. presentation	Daily	Weekly	Monthly	Annually	Never
8. World Wide Web	Daily	Weekly	Monthly	Annually	Never
9. databank e.g. Orbits	Daily	Weekly	Monthly	Annually	Never
10. programming language	Daily	Weekly	Monthly	Annually	Never
11. subject-specific program	Daily	Weekly	Monthly	Annually	Never

14	1.
14	2.
14	3.
14	4.
14	5.
14	6.
14	7.
14	8.
14	9.
14	10.
14	11.

15. Decision making

Have you had any input into the ...

1. long term plans of the school as a whole?	Yes	No
2. methodology of teaching in your department?	Yes	No
3. evaluation methods in your department?	Yes	No
4. content of courses in your department?	Yes	No

15	1.
15	2.
15	3.
15	4.

16. Computer-related decision making

Have you had any input into the ...

1. decisions with regard to who teaches the subject computer literacy?	Yes	No
2. decisions with regard to the purchase of computer hardware?	Yes	No
3. decisions with regard to purchasing of computer software?	Yes	No
4. discipline code of the computer room?	Yes	No
5. physical design of the computer room?	Yes	No
6. hours of the computer room?	Yes	No
7. long-term plans for the computer room?	Yes	No

16	1.
16	2.
16	3.
16	4.
16	5.
16	6.
16	7.

17. Advice

From the computer department at school are you able to get advice on the following computer applications when you need it?

1. word processor	Yes	No	Never considered asking
2. spreadsheet	Yes	No	Never considered asking
3. database	Yes	No	Never considered asking
4. presentation package	Yes	No	Never considered asking
5. World Wide Web	Yes	No	Never considered asking
6. e-mail	Yes	No	Never considered asking
7. graphics	Yes	No	Never considered asking
8. databank e.g. Orbits	Yes	No	Never considered asking
9. programming language e.g. Logo	Yes	No	Never considered asking
10. laser printer	Yes	No	Never considered asking
11. game e.g. Simcity	Yes	No	Never considered asking

17	1.
17	2.
17	3.
17	4.
17	5.
17	6.
17	7.
17	8.
17	9.
17	10.
17	11.

18. Access to a computer application

Do you have access to the following computer applications at school when you need it?

1. word processor	Yes	No	Never considered using
2. spreadsheet	Yes	No	Never considered using
3. database	Yes	No	Never considered using
4. presentation package	Yes	No	Never considered using
5. World Wide Web	Yes	No	Never considered using
6. e-mail	Yes	No	Never considered using
7. graphics	Yes	No	Never considered using
8. databank e.g. Orbits	Yes	No	Never considered using
9. programming language e.g. Logo	Yes	No	Never considered using
10. laser printer	Yes	No	Never considered using
11. game e.g. Simcity	Yes	No	Never considered using

18	1.
18	2.
18	3.
18	4.
18	5.
18	6.
18	7.
18	8.
18	9.
18	10.
18	11.

19. Teaching at PHS using the computer

Have you used any computer application in the teaching of a lesson ...

1.at PHS?	Yes	No
2.at PHS during 1996?	Yes	No

19	1.
19	2.

APPENDIX B

THE INTEGRATION OF COMPUTERS AT PINELANDS HIGH SCHOOL: A CASE STUDY

2 September 1996

Hi

Thank you for completing the questionnaire last week. I am truly grateful.

Would you please complete this short questionnaire which is for those who have used the computer for teaching - stats to hand indicate that 23 teachers have used the computer in teaching.

Please complete one of the attached sheets for each of the subjects in which you have used the computer for teaching.

I would appreciate it if I could fetch the results tomorrow, Tuesday. Please drop the sheets in my pigeon hole.

Many thanks in advance
Pam Miller

1. Have you used any computer package(s) in the teaching	Yes	No	1.
2. Have you shared information (printed or verbal) about a			2a.
a. teachers in your department?	Yes	No	2b.
b. other adults in the school?	Yes	No	2c.
c. teachers not from PHS?	Yes	No	
3. Have you published anything about (a) computer-related lesson(s)? If YES, please specify titles of	Yes	No	3.
4. Have you mentored any person in a computer-related	Yes	No	3*.
5. Were you mentored by anyone in a computer-related	Yes	No	4.
6. In general, in your computer classes, ...			5.
a. do the students work in (A) pairs/groups or (B) on	(A)	(B)	6a.
b. would you prefer the students to work in (A) pairs/	(A)	(B)	6b.
c. do you act as a (A) facilitator or (B) focus?	(A)	(B)	6c.
7. What computer applications have you used in teaching during the last year? (Please list)			7*.
			8*.
8. Which of the applications which you use in teaching do you have access to at home? Please indicate on the list			9.
9. In general, in your computer classes, is the material of the	Yes	No	10a.
10. In general, in your computer classes, do the students use			10b.
a. the purpose of learning a specific skill e.g. typing.	Yes	No	10c.
b. the specific purpose of learning the package.	Yes	No	10d.
c. retaining information e.g. drill and practice.	Yes	No	10e.
d. processing information by typing/drawing e.g. word	Yes	No	10f.
e. communicating with someone e.g. e-mail.	Yes	No	10g.
f. finding information and possibly drawing conclusions	Yes	No	10h*.
g. creating new knowledge e.g. multimedia	Yes	No	
h. (your own wording)	Yes	No	