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ABSTRACT

The first volume of a three-volume report on a three-year study of the use of computers in secondary school classrooms, this document reviews the context of the research project: its organization; the basis of the research strategy employed; and the character of the schools, teachers, and students involved. The project was conducted by the education faculty at the University of Western Ontario and carried out in two networked secondary schools. The effects of computer use on classroom teaching and learning and on the structure and presentation of curricular materials were examined. The project also considered how computer practice might maximize learning opportunities and how innovative computer activities can be initiated and sustained. The project was structured to include separate investigations into the effects of computer use in several distinct subject areas, including the use of spreadsheets, and the effects of teachers' use of computers on classroom management. This volume discusses the development of the research goals, objectives, and strategy; gives an account of ministry guidelines and board policies; describes the research sites; and provides biographical sketches of participating teachers. An analysis of a student questionnaire designed to determine the student's backgrounds and computer attitudes is also provided. Twelve figures and 10 data tables display school and student statistics and the layout of the participating schools' facilities. A chronology of research activities, facsimiles of the student questionnaire, and participant consent forms are appended. (Contains 31 references.) (KRN)

Research Unit on Classroom Learning and Computer Use in Schools

Curriculum and Context

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ABSTRACT

This three-year study, carried out by the Faculty of Education, University of Western Ontario, in co-operation with the Board of Education for the City of London, and the Ontario Ministry of Education, undertook to assess and examine the use of computers in classroom learning at the secondary level; to further assess and examine how computer practice might be adapted to maximize learning opportunities; and to provide a series of case studies of how innovative activities in the school with regard to computers can be initiated, implemented and sustained.

The project was structured to include separate investigations into the effects of computer use in several distinct subject areas; in particular: art, history and contemporary studies, geography, family studies, and technological studies. It also included studies of the use of spreadsheets across the curriculum, and of the effects on classroom management of teachers' use of computers. In each of these areas, the four Principal Investigators defined their own specific topics for scrutiny. Over-arching these individual investigations was the more general research goal of examining the effects of computer usage on the context of classroom teaching and learning, and the structure and presentation of curricular materials. This research took place in two networked secondary schools, one equipped with a computer laboratory with twenty workstations, the other with small clusters of workstations in each classroom being observed.

This summative report is organized into three volumes: Volume 1 reviews the context of the research project: its organization, the basis of the research strategy that was used, and the character of the schools, teachers and students involved. Volume 2 contains the Principal Investigators' reports from each of the sub-projects. Volume 3 explores a number of research themes, and summarizes the findings and recommendations which have emerged.

- August 30, 1991

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VOLUME 1: CURRICULUM AND CONTEXT

1.1 INTRODUCTION
by Ivor Goodson, Marshall Mangan and Valerie Rhea

"Curriculum and Context in the Use of Computers for Classroom Learning" was a three-year research project, funded by the Ontario Ministry of Education, and conducted by researchers at the University of Western Ontario, in collaboration with the Board of Education for the City of London, Ontario. The goal of the project was to examine the effects of the use of microcomputer networks in secondary schools, across a broad range of subject areas and applications.

The project was structured to include separate investigations into the effects of computer use in several distinct subject areas; in particular: history and contemporary studies, geography, art, family studies, electronics and drafting. It also included studies of spreadsheets across the curriculum, and the effects of teachers' use of computers on their classroom management practices. In each of these areas, the Principal Investigators have defined their own specific topics for scrutiny. Over-arching these individual investigations is the more general research goal of examining the effects of computer usage on the context of classroom teaching and learning, and the structure and presentation of curricular materials.

Field research was conducted at two London area high schools, which go by the pseudonyms of "Brock" and "Tecumseh" in our reports. At Brock, six teachers and at Tecumseh, five (and their classes) were designated as the primary participants, while another nine teachers were trained in the use of the computers as a potential "backup" team.

The initial phase of the project, which encompassed planning, equipment acquisition, and staffing, began in September, 1988. Training and data collection began with the second semester of the 1988-89 school year. The first interim report (Goodson, Mangan, and Rhea, 1989a), submitted in April, 1989, described our basic approach to the study of the cross-curricular use of microcomputers in secondary schools. It included a review of related research within Ontario, statements of research plans by each Principal Investigator, and a series of external associates' reports relating to our research strategy.

Our second interim report (Goodson, Mangan, and Rhea, 1989b) provided a summary of the progress made through September, 1989. It described the steps that had been taken in organizing the project and gathering field data, and outlined some of the research topics and hypotheses which had emerged as focal points for further in-depth investigation. The third and fourth interim reports (Goodson, Mangan, and Rhea, 1990a; 1990b), based on our first three semesters of observation, identified some new themes, and further developed some of those identified earlier. The fifth interim report (Goodson, Mangan, and Rhea, 1991) attempted to summarize the major findings in each subject area to that point.

This summative report is organized into three volumes: Volume 1, "Curriculm and Context", reviews the context of the research project: its organization, the basis of the research strategy that was used, and the character of the schools, teachers and students involved. Volume 2, "The Use of Computers for Classroom Learning", contains the Principal Investigators' reports from each of the sub-projects. Volume 3, "Closing the Circle: Conclusions and Recommendations", explores a number of research themes, and summarizes the findings and recommendations which have emerged.

- August 30, 1991

1.2 THE DEVELOPMENT OF THE RESEARCH STRATEGY
by Ivor Goodson, Marshall Mangan, and Valerie Rhea

1.2.1 RESEARCH OBJECTIVES

The original objectives of this project were detailed in the contract with the Ministry of Education, which was signed in 1988: in general, "The studies will assess and examine the use of computers in classroom learning" (p. 11) within the secondary school curriculum. As mentioned above, the project included separate investigations into the effects of computer use in several subject areas. Overarching these individual investigations has been the more general research goal of examining the effects of computer usage on the context of classroom teaching, and on curricular materials. The project researchers made a conscious choice not to start with specific hypotheses regarding the nature of these effects (see section 1.2.4 below), although we were guided by a central set of concerns and interests. These included the impact of computers on, for instance:

- The social organization of classroom work: are students working together in groups to a greater or lesser degree? Do they require more or less supervision and assistance? Is there more or less dialogue in class? Do students take initiative in organizing their own activities?
- Teachers' own perceptions of the difficulty of using computers, their sense of competence and control within computerized classrooms, and the general impact on teachers' lives (see Ball and Goodson 1985).
- The organization of the curriculum-in-practice, i.e., the topical focus of classroom lectures and discussions, and the nature of student assignments, both in class and homework.

A central predilection which has guided this project from the outset has been that, whilst accepting the primacy of events in studying education enterprises, we have also sought to focus elsewhere. In particular, we have tried to understand what might be called "the power of context". This follows the kind of sociological work being promoted by the British sociologist, Anthony Giddens, who uses the term "structuration" (for an overview, see Clark, Modgil, and Modgil, 1990). Essentially, the argument is that we can only understand events and develop a theory of events if we also understand context and assumptions. Alongside a story of events, therefore, we must develop a theory of context.

In this report, we have stayed close to our belief in the primacy of events and action. Hence, the central reports by the Principal Investigators carry stories of action and implementation as their central motif. However, over and above these reports of events and actions, we have tried to examine the power of context and the power of preactive assumptions. This approach stems from a belief that, although preactive context and assumptions do not completely *determine* events, wilful individual acts of transcendence, transformation and resistance are rare. Hence, in studying the educational enterprise, a theory of context remains vitally important to the development of emerging stories of events and actions.

We have chosen to call this search for a theory of context a *social constructionist perspective* (Goodson, 1991b; Goodson and Mangan, 1991). Here we have been searching for many of the historical and contextual parameters for the action we have been studying. These would include the prior assumptions which are built into computers as a form; the history and political

construction of the ICON as a particular manifestation of the culture of computing; the antecedent subject subcultures of each of the subjects we have studied; the life histories, teaching philosophies, and assumptions of the project teachers; and finally, some sense of the history of the two sites where the work has been undertaken and studied.

1.2.2 RESEARCH AND EVALUATION OF COMPUTER USE IN SCHOOLS

The kind of topics enumerated as concerns above have not, in general, been extensively researched in this province, *especially at the secondary school level.* There has been some exploratory research at the elementary level, and a number of limited implementation and evaluation studies.

Although not a part of the formative evaluation process specified by the Ministry of Education (see Gillis, 1986), these studies have frequently shared similar goals with that process. In Beynon's terms, they fit within the "evaluative paradigm", with an emphasis on "documenting the kind and degree of microcomputer deployment in schools and making policy-related recommendations. ... The model stays close to the practicalities of implementing" the technology (Beynon, 1989). As such, most of them may be considered part of the considerable expertise and material resources that have gone into the development and testing of educational computer materials in Ontario over the last several years. MacDonald (1974) uses the term "educational evaluation" to refer only to this type of practical, policy-oriented effort, while reserving "educational research" to designate a more detached and general form of investigation. He describes the "researcher" as one who "stands outside the political process, and values his detachment from it" (p. 12).

The dilemma we were faced with, then, was how to reconcile these different conceptions of what our project might be. We recognized the importance of both of these kinds of educational investigation, and we knew that our project, if construed as an "evaluation", could make meaningful contributions to the development of policy in one of the most important areas of current educational innovation. However, we were also aware that the general tenor of educational computing research over the last several years had been too narrowly confined to technical issues, without sufficient regard for the more profound effects which the introduction of technology might be having on classroom environments. We recognized a need for the discovery and development of theory regarding the ways in which life in schools more generally is likely to be affected by the introduction of this demanding, expensive, and radically new approach to curriculum and pedagogy.

In the end, we came to view the project as an attempt to conduct both "evaluation" and "research" simultaneously. We judged that we could carry out both kinds of study by building specialist clusters within our fairly large team of researchers. We recognized that this was no simple task, and that it might indeed contain irreconcilable contradictions. Nevertheless, we felt we could rely on the diversity of the people involved, and the range of their academic objectives, to propel and maintain these independent thrusts. As the project has progressed, there have been a series of changes in personnel, in areas of concentration, and in our styles of research, evaluation, and reporting. For the most part, these changes have been positive, resulting in a productive cross-fertilization of ideas and insights. At the same time, we have noticed, through our attendance at conferences such the annual meetings of the American Educational Research Association (AERA) and the Educational Computing Organization of Ontario (ECOO), that the

cultural and social dimensions of educational computing are becoming more prominent foci of research around the world (see, for instance, Brine, 1991; Ragsdale, 1991).

Our decision to attempt the conduct of both an evaluation of a technological innovation at a certain set of sites, and a research project into the impact of that innovation on teachers' practice, has led us into a series of iterative, reflexive evaluations of our own field methods. Through this process, we have developed a set of guiding principles, which in turn have led us to a number of detail changes in the conduct of our field research. In general, we adopted the posture of staying physically close, but procedurally detached, from the progress of the innovation. As detailed in later sections, we left the hardware installations, software selection, training, support, and maintenance functions to the staff of the co-operating Board. However, we saw no purpose in allowing difficult situations to fester when we had expertise that could help. We therefore decided that the Research Officers, in their regular visits to classrooms, would answer questions if asked directly, would assist with technical problems when they could, and would report difficulties to the Board liaison when appropriate. In general, however, they were to remain as unobtrusive as possible, and intervene in the classroom setting as little as was feasible.

A certain division of labour was also settled within the project. The individual Principal Investigators assumed responsibility for the analysis of the data as they affected the evaluation of their particular subject- or software-related projects. Besides formulating the overall research strategy for the project, and its on going co-ordination. The Project Co-ordinator undertook to address the social, economic, and epistemological issues which usually are not on the research agenda of evaluation studies. The Research Officers, as the people closest to the field data and the ones able to devote their full-time efforts to the project, assisted all the investigators is the ongoing formulation of research themes and methods, as well as initiating drafts of the reports.

The dual focus of our project is also reflected in the organization of this Summative Report. It contains both a series of case studies on the progress of the innovation in each of the several areas defined by the Principal Investigators (see Volume 2), and an extensive theoretical section which elaborates on the various themes identified during the course of our study (Volume 3). At the end of each section, we have presented a series of concrete recommendations, which we hope will contribute to the formulation of future policy in this area. In this way, we have attempted to provide both a theoretical development which will contribute to the general understanding of the phenomenon, and a set of practical implications for policy makers.

To try to make an assessment of the differences between more traditional classroom environments and computerized classrooms, the research began in a selected number of classrooms during the initial period of installation and training, before computers were in regular use. These same classrooms were then observed after the introduction of computers. As the project progressed, we strove to record the changes in the ecology of these classrooms, in patterns of social organization, in learning and teaching strategies.

What follows is a review of our approach to the general research objectives we have described, based in part on material from our first Interim Report. In this review, we will describe the preliminary typology of learning activities, and the methodological approach, with which we began our empirical data gathering. We will then recap the ways in which this methodology developed, and some of the results which it yielded.

1.2.2.1 **Comparisons Between Previous Studies and This Project**

We will not repeat here the review of previous research presented in our first Interim Report (Goodson, Mangan, and Rhea, 1989a, section 1.3). However, we do feel that it is worth pointing out once again the characteristics and objectives of this project which set it apart from those that have gone before. In addition to its unique topical focus, no other study we know of has targeted the same school level over the same time span.

1.2.2.1.1 *School Level*

The most obvious and major distinction between this project and the others is the school level at which it is directed. All but one of the previous studies involved elementary schools, with only the Quinte Lighthouse Project studying a secondary school (see Catherwood and Holt, 1988). However, the Quinte Project's purpose was very different from our own. It was undertaken with the practical goal of implementing computer use in all areas of the curriculum, and integrating OESS software into existing guidelines. No critique of that software beyond a technical level was involved.

As Beynon (1989) points out, the one U.K. study which compared computer use at the primary and secondary levels found a markedly different set of constraints operating within each. His review points to some areas which warrant investigation in Ontario, particularly the effects of subject boundaries on the ways computers are used, and how they are integrated into students' programs.

1.2.2.1.2 *Time Span*

This project had a scheduled duration of approximately three years. Most of the other projects were of a much shorter duration, ranging from four weeks to two years. Most similar to our project in this regard is the regional pilot test centre in Kingston, which could run up to six years.

1.2.2.1.3 *Number of Schools*

This project will involve two secondary schools, one set up with a computer lab, the other with small clusters of workstations in various classrooms. Other projects range in coverage from one class to eight schools. The Quinte and Kingston projects involved only one school each.

1.2.2.1.4 *Equipment*

The Sullivan, Carmichael, and Heap studies involved using various equipment existing in the classrooms prior to the beginning of the projects, none of which included Grant Eligible Microcomputer Systems (GEMS). The Quinte and Kingston projects, as well as our own, however, all used equipment funded by the Ministry of Education, which met the Ministry's functional specifications. These specifications require in part that the equipment support multiple users running a variety of programs simultaneously.

At the time that our project acquired its equipment, there were only two eligible vendors: IBM and Unisys. The Board liaison, after consulting with project researchers, elected to go with the Unisys ICON system. In part, this choice was influenced by the fact that we also wished to use software from the Ontario Educational Software Service (OESS). These programs had already been subjected to an extensive process of formative evaluation. By choosing this configuration of hardware and software, we were adopting the most widely-used and thoroughly-evaluated systems

on the Ontario educational scene. It was our intent to take advantage of these development efforts, in order to move beyond them.

1.2.2.1.5 *Research Agendas*

Most of the earlier studies shared certain broadly similar research goals regarding the effective use of computers. Many have employed a similar methodology, in that they involve close observation of the classroom interactions of students and teachers affected by computer use. However the specific areas of interest have varied from project to project.

The findings of these recent projects have frequently been similar to those conducted within the evaluation paradigm in the U.K. studies reviewed by Beynon (1989). These studies have pointed to some areas of interest, and suggested topics for closer scrutiny. In particular, they indicated a need for further research into the areas of:

- differential use according to gender, race, and social class;
- the impact of computer use on classroom social structures;
- the effects of collaborative use on computer-related learning processes;
- potential "therapeutic" and motivational uses, in providing education for students with special problems;
- the importance of teachers' computer literacy.

In addition to exploring these areas, we wanted to begin an assessment of the cost-effectiveness of computers. We share the view recently expressed in *The Canadian School Executive*, and cited by the Provincial Auditor:

> If the computer is to justify its considerable costs, educators must have confidence that some growth is occurring which would not otherwise have evolved using traditional methodology (quoted in Ont. Prov. Auditor, 1988, p. 76).

The Annual Auditor's Report concluded (and the Deputy Minster of Education agreed, in his reply) that in this area "more effectiveness research [is] required" (pp. 76, 80). In a similar vein, Beynon (1989) points to the extravagant claims made by educational computing enthusiasts, claims which have so far gone largely untested. Pursuing some assessment of cost-effectiveness in this manner requires that we attempt some comparison between traditional classroom learning and computerized classroom learning.

Seen in this way, it is not simply an issue of fiscal cost juxtaposed against a measure of effectiveness. It is, perhaps more importantly, a question of opportunity costs—costs which are both fiscal and epistemological. Fiscal-opportunity costs relate to how many teachers could have been employed, how many textbooks purchased, how many new classrooms built and old classrooms modernized and refurbished, etc., if the money spent on computers had been otherwise earmarked.

Of greater concern to this project, however, were the epistemological-opportunity costs. Epistemological-opportunity costs refer to activities that could have been undertaken in the time spent on computers—time spent reading books, discussing world problems, going on a geography field trip, etc.

These are some of the areas we hoped to address in our research. However, we also wanted to maintain this project as an exploratory study, which had to remain open to novel circumstances. We felt it must be ready to adapt to those circumstances with a flexible methodology. As it turned out, this became one of the greatest strengths of the project, and produced some of our most

useful insights. The next sections describe our approach to this situation, which incorporated a tentative set of research topics and an initial classification scheme, without attempting to specify detailed hypotheses in advance.

1.2.3 TYPOLOGIES OF LEARNING ACTIVITIES

One of the basic preoccupations of learning theorists over the years has been the creation and application of typologies of learning and teaching activities (see, for instance, Bloom et al. 1956/1972). Not surprisingly, these taxonomies have seldom proven themselves capable of accounting for the full range of human abilities, interests, and aptitudes expressed in teaching and learning situations. Although we recognize that no typology is capable of such a full accounting, we believe there is some heuristic value in being able to make at least an initial classification of observed behaviour. In reviewing some of the most solidly established systems, we found a sufficient consensus among them to allow a side-by-side comparison. A brief review of their main characteristics may assist in orienting our analysis.

Figure 1.1: Major Typologies of Learning Activities

<table>
<tr><th colspan="2">Bloom et al. (1956/1972)</th><th>Gagné-Briggs (1974/1988)</th><th colspan="2">UNCAL (1977)</th><th>Taylor (1980)</th></tr>
<tr><td>Cognitive Domain</td><td>Affective Domain</td><td>Learned Capabilities</td><td>Student-CAL Interaction</td><td>Computer Activity</td><td>Computer Activity</td></tr>
<tr><td rowspan="2">Recall/ Recognition</td><td rowspan="2">Receiving Stimuli</td><td rowspan="3">Verbal Information</td><td>Recognition</td><td rowspan="3">Instruc-tional</td><td rowspan="4">Tutor</td></tr>
<tr><td>Recall</td></tr>
<tr><td rowspan="2">Compre-hension</td><td rowspan="2">Responding to Stimuli</td><td rowspan="2">Compre-hension</td></tr>
<tr><td>Motor Skills</td><td rowspan="3">Revel-atory</td></tr>
<tr><td rowspan="2">Application</td><td rowspan="2">Valuing</td><td>Attitudes</td><td rowspan="3">Intuitive Under-standing</td><td rowspan="5">Tool</td></tr>
<tr><td>Analysis</td><td>Concept-ualization</td><td>Cognitive Strategies</td><td rowspan="2">Emanci-patory</td></tr>
<tr><td>Synthesis</td><td>Organi-zation</td><td rowspan="2">Intellectual Skills</td><td rowspan="2">Construc-tive Under-standing</td></tr>
<tr><td>Evaluation</td><td>Charac-terization</td><td>Conjec-tural</td><td>Tutee</td></tr>
</table>

The first five columns of figure 1.1 present a comparison of the categories used by Bloom et al. (1956/1972); Gagné, Briggs, and Wager (1974/1988); and the British UNCAL project (MacDonald et al., 1977). Horizontal lines represent our own attempt to map a rough

isomorphism among the different schemes, while recognizing that even within their original contexts, these lines are not as hard and fast as they appear in this figure.

The Bloom taxonomy was developed without specific reference to computer-assisted learning. The Gagné and Briggs typology has been addressed more specifically to the design of computerized instruction in recent editions (see Gagné, 1987), while the UNCAL typology was developed specifically for the analysis of computer-assisted learning (CAL) (MacDonald et al., 1977). They all share a roughly hierarchical concept of both knowledge and learning processes, such that the memorization of individual facts is at the bottom, while the creative application of concepts is at the top. The Bloom taxonomy recognizes two different "domains", the cognitive and the affective. The UNCAL system distinguishes types of student learning processes, as well as types of computer activities. They are presented in the figure according to our own analysis of their interaction. Gagné and Briggs do not make this type of distinction, but their inclusion of "attitude" training as a distinct category indicates that they consider affective development an important area. The Bloom system also makes fine distinctions among "synthesis", "evaluation", "organization", and "characterization" at the upper end of the scale, which are not recognized by the other typologies.

For the purposes of this study, we initially tried to make use of the UNCAL typologies, both because they were developed within the context of computer-assisted learning, and because they incorporate an awareness of the other, earlier systems. The UNCAL project (1974-1977) made use of these systems in developing one of the most theoretically sophisticated analyses of CAL up to that time. However, the advances in educational-computer resources in the years since that study, the further development of CAL-related analytic theory, and the unique situation within Ontario schools all suggest that these typologies may not be adequate to the range of research tasks involved in this project. Beynon (1989) has located these typologies as "a good starting point", but notes that they "have yet to be tested, extended, and re-defined" (p. 197).

One of our goals was to make a contribution in this direction. In particular, we intended to examine teacher effects as well as student effects: the impact of educational computers on basic issues of pedagogy and the organization of classrooms, as well as their efficacy as learning resources within the secondary school curriculum. The classroom computer is a unique medium which has the potential, for better or worse, to restructure forms of communication and pedagogical interaction among teachers, administrators, students, and parents. A major goal of this project was be to characterize the ways in which this restructuring occurs.

One classification system which we felt might facilitate this analysis was that presented by Taylor (1980): The computer in use as "tutor", "tool", or "tutee". Tutorial computer use is the conventional drill-and-practice or page-turning type of program; tool use is typified by word processing or spreadsheet applications; while the computer as tutee is "instructed" by its user—usually by being programmed, or used in some other creative way through a complex multi-purpose program. The sixth column of figure 1.1 presents these three uses alongside the kinds of learning with which we would (initially) expect them to be associated. Although we envisioned the UNCAL typology as helpful in characterizing student learning activities, we hoped to be able to use the Taylor typology, or some expanded version of it, as a means of classifying human-computer interactions, in order to capture their nature as media and as mediations. We expected that these mediations would affect the relationships between teachers and students, and between teachers and their other school-related activities.

1.2.4 CLOSELY OBSERVED CLASSROOMS

The basic methodological posture of this research project stressed the emergent nature of participants' perspectives and the social construction of classroom realities (Goodson, 1990). As a result, we keyed into those methodological paradigms which allow theoretical insights to emerge from closely observed environments. One such paradigm is what Parlett and Hamilton (1977) have characterized as "illuminative evaluation". As these authors point out, illuminative evaluation is based upon an anthropological, rather than an experimental, model (pp. 9-10).

Drawing upon the tradition of "grounded theory" propounded earlier by Glaser and Strauss (1967), illuminative evaluation was developed explicitly within the context of the assessment of educational innovation. The authors point out that such innovative contexts do not lend themselves well to the traditional experimental paradigm, which requires predefined research hypotheses and strict control of independent variables. They offer a number of reasons why this is so, including: the ethical implications of manipulating educational settings and the people involved; the impossibility of controlling ongoing changes during the implementation of the innovative program; the risks of losing important relevant data not included in predefined objectives; and the insensitivity of large-scale projects "to local perturbations and unusual effects". Such effects, which may be crucial to an understanding of the overall situation, are better appreciated through small-sample intensive research (pp. 8-9).

We found these criticisms of the experimental approach to the assessment of educational innovation to be quite pertinent to our research setting. This setting involved the study of an educational innovation which entails a considerable re-orientation of both the physical and curricular organization of the classes involved. We knew it would not be possible within this setting to control, or even to specify, all of the relevant variables ahead of time. Instead, by a process of regular and intensive, yet non-intrusive observation, we expected central themes and crucial areas for further research to emerge during the early stages of our investigations. These themes would then become the focus for more intensive investigation in the later stages of the project, using a process of "theoretical sampling" and "comparative analysis" (Glaser and Strauss 1967). These methods allow subpopulations of emergent interest to be selected for particular attention as the project progresses, based on their comparative attributes relative to other participants in the project.

The effectiveness of such an approach clearly required that the field researchers establish a certain rapport with subjects. The purpose of establishing this rapport is to recognize the sense-making activities of the people involved—students, teachers, and school administrators—as an essential part of the phenomenon under study. To the greatest extent possible, we set out to record, report, analyze, and understand the meanings which these participants in the project themselves attributed to the effects of computer use in their schools. We viewed teachers as "reflective practitioners" (Schön, 1983) — professionals who embody a repertoire of expert knowledge in their everyday practice, and who constantly strive to expand and improve that store of knowledge by reflecting upon the problems they encounter in their practice. We sought to tap these reflections as they related to the innovation under study, through a series of regular, open-ended interviews and discussions.

Blomeyer (1989) has reviewed some of the more recent developments of this basic methodology, including "responsive" and "democratic" forms of evaluation. These methods, motivated by a concern for the respect and dignity accorded their subjects, suggest that

"participant observation" should become much more a process of participation (by all parties involved), and less one of detached observation. Thiessen (1989) reviewed a number of projects in which researchers and educators have worked collaboratively with students in both developing curriculum change and in evaluating its future direction.

Although we are sympathetic to the ethical positions of these methods, which attempt to involve participants as active and critical members of the research team, we believed that this project, in its attempt to simultaneously incorporate both the "evaluation" and the "research" models referred to by MacDonald, should not adopt such forms of intervention research. We felt that, if we allowed the Research Officers in the field to become too closely identified with the implementation team, we risked sacrificing their critical perspective on the data they collected. The project's "research" function could have been entirely eclipsed by its "evaluation" function if the observers become too heavily involved with the success of the various implementation projects.

On the other hand, we could not allow the "research" function to completely predominate (e.g., by demanding that an inordinate amount of teachers' energies be directed toward critiques of the innovation process). If we had, we might have actually worked to defeat a process which generally requires enthusiasm and extra effort from teachers if it is to benefit students. In any case, a posture of strongly interventionist research always risks creating an unnecessarily artificial situation, in which the level of external involvement in the classroom is much higher than it would be in similar innovative projects which were not also subjects of research. Such a posture would only add further limitations to any claims of generalizability we might be able to make.

Given this context, we saw little choice but to position the field researchers as sympathetic but detached observers of the innovation process. We felt that we would risk creating unwarranted intrusions into an already highly novel and potentially stressful school situation if we were to allow them to assume the roles of either on-stage critics or implementation consultants. Although we recognized that the presence of observers was bound to affect the situation, we felt we must strive to minimize those effects, and to document them whenever they became apparent. Above all, we have sought to portray and to capture the participants' perspectives with a minimum of interference in the classroom setting.

To take this position is neither to claim access to purely objective knowledge, nor to deny the importance of subjects' understandings. It is to strive toward a research situation which is capable of providing a "fair trade" with the participants (Goodson, 1991a). This trade cannot be accomplished if the research's only goal is to put a pre-formatted system in place without regard to teachers' and students' problems. Nor is it fair to provide an "expert" analysis of the innovation's progress, which ignores the interpretations and meanings the participants bring to the situation.

By the same token, classroom research also fails to achieve a fair trade if it merely reports those situated understandings (as seems to be suggested by Kemmis, 1988). It must be capable of both responding to, and expanding upon them, by offering participants different perspectives informed by different backgrounds and priorities. As the UNCAL project stated as its first aim, we should strive "to encourage the process of self-criticism ... by bringing to bear the perspective of an 'institutional outsider'" (MacDonald et al. 1977, p. i). At the same time, we must not impose that perspective as the only valid viewpoint, nor claim that it is somehow inherently superior to other reasoned accounts. This is what the analysts have to offer as their part of the

bargain, and we do not pretend that it is easy to achieve the balance we are seeking. If successful, this approach can make greatly facilitate the linking of "researchers" and "evaluators", as well as linking classroom practitioners and university theoreticians.

To achieve this, we recognized that our methodology must have mechanisms for accomplishing the anticipated trades. Some of these mechanisms have been mentioned above, in terms of offering minimal technical assistance, and conducting open-ended interviews in which respondents can direct the agenda. In addition, as our analyses developed, we made an effort to involve teachers, to the maximum extent they wished to participate, in reviewing these analyses. We regularly made available to them our findings, and elicited their comments. In this way, we tried to give back to the teachers, and to their schools, some of the gains which we realized in terms of an improved understanding of the process and problems associated with computer use in high schools. Similarly, we set out to interview students on a regular basis, without disrupting their learning schedules more than was necessary. Eventually, we conducted six or more interviews with each of the participating teachers, and over 185 interviews with students. In the process, we compiled a data base which should make possible an adequate account of participants' own experiences and understandings of how computers relate to their schooling.

Clearly, the primary field methodology of this type of research is classroom observation and recording. It is not, however, restricted solely to this method. As summarized by the editors of *Beyond the Numbers Game* (Hamilton et al., 1977), this methodology involves collecting data from a number of different sources, with the aim of "triangulating" the phenomena under study, and thereby obtaining as complete a picture as possible:

> Observation, interviews with participants (students, instructors, administrators, and others), questionnaires, and analysis of documents and background information are all combined to help illuminate problems, issues, and significant program features (p. 5).

Details of the implementation of this methodology within our project are given in the next section.

1.2.4.1 Details of Field Methods

The research for this study was carried out by the Principal Investigators in each of the subject areas, as well as by the full-time Research Officers. The Research Associate's report by Blomeyer (1989) details a number of sources of potential data distortion in the process of this type of "naturalistic inquiry" (section 5.2.2). Parlett and Hamilton (1977), in describing their methodology, address similar concerns over the subjective nature of illuminative evaluation (p. 18). They recommend some precautionary tactics designed to prevent the dominance of strictly personal or idiosyncratic interpretations of observed events, several of which we adopted. Observers switched sites on a regular basis, critiqued each other's observations regularly, and occasionally worked in tandem, in order to cross-check findings and to compensate for any partiality on their part.

In-service training sessions on the computers were observed by the researchers in order to record the teachers' responses to the technology, and the amount of training required for them to feel comfortable with it, prior to classroom use. The classrooms involved in the project were observed both before and after the introduction of the computers. The Research Officers visited all designated classrooms on a regular basis throughout the life of the project. They were involved in note-taking, audio-taping, video-taping, and photographing classroom activities.

At two crucial points in the course of the project, we also included events which mark this form of investigation as an exception to the business of research as usual: formal teacher feedback sessions. Although we do not subscribe completely to the kind of "action research" paradigm advocated by, for instance, Carr and Kemmis (1986), we do believe that it is essential that educational researchers position themselves, not as interlopers in schools, but as fellow professionals intent on sharing with teachers their insights into the complex processes of schooling. In order to do this, it is important that researchers expose their preliminary analyses to the scrutiny of the participants, in order to verify that those analyses have correctly interpreted observed events in ways which teachers can recognize and acknowledge.

We scheduled the first teacher feedback session for February 21, 1990. We had several reasons for delaying the first exposure of our analyses until the third semester of fieldwork. First, we did not feel we had accumulated a sufficient base of data prior to that time to allow us to support our theoretical assertions as anything more than tentative themes for further research. We also felt that a certain period of time was required for participants and researchers to get to know one another well enough to feel comfortable when involved in a potentially intense intellectual exchange. Finally, but equally importantly, we did not wish to interfere more than absolutely necessary in the natural settings in which teachers were coping with their first encounters with classroom computers.

Our second feedback session was held on May 17, 1991, as late in the course of the project as we could feasibly arrange it. The purpose of this session was to allow teachers to contribute to the process of finalizing both theoretical themes and the practical recommendations for change which we expected to include.

Prior to each session, all teachers in the project were provided with transcripts of their interviews, and of the Principal Investigators' reports which pertained to their subject area. On the appointed day, they were released from their teaching duties by the Board of Education, and spent several hours in both small, subject-centred workshops, and in plenary sessions covering cross-curricular issues. In general, the teachers expressed satisfaction with the analyses they had read, and provided us with positive feedback about the course of research which we had adopted. They were also very frank and frequently very explicit in expressing their opinions about the impact of educational technology on their classrooms, and the kinds of changes needed in order to make that technology more effective in future. We have striven wherever possible to incorporate their insights into this report.

The dialogues conducted during these sessions have been very valuable to us as researchers, and hopefully they have been equally so to the participating teachers. In many ways, they served to initiate subtle alterations in our relationships with the participants which had not been entirely anticipated. Once the ice was broken in the initial session, for instance, our informal discussions with teachers and our loosely-structured interviews became a kind of ongoing feedback process. The participating teachers began to give us spontaneous comments on research themes, and even suggested new avenues of inquiry and new subjects for inclusion in our investigations. Interviewers began to "try out" hypotheses in interviews, and received immediate on-the-record reactions from interviewees. As a result, both our personal and professional relationships with the participants have been deepened and enriched in ways which have contributed significantly to the final outcomes.

1.2.4.2 Summary

This project began with a central set of topical concerns, and with a commitment to a style of research which would be informative simultaneously to educational theorists, administrators and policy-makers, and the practitioners in the classroom. At the same time, we were determined that this research must not be exploitative of the teachers who had volunteered to take part in our inquiries, nor oppressive of the students whose educational experiences were being affected.

Living up to these commitments has not always been easy; a position as expert, with a comfortable residence in the ivory tower, will always be easier. Through a process of self-reflection and self-critique, however, and a continuing determination to listen to the voices of the participating teachers, we have evolved a set of methods which we believe have gone quite a way towards accomplishing our ambitious goals. The fact that we were able to compile a massive and extensive database of insightful observations and comments; that we were able to contribute to the guidance of an innovation which has paid professional dividends to the participating schools and teachers; and that we have completed the project in the enviable position of being able to call all the participants our friends, to us validates our initial decision to adopt a flexible qualitative methodology.

That methodology, based on concepts derived from grounded theory, illuminative evaluation, and to some extent, action research, resulted in a form of fieldwork which combined many disparate resources to provide a story of action within a theory of context. Through classroom observation, interviews, questionnaires, classroom interaction analysis, informal discussions, and feedback sessions, we have as attempted to enter as deeply as possible into the teachers' world, without usurping their role within it. We have come away with no doubt partial, but often intimate, understandings of that world, and our task in this report is to attempt to communicate those understandings as best we can.

In the remainder of this volume, we will describe the evolution of the Research Unit which provided the organizational core for the conduct of the research. We will then "set the scene" for readers with narrative descriptions of each of the schools, and each of the teachers, who took part in this project. Finally, we will present a picture of the student populations who took part, through the use of both narratives and an analysis of student questionnaire responses. Volume 2 will present the Principal Investigators' reports, and Volume 3 will contain the over-arching theoretical analyses developed during this project. A summary of the recommendations for future policy and practice which have arisen out these analyses concludes our summative report.

1.2.5 **THE DEVELOPMENT OF RUCCUS**

The Research Unit on Classroom Learning and Computer Use in Schools (RUCCUS) was founded in 1989, at the outset of this project, and was charged with the collection, organization, and storage of the data gathered during its progress. The Unit, which is directed by Ivor Goodson, now houses five educational research projects of various sizes and scopes, and has four full-time contract employees, as well as a number of associated researchers.

For the purposes of this project, RUCCUS was authorized to obtain a complete ICON computing network, in order to facilitate familiarization with the equipment and the software being used in the schools. This equipment also served as our only office system for the first few months of the project. As the accumulation of data grew, however, and as our commitments to produce reports, transcripts, correspondence, and internal documents grew, we found that we

needed a number of other equipment and software acquisitions. These were reported in our earlier Interim Reports, and will only be briefly recapped here.

1.2.5.1 **Hardware and Software Acquisitions**

The research contract with the Ministry specified that the Faculty would be provided with a range of hardware and software, similar to that which was being installed in the participating high schools. The Board also agreed to assist the Faculty in acquiring other necessary equipment for data collection, specifically audio tape recorders, video cassette recorders, lap-top computers, and the necessary accessories.

Delivery of some of these resources was subject to various delays and technical problems, which is not unusual in a project of this size, but which did inhibit implementation of some of our original research plans. Specifically, the installation of very early versions of Unisys' PW300 computers was hampered by hard-disk failures at all three locations. Although these problems were corrected by the supplier, they combined with other glitches to greatly curtail the CD-ROM portion of the project. On another front, technical problems with constructing an interface between the school ICON systems and a VCR meant that our intent to tape-record student/computer interactions was not implemented to the degree we would have hoped. Neither of these problem areas seriously impeded the central goals of the research, but they have forced us to concentrate our efforts in other areas.

By the end of the first semester of observation, we had, at the Faculty of Education:

- 1 Unisys ICON fileserver
- 3 Unisys ICON2 workstations
- 1 Epson Apex80 printer
- 1 Hewlett-Packard PaintJet printer
- 1 Unisys PW300 DOS microcomputer
(with external disk drive and mouse)
- 2 Toshiba T1000 lap-top microcomputers
- 3 portable audio recorders + accessories
- 2 video cassette recorders

In terms of software, the Unit had:

- Copies of all curriculum-related software in use in the participating schools
- Site licenses for *WordPerfect* for all ICONs and lap-tops
- 1 copy of *DataPerfect* for the PW300
- 1 copy of *Microsoft Windows* for the PW300

By the end of the second term of observation, in addition to the hardware described above, we had acquired our Sony CD-ROM drive, and a Hewlett-Packard LaserJet Series III printer. Eventually, we also obtained a 386-based Empac DOS computer, and software which included *SPSS-PC+* and *Harvard Graphics*. This has made possible the complete production of our Interim Reports and all other RUCCUS documentation in-house.

1.2.5.2 **Classroom Observations; Teacher and Student Interviews**

The chart presented in Appendix 1.1 shows in detail the data collection activities of the project, as well as the meetings, conferences, and feedback sessions attended. All in all, 258 classroom visits were conducted, as well as 62 teacher interviews and 187 student interviews. All

of these interviews were tape recorded, and subsequently transcribed. Once transcribed, the interview records, along with classroom observation and summary notes, were broken into small segments to be coded and loaded into the computer database.

1.2.5.3 **Computerized Database**

Over the duration of the project, a computerized database was steadily built up, which now contains close to nine thousand individual records, comprising over five million characters of encoded data. We consider this database to be one of the most valuable assets produced by the project; an asset which could potentially be exploited for a great deal more in the way of research findings in the future.

This database has payed vital dividends throughout the project. One of the Principal Investigators has taken a copy of the base, which he used for his individual inquiries. In addition, several focused searches were conducted by the Research Officers according to specifications received from the Principal Investigators. Results of these searches were then used by the Principal Investigators as they prepared their analyses for inclusion in this and earlier reports (see Volume 2).

The construction of the database has proven to be more than a convenient means of text storage and retrieval, however. As part of the coding process, we developed a list of over fifty keywords, representing analytical themes and sub-themes. The generation and application of these keywords corresponds closely to the process of locating emergent categories, as specified by the methodology of grounded theory (Mangan, 1991; Hutchinson, 1988; Glaser and Strauss, 1967). In this way, the use of the database software has added structure and rigour to the early, exploratory phases of this project, as well as providing the fundamental resource for our later conclusions and recommendations.

1.2.6 **SUMMARY**

With this overview of our basic objectives and methodology in place, we can now turn to a description of the context in which our data-gathering took place. In the sections that follow, we will review the Board and Ministry policies in effect at the time the project began, followed by description of the school sites, the teachers, and the student populations that participated in our project.

1.3 MINISTRY GUIDELINES AND BOARD POLICIES

by Peder Nielsen

(Originally published as Chapter 3 of Interim Report #1)

1.3.1 THE MINISTRY

According to *Ontario Schools: Intermediate and Senior Divisions*, the major purpose of schools is to help each student to develop his/her potential as an individual and as a contributing, responsible member of society in an environment fostering equal opportunity for all. In order to accomplish this, one needs to be aware of the uniqueness of each student and use the appropriate strategies which result in positive learning experiences for that student.

As microcomputers are increasingly becoming part of the work place, schools need to be receptive to their use in programs which focus on business, technical, and vocational training. This results in changes in curricular materials and additional professional development for teachers.

With the development of exemplary software, one must provide a greater awareness of the application of the computer as a tool in the everyday learning strategies of the students. No longer should the computer be the domain of the Computer Studies area but should be an integral part of the resources and strategies available for students in any program of study. This latter point is confirmed by the description of resource-based learning as advocated in *Partners in Action: The Library Resource Centre in the School Curriculum.*

In recognizing the diversity in abilities and interests among students, the Ministry advocates that the process of learning is as important as the content. In order to promote the participation of students as active members in the dynamic process of learning, various strategies need to be addressed. The integration of computer technology is a viable alternative as it allows for the accommodation of various learning styles, the individualization of programs, the development of communication skills, and the mastery of content by the student at his/her own speed.

The position of the Ministry of Education for the Province of Ontario can perhaps best be summarized by looking at an excerpt from the following memorandum.

POLICY/PROGRAM MEMORANDUM #911987 February 2

INTEGRATION OF COMPUTERS INTO ELEMENTARY AND SECONDARY SCHOOLS

The Ministry of Education recognizes that new developments in information technology, particularly computers, are increasingly influencing the way in which we educate students. Its expectations concerning information technology are described below.

All students in Ontario schools shall have the opportunity, to the full extent of their abilities, to become knowledgeable and creative in their use of computers as personal tools.

Ontario's curriculum policy reflects the need for flexibility and autonomy in learning. Computers can be used to support this policy.

All subject guidelines now being developed for the Intermediate and Senior divisions will include suggestions on the use of computers, including statements on the most appropriate applications for students and for specific disciplines.

Local curriculum, development, implementation, and in-service activities should reflect this general integrative thrust. School boards should design and implement system-wide and/or school-based plans that will help teachers and their students to exploit this technology for educational purposes in all appropriate areas of the curriculum.

In conclusion, the Ministry of Education, school boards, and others within the educational community are working together to develop innovative applications for computers that will effectively serve the abilities and needs of learners, exceptionalities notwithstanding, within the Primary, Junior, Intermediate, and Senior divisions.

1.3.2 THE BOARD

The Board, responding to its goal of "Success for Every Student", provides a rich learning environment in an educational system which it considers to be a dynamic enterprise. In its elementary panel (26 800 students), there is an emphasis on child-centred learning, while in the secondary panel (16 400 students) the focus is on preparing students for a rapidly changing society be it for further education or job preparation.

Throughout the system, the Board is committed to providing a wide range of learning activities at all levels of difficulties. Teachers (1450 elementary and 1100 secondary) are encouraged to base their strategies on individual learning styles in order to provide equal opportunities for students to grow intellectually, physically, emotionally, and socially.

This commitment to individualized learning has resulted in the incorporation of such endeavours as: whole language; universal junior kindergarten; outdoor educational centres; concentration of technological training programs; a proposed school for performing arts; establishment of a centre for adult education, French Immersion schools, French as a First Language schools, and English as a Second Language programs; special education programs; values education; and the implementation of the computer as a personal tool for learning.

Following is a reproduction of the Board's philosophical comments on its role. These statements articulate explicitly the Board's position.

1.3.2.1 Mission Statement

The primary mission of this Board is to provide equal opportunity for an education which fosters the intellectual, physical, social, and emotional growth of each individual learner. The attainment of excellence in academic areas, practical skills, and development of attitudes is central to this mission, to the end that learners may acquire the foundation for life in a changing society.

1.3.2.2 Educational Philosophy

An educational system both reflects and shapes the values of the community and, at the same time, provides leadership and a sense of vision in shaping and developing those values. Equal access to educational opportunities is provided for each learner.

The central task of the schools is the development of each individual learner in an environment which nurtures all aspects of personal growth and provides a wide range of educational opportunities. In carrying out this task, the foremost obligation of the school is to the individual, and thus the instructional program is student-centred. Each school develops a unique character and style suited to the students in its community.

The school program is a broadly based set of experiences designed to foster the harmonious development of the learner, not only intellectually but also physically, socially, and emotionally. Schools provide opportunities for students to develop their highest academic potential in a range of curriculum areas appropriate to their abilities and interests. Students acquire the basic skills necessary to continue to learn throughout their lives, as well as those skills necessary for useful and productive work. The development of attitudes which will lead to responsible behaviour as citizens of the school, home, community, and world is encouraged. Schools foster the development of students who feel that they are worthy, respected, responsible, and have unique contributions to make to others.

In a world in which rapid change is a way of life, schools assist in preparing people who will be able to adapt to changing times by acquiring a basic core of values, attitudes, and skills which allow them to make rational judgements and decisions.

Educational programs are based on the premise that all students, given suitable conditions and sufficient time, can learn appropriate academic and life skills. The essential educational task is to build competence, through successful learning experiences, and a sense of self-worth. Instruction is organized to permit continuous progress with programs differentiated to fit varying student values and needs. Assessment procedures are designed to enhance the student's sense of progress and mastery.

Schools provide a caring and nurturing environment for students in which every employee acts as a model in terms of character, attitudes, and behaviour. This occurs best when employees work as an effective team with a sense of commitment to students and parents.

Education is a shared responsibility of students, teachers, and parents. The school system provides, through a range of channels, accurate information to parents and the public regarding the Board's philosophy of education, school programs, and the resources available to the community through the Board.

In order to clarify the Board's position regarding the exciting and challenging implementation of computer technology in the learning process, the "Directions for Instructional Software and Computer, Version 3" was produced. Following is an excerpt from this document.

PHILOSOPHY & POLICY STATEMENTAPRIL 1989
DIRECTIONS FOR INSTRUCTIONAL SOFTWARE & COMPUTERS, VERSION 3

Preface:

Both the Ministry of Education and this Board recognize that the new developments in information technology, particularly instructional computers, are increasingly changing the way students learn.

The purpose of "Directions for Instructional Software and Computers, Version 3" (D.I.S.C.3) is to specifically outline this Board's current instructional computer direction, and this Board's implementation plans for the next three years. Detailed planning for a period longer than three years is not productive in light of the technological changes in this very dynamic area.

Basic Expectations:

All students shall have the opportunity, to the full extent of their abilities and within the resources of the Board, to become knowledgeable and creative in their use of computers as personal tools.

The principle of equal opportunity of access, across the system, for each student must be attained.

Teachers developing or delivering programs for students in the Primary and Junior divisions shall include computer applications, where appropriate, in the areas of study defined in *The Formative Years* and *EPJD*.

Teachers developing or delivering courses of study for ALL subjects offered in the Intermediate and Senior divisions shall incorporate computer applications, where appropriate.

The mission statement of this Board reflects the need for flexibility and autonomy in learning.

Students will be given opportunities to use computers in many dimensions of their learning environment. Students will develop skills in writing, composing, exploring, drawing, calculating, analysing, problem solving, role playing, and accessing information sources through computer-assisted techniques. This can be accomplished through the use of word processors, simulation programs, graphics editors, sound editors, spreadsheets, database managers, and other software which supports creative thinking.

Students will explore the ways in which network configurations can provide a medium of communication with peers and teachers both within and outside the school building.

Students will be given the opportunity to access computer equipment on a stand-alone basis where appropriate.

All program development and delivery will emphasize the integration of computer experiences broadly into the school curriculum. Courses offered under the Computer Studies Guideline, 1983, will continue to focus on computer architecture, programming, and applications software.

All Board program documents which are developed will include specific statements on the most appropriate computer applications for students.

The Board's approach to the selection of instructional computer resources is summarized as follows:

BOARD PROGRAM DOCUMENTS --> SOFTWARE --> HARDWARE

The Elementary Panel (PHILOSOPHY):

The acquisition of effective learning skills will lead young people to become lifelong learners. The process of learning needs to be emphasized as much as the content. The integration of computer technologies into the learning process must be compatible with this view of the learner.

Teachers, acting as facilitators, must ensure that computer uses and applications are combined with other program delivery strategies to support the following aims:

The accommodation of a variety of learning styles, abilities, and needs.

The individualization of student learning activities.

The development of the skills of critical inquiry, information management, computation, and communication.
The mastery of program objectives.
The development of the skills involved in successfully collaborating with others.
The encouragement of students' positive attitudes towards themselves and towards learning.

The Secondary Panel (PHILOSOPHY):

CAL:

The use of computers will focus on:

The accommodation of a variety of learning styles, abilities, and needs.
The individualization of student learning activities.
The honing of the skills of critical inquiry, information management, computation, and communication.
The mastery of program objectives.
The refinement of the skills involved in successfully collaborating with others.
The fostering of students' positive attitudes towards themselves and towards learning.

Computer Studies:

The computer itself is the primary object of study in Computer Science, Data Processing, and Computer Technology courses.
The use of industry standard software, such as word processors, electronic spreadsheets, and database managers in a problem-solving mode. (*WordPerfect, Lotus, dBASE III*)
Students are to program the computer to solve a particular problem or to permit electronic diagnostics.
Students must study the societal impact of technical advances generally and appreciate the opportunities available in computer-related careers.

Business Studies:

The computer has become the central tool in a business operation and all aspects of the business environment are changing to accommodate computer technologies.
New procedures are now available to integrate computerized systems, electronic mail, document distribution, teleconferencing, and multifunctional workstations. Students must acquire marketable skills in these areas, as well as the traditional skills of communicating, keyboarding, data processing, accounting, and marketing.

Technological Studies:

The secondary school must introduce students to technology and provide the students with basic marketable skills that can be applied in the workplace.
Courses designed for technical literacy and personal use require equipment which is generic in nature. Courses designed to train students for job entry require equipment which is closer to industry standards.

Co-operative Education placements must continue to play an important role in exposing students to new technologies. In this mode, students will have opportunities to observe and use specialized technical-production equipment. Example: CAD, Computer Graphics, Engine Analyses.

Applied Sciences:

Since computers are essential tools of inquiry for the scientist, engineer, and social scientist, students will be given opportunities to develop skills related to data acquisition, analysis, presentation, simulation, data banking, and graphic display.

Uses will include:

Chemistry—interfaced gathering of pH, temperature, and chemical-analysis data.

Physics—acquisition over time of forces, speeds, temperatures, wave superpositions, and light intensities.

Biology—plant and animal physiology investigations, database development, and inquiry.

Geography—preparation of maps and charts, analysis and presentation of data.

The applications outlined above are distinct in nature and are in addition to CAL uses which assist and individualize the achievement of program objectives in these subject areas.

Guidance

One of the aims of the guidance service is to provide current data regarding job characteristics. To accomplish this, the current CHOICES software program (IBM version) is to be extended for use in all the secondary schools.

Automated School Library Resource Centres

Currently, school resource centres, the professional library, and the ERS Cataloguing service are not automated with the computer technologies.

Ministry program guidelines clearly require that students learn the skills used in modern electronic information retrieval.

The Board sought a request for proposals, including several appropriate hardware/software configurations and their costs, in order to achieve the following:

An on-line computer network joining each school resource centre, the professional library, and the ERS cataloguing unit.

The software will contain modules of a circulation system with bar-code reading capability; a shelf-list inventory system; a search system which includes title, author, and subject; a centralized cataloguing system; and the ability to integrate with the university, community college, and public library which are found within the city where this Board is located.

Staff Education and Development

A teacher on special assignment will provide the implementation leadership for the networked computer-assisted learning direction in the Elementary panel schools.

A teacher on special assignment will provide the implementation leadership for the use of labs in Secondary panel computer and business studies programs.
Staff development associated with the secondary panel CAL project at Brock and Tecumseh will be supported through the project grant from the Ministry of Education.
In the fall of 1989, the automation of school resource centres will be planned and under way. At that time, non-teaching personnel will be required to implement this project.

1.4 THE RESEARCH SITES
by Peder Nielsen

Editors' Note: *The field research for this project took place in two area high schools, which go by the pseudonyms of "Brock" and "Tecumseh" in this and all previous reports. In order to understand the context of the innovation under investigation, we will begin our depiction of these sites with a reproduction of the original site descriptions produced by the Board liaison, Peder Nielsen.*

1.4.1 SITE DESCRIPTIONS
(Originally published as chapter 4 of *Interim Report #1*)

1.4.1.1 Statistical Background

Out of fourteen secondary schools, two sites were chosen from this urban school board. Brock is an older, large composite school, historically rich in the teaching of Technical and Business Education. Tecumseh is more representative of the average high school composition found in many school boards across the province.

Table 1.1 to Table 1.3 indicate the enrolment of all students by grade and gender, and the proportions enroled in OAC programs on September 30 from 1986 to 1989.

Table 1.1: School Enrolment by Grade Level (1986-89)

Grade	Brock			Tecumseh		
	86-87	87-88	88-89	86-87	87-88	88-89
9	403	353	375	144	208	189
10	537	487	453	173	203	210
11	654	587	652	186	253	203
12	662	582	815	195	262	243
13(OAC)	668	432	388	170	140	184
Total	2924	2441	2683	868	1066	1029

Table 1.2: School Enrolment by Gender (1986-89)

Gender	Brock			Tecumseh		
	86-87	87-88	88-89	86-87	87-88	88-89
M	1619	1358	1501	434	535	496
F	1305	1083	1182	434	531	533

Table 1.3: School Enrolment in OAC Programs (1986-89)

OAC Enrolment	Brock			Tecumseh		
	86-87	87-88	88-89	86-87	87-88	88-89
Total	N/A	214	236	N/A	154	184
% of School Population	N/A	8.8	8.8	N/A	14.4	17.9

In order to appreciate the composition of the course selections of students, Table 1.4, Table 1.5 represents mean per cent of courses taken at various levels by grades during the academic year 1987-88. Data are for the entire system.

Table 1.4: Per Cent of Courses Taken at Various Levels by Grade (1987-88)

Level of Difficulty	Grade					
	9	10	11	12	13	Total
Advanced	54.7	55.0	49.2	53.4	83.1	57.3
General	37.0	37.0	45.7	41.5	16.9	37.0
Basic	8.2	8.0	5.1	5.1	0.1	5.7

For Grades 9 to 12, it appears that slightly more than half the students were enroled in advanced level courses. As expected, the vast majority of Grade 13 students were enroled in advanced level courses. However, there were some students who were registered in Grade 13 but were taking out-of-grade courses of which some were at the general level. These were probably general interest courses, such as a practical technological or business course, a recreational course, computer awareness, etc.

The results of investigating the gender distribution of courses taken at various levels of difficulty are shown in Table 1.4, Table 1.5. These data were based on enrolment during 1987-88. The data for basic level were not available.

Table 1.5: Per Cent of Courses Taken at Various Levels by Gender (1987-88)

Level of Difficulty	Percent of Courses Taken						
	Gender	0	1-25	26-50	51-75	76-99	100
Advanced	F	16.8	9.0	10.2	21.1	16.3	26.8
	M	23.6	9.8	10.9	18.9	14.1	22.6
General	F	31.2	25.7	15.1	9.5	6.5	12.0
	M	29.4	22.1	14.5	9.9	7.6	16.5

An example of interpreting these data would be that of all the girls enroled in this school board, 21.1% of them were taking half to three-quarters of all their courses at the advanced level; whereas, only 9.5% of the girls were taking half to three-quarters at the general level. Approximately a two-to-one ratio.

Another interpretation would be that 22.6% of all boys in the system take all their courses at the advanced level; whereas 16.5% take all their courses at the general level.

Although the difference is small, there is generally a higher per cent of girls than boys taking the majority of their courses at the advanced level.

When comparing the mean percent of courses taken at the three levels by school during 1987-88, it appears that Tecumseh is very close to being representative of the average city enrolment (see Table 1.6). This reinforces the previous notion that Tecumseh is typical of the average secondary school in this board. The heavy emphasis at Brock on Technological Studies is reflected in the fact that almost 70 per cent of courses are taken at the general level.

Table 1.6: Per Cent of Courses Taken at Various Levels by School (1987-88)

School	Enrolment	Advanced	General	Basic
A	756	92.9	7.1	0.0
B	848	81.5	18.4	0.1
C	777	78.1	21.9	0.0
D	1,039	76.0	24.0	0.0
E	2,004	68.0	31.8	0.2
Tecumseh	971	60.7	39.3	0.0
G	1,299	59.9	40.0	0.1
H	949	59.9	40.1	0.0
I	885	59.5	40.4	0.1
J	1,280	41.9	58.1	0.1
Brock	1,882	29.1	69.8	1.0
L	337	0.0	0.0	100.0
M	400	0.0	0.6	99.4
Total	13,427	57.4	37.0	5.7

The disparity between the enrolment figures in Table 1.6 and those in Table 1.1 is due to the different population references taken. Table 1.1 data refer to the total student enrolment on a specific date regardless of the number of courses taken. Table 1.6 data refer to only those students who have been enroled in at least three courses during that school year.

In general, it appears that Tecumseh is very representative of an average school in this board.

1.4.1.1.1 *Brock*

This school was originally constructed in 1912 with an enrolment of about 150. It was one of the first fully technical schools operating in Ontario at that time. Over the next five decades, several additions were constructed, resulting in the present-day enrolment of about 2700. The school is located in the centre of the city. True to its composite nature, just about every course offered throughout the city can be studied at this school. As well, many specialty courses are offered only at this site.

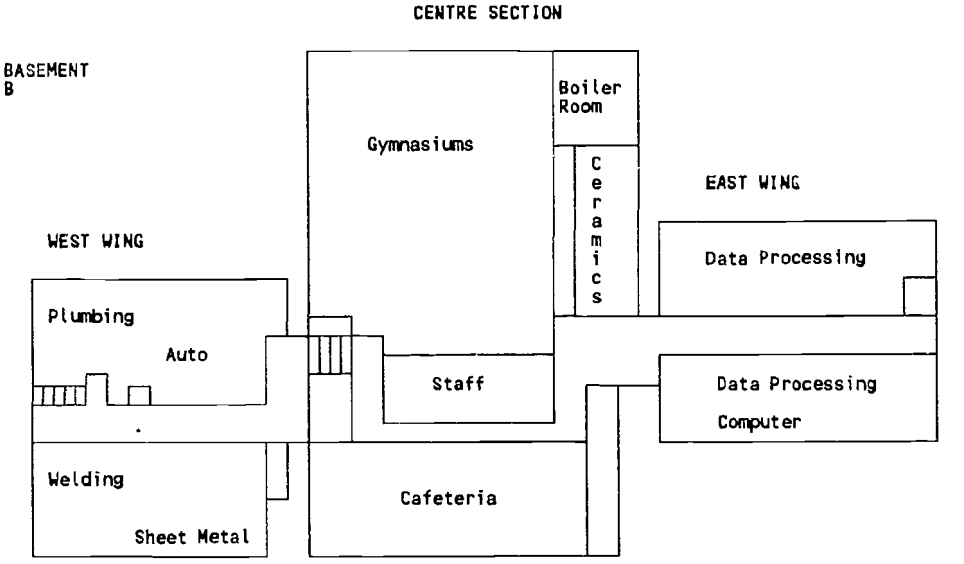
The staff consists of a Principal, four Vice-Principals, large Technological and Business departments, each headed by a Director, and a traditional Academic department. Table 1.7 gives the overall department structure, with the number of teachers in each department indicated in parentheses.

Table 1.7: Brock Staff

Technological Studies	Academic Studies	Business Studies
Director (1)		Director (1)
Automotive (9)	English (17)	Accounting (5)
Drafting (6)	Mathematics (14)	Marketing (3)
Electricity (3)	Science (12)	Computer Studies (4)
TV Arts (3)	History (8)	System Support (6)
TV Technology (1)	Geography (5)	
Environmental Control (3)	Moderns (8)	
Family Studies & Fashion Arts (9)	French Immersion (1)	
Graphic Communications (5)	Physical Education (12)	
Machine Shop (3)	Student Services (9)	
Nursing Assistant (4)	Music (3)	
Art (16)	Library (3)	
Welding & Plumbing (4)	Special Education (5)	
Building Construction (4)	English as a Second Language (14)	

The physical design of the school is represented by the floor plans shown on the following two pages (Figure 1.2 and Figure 1.3). Notice the location of the computer lab being dedicated entirely for this project is marked on Figure 1.2 (Ground Floor).

Figure 1.2: Floor Plans for Brock



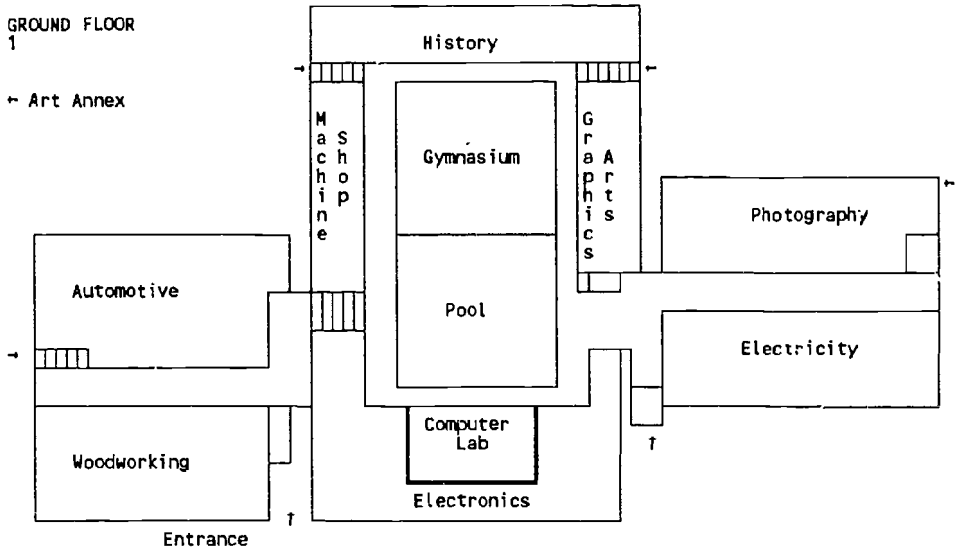
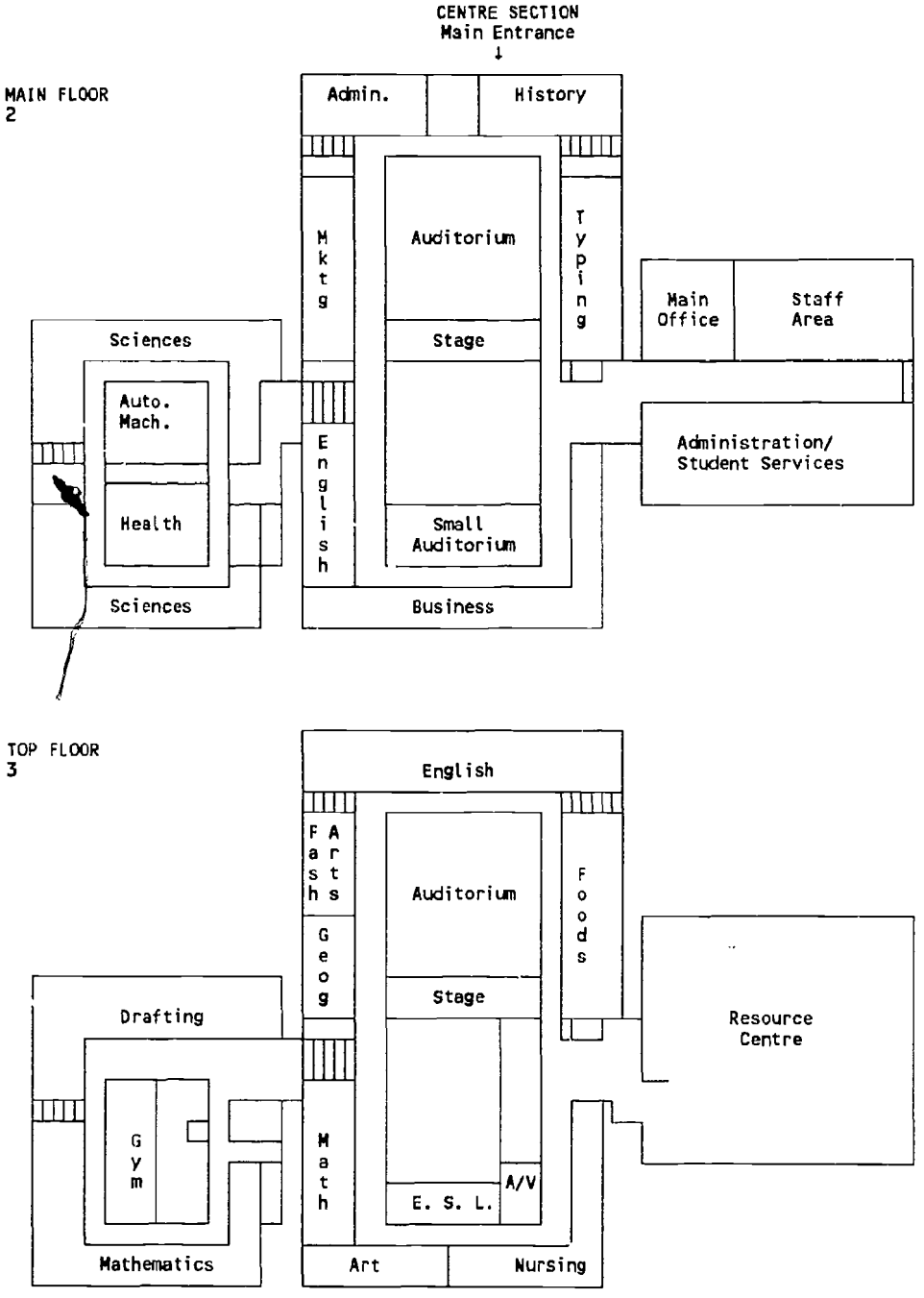


Figure 1.3: Floor Plans for Brock (Continued)



1.4.1.1.2 *Tecumseh*

This suburban school was constructed more recently in response to growth in the early 1960s. It has a present enrolment of about 1000.

The staff consists of a Principal, two Vice-Principals, a small Technological department and Business department, each headed by a Director, and a traditional Academic department. Table 1.8 gives the overall department and staff structure, with the number of teachers in each department indicated in parentheses.

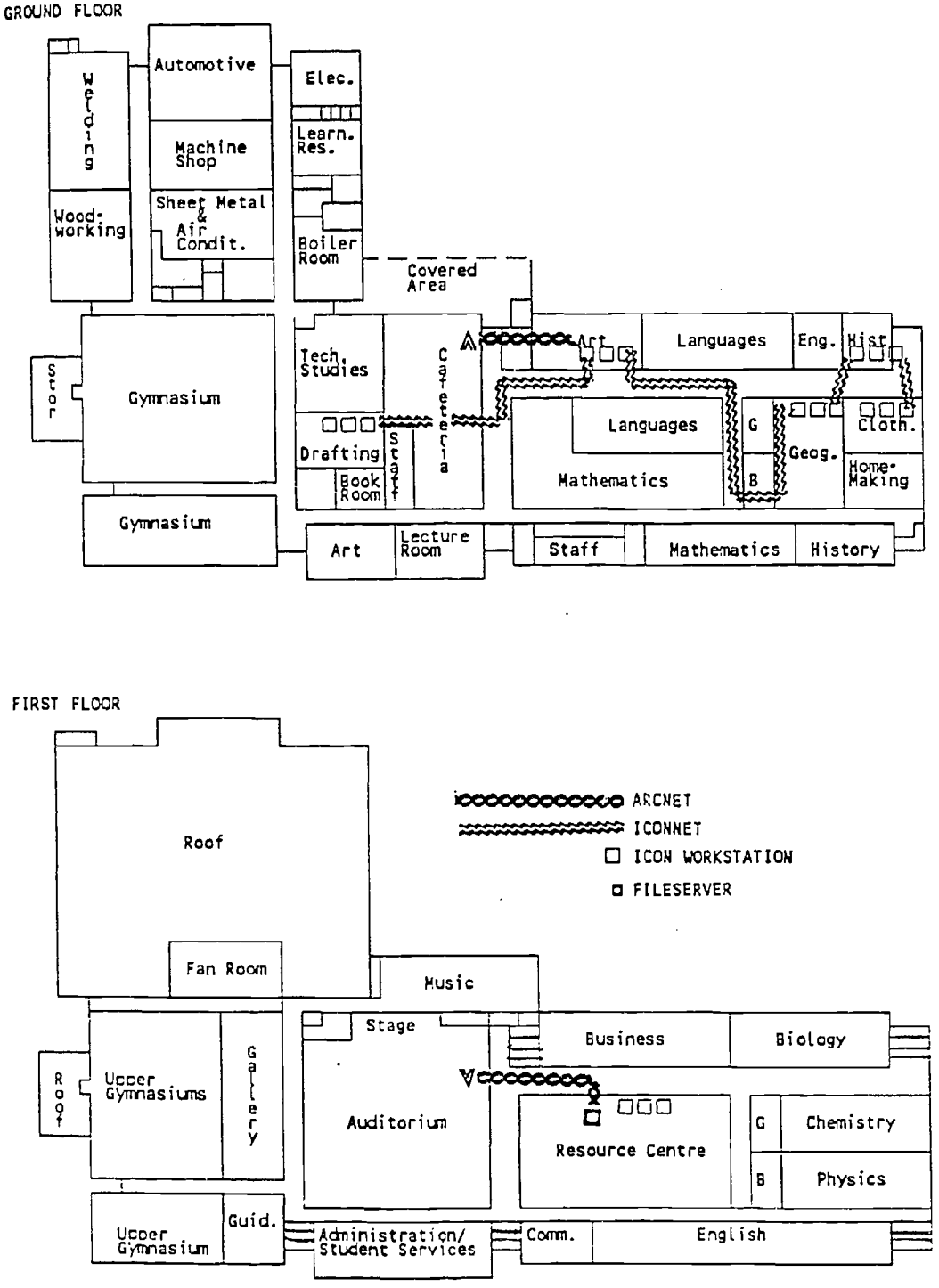
Table 1.8: Tecumseh Staff

Technological Studies	Academic Studies	Business Studies
Director (1)		Director (1)
Technical Courses (2)	English (7)	Business Courses (6)
	Mathematics (7)	
	Science (6)	
	History (4)	
	Geography (2)	
	Moderns (4)	
	Physical Education (5)	
	Music (2)	
	Library (1)	
	Special Education (1)	
	Family Studies (4)	
	Art (3)	

1.4.1.2 **Floor Plans and Computer Installations**

The physical design of Tecumseh is shown below (Figure 1.4). Notice that, in this school, a cluster of networked computers is used. The five classrooms and the Resource Centre have been marked on the floor plan, as has the wiring of the network.

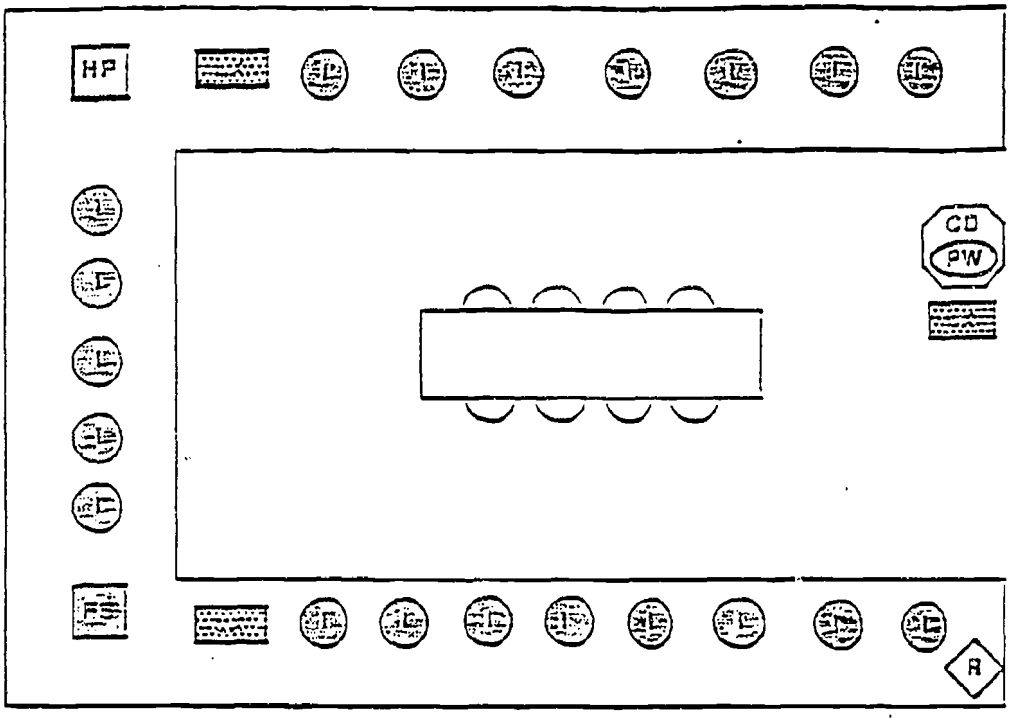
Figure 1.4: Floor Plans for Tecumseh



In order to research the pedagogical impact of computer configurations, Brock was equipped with a laboratory-networked configuration. In this arrangement one room was set aside as a dedicated laboratory which can be reserved by the project teachers. Figure 1.5 indicates the physical arrangement of the equipment.

Included in this arrangement is a video screen multiswitching unit developed by Robotel, which allows the instructor to be in constant communication with the users and permits complete control over each of the computers. The teacher can decide which screen image should appear on which other screen(s). This system essentially replaces the need for projectors and/or large monitors attached to a single unit.

Figure 1.5: Brock ICON Network Layout

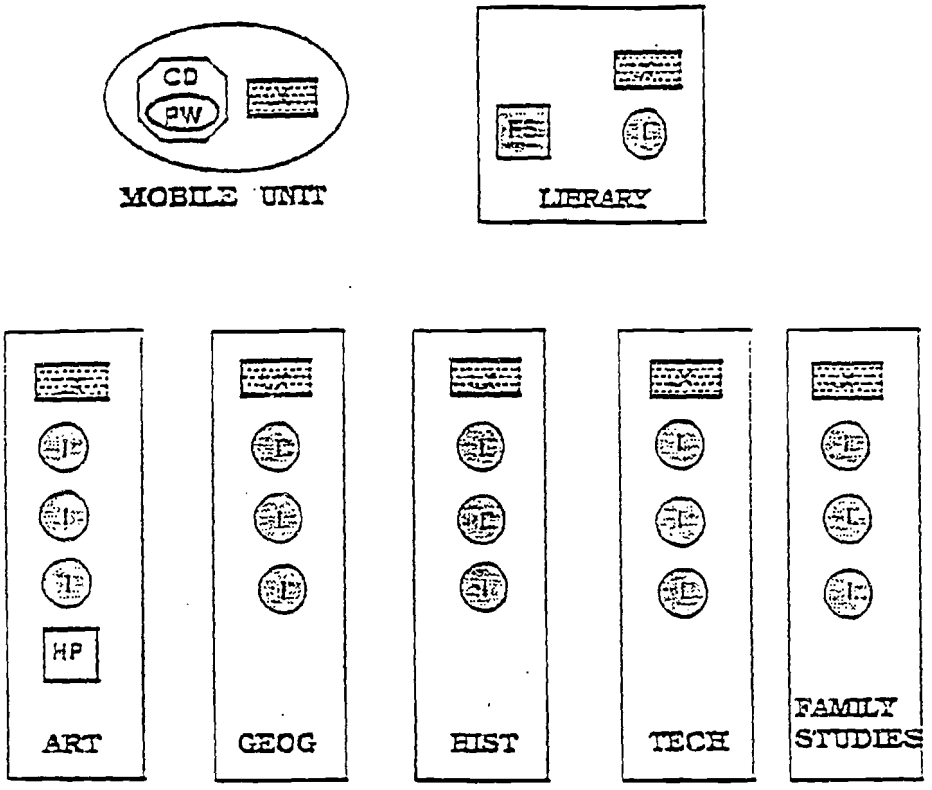


20		ICON 2 COMPUTER
1	PW	PW 300 (DOS COMPUTER)
1	FS	FILESERVER
1	HP	COLOR JET PRINTER
3		LX-800 PRINTER
1	CD	CD PLAYER
1	R	ROBOTEL MICROSELECT

The physical design at Tecumseh, however, consists of a few computers placed within the classroom of each project teacher. The implication is that the computer is always accessible, but only for a few students at any one time. In such an arrangement, the teacher needs to be sensitive to activity-centred learning strategies. Although the computers are located in different rooms, they are still all part of a network. In this report, this arrangement is referred to as a cluster network.

As well as placing three computers and a printer in each classroom, one computer is also available in the Resource Centre for access by project students in their non-timetabled periods. This computer may be accessed by other students at the school in order that the researchers may study the impact of the presence of this technology on other students using the Resource Centre. Figure 1.6 indicates this arrangement.

Figure 1.6: Tecumseh ICON Network Layout



16 ICON 2 COMPUTER

1 PW 300 (DOS COMPUTER)

1 FILESERVER

1 HP COLOR JET PRINTER

6 LX-800 PRINTER

1 CD CD PLAYER

1.4.1.3 **Teacher Profiles**

A comparison of the staff initially involved with this project is summarized in Table 1.9 and Table 1.10. The actual members could change during the duration of this project due to normal staff mobility.

It is noteworthy that the proportion of female teachers participating is lower than the proportion of female teachers in the two schools. The absence of more female volunteers may be significant.

Table 1.9: Project Teaching Staff—Brock

Subject Teacher	Gender	Position	Teaching Experience
Art	F	Teacher	2 years*
Geography	M	Teacher	25 years
History	M	Teacher	7 years
Technology	M	Department Head	21 years*
Family Studies	F	Teacher	19 years

* Plus trade or work experience

Table 1.10: Project Teaching Staff—Tecumseh

Subject Teacher	Gender	Position	Teaching Experience
Art	F	Teacher	5 years
Geography	M	Department Head	19 years
History	M	Teacher	20 years
Technology	M	Tech. Director	14 years*
Family Studies	F	Department Head	25 years

*Plus trade or work experience

In addition to these teachers, a "back-up team", consisting of one teacher in each subject area in each school, has been assembled and is presently undergoing training. This will allow for quick substitution of trained staff if any of the initially nominated teachers must leave the project.

1.5 BIOGRAPHICAL SKETCHES
by Ivor Goodson, Marshall Mangan and Valerie Rhea

As stated in our section on Research Design (1.2), we consider it imperative in developing an account of any educational setting to achieve the deepest possible understanding of the people who are the significant actors in that setting. The previous section has provided, as it were, a picture of the schools and teachers involved in the project "from the outside". It has described the physical layout, and some of the objective characteristics of the schools and their populations of teachers and students. However, in order to more fully appreciate the ways in which these people make sense of their situation—the values, goals, and backgrounds they harbour, and which give shape and substance to their actions—we must first have some appreciation of their personal and professional lives.

The Research Officers who conducted the bulk of the field work on this project have, over the last two years, gotten to know the participating teachers in a number of different contexts: classrooms, informal discussions, interviews, conferences, and social events. We feel that we have developed genuine friendships with every teacher in the project, and that we have forged important and mutually rewarding professional bonds with them. It is not possible in a series of short descriptions to convey the personalities of these teachers, as we have come to understand them. Nevertheless, in order for readers to have some comprehension of the human context of the innovation under study, we will present in this section a biographical sketch of each participating teacher (teachers have been assigned pseudonyms to help maintain confidentiality. These pseudonyms will be used throughout the remainder of the Summative Report). Most of these will be kept short, with the intent of providing only a brief snapshot of the teacher's life story. At the end of this section, however, we will present one biography—that of art teacher Barb Cunningham—in more detail. By doing so, we hope to illustrate the extent to which this form of research can illuminate teachers' lives, and the degree to which a more thorough understanding of those lives can contribute to an understanding of their professional practice. Our intent is to allow readers to develop a more complete concept of each teacher's "voice", as they speak and are spoken about in the sections that follow.

1.5.1 THE TEACHERS OF TECUMSEH SECONDARY SCHOOL

1.5.1.1 Betty Brinson

Betty Brinson is the head of the family studies department at Tecumseh, and as such teaches courses in what were the traditional family studies courses of foods and clothing, as well as the more contemporary studies of personal life management, parenting, and the Canadian family, where the emphasis is at this time.

She was born and raised in Walkerton, where she attended the only high school in the area, containing approximately 300 students. Like several other teachers in our project, she comes from a family that is involved in education: both of her parents and an aunt were elementary school teachers.

Betty chose to teach at the secondary rather than elementary level because she wanted to go to university and at that time only high school teaching required a university degree. She attended the University of Guelph, where she majored in Household Science. She then went to the Ontario College of Education in Toronto. As her other teaching subject is math, when she began teaching in 1963, she taught math for a couple of years, but has not taught it in some time. Her prior teaching experiences have included teaching in Ottawa and Waterloo, as well as another high school in London.

Betty is always eager to learn more about her subject area, and finds both her colleagues and students important sources of knowledge:

> The most important thing I've learned on the job ... I guess the different strategies. I think I learned a lot from different teachers that I've worked with. That's what I find most important. And from the kids, the kids teach you a lot too.

Betty is constantly trying to keep up with the latest techniques, and has incorporated these into her teaching. While she underestimates her own creativity, she states that she is now trying to teach to what she now recognizes as different styles of learners:

> I realize that you're supposed to be teaching to different styles of learners. I just learned that in the last few years. So I try to vary it much more than I used to. Try to have the activities that will hit each type of learner.

Like other teachers in the technological and family studies areas, she does a great deal of one-to-one work with her students, who are generally working on a variety of assignments. The nature of the subject matter as well as the limited equipment availability make this a necessity in her area. As such, though, the incorporation of computers into her courses posed no major shifts in her teaching style.

She finds her present job very challenging and time-consuming, as she must keep very current because as she says, "everything's changing". Finding curriculular resources is one of her biggest jobs, as there is no one textbook that is suitable to her subject courses.

> You're supposed to be an expert on housing, clothing, food, family, parenting, you know, all the different areas. So collecting resources requires constant clipping of newspapers and saving magazines to go through because in this subject area, it's important to keep up-to-date.

In addition to Betty's involvement in this research project, she has also been very busy during this period on various curriculum writing projects in her subject area, such as the co-operative education in the parenting program, and serving on the Family Studies Task Force. With her courses changing to meet these new draft versions of requirements, she has had to do a great deal of extra preparation for her classes. While she recognizes that these changes require a great deal of work, she feels that they are worthwhile, as the change in emphasis has improved the content of family studies.

1.5.1.2 **Wendy Farnham**

Perhaps the best way to introduce Wendy Farnham is to quote part of the opening of her life-history interview:

Wendy: Well, I was born in Bracebridge ... sort of northernish Ontario ... . My Dad was a school teacher. And we moved around quite a bit ... so we lived all over the country, mostly Ontario. I have two sisters, one younger and one older, and they're both school teachers, too. Even my grandfather was a school teacher. And I have a daughter who's just going into Althouse next year. So she'll be a fourth generation teacher.

Interviewer: When did you decide in your own, sort of, time of life, that you were gonna fit into the family tradition?

Wendy: I, well ... I guess I was probably in my thirties before I decided that. I had always seen the flaws in, in being a teacher, the problems. Because my father would come home from school and he'd never stop being a teacher, you know ... he just carried it right into the household. ... And so I was always kind of against it. And then I, I was always interested in art, and my family is too. Everybody in my family has always done a lot of art. And so I got my degree in Art. ...

Clearly, Wendy has had some strong family traditions which have pushed her in certain directions, although she has frequently pushed back. She has had a career as a mother and homemaker, as well as several years in commercial art and part-time teaching, before becoming a full-time teacher just six years ago.

There are some striking similarities between Wendy and the other art teacher in the project, Barb Cunningham (see section 1.5.2.6 below), but there are also important differences. Wendy is at a later stage in life, with grown children, while Barb is younger and still single. Both come from families of teachers, both are interested in physical education and competitive sports, and both have described their difficulties in school, which they attribute to dyslexia:

Interviewer: Did you enjoy school? I mean, you had it at home by the sound of it. But did you enjoy it when you went?

Wendy: I'd say no. Because I'm dyslexic. And I was and I still am. And I'd say mostly, it was a pretty big put-down for me. I'd do very well in some things and very bad in other things. And uh ... people didn't understand it then. And so I was in remedial reading. And I was in remedial math. And I used to try and tell people about the words jumping around. And about not being able to tell a plus sign from a minus sign, you know. And people didn't understand it, you know? My Dad used to say he thinks I was just stupid. [laughs] That was his only explanation for it. "You must be stupid or something." So school was not pleasant for me...

It may be this unpleasant experience of school which has given Wendy her sympathetic, at times almost protective, attitude toward her students.

Interviewer: Do you think that going to those in-service sessions imposed a strain on your classes, in terms of you not being there, and. ...?

Wendy: It does as far as my general-level grade 9's. 'Cause I'm more than their teacher, I'm their **mum** when they're here. ... [laughs]. So for them, especially, life is difficult if your teacher isn't there ... The grade 9's need an art teacher, and they need someone who knows them. So, I felt that I was cheating them a little bit by being away then.

Classroom observations regularly noted Wendy's individualized coaching style. Consistent with the subject subculture of art, she rarely lectured. Instead, she circulated through the class, helping each student as needed, and doing what she could to encourage them to take creative risks and to be resourceful. When the computers were added to her classroom, she incorporated them smoothly into this teaching style. Her own willingness to explore and experiment made her comfortable with educational technology from the start.

Interviewer: How does being involved in the project like this fit into that?

Wendy: It's hard to say. I don't know if I can answer that. I don't know where it fits in the cycle of things. I just follow my nose.

Interviewer: You still have the interest to be involved in something new and...?

Wendy: I am a forever curious person.

Interviewer: Okay. So you would be willing to try something new?

Wendy: Oh, sure.

1.5.1.3 Carl Higgins

Carl is the technical studies director at Tecumseh. In addition to his duties as director, he teaches courses primarily in drafting as well as some electricity, electronics, and geography. His department also offers courses in automotive mechanics and woodworking.

Carl was born in the United Kingdom in 1939, where he attended school and trained for a career in drafting. While he enjoyed his post-secondary education immensely, he stated that his dislike for contact sports, his thoughts on religion, and his Scottish background were factors in his negative experiences in secondary school, which was an all-male boarding and day school.

When Carl came to Canada with his family in 1956, he continued this drafting career in the auto industry. After three years of so doing, he decided to follow the family pattern and pursue his training in the military, with the rank of second lieutenant. When he realized that the top positions only came to those with university degrees, he decided to leave the military and continue his post-secondary education at Western. As he was married and supporting a family at the time, he chose to do so at night school, and worked as a surveyor for the government of Ontario during the day. He graduated

with an honours degree in geography. It was while he was working as a surveyor that he changed his mind about his career. As he said,

> [I] decided that because half of my work [surveying] was teaching people, and that was the part I liked best, that I would become a teacher.

Carl's accredited teaching subjects include both technical studies and geography. As he said:

> When I graduated, I had a choice ... entering teachers' college and going through the geography program, or going through the technical program, because I have both backgrounds. So I decided it was more likely that I would get a job in the London area if I were to do the technical program ... so I did the honours geography program simultaneously with the technical program. It was a lot of work.

He has continued his pursuit of education over the years, both in university and in the army. He entered the army reserves, and ultimately qualified as a lieutenant colonel and commanded a battalion. In terms of educational qualifications, he is presently certified both as a technical director and a principal. He has also recently obtained his Master of Education degree in administrative studies.

Carl describes his teaching style as using a "coaching method", whereby he works with students individually, challenging each student at their level:

> I'm basically a drafting teacher, and drafting teachers like to coach as individuals. They like one-on-one. I'm not really comfortable with a very large group. I would prefer to deal with ... I don't mind dealing with four at a time, but I like the coaching set-up better than the ... how do you say it? Like a ring-master ...

While his classes may include a short lecture at the beginning of the class, with note-taking and a question period, the majority of the class time is spent with students working at their own pace on various projects, with Carl circulating around the room, assisting, questioning, and inspiring as necessary.

Carl enjoys the new challenges that come with teaching, and does not like to repeat his lessons:

> I would think that if I wasn't doing something new each year, it would really bother me. Like I don't keep any of my lesson plans or anything ... or even overheads. They get tossed out every year. So I start fresh. I think it keeps you looking at the subject, keeps you current.

In this way, the introduction of computers into the curriculum fits in with Carl's style. He is very interested in the use of computers both in the education system as well as for his personal use and has invested in a home computer system, which he uses regularly.

In addition to the work Carl does as technical director in his school, he is also heavily involved in community work and further education. During the course of the project he has completed courses in navigation, radio communications and *AutoCAD*. While these have made great demands on his time, he is also very dedicated to St. John Ambulance, where is chairperson of the southwestern Ontario region.

1.5.1.4 Elliot Nance

Elliot Nance teaches history, economics, and "Society: Challenge, and Change." He was born and raised in eastern Ontario, and attended Queen's University in Kingston for his undergraduate training. His ancestry is deeply rooted in both French and English Canada, which may partially account for his interest in Canadian history. As he says:

> Well my grandparents on the French side, that side goes back to the Champlain period. ... Both my grandparents fought in the Boer War, oddly enough: One a French Canadian, one an English Canadian.

Like several of the other participating teachers, Elliot enjoyed his own experience of school:

> Generally school was a good experience for me. I'm your typical middle class, over-achieving academic type student. ... English, History, Geography, those kinds of courses were quite easy.

Also revealed in this quote is Elliot's self-reflective, even mildly self-deprecatory attitude. As the project progressed, this attitude was frequently displayed through his comments on his own practice and the implications of computer use for it.

Elliot came to London in the early seventies, shortly after getting married, because his wife was teaching here. After completing his pre-service training in summer school at Western, he began teaching in local high schools—a time he remembers well:

> Well, looking back on it, I still think the first year of teaching was the best year of teaching I've ever had. In that every day was unpredictable, somewhat of a challenge. You never knew what was going to happen in the classroom. It's in the last ten years I've been wondering about the way I prepare. At that time I think I was so subject oriented, and I also—I know the first years, three or four years teaching, I felt I was really offering students something that they needed.

An important part of Elliot's motivation for teaching, and a continuing influence on his pedagogy, is his concern with social causes. A former social worker, Elliot still searches for ways to incorporate his ideals into his teaching:

> Well, I came out I think with that sense of sixties idealism. And I was never a real radical in the sixties. I always tended to be an observer. When people were going to Woodstock, to me it was just a concert. But I came in thinking that society probably needed some changes in many areas and certainly a social science, social studies, history teacher, generally had access to information about the nature, the state of the world. And probably was in the position to motivate and move students towards changing society.

These concerns have also been expressed in his participation in the teachers' federation and other community activities.

Elliot projects a very relaxed and composed attitude most of the time. He tends to be somewhat critical of his own teaching style, describing it at times as "teacher-centred" or "content-oriented", when he would like to give students more autonomy. This may only be a reflection of the high standards he sets himself, though. To the observers, his classes often seem to employ more participatory methods of teaching and evaluation

than most other social studies classes. His concerns for his students, and his subject, though, are always filtered through the basic reserve of his personality.

> I don't think I would ever use the word passionate to describe my nature, you know? ... I'd like to see students come out of my classes thinking they can do something. But I'm certainly not a social activist. There are some teachers in the system who plunge wholeheartedly into group dynamics and social processes. I tend not to be that way. I think it's my, I'm a more reserved person.

1.5.1.5 Harry Thorne

Harry Thorne comes from quite a different background from most of the other participant teachers. While they were generally raised in small towns or medium-sized cities, Harry grew up in the country outside of Orillia, Ontario, and completed all eight years of his elementary schooling in the same one-room school.

> Eight grades in a one-room public school ... my dad owned a lumber mill, so I was brought up in the lumber industry (laughs). Um, and he died when I was eleven, and so my brother, my older brother, took over, he—I'm the youngest in the family. ... So my brother at that time was twenty-two or twenty-three, so he took over the business.

Clearly, this succinct quotation encapsulates a number of formative influences in Harry's life: first, the atmosphere of the rural school, which Harry found very stimulating ("you tend to listen to what's going on in other grades"). Then there was the maturity forced upon his family by the pr nature death of his father, and the strong tradition of keeping the family business going.

Harry's life became more like the other teachers when he came to London to attend university, and stayed on to attend teachers' college and start his career. That career has continued to include efforts in running a small business. Harry is just enough younger than the teachers who gained their accreditation through summer schools, that he can remember entering the teaching market at the end of the boom:

> I started up a hobby shop basically at the same time as I started teaching. ... And so I worked there on weekends and holiday time and stuff like that. Simply as a back, a back-up, in case teaching didn't pan out, at that point. And then, after two or three years, when things settled down a little bit, um, I continued on until 1979 with the hobby shop. At which time I sold it. It was just getting too much. ... In the summertime I work on, uh, I have a little construction business of my own, I do renovation work.

Harry is quite clear about the ways that this experience in business carries over into his teaching, as revealed in this dialogue:

> **Interviewer**: You said you had an interest in retailing. Do you think that comes from the fact that your family had a business when you were growing up?
>
> **Harry**: Well, certainly the interest in business has always been there, and the, uh, and I still have a keen interest in business and not necessarily retailing, but business in general.

Interviewer: Uh-huh. And does that work into your teaching of geography, do you think, or ... ?

Harry: Oh, I think, uh, you know, if you talk about um. ... I think teachers generally should make good salesmen. And if they don't then they should find another business because really, I think that's really what we do on a day-to-day basis is try to sell things. And, uh, the experience in retailing and dealing with the uh, salesmen and the industry, that part of the industry, I think it taught me a lot that helped me in teaching, actually.

This influence is apparent in Harry's frequent emphasis on economic aspects of geography. In terms of style, Harry is in many ways an unabashed traditionalist, but this traditionalism is not simple inertia; it is backed up by a clear educational philosophy.

> I'm very content-oriented. And that's maybe my old-fashionedness coming through, where a number of teachers are more—social-oriented? And I don't see a problem with that. ... But I find the kids get so much of that other style now, that everybody jumps on the bandwagon, that in a lot of cases, they don't mind it. They don't mind facts and figures and content. It gives them something a little more to grab a hold of, especially when they're studying for things. ... I think a lot of the kids are looking for guidance, and being able to say, "hey, this is what's on the test" ... they don't seem to complain about that.

Harry's classes, as might be expected, involve a fair bit of review of the textbook readings, with frequent questioning of the students. The classes we observed were generally grade nine and ten introductory sessions, and were often crowded to (or beyond) the capacity of the classroom. Harry managed, however, to maintain firm control over these classes, and to generally keep them involved in the activity of the moment.

1.5.2 THE TEACHERS OF BROCK SECONDARY SCHOOL

1.5.2.1 Chuck Grambling

Chuck Grambling is one of the youngest teachers participating in this project, both in terms of his age and his experience in the profession. Although he received his certificate in 1981, he did not find full-time employment as a teacher until 1983. Thus, as the project began, he had six years of full-time teaching experience, plus a couple of years of supply teaching. Compared with the other social science teachers, especially, he is a relative newcomer, and describes himself as such:

Interviewer: In terms of your teaching career ... what stage would you say you are at...?

Chuck: Well I guess, being classified as a rookie around here, with a whole eight/nine years teaching experience. (Laughter)

Interviewer: That's still considered ... you're still considered a rookie are you?

Chuck: Still one of the younger guys around, I guess.

Born and raised in London, educated in area schools and at Western, Chuck comes from a family that is itself heavily involved in public education. His father is a high school teacher in London; his mother is a secretary in a separate school. His wife was

a secretary at Brock until she gave birth to a son during the second year of the project. He also has an aunt and uncle who are teachers, and openly acknowledges the influence of these relations upon his career choice. By his own account, Chuck was a successful student, who fit in well with his school system, and generally found school an enjoyable experience.

Interviewer: What was school like for you?

Chuck: Great, positive experience. Enjoyed going. Uh ... hardly ever, never sick, never missed a day. Always there. Enjoyed it all the way through. Probably...

Interviewer: A teacher's dream.

Chuck: ... yeah, that's probably why I ended up where I am.

Interviewer: That's right. (laughter)

Chuck: I never wanted to leave. I'm still here.

The choice of teaching as a career came naturally to Chuck, then, reinforced by positive role models both at home and at school. Interestingly, as a product of the local school system, Chuck now finds that he has former teachers as professional colleagues.

> I enjoyed very much I think uh ... most of my teachers in high school. As a matter of fact, I'm still seeing them. A lot of people tnat are my peers right now are people that taught me back in high school ... that I'm working very closely with now. I think they had a definite influence as well.

Social science was not Chuck's first choice as a teaching focus, however. He majored in physical education and maintains an active association with the city's sports programs, both by coaching football and by acting as the convenor for interscholastic hockey. When asked whether he had any regrets regarding the direction his career had taken, though, he expressed few. In fact, he voices great enthusiasm and fondness for the course being observed during this project, both because of an interest in the subject and because of the reactions of his students.

Interviewer: Do you like teaching "Society: Challenge and Change"?

Chuck: Love it.

Interviewer: Do you?

Chuck: That's my baby. I - I *extremely* like that course. ... Because, like, well, when I went to Western, like, Physical Education is my major, and then I took all Sociologies and Psychologies to complement my Phys-Ed courses to get my B.A. ... So I really enjoy teaching in that subject area. There's so much you can do and there's so much application. The kids are so involved with it because it's something that—your everyday life and breathing is your experience. Everybody walks into that classroom with something to contribute. ... I come out of there in some classes—"Boy, was that ever exciting, just listening to that person talk." And then the other kids have just, you know, complete attentiveness listening to them.

In class, Chuck's teaching style could be considered typical of the social science teachers we have observed. He maintains a fairly strict control over his students'

activities, and in general follows a teaching style described by other social science teachers as "Socratic". This form is characterized by generally brief lectures, often reviewing material covered earlier in readings or class assignments, and punctuated by frequent questioning of students. There are also student presentations and discussions. Topical material is presented through the use of several different media, including videotapes, films, audio recordings, overhead projectors, and photocopied handouts. Although he acknowledges that he has adopted a consistent teaching approach, Chuck also emphasizes his willingness to experiment with different modes of delivery for his syllabus:

Interviewer: Have you found that your style has changed at all along the way?

Chuck: I think it's been pretty much, pretty much consistent all the way through. ... I still, I'd like to, I leave everything open. I'm definitely very willing to change in variety of—changing things up a little bit, or trying new—always looking for new strategies and techniques, things that are going to be interesting. But I really don't think things have changed that much. I like to think of myself as being fair and honest with the kids as to, you know, issues that we're dealing with and that. Personally, I feel I have a good sense of rapport with all my students.

The end of this quotation illustrates an important aspect of understanding teachers' lives and professional practice. Like virtually all the teachers in this project, Chuck views his teaching style as springing from and being closely related to his basic values as an educator. His professed willingness to constantly review and renew his classroom practice stems from a desire to maintain rapport with his students, and to make his class an interesting place to learn. These commitments are, not surprisingly, reflected in his approach to classroom computing.

1.5.2.2 **Ed Thompson**

Ed Thompson, like Chuck Grambling, was born, raised and educated in the London area, and received most of his post-secondary education at the University of Western Ontario. He was in his early fifties during the period of observation, and described himself as nearing retirement. Ed doesn't look his age, though, due probably to his history of competitive swimming and a life-long interest in physical education. With his stocky athletic build, booming voice, and energetic approach to teaching, he rarely has trouble maintaining his students' attention in class.

As head of the geography department at Brock, and with almost thirty years experience teaching in area high schools, Ed Thompson is one of the more senior teachers in the project, and has worked closely with Walt Harvey for several years. Although he did not identify other teachers in his family tree (his father was a mechanic), he recounted a long-standing interest in academic pursuits, teaching and coaching:

Well I've been a teacher ever since I was about eleven years old in a variety of ways. ... from the time I was very young I was involved with teaching young

people. ... in the wintertime at the "Y" doing both the swimming and gymnastics. ... Yeah I've been involved in coaching in a variety of ways.

Ed Thompson identifies his formative influences as the teachers who gave him autonomy to conduct his own research, and those with broad and eclectic interests. His teaching style, and his use of computers, continue to reflect these values. He describes his classroom approach as follows:

> Socratic. Largely Socratic. ... It has changed a little bit. It's more variety, but when you get right down to it, my teaching style is still largely Socratic. ... The way I set things up is normally we go through the geography that we do probably three or four times. So there's repetition. Repetition takes the format usually of theory, then practical, then analysis of what we've done ah ... and then testing. So that's normally what we do, so I'm not teaching Socratic method every period.

Although he had very little computer experience prior to joining the project, Ed has become an enthusiastic user, and has developed probably the greatest depth of technical knowledge among participant teachers. He has taken on the role of Site Administrator, and is also considered informally to be the school expert on ICON use. He has gone to some lengths to set up exercises which allow his students to use geographic databases to further their own research projects. Although he says he still considers himself a computer novice, he also credits the project with having renewed his interest in teaching.

> I think from my point of view one of the things that has happened to me is that I've got a lot keener about teaching. ... Since the computer thing has come about, and I've been able to sort of take on a leadership role with regard to the use of these things with kids, I really found myself a lot keener than I probably would have been otherwise.

1.5.2.3 Walter Harvey

Walter Harvey—"Walt" to his friends—is another senior geography teacher at Brock. Unlike Chuck and Ed, he wasn't brought up in London, but has lived all his life in southwestern Ontario. Born in Toronto, he grew up mostly in Windsor, and went to university there. He also taught there briefly, and in St. Catherines, before settling in London in 1967. His professional education, like several of the senior teachers in our project, came through the summer-school programs offered during the late sixties and early seventies as a means of coping with the acute teacher shortage of the time.

Walt is clear about his motivation for teaching: he has a passionate interest in both history and geography. The fact that his wife is also a teacher has allowed them to combine vacation travel with an expansion of their geographic knowledge.

> I really enjoyed history. I still do. A matter of fact, if I read a book for pleasure it's history. A geography book is interesting but it's more work. I really enjoy reading history. Okay. I'd have to say I'm a semi-expert on World War II trivia. Okay? That war really fascinates me. I've read hundreds of books.
>
> I like to teach [geography] for the most part because I really like the subject. Especially since I have gotten married, my wife and I have taken a lot of exotic trips, for example around the world in a year off in 1981 so I've been to

perhaps 45 countries in the world. I really enjoy seeing other parts of the world and the cultures and the food and the people.

Although Walt describes his teaching style in terms almost identical to those used by Ed Thompson ("a lot of my lessons are based around a good old-fashioned Socratic lesson"), in class he is generally more relaxed and informal. He enjoys chatting with students between classes, and joking and teasing with them during class. This style can lead a casual observer to underestimate the degree of preparation and precision that Walt enforces upon himself. In fact, those standards are very high.

Walt's high standards are probably a central reason why he did not adopt the use of computers during the first three semesters of the implementation. The project came at a very bad time for Walt, a time when other personal and professional demands left him very little time and energy for new activities. The coach of the city-champion soccer team, and a member of a writing team for a new OAC curriculum, Walt also does volunteer work at a local hospital. His high standards are evident in these activities, too:

> I was always out there for every single practice and every single game. Travelled by bus to every single game but I'm still ... they chose who's going to play and everything else. They chose the team. ... That's how we won city because they were so good.

At times these other responsibilities produced conflicts, and Walt was unable to attend some of the in-service training sessions, which further handicapped his computer use. Although in interviews he would point to these other responsibilities, he rarely relied on them as excuses. Instead, he tended to blame his own lack of organization:

> I had too many things this year, I have not enjoyed this year at all, and uh, I gotta get myself back on track for next fall. ... The worst six months of my whole career. I'm down on myself ... it's my fault ... just things were just, just not fun. Okay? I didn't have fun this semester.

Walt was not willing to go into the computer lab until he knew he was ready, and he did not feel he was ready until the fourth semester of the project. In some ways, we were slow to understand this. Without inquiring into the influence of teachers' lives on their practice, we might never have.

1.5.2.4 Diane Mirabella

Diane Mirabella is a family studies teacher at Brock, where she has been teaching courses in foods and nutrition and diet therapy for just over twenty years. She is also involved in the co-operative education program.

Diane was born and raised in Timmins, where her family has lived for some time. As the oldest of six children, she was often relied on to assist with the care of her siblings. She also reported having the strictest upbringing and needing to break barriers with her parents in order to do things. With great familial demands on her time, completing school work was often a challenge to her.

Diane left Timmins in order to attend Western's home economics program, with an interest in physics as well. While she had no plans of teaching at that time, she was anxious to leave home and felt that it would be a good experience for her. Her boyfriend, who later became her husband, was studying to become a teacher, and

provided additional inspiration for her to consider a career in education. However, as she says, her love for teaching grew:

> No, I never intended to teach. Like some people I know they're born with this desire, right? And actually until the very first day that I went out practice teaching and I stood in front of a class. As soon as I started I knew, this is it. You can do what you want. You can be as nutty as you want. You can do whatever you want. And like you close the door. And again you got this lovely little isolated world where you're controlling. It's fun. It's so much fun ... You've got all these individuals, that are just so interesting. And they're enjoyable to be with, and they pay you to do it! There's so many good things about it, I really like it.

Diane places high emphasis on collaborative learning and the promotion of self-esteem in her classes:

> I think that's one of my first priority things is to provide a really safe, pleasant atmosphere where they feel confident about learning, and they feel comfortable about learning. I think that has to do, I think if you don't control to a certain extent the relationship between the students, or try to build it so that there's a really pleasant—Even the way you feel toward the students, or the way you treat them, it's not going to work unless everyone in the class is a part of it.

By the end of the term, each of her students knows everyone else in the class well, and are capable of working with them, a skill she rates very highly. She recognizes that her subject area lends itself to this kind of activity.

When asked about her teaching strategy, Diane responded that while she provides the opportunities for her students work collaboratively with other students and independently of her, her classes are very controlled:

> I control the environment. So that the students are controlled within an environment. So the way I have set things up I might not be standing there teaching them. But the expectations are always clear. So they know where they're going. And they know that they have a time frame within which to work. And they know what ultimately they have to come up with within that time frame. I'd say it's very strictly controlled.

While Diane provides the framework for courses, she looks to her students for input into the development of specific goals and objectives for them.

> I will say, "This is what my goals are for this course. Now these are the choices that we have. Tell me what you want to do within this framework and we'll do it." And that way you are approaching the whole thing as a team rather than on an individual basis. And that makes a big difference.

In addition to the extensive efforts Diane puts forth in preparing activities for all of her classes, she has also been heavily involved in curriculum writing teams in family studies at the school board level.

1.5.2.5 **Ken Morton**

Ken Morton is the head of the electronics department at Brock Secondary School. He is involved in teaching a variety of electronics and computer technology classes, both in school and through co-operative education in the community. He is near the end of his teaching career, and is looking forward to retiring from the education system.

Ken was an only child, born in 1932 in Woodstock, where he also grew up. Like many of the teachers in our project, he enjoyed school as a child. Both his involvement in sports and with the lighting and sound crew played major roles in his high school life. After completing an academic high school program, he attended Ryerson Polytechnical Institute in Toronto for electronic technology. Upon completion of the program, he worked as a technologist for Westinghouse, working on defense contracts, design, development and research areas for twelve years.

Following his term of employment in industry, Ken taught Electronics for five years in Hamilton. While in this position, he came to London to visit the educational television facilities, and was so impressed with them, he decided to join the group. For eleven years he taught senior students from around the city the technical aspects of television, behind the camera. While in this job, there was an opening at Brock for a department head of electronics. He applied, and has been in that position for the last eight years. Over the years while he was teaching, Ken upgraded his education to include teaching certification as well as a university degree.

Like many other technical teachers in our group, Ken prefers a one-to-one teaching situation, combined with small groups, only seldomly conducting full-class lectures. His subject area and available equipment support, or actually require, his individual and small group approach. For example, his classroom equipment includes a variety of microprocessor trainers, IBMs, Ataris, Commodore 64s. As such, with no full set of equipment, his classroom setup necessitates the approach he has taken.

While Ken is near retirement, he is still very keen to keep up-to-date with the latest in electronics and computer technology. He states that he does so not only for his own interest, but also as part of his responsibilities:

> I'm the department head, and I still have to think of my department. At the same time that I am doing this, we just got a new IBM system, 2 IBMs and eight Ataris, and we are learning a lot of different software packages, because that is really where the electronics industry is right now.

In addition to the work required for teaching and heading a department, Ken is also involved with his family, his church, golfing, three different computer-user groups, a bridge group, a stock group, an investment group and various curriculum writing teams for the school board.

1.5.2.6 **Barb Cunningham**

In order to fully appreciate the complexities of the teachers involved in the project and to understand how their life histories, subject subcultures, and pedagogic predispositions influence their teaching, we have provided an in-depth profile of one participating teacher and her experiences in this project, in addition to the brief

biographies offered on the other teachers. We feel that this is a valuable way to view the research, as we said in an earlier report:

> The total curriculum is always complex, multiple and, taken as a whole, often incoherent. It follows that such things as identities, motives, inclinations and dispositions of teachers and learners are never incidental to teaching and learning: they are always integral, and sometimes dominant. Fine-grained analysis of teaching as interaction can therefore only produce partial accounts. The whole is inevitably greater than the sum of its parts. If we are to track the messages transmitted and received, modified and created, we need to look as closely at biography and context as the immediate transmission of signs ... Accounts of the strategies of individuals provide windows on the culture in which interaction, biography, social context and history intermingle, clash or fuse. (Goodson, Mangan and Rhea, 1991, pp. 27-28)

With this in mind, we will now look at the in-depth profile of one art teacher, Barb Cunningham.

1.5.2.6.1 *Life History*

Barb Cunningham was born in 1961 in Cambridge, to parents who had moved from British Columbia to settle down and raise a family in Ontario. Her parents' careers were also in the field of education. Her father had been a figure skater, a firefighter and a surveyor for the British Columbia government, before going into sciences and becoming a science teacher, and then a geography teacher. Following this, he then went into arts and became an art teacher, which is the position he held when she was enroled in the same high school. Her mother was a physical education teacher.

Barb is one of three children in her family: she has an older sister and a younger brother, in her words, a "perfectly planned educational family" with 2 1/2 years between siblings. With teachers as parents, summer trips were regular and educational: the family would often drive to the West coast to visit relatives, with lessons on landscape, geography and science comprising a "summer school" of sorts in the car.

As is often the case among siblings, there was competition for attention and accomplishments in both sports and academics. Different personalities were obviously apparent among the children, with Barb reporting that while she is a very optimistic person, her brother, despite her repeated efforts to change him, is not and this leads to numerous family clashes. She also noted that she has a very close relationship to her mother.

Sports has always played a major role in the Cunningham household. Barb began figure skating at 4 years old. Despite her parents' best intentions, figure skating did not turn out to be a rewarding experience for her, as her instructor did not believe in positive feedback, strictly relying on negative feedback to the skaters. In addition to figure skating, she also became involved later with speed skating, high jumping and basketball. Her emphasis switched from figure skating to speed skating when she was in high school, as she appreciated its instant rewards, and less political atmosphere. This was a very beneficial to her, enabling her to build up the confidence she lost during her

involvement with figure skating. Recently, she was awarded a plaque from the City for her continued participation in speed skating.

Her connections with basketball continued throughout her high school, college and teaching days. She now coaches students interested in basketball and track in her high school. She is also involved in a local women's basketball league.

Barb has reported that she did not have a great deal of self-confidence as a child, mainly due to her negative experiences in sports. This negative feedback and competition among siblings also lowered her self-esteem, as she said:

> Figure skating was really frustrating. So I went to speedskating. It was all positive. People there went over backwards to help you out and make you feel welcome ... I did both of them for a year and then I just decided I wanted to go into speedskating even though I **really** missed figure skating. I loved it so much. Because it is a really creative outlet. Uh ... but the speedskating, it's just the people in it and uh ... I got to go so much further. Like, I was on teams, and everything's paid for, and I was travelling all over the province, the country, and the States and everything ... It made me grow up a lot and it opened my mind to a lot of other things. Made me realize that people aren't all stuck up snobs. [laughs] You know, when you think of all the time I spent in figure skating, I was being pounded down. And everything was negative, so of course, I didn't have a positive outlook on myself. It was more of a negative outlook on myself. And my brother and sister were like that. They were always critical. And they always cut me up and stuff because I was the shy one in the family. I didn't really speak out or anything. I'm not any more, I know. [laughs]

In spite of her lack of self-confidence, by the time she was in Grade Four she realized that she was shy and insecure and seeing no logical reason for it, pushed herself to become more independent and assertive, a task at which she certainly succeeded! As she said:

> I was more the independent one in the family even though I was the shy kid ... A lot of it I think had to do with because I realized that I was shy and insecure in myself, you know. I didn't have confidence so I kept pushing myself, pushing myself, and pushing myself. It wasn't my parents who were pushing me. It was me because I thought, "What am I scared of? Why am I so scared to do this?" It's like, I can remember in grade four I wouldn't even go and sign up for something unless my mother came with me. I thought, "This is ridiculous, why can't I do it? I'm scared inside. But why?" ... And I would think about it because if my mother came, how would that change the situation? ... I used to be petrified until I finally said, "Why am I petrified? There's no reason to be scared."

This newly-found independence, brought on by self-inspection and positive sports activities, also led to the acquisition of a paper route, enabling her to purchase her own clothes, which she thinks further developed her self-esteem.

Her earlier lack of self-confidence was also influenced by her academic problems. She reported that she always had problems with English in school, and thinks that she may be dyslexic.

I got good marks except for English. I had problems with English. Sometimes now, I think maybe I was a little dyslexic ... I still read sentences and have to read them two or three times to figure out exactly what they're trying to ask. And I'm going, "Is this normal? I should be able to read through it and figure it out in seconds." I think there has been a problem there as far as reading. And so of course, my mother always said, "Now you're weak in reading, so you have to work on it." I don't think that was good, because that again is a negative statement. "You're weak in reading" instead of maybe saying, "Well, try your best", you know, "As long as you keep working at it then you're going to improve." I think it's, so you know, maybe why I'm petrified to be a parent. Because it's so important what we say. The fact that my mother kept **always** telling me, "You're weak in English, so we have to work hard at it", so I eventually I got to the point that I just figured, "Well, I'm weak in English, so why bother working at it?" [laughs]

While this weakness was also a matter for ridicule among her siblings as she states, she feels that her abilities were greater than she was given credit for as a child, something she did not realize until she was in college:

Then, of course, it was brought up to my sister and brother that I was weak in English. So they would always say, "Yeah, you can't write essays Barb 'cause you're weak in English, right?" And it went on and on and on and what's hilarious though, is when I got to college and one of the first assignments we had to do was a design assignment. Underneath each design—we had six designs—we had to write up in our own words what we saw visually happening in those designs, which is a very hard assignment, especially for someone who is very weak in English! [laughter] ... So anyways, [this teacher] gets these assignments, she says, "I don't know how you people ever passed out of high school. I've never seen anything so pathetic in my life. English is my second language and I can write much better than most of you people in this class." And I'm just sitting there, "Oh, my god", just petrified. I'm going, "I thought when I went into art, I'd get away from English. Oh, my god." I was just petrified. She says, "But here's a couple that I think are very outstanding", right? And she reads **mine**. So all these years I thought I was weak in English and here mine ended up being one of the best ones in the class. So obviously, I wasn't **weak** in English ... And I couldn't believe it, you know. Whereas now I write poetry and stuff like that, which has been a nice creative outlet for me but it had been stunted for so many years.

Throughout high school, with her involvement in other sports, education was a more positive experience as well. She excelled in the Arts program, winning awards despite her father's attempts to be overly unbiased and to grant them to other students. In addition to sports, she was also involved in her church choir as a teen and played the violin in a youth orchestra, both sources of positive reinforcement here, aiding in the development of her increased independence and self-esteem.

Upon completion of high school, the furthest thing from her mind was to become a teacher. She enroled in a Technical Illustration course at Sheridan College. Sheridan,

a College of Applied Arts and Technology, located in Oakville, Ontario, was chosen by Barb for its highly acclaimed art program. Following her course, in order to continue playing on the college's basketball team, she decided to stay an extra year at Sheridan. It was during this year that she took the program in Computer Graphics, and discovered that she actually enjoyed it. This was a great surprise to her, for she didn't expect to ever use computers in her career. As she said,

> I had no idea that I would ever end up with computers, because I thought I wasn't smart enough to be on a computer. That was the whole thing. It used to be that we had to be **smart** to be on a computer ... If you didn't get top marks in math, you didn't get to work on a computer. Mind you, it was the type of computers they had then. So, of course, in your mind, if you think you're not smart, you aren't allowed to use computers. So when I, when it was actually introduced to us [at Sheridan], and we heard about the program, and I went and took a look at it, when I was in my last year there, I thought, "These look simple enough for me!" [laughs] "I think I can handle this!" So then I decided, "Well, let's try it out", and of course I was right. They are pretty easy.

Little did she know that this extra year, resulting from a desire to play basketball for one more year was going to become a major part of her career in the future.

When she graduated from Sheridan College with her combined programs in Technical Illustration and Computer Graphics, she accepted a position with a Toronto company involved on the leading edge of computer graphics. In one of her projects, she was involved in the production of the first complete computer graphics rock video. The job was very demanding, as she was "low man on the totem pole", and the company was short-staffed. Not only was she responsible for producing work for clients, but she was also responsible for keeping the computer equipment operating, running diagnostic tests, and debugging software. After three months on this high-stress job, she contracted mononucleosis and had to leave the company, but did so with excellent recommendations. Upon recovery, she worked in an art gallery, a job with no stress at all, for a brief period of time but found that it was too boring for her.

As shown by her experience at the computer graphics company, her health has frequently been a concern to her. She has had a great many health problems over the years, including problems with her kidneys, intestines, and food allergies, and is now undergoing further tests. It was at her doctor's insistence that she discontinued her stressful job at the computer graphics company. She had taught summer art programs when she was in school, and considered teaching as a career at this time, leading her into what she considers to be the perfect "no-stress" job, teaching!

This has all led her to where she is now: teaching commercial art with a Diploma in Education (Technological Studies) at a local high school with a specialized art program. Although she loves teaching, she does not plan to teach for the rest of her life. There are many options open to her at this time that she is considering: she would like to combine outdoor education with art; she has been offered several jobs in commercial art; she could increase the amount of freelance work she is already involved with; and she would like to get married and raise a family soon. If she chooses the

latter option, she would like to quit work and devote her time to her family, with the occasional freelance artwork on the side.

1.5.2.6.2 *Pedagogic Predispositions*

Barb's subject area, training, background, age, experience and personality intertwine to give her own style of teaching. We have found that computers fit in very well with Barb's teaching style, as she adapts quickly and easily to changes and has an individualistic, facilitative approach to teaching. Upon observing her class on any given day one would see a teacher casually circulating around the class, answering questions here and there, offering suggestions, promoting peer collaboration and assistance. As she says:

> I've also been trying to work with this co-operative learning thing, because I feel it applies quite nicely into the art program. Even though they have individual assignments, but when I'm wanting them to discover information, instead of standing up there and lecturing, I will give them a series of different things to do, so they can actually be making things and answering questions within that group, and then afterwards, we'll take a look at what they've made and discuss it and through the discussion of what they've made, will bring out the points of what the lesson's supposed to be about. And then of course some of the questions will pertain to what they're creating and the information. So anyways if I can't get the information by them having to create something within that group, then it comes out of a straight question. I find that it works very well because especially in commercial art, if they get out in the studio, they have to work as a group. Often, like you do the type, you do the illustration, you're doing the layout, we all have to work together to pull it together. Even though individually they have their specialities, and as far as their, their artistic area. So when they work in a group they're creating something, but they don't have to worry because it's not going to be marked but they have to create something, a design or some type of commercial art piece, or whatever.

Barb's style includes freedom to do a great deal of this co-operative learning among the students. She sees herself as a facilitator and motivator of the students more than a teacher, guiding and challenging students as necessary:

> So it's like, "no, no, try this, try that", but I don't try to give them too much information, like they often say, "How are we supposed to know the answer to this if you haven't told us yet?", and I say, "It's back there somewhere in your mind", then I would say, "Between the bunch of you, you should be able to figure out something, make up an answer, you never know it might be right!" So I'm trying to encourage them not to be frightened, just to try things, 'cause they're always so worried whether they're right or wrong. I don't care if you're right or wrong, just answer the question! And we're going to discuss it later, and it actually ends up interesting because some of them if they don't know what it is, that they come up with these crazy definitions for things, and then of course that, that makes the class even more creative. In other words, and also, "that's a valid answer, you know, if I didn't know what that was, I think that's

a really good definition for that, that term or whatever". And, but then it also gets them thinking and being more creative as well, 'cause like I said, nobody says what's right and wrong. Yes the definition, yes this is the right definition but what's wrong with having fun with it?

Ironically, if anything, computer lab use has probably restricted the freedom in her class as it requires that all students must be working on one type of activity at one time. This is generally not the case in her classroom on non-computer days. Barb has reported that computers are not an extra burden to her, as they do not require her to spend any more time than she would normally on lesson preparation. She said that in her courses she does not spend a lot of time on preparation, with or without the use of computers.

The most significant component of Barb's style is her closeness with her students. The similarities in age to the mature students who enrol in the specialized art courses that she teaches, her calm manner and pleasant personality make her very popular with her students. To an observer, the music playing and the constant chatter in the room give one the feeling of enjoyment in the room. The students' feelings about her were obvious to all teachers involved in in-service training sessions when her students found her in the computer lab and presented her with a cake and gifts. Barb finds that in her role as a teacher she also deals with the students' lives, not just their art. Her enjoyment of the job and of the students is apparent at all times.

While she thinks it is important to know the students as people, to truly get to know them has created some concerns for her:

I think it is important especially in art because our work is personal, and if they feel distant from you they may not be as expressive. But if they get too personal, they might get frightened that there might be something wrong and disappoint you as well. That's kind of a hard thing to work ... to figure out.

Barb has found that there are very fine lines in this style of teaching, but is concerned because it is easy to cross them; she finds that it is easy to become friends, as they are much older than most students. She also feels obligated to behave as a role model. She consciously works at staying within the fine lines of friendship and professionalism. While she will socialize with her students in public, she draws the line at entering students' homes.

Her trust in her students is generally very rewarding, however it has backfired on her recently. One evening she discovered that her credit cards had been stolen. Upon a police investigation, it was discovered that two of her students had stolen them and made numerous purchases on them. They were caught and charged by the police. While she agreed to take the two girls back into her class, as she thought it was a better place for them than on the streets, it was under the condition that they give her maximum effort; to date they have not followed through with this and have disappointed her. While she has tried not to let this affect her feelings towards her students, she finds that her perspective has changed and she is more cautious.

Despite this negative incident, Barb still loves teaching, enjoying the younger students as well. She finds something special in all of her students, as she states in the following interview excerpt:

I'm finding that some of the grade nines are not as intimidated either. You get the older group, they are not as expressive or trying things because they want it to be perfect from the start ... it's really hard to break them apart whereas you give some clay to these grade nine kids and who knows what'll happen with it, you know what I mean? And like you have to give them some direction, but it just, I don't know, I guess they're still a little bit more expressive, you know they're not as refined and controlled, you know? It's kind of nice to have kids that are just a little more free spirited, and not worry about what the final product is.

Barb's confidence is very appealing to her students. While the research project spanned her second, third and fourth years of teaching, her confidence in the subject matter was very apparent. In addition, her computer background enabled her to take the technical problems in stride, without the feelings of inadequacy and helplessness that teachers often encounter when dealing with new technology.

In addition to her confidence, Barb's optimistic outlook is very apparent to her students and peers. She vowed that she would not approach teaching the way her figure skating coaches did as a child: she wanted to make school a happy experience for her students, an opportunity to build up their self-esteem. In her own words:

So I got into the teaching because I wanted to try and make it easier for people who it seems to be a struggle for ... .And I also give them positive feedback ... What I'm trying to do is mostly create a positive feeling in the sports and in schooling.

Barb decided early on that it was better to have a sanguine outlook at all times. While she follows this through in her feedback to her students, similar to the situation with friendships with the students, Barb has found that there is a fine line between positive feedback and too much positive feedback, which has on occasion lead to inferior work on the part of the student. Again, she works hard to balance these aspects.

Along with her friendships and positive outlook with her students, Barb's experiences participating in the school sports programs are very important to her. Constantly striving to give constructive feedback to her players, while still challenging them and giving productive suggestions, she enjoys school sports. Responding to rumours that the art department may move to a new location off the site of the school, she stated that if this is the case she would not like to remain part of the school, for the present mix of students and the extra-curricular activities are a major part of what draws her to the school now.

While earlier descriptions of the relationships with her students, her easy-going manner, and music playing in the class may lead one to believe that she is a pushover with her students, this is far from the case. In fact, control is a major aspect of her teaching. Very early on in the project, she stated this control as follows:

I'm different from the other art teachers. While other teachers give extensions, I give assignments and deadlines. If they truly want to be commercial artists they have to learn that. If the client needs something by a certain date, you **must** come through or you may lose the contract.

Barb discussed this aspect of control in a recent interview as follows:

Interviewer: It seems to me that while on the surface it appears that your classes are very free and students are all just doing what they want, it seems that underneath you know exactly what, what you're doing and you have a very close plan of what you're doing and there is quite a bit of control, down beneath. What do you think?

Barb: Oh definitely. I don't know how, but... [laughs] Yeah actually I surprise myself because sometimes I walk out of there going, you know, it looks like massive chaos is going in here, do I really have control of this situation? But yeah I do, when I sit down and think about it, yeah I do. It's, they're doing what I, you know, basically what I had hoped that they'd be doing, they are being creative the way I want them to be. And if they're not, I pull it back in, sometimes it does get a little out of control and I think sometimes that's good too, to get it a little out of control and bring it back in and focus. Because that's when I think different things happen and people get different views and things, and sometimes the kids you know, on days where they just can't work and sometimes be out of control for a while is enough to get that energy out so that then they can bring back into focus and they'll actually work. I have one student that he just had to freak out everyday, 'cause he had so much energy and he was so creative that he couldn't sit down and just work, he had to like dance around and scream and yell, but then you said, "OK, that's enough, sit down and get to work", but you could let him do it and then he'd focus, but if you didn't let him jump around he wouldn't do anything because he couldn't, he had all this excitement and creativity going on inside like jellybeans going around inside his body and like when you're excited about something you can't sit down and concentrate you have to jump around and get it out of you, get that physical part out of you and then you can focus. So sometimes I think it's good to, things can get a little bit crazy for a while and, as long as you can pull it back.

This control and strictness is known by her students, who have clear ideas of what is expected of them in her courses:

Barb: I guess where I put these strict restrictions, is **not** on the creativity, it's more the process. You know, it's really hard to explain because it's not always the format, sometimes the format is, OK, you have to stick to this format. So the format then is a restriction, it has to be this size because that's the publication and it must be two colour. As far as the layout's concern, they may be totally creative, in other words, their final piece looks completely different only they're all the same size and they're

two colours, but it could be two different colours. But other than that the subject matter's completely different. But then sometimes, the subject matter is controlled but the format isn't controlled.

Interviewer: So just some aspect of it.

Barb: Yeah, so I guess it's just different aspects of the different assignments. I put down these are the objectives of that assignment, they **must meet those** in order to pass and then on top of that is now how far they pushed it, and it's where they really get the marks from me. So in other words, if they have got the exact format and it's neat and precise, and it's all, say it's a mechanical, it's marked up properly so everything's measured, all things that are important, because if it's not done right, then you can't print this piece. If that's all done they're going to pass. Now what have you done with the actual artwork and that's where they get above the marks. I guess every assignment it changes where the control is.

So while this sense of control may not be immediately apparent to the observer, it is deeply entrenched in Barb's pedagogy, and the students are very aware of this. This allows her to relax a bit in her personal manner with her students, as they understand what is expected of them in terms of her work.

Occasionally she has found that she has become too close to her students, too quickly. She reported that this happened last year and that she is trying to keep her distance a bit more this year. She is taking this step because she has found that it can be a problem in the class, with both quality and quantity of work suffering. In so doing, she is willing to give up some of the friendship in the class in order to keep the control she requires.

This control is also apparent in her actions with the grade 9 students, a group that she enjoys because of their lack of intimidation in creating their artwork. Unlike many of the senior students who are very serious about becoming artists, they are more eager to take risks and experiment. This risk-taking and lack of intimidation was also generally apparent in their behaviour, however. She reported that one of her reasons for using the computer lab for the art history study was that the students were easier to control in the lab than they were in the classroom. This group apparently were uncontrollable for their previous art teacher in the classroom. Barb found that with the computers they were kept involved and interested, therefore much better behaved than they were in the past. Even with this improved behaviour, however, she states that she does not allow them the freedom that she does with her older students. She has firm beliefs about the amount of control and freedom she is comfortable with each group of students and acts accordingly:

Interviewer: Do you find yourself treating your grade 9 students differently?

Barb: Oh yeah. Definitely ... but I still believe in treating them like human beings. Not just like they were an object or as I know some teachers do ... I try to be patient with them...

Interviewer: But you find you have to keep a greater distance for yourself with them, and be stricter?

Barb: Yeah. And where I become more personal is through their work, not through their personal life, where the older ones I am getting more personal with them through their own lives and what they do other than just art.

Barb is firm, though, in that even when she allows friendships to develop, this is kept separate from the evaluation. She states this in her discussion about students who stay at a greater distance from her, not forming friendships:

> I think that could be part of the problem with a couple of the students is that they see that the other students get along with me well, are able to open up to me, but for some reason they haven't. I think that can be a problem as well. Because they may feel like maybe I'm playing favourites, even though I am not. I know I'm not because it doesn't reflect in the marks. **If they don't do the work they won't get the marks.** If they do a good job they are going to get the marks.

Barb also enjoys the control that use of the *Robotel Microselect* allows in computer instruction. With each new group of students in the lab, she introduced the hardware and software with the use of this device which takes control of all of the monitors, displaying only what she wants projected from her terminal. She found that it focused them on the one activity. After this initial instruction, she typically allowed them to explore the many programs and functions of the different software on the system. Occasionally, when she found a group of students having difficulty with a specific feature, she would once again take control of their screens with the *Robotel Microselect.*

Barb enjoys using these forms of educational technology with her students, finding that they suit her style and subject matter. She found that using *Art Treasures* was ideal for her grade 9 art history students for several reasons: she doesn't believe in teaching it in the traditional manner, with slides, as she finds this too boring for the students, who require a more hands-on approach, as they are tactile people; her lack of in-depth expertise in the area made it an ideal pre-packaged, appealing activity for herself and the students; and it offered a greater level of control.

And finally, while Barb is unsure whether her students are learning things on the computer that they couldn't another way, she has concluded that they are indeed useful in commercial art, as their creative process is accelerated with computers, giving them instant feedback. This is important to her as generally much creativity is lost in the time taken in the process with traditional methods, and this may be the niche that computers fill in the area of art.

1.5.2.6.3 *Subject Subculture*

As a commercial art teacher in a very large high school with an extensive art program, Barb is exposed to a number of unique opportunities and challenges. With her technical teaching certificate, she mainly teaches students in the senior grades, occasionally teaching grade 9 students. She has reported that she completely enjoys the variety of teaching, regardless of what assignment she is given.

Her participation in this project has added several new challenges for her within her school and department. Tensions developed within her department and school when a room formerly used as an art gallery was allocated as the site of the computer lab for this research project. Heated discussions and demonstrations among staff members, as well as displays by students of the art department developed in response to this. Her position as a member of the art department as well as a participant on the computer research project placed her in a delicate position, which she has handled gracefully. As well as being a junior member of a sixteen-teacher art department, she has had a rough road to travel.

In addition to the problems with the physical location of the computer lab, Barb has had to face other major challenges within her department: that of other fine arts teachers who do not consider commercial art as true art, thereby giving it low status within the department; and that of other colleagues not considering computer art to be a valid form of art. Despite these concerns, however, the students within the department have reacted positively to this new art form.

Barb has commented that only two of her colleagues support her in her program: another art teacher whom she has instructed in the use of the computer lab, and her department head. While she has found that most of the art department is either against what she is doing, or disinterested, she has stated:

> It doesn't matter. I've always been going against the grain. That's me. I'm not a normal person. I am always going the opposite ... I don't conform. But I don't let anyone know I don't conform.

Like many of the other challenges she faces in life, Barb deals with the response of her colleagues in stride. She feels that people are responding to computers in the way they did to photography when it became a new art form. For a long time it was not considered to be a valid form of art, but it now has reached that point.

She gives the same advice to her commercial art students who are challenged by their peers who do not consider commercial art to be true art. She strongly feels that one needs to be independent and confident to be a successful commercial artist; if students do not have the guts to stand up to peers and say they want to be a commercial artist, they are not suited for it anyway.

Barb finds commercial art to be different from other subjects in many ways, including the lack of specific curriculum guidelines:

Interviewer: Are there curriculum guidelines for your area?

Barb: Not at all. There is for art, but not specifically for commercial art. But basically I follow Ministry guidelines for the art ... But there's no textbooks or anything, so it's not like you can give them readings or give them something to follow. Because it's more creative, there's no right or wrong answer to anything as well. It's not like I can say, "Well it's wrong, this is right." There's some technical aspects of different areas that, basically you can judge them on that. I guess also in the classroom it's more, I guess there's a lot of one-on-one, as opposed to just lecturing to the whole class.

Barb has mixed feelings regarding the use of computers in commercial art. When she was employed in the computer graphics business, she found that while she was given the latest in technology, she was also given even more work to do. She found this to be against the emancipatory aspects of it:

> We can do this faster but our lifestyle is becoming more stressful because now you can do it faster ... The computer is **supposed** to make our jobs easier.

In light of this personal experience, one of her main goals is enabling students to have a proper perspective on how computers should fit into their lives, without letting it take over completely. She uses her own experiences to guide her in instructing her students in this regard:

> My whole job was revolving around computers, and that's not what I wanted to do. And I think I have it right now, it's just once-in-a-while thing for me, and I think that's just great. Because that's what it **should** be. Your whole life shouldn't revolve around a computer. It's just another type of medium, that you can do certain things and it will make things easier for you in certain ways.

She feels strongly that computers should be used as **one more tool** that an artist has to work with, and that students should be able to use all tools:

> We have to learn how to do things by hand as well ... about how then we know when it is to our advantage and when it is to our disadvantage.

While pen and ink are Barb's preferred media, she fully acknowledges the possibilities and advantages of computers, the most significant of which are speed and storage. As a result, she has incorporated the use of computers into various portions of her commercial art program.

Her subject-specific activities have varied a bit over the years involved in the project, and with the classes she was teaching. Her case is unique in that not only did she have a strong background in computers prior to the project's commencement, but she also had a computer integrated fully into her classroom activities. This single Macintosh computer and attached laser printer were used for a variety of activities, both within the classroom and for promotion of school-wide activities, a task often delegated to her class.

Barb added a variety of ICON-oriented assignments to her prior Macintosh computer assignments. Her ICON uses were different in that with access to a full lab of computers she was able to involve the entire class in computer assignments at one time. The hardware and software provided in the lab was also different, in that the software was lacking in the desktop publishing and fonts available on the Macintosh, but superior in the large colour monitors and colour printer.

This full-lab situation, which is desired by many teachers, ironically proved to be another challenge for Barb in her art program. As is often the case in art, students work on individual projects at their own paces. The physical setup and location of the lab two floors down from the art room required that all students be working on computer assignments at the same time, something that rarely happens in her classes. As time progressed, Barb compromised this concern by dividing her time and students between both rooms, running back and forth between the two. This was possible as her students were for the most part adult students, capable of monitoring themselves. This

was not the case, however, with her grade 9 students, with whom she remained in the computer lab during every moment of instruction.

Assigned computer activities varied among the courses and grades. With the grade 9 students that she had for a single half-term of art history, she spent the entire time in the computer lab. Based on the content of *Art Treasures*, she developed a unit that included familiarization with all the artwork described in the program, followed by library research on one particular piece of work. The students then were to draw an artifact on the computer, using *Spectricon* or *Draw*, and write a report on it using one of the system's word processing packages.

With the senior commercial art classes that she had repeatedly during the life of the project, Barb focused her computer-use time on a packaging assignment that required students to design an entire packaging unit for a single product. This included special boxes, bags, wrapping, cards, flyers, coupons etc. for this product. This was done in *Spectricon* taking advantage of the patterning and flipping of images, and printed on the colour printer. Students also experimented with *IPaint*, but with less success.

Barb felt very strongly about the colour printouts available from *Spectricon*, as artists are very tactile people, requiring the ability to touch their work. She does not feel that viewing work on the screen is adequate for artists, and that the printout is crucial for them. She found personally, in her experience with computer graphics, that part of her dissatisfaction with the job was her distancing from her work by only being able to view it rather than to touch it. By having the colour printouts from *Spectricon*, her students do not have this distancing problem. In addition to this, she found that her students were always anxious to get printouts, something she attributes to their thinking that it is similar to being able to be able to print something off a television screen, something very novel to them.

The strategies used by students in creating their computer art were surprising to Barb. While typically their reactions were positive, with contagious enthusiasm among classmates, some students had concerns with it not being a true art form. She dealt with this in stride as well, successfully working with these students to overcome their concerns and fears. She was impressed with their experimentation with clip art and their use of this as a basis for manipulating their own creations in *Spectricon*.

To her surprise, most of the students did not spontaneously create multiple versions of the same creation, what seemed to be an obvious use of the strengths of computer art. However, when she suggested this to certain students, the results were overwhelming: many students went overboard printing multiple copies of the same image, in different shades of colour, causing increased use of colour printer cartridges and paper. As Barb said, referring to one student who went overboard with this feature:

> I've created a monster here! [laughs] 'Cause once she realized, "Wow I can just change one colour and print it out to see if it looks perfect", you know and like of course the printout's different than up on the screen.

This quotation also leads us to the issue of technical problems that arose during the course of the project, and how Barb dealt with these in her art classes. The main concern was with the incapability to print from *Spectricon* during the first term of the project, but this problem was alleviated during the summer term. The other concern was

frequent crashes of the program. While the intensity of this problem decreased during the course of the project, Barb's responses to them are notable. Firstly, because of her experience with having to be responsible for the repair of systems, she did not panic when the network went down, or the program crashed. For her it was a treat to be able to simply call the board liaison to take care of the problem. Secondly, she approached technical problems as a good learning experience for the students, emphasizing the importance of saving their work regularly. Thirdly, she often marked students' work from the screen in the process of their creation, therefore often having something to submit even if the work was lost. Fourthly, and perhaps most interestingly, she often prompted students to work with their "crashed" art, creating something new and different out of it. Nothing was ever looked at in a negative light. Everything was approached as an opportunity to learn more and do more.

While Barb found the ICONs to be useful for the production of computer art, she was not so convinced of their role in assisting her with her administrative tasks. The nature of marking artwork is very untraditional, in that there are often assignments of different sizes and shapes scattered all around a room, something that does not lend itself to sitting at a computer terminal to key in marks. In addition to this, the ICON lab was located two floors down from her classroom: quite a distance if one wants to quickly update a few marks or print out a memo. As a result of this, Barb did not use the ICONs at all for these tasks.

Barb did, however, use her classroom Macintosh regularly. Curricular guidelines, lesson plans, letters, purchase orders and memos were all completed and edited as necessary on this system. While Barb found the Macintosh useful for this, she still did not use it for marks management, as she finds that it would be more work than it is worth, as she only has ten marks for each student, worth 10% each. As she only needs to add these ten numbers together to get the mark at any time, she does not feel that use of a marks management program is a useful way to spend her time. This is a lesson she tried to teach her students at all times: to distinguish between those times when computer-use would be advantageous and when it would not.

With her background with computers, Barb also came into the project with some preferences and concerns about computer use in the area of art. She was eager to be involved in the project not because she was anxious to use ICONs per se; she was more interested in using this opportunity to point out the necessity for **different** computers for her subject area. While she thought that ICONs would be fine for other levels or subjects, she felt that Macintoshes were best suited for her area of interest, computer graphics. However, experience in the project was more positive than she anticipated as her past experience with ICON software did not include *Spectricon*, a program with which she was pleasantly surprised.

Regardless of this, her goal is still to acquire a small lab of five to ten Macintoshes in her classroom for the use of her students. Presently, with students using both the Mac and the ICONs, they are experiencing incompatibility problems: students want to be able to work on the Mac and print on the printer in the lab, or write on the ICON and incorporate into *PageMaker* in the classroom for desktop publishing and a laser printout. At this time, however, neither combination is possible. Barb would like to

change the possibilities in this area. Presently during each semester she has 60 students using the lone Mac in her room, a workload too high for one machine, both in terms of physical capabilities and for accessibility. When she recently heard rumours within the school that the computer lab may be moving, she stated that she was going to attempt to obtain the colour printer and one ICON for her classroom, in order to increase the computer access in her classroom.

Barb has found her computer expertise to be both positive and negative: while it allows her to offer a rich program to her students, it can also be frustrating for her. With full knowledge of software and hardware possibilities for her area, but yet unable to access or obtain them, she finds it disheartening. Participation in last year's ECOO conference also magnified this for her: while she went to the presentations and vendors' displays thrilled with the possibilities, she had to return to her classroom, where it took four years of requests to receive a scanner, and still has not seen any of the other hardware she has repeatedly requested. She hopes that she may see further developments in the use of computer technology in her classes in the future.

1.5.2.6.4 *Conclusion*

As this profile of Barb Cunningham illustrates, her classroom practice is influenced by her life history, subject subculture and pedagogic predispositions. These characteristics influence any classroom practice, including the takeup of technology into schools. With these teacher profiles as background, subject subcultures and teaching styles will be further discussed in upcoming sections of this report.

1.6 STUDENT QUESTIONNAIRE ANALYSIS
by Ivor Goodson, Marshall Mangan and Valerie Rhea

The primary methodology of this project was built upon classroom observation and personal interviews. Beginning with the second term of observation (fall 1989), however, we also distributed a one-page questionnaire (see Appendix 1.2) to the students enroled in the classes being observed. The questionnaire was administered during the first week of classes, before most of the students had much exposure to the computers. Its main purpose was to allow us to get a grasp of the backgrounds and prior computer experience of the students involved in our study, in order to facilitate the choice of candidates for interviews. There are some interesting observations which can be made, however, by examining the statistical summaries of the questionnaire items. These summaries allow for a comparison of the two schools under observation over the three terms during which the questionnaire was administered.

1.6.1 INFORMED CONSENT; RESPONSE RATES

Participation in the use of computers was a normal part of the curriculum in the selected classes, and as such was not optional for the students enroled. Completion of the questionnaire, and participation in the interview process, however, was optional. Informed consent to participate was indicated by completion of a form, which was developed in consultation with the University's Ethical Review Committee. We began with the assumption that almost all students would require their parents' consent, and therefore directed the consent form at parents (see Appendix 1.3). We soon discovered, however, that a considerable proportion of the students in the project were over the legal age of consent, and could sign their own forms. We therefore developed a second consent form, which was used during the last semester of observation (see Appendix 1.4).

Although some students apparently found this process somewhat intimidating, in general the majority completed the consent forms and questionnaires. Participation rates in each term were fairly equal among students in both schools, and between the genders (ranging between 55% and 70%). However, they varied greatly from class to class, from a low of 13% participation to a high of 94%. In total, we received 159 completed questionnaires during the second term of observation, 151 during the third term, and 180 during the fourth term, for a total of 490 respondents.

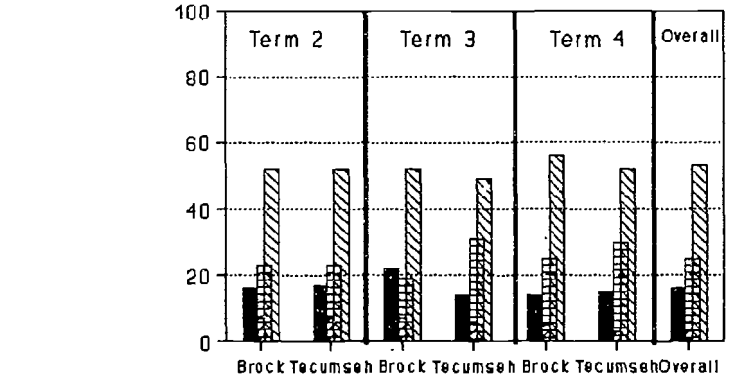
In order to give an impression of the background of students in our study, the following sections will display and discuss breakdowns of the proportional distribution of students in each school and each term, as well as the overall distribution of the 490 respondents, for comparison.

1.6.2 BACKGROUND OF STUDENTS

1.6.2.1 Place of Birth

Figure 1.7 shows the proportional distribution of students in each school and each term, by their reported place of birth.

Figure 1.7:
Students' Place of Birth,
by School and Observation Term



Totals may not add to 100% due to rounding errors.

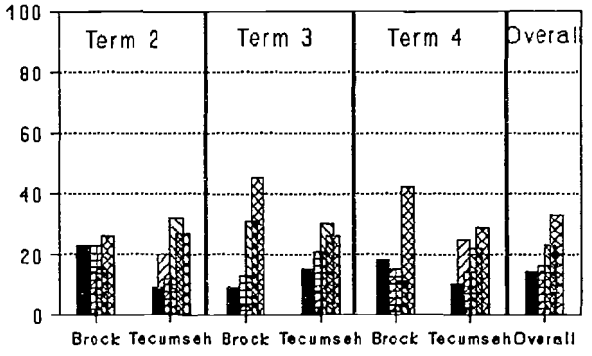
In each semester, roughly half of the students completing the questionnaire were native Londoners, while a fairly small percentage listed their birthplace as being outside of Canada. There was no significant difference between the two schools in either of these figures. We found this somewhat surprising, as one gets the impression when visiting Brock that its student body is composed of a greater variety of ethnic backgrounds, and more children who are recent immigrants to Canada. The clash between these (admittedly superficial, but consistent) impressions may reflect the selective nature of the project.

1.6.2.2 Subject Enrolment

As shown in Figure 1.8, the majority of participating students were enroled in history and geography classes, traditional "academic" subjects which may not be chosen as often as some others by foreign-born students.[1]

[1] This impression was confirmed, to some extent, by an auxiliary analysis. It showed that, for instance, at Brock during the second semester of observation, foreign-born students comprised a much higher proportion of the family studies and electronics classes than they did in history and geography.

Figure 1.8:
Subjects in which Students were Enroled, by School and Observation Term



Tech. Studies	23	9	9	15	18	10	14
Art	14	20	3	8	15	25	14
Fam. Studies	23	12	13	21	15	14	16
History	15	32	31	30	11	22	23
Geography	26	27	45	26	42	29	33

In other words, although we feel the questionnaire fairly represents the students taking part in the project, the project may not be representative of the general student populations in the schools.

1.6.2.3 **Post-Secondary Plans**

The academic orientation of the participating students is apparent in their responses when asked about their future plans, as shown in Figure 1.9 (in this display, students could indicate plans in more than one category. Therefore, percentages may not add to 100).

Figure 1.9: Students' Plans After Completing School

PLANS FOR POST-SECONDARY EDUCATION	TERM 2		TERM 3		TERM 4	
	Brock	Tecumseh	Brock	Tecumseh	Brock	Tecumseh
Community College	29.4%	23.5%	19.2%	24.0%	22.5%	14.5%
University	16.8%	44.5%	26.9%	43.3%	34.8%	29.0%

CAREER PLANS	TERM 2		TERM 3		TERM 4	
	Brock	Tecumseh	Brock	Tecumseh	Brock	Tecumseh
Manual	8.3%	8.3%	22.9%	11.4%	11.8%	9.8%
Clerical	6.7%	0.0%	11.4%	2.9%	2.9%	0.0%
Professional	30.0%	50.0%	17.1%	51.4%	39.2%	40.2%

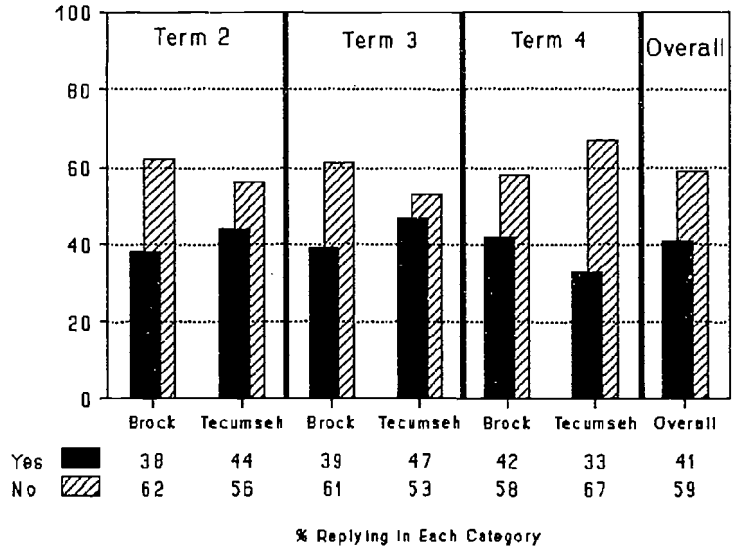
The proportion of students who said they planned to attend college and/or university approached 50% in most terms. On the first two questionnaires, the proportion of university-bound students was noticeably higher at Tecumseh than at Brock, but on the last questionnaire this relationship was reversed. In general, this is reflective of the subjects and sizes of classes included in the sample. In all terms, only tiny proportions of the responding students said they planned to do manual or clerical work after high school. Professional work was sought by about a third of all students. Whether these figures are indicative of the general student population or are influenced by the nature of our sample is not known to us. They may reflect the generally high aspirations of students in high school, or they may be affected by an under-representation of the more vocationally-oriented subject areas in our sample.

1.6.3 COMPUTER BACKGROUND AND ATTITUDES

1.6.3.1 Computers at Home

The extent to which computers have entered the daily lives of the participating students was very apparent from their questionnaire data. As shown in Figure 1.10, between a third and a half of the participating students reported that they had a computer at home.

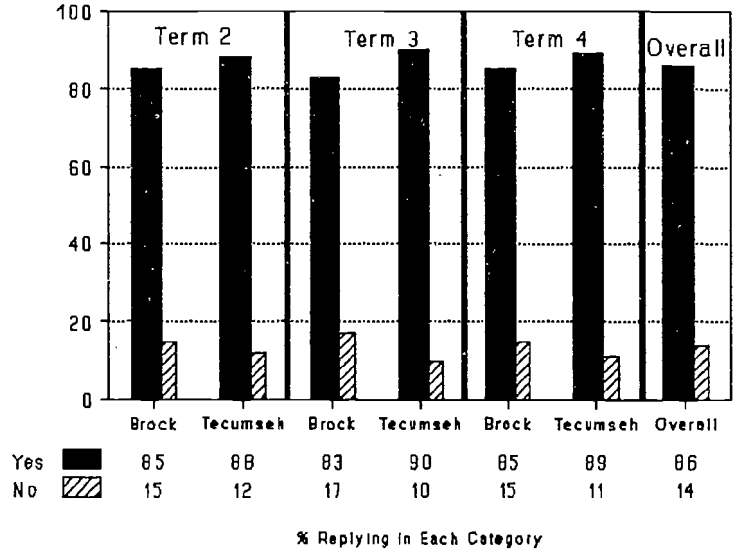
Figure 1.10: Do Students Have Computers at Home, by School and Observation Term



1.6.3.2 **Prior Computer Use at School**

A large majority of students also reported that they had used computers in school (mainly at the elementary level) prior to participation in this project (see Figure 1.11).

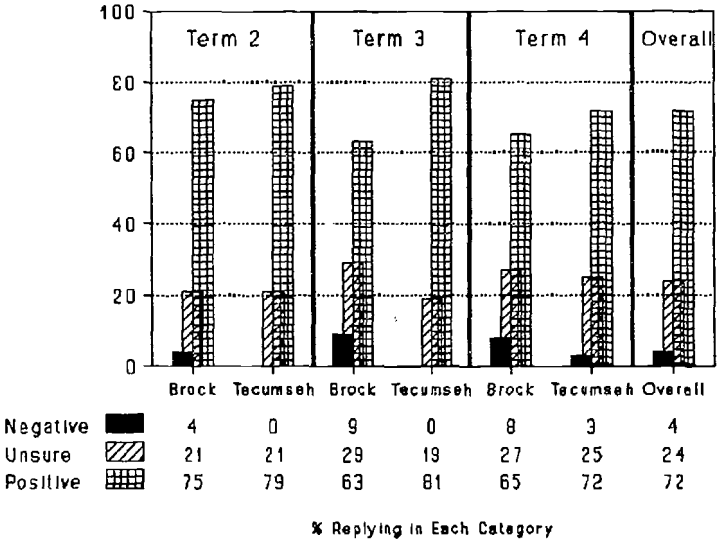
Figure 1.11: Have Students Used Computers in School Before, by School and Observation Term



1.6.3.3 Attitudes Toward Computers in School

When asked about their general attitudes toward computers in education, the overwhelming majority (usually about 3/4) of students indicated positive feelings. As Figure 1.12 indicates, in the second and third terms, there were no openly negative attitudes expressed by anyone from Tecumseh school.

Figure 1.12:
Students' Attitudes Toward Computers in School, by School and Observation Term



Between a fifth and a quarter of students were still unsure of their feelings about computers when surveyed at the beginning of the term, perhaps because they had not experienced their use at the secondary school level. However, there were plenty of students with no prior experience who were quite prepared to react positively to school computing. The source of this enthusiasm is difficult to locate. It may be a result of general media influence, or the students may be affected by their teachers' and peers' positive attitudes.

One surprising observation was that the total of students expressing "negative" or "unsure" attitudes toward school computing has grown in each semester of our study, while the size of the "positive" majority has shrunk from 77% overall to 68%. Fall 1990 was also the first time that students from Tecumseh registered any negative predispositions—two students recorded such responses. Although this is not a drastic trend, it does seem to be in the opposite direction of what might be predicted as computer use in schools becomes more common.

Over the course of the three terms in which the questionnaire was administered, there were usually no significant differences in the responses on these variables between students in the two schools. There were also no persistent differences in the responses of males and females in their attitudes towards computing.

While it might be expected that those students having computers at home or those with prior computer experience at school might indicate a more positive attitude towards computing, this was not usually found to be the case in our surveys. Students indicating positive, negative and unsure attitudes were evenly distributed between those with prior experience and those without.

Although in *Interim Report #4* we found significant relationships between familiarity with computers and students' expressed attitudes, and between gender and attitudes (Goodson, Mangan and Rhea, 1990b, p. 12), this now appears to have been an anomaly, as no significant differences appeared in any other semester's sample. The results from our questionnaires indicate that overall, students feel very positive about computers, regardless of their gender, ethnicity, prior experience or access to computers.

These data were used to help select a group of students for interviews which we felt would represent both schools, both genders, and the various subject areas, ethnic backgrounds, opinions regarding computers, and levels of computer experience found within the participating classes. Selected comments from these interviews can be found within the Principal Investigators' reports which make up volume 2, and in the thematic analyses which comprise volume 3.

APPENDIX 1.1:
Chronology of Research Activities

Glossary of Terms

Pre-contract Team: Bob Andrews, Bob Clark, Ivor Goodson, Diane Goldstein, Jack Little, Al Slemon, Pat Sweeney

Planning Team: Marilyn Brown, Bob Clark, Roger Clark, Diane Goldstein, Ivor Goodson, George Haché, Peder Nielsen, John Rutledge, Al Slemon, John Walsh

Organizational: Project teachers, Peder Nielsen, Marshall Mangan, Valerie Rhea

Research Team: Ivor Goodson, Marshall Mangan and Valerie Rhea

Project Team: Roger Clark, Ivor Goodson, Marshall Mangan, Allan Pitman, Valerie Rhea, John Rutledge
September '89 to May '90—George Haché

Management: *Faculty:*
Ivor Goodson, Diane Goldstein, Marshall Mangan
Ministry:
Dan Russell,
September '88 to January '90—Peter Weygang
January '90 to Present—Shirley Van Neuland
Board:
September '88 to January '90—Dick Stennett
September '88 to September '89—Peder Nielsen, Pat Sweeney
September '89 to Present—Doug Little, Ernie Huggins
January '90 to Present—Steve Killip

School
- **B** Brock
- **T** Tecumseh
- **O** Other (Neither Brock nor Tecumseh)

Subjects:
- **A** Art
- **D** Drafting
- **E** Electronics
- **F** Family Studies
- **G** Geography
- **H** History
- **Summary** Summary notes made by researchers after attending classes

RESEARCH UNIT ON CLASSROOM LEARNING AND COMPUTER USE IN SCHOOLS—ACTIVITY CHART

Date	Meetings	Classroom Observations			Interviews and Other Activities
		Date	School	Subject	
1988					
June					Contract Signed 01
October	Planning Team 03 Planning Team 07 Planning Team 24				
November	Planning Team 07				
December	Planning Team 02 Planning Team 05				Presentation: Quinte School 08
1989					
January	Research Team 16 Organizational 16 Organizational 17 Management 19 Resarch Team 23 Project Team 30 Research Team 30				Quinte School Visit 13 Review Quinte School Visit 31
February	Research Team 06 Research Team 08 Research Team 13 Research Team 21 Management 21	15 20 23	B T T B	G Summary G,A,H,Summary A,H,F,G,Summary	Training: 15,22
March		02 07	T B	G,H,A,D,Summary A,H,F,G,Summary	Training: 01,08,21 Interim Report #1
April	Project Team 03 Research Team 20	07 11 12 13 14 17 18 21 25	T T B B B B B T T T	Summary H,A,Summary F A,Summary E,H,Summary A,H,F,G,Summary A,H,F G,A,Summary G,H,A,D,Summary G,H,A,Summary	Training: 05,12,18,19 Bob Blomeyer Visit & Consult.

Date	Meetings	Classroom Observations			Interviews and Other Activities
		Date	School	Subject	
May	Management 05 Research Team 10	09	B	A,H,F,G,Summary	7 Teacher Interviews 18-30 Doug Noble Visit 02
			T	A,D,Summary	
		11	B	A,H,F,Summary	
		12	B	H,A,Summary	
		16	B	A,H,F,G,Summary	
			T	Summary	
		17	T	G,F,A,Summary	
		18	T	H,G,F,A,D,Summary	
		19	B	H	
		23	T	H,Summary	
		25	B	A,Summary	
		26	B	F,G	
			T	F,A,Summary	
		30	B	Summary	
June	Organizational 21	01	B	E,Summary	2 Teacher Interviews 01 32 Student Interviews 13-14
		14	T	Summary	
August	Project Team 09 Research Team 15 Project Team 24 Project Team 28				
September	Management 21	07	B	Summary	Interim Report #2
		08	T	Summary	
		12	T	Summary	
		13	B	Summary	
		14	T	Summary	
		15	B	Summary	
		18	B	G	
		26	T	F,D,H,G,A,Summary	
		28	B	H,F,E,A,Summary	
October		03	T	F,A	Training: 05,17 Ethics & Technology Conference 25-29 10 Teacher Interviews 18-23
			B	A,G	
		04	B	H	
			T	D,H,G,Summary	
		06	B	H,E	
		10	B	Summary	
		11	T	Summary	
		18	T	D	
		19	B	F,E,A	
		23	B	Summary	
		31	T	D,H,G,A,Summary	

Date	Meetings	Classroom Observations			Interviews and Other Activities
		Date	School	Subject	
November	Management 21	01	B	A,H,F,Summary	1 Teacher Interview 02
		03	B	A,H,G,Summary	
		09	T	F,D,H,A	
		13	B	Summary	
			T	Summary	
		16	B	A,G	
		20	B	F,Summary	
		21	B	A,E	
			T	D,H,Summary	
		28	T	F,A,Summary	
			B	F,Summary	
		30	T	D,Summary	
December	Research Team 01 Project Team 19	01	T	Summary	RCAC Conference 07
		05	B	F,Summary	
		06	T	D,H,G,Summary	
		07	O	Summary	
		12	O	Summary	
		13	T	D,G,A,Summary	

1990

January	Management 23	26	O	Summary	Symposium on Ed. Tech. 17 47 Student Interviews 09-11 5 Teacher Interviews 19-30
February	Research Team 02 Project Team 19 Research Team 20 Project Team 27	21	O	Summary	Training: 15 Feedback Session 21 Curriculum Retreat 29 4 Teacher Interviews 12
		26	T	E,H,G,A	
March	Management 20	01	B	Summary	Interim Report #3
			T	Summary	
		02	B	H	
		06	B	A,F,G,E,Summary	
		22	B	Summary	
		27	T	G	
April	Project Team 03 Research Team 20 Research Team 30	02	B	F	AERA Conference 14-20 ECOO Conference 25-27
		04	B	Summary	
			T	Summary	
		05	B	A	
		11	B	H	
		12	B	H	
		18	T	A,Summary	
		20	T	Summary	

Date	Meetings	Classroom Observations			Interviews and Other Activities
		Date	School	Subject	
May	Research Team 02 Organizational 09 Research Team 23 Management 23	01 02 10 11 15 18 22 23 24 30	B T T B T T B B B B T T	A,G A,Summary F,E,H A Summary E A F F F H,G,A,Summary Summary	
June		01 05 06 07 11 18 19 20 21 27 29	B B T T B B T T O B O B	A Summary Summary Summary Summary Summary Summary Summary Summary Summary Summary A	11 Teacher Interviews 12-22 49 Student Interviews 05-08
September	Research Team 07 Project Team 14	10 18 19 26 	B T B T B	Summary D,H,A H,F,G,E,G,Summary F,D,H,G,A,Summary F,G,E	Interim Report #4
October	Research Team 10 Research Team 17 Management 23 Research Team 25	01 04 11 15 17 23 24 30	B T B B T B T B B	Summary D,H H,F,E,Summary Summary Summary Summary Summary Summary Summary	

Date	Meetings	Classroom Observations			Interviews and Other Activities
		Date	School	Subject	
November		07	B	Summary	
		08	B	Summary	
			T	Summary	
		13	T	Summary	
			B	Summary	
		14	B	G,Summary	
		20	B	Summary	
		22	T	Summary	
		27	B	Summary	
		28	T	D,H,A,Summary	
			B	Summary	
		30	B	Summary	
December		07	T	Summary	RCAC Conference 13
		11	B	Summary	Computers in Ed. Conf. 04-06
			T	Summary	
		12	B	H,G,Summary	
		13	O	Summary	
		19	B	A	
		20	T	Summary	
		30	B	F	

1991

January	Research Team 10	11	B	Summary	11 Teacher Interviews 22-31
	Research Team 14	17	B	Summary	59 Student Interviews 08-11
		23	T	Summary	
		24	B	Summary	
February	Research Team 04	06	B	Summary	TDP Conference 11-13
	Project Team 04	19	B	Summary	10 Teacher Interviews 26
	Management 14		T	Summary	
		20	T	Summary	
March		22	O	Summary	Interim Report #5
April		18	T	Summary	1 Teacher Interview 26
					AERA Conference 02-07
					Bridget Somekh visit 29-03
May	Research Team 13				ECOO Conference 06-09
	Project Team 13				Feedback Session 17
June	Project Team 06				
	Management ?				
August					Summative Report

Appendix 1.2:
Facsimile of Student Questionnaire

Date:_____ Name: _____ Sex: M__ F___

Date of birth: _____ Place of birth: _____

Period: ____ Teacher: _____

Subject: _____

What other subjects are you presently taking?

1. _____ 2. _____

3. _____

What subjects do you plan to take next semester?

1. _____ 2. _____

3. _____ 4. _____

What do you plan to do after you finish school (attend college or university, go to work, etc. - please be as specific as you can)?

_____

Do you have a computer at home? Yes ___ No ____

IF yes: what kind (Brand and model)? _____

Have you ever used a computer <u>in school</u> before? Yes ___ No ____

IF yes: what year(s) in school? _____ _____

what kind(s) (Brand and model)? _____

_____ _____

what sorts of things did you use them for?

word processing ____ drill & practice _____

simulation games ____ other ___ (please specify):

_____

In general, how do you feel about using computers in school?

positive ___ negative ___ unsure ____

(You may put comments on the other side if you wish)

Appendix 1.3:
Facsimile of Participant Teacher Consent Form

"Curriculum and Context in the Use of
Computers for Classroom Learning"

A Research Project Co-Sponsored by
the Ontario Ministry of Education,
the Board of Education for the City of London, and
the Faculty of Education, University of Western Ontario

Dear _____:

As you are aware, you have been chosen to participate in a pilot project involving the use of microcomputers in London area high schools. Our research team is assessing the effects of these microcomputers on your total classroom experience.

In order to assist us in this process, we will be interviewing participating teachers from time to time. These interviews will be largely open-ended, but will center around questions regarding your and your students' reactions to the microcomputers, and the ways in which you feel your classrooms have been affected by them. Each interview will be approximately an hour in length, and will take place at a mutually convenient time and place. They may be tape recorded so that we do not miss any of your comments, which we view as vital to our research.

The purpose of this letter is to formally request your informed consent to participate in these interviews. There are no known risks associated with the procedures we plan to use. You will never be mentioned by name in any reports of our research. All of the interview materials will be restricted to our research group, and will be destroyed within five years of the completion of the study. You may withdraw your consent at any time.

Please fill out the form below, and return it to a member of the research team, whether or not you wish to participate. If you have any questions or comments, you may contact Dr. Ivor Goodson at 661-3716, or Dr. Marshall Mangan at 661-3845. Thank you for your consideration.

Sincerely,

Dr. Ivor Goodson
Project Co-Ordinator

==========

I (circle one) DO DO NOT consent to participate in the interviews described above.

_____ _____
(Date) (Signature)

Appendix 1.4:
Facsimile of Parent Consent Form

"Curriculum and Context in the Use of
Computers for Classroom Learning"

A Research Project Co-Sponsored by
the Ontario Ministry of Education,
the Board of Education for the City of London, and
the Faculty of Education, University of Western Ontario

Dear parent or guardian,

As you are probably aware, your child is presently involved in a pilot project involving the use of microcomputers in London area high schools. Our research team is assessing the effects of these microcomputers on your child's total classroom experience.

In order to assist us in this process, we will occasionally seek feedback from students about their computer use, using short questionnaires and interviews. Questionnaires will be administered during class time. Interviews will be no more than half an hour in length, and will take place during or immediately after school hours. In order to insure confidentiality, these conversations will take place in a quiet area of the school, away from other students. They may be tape recorded so that we do not miss any of your child's comments.

The purpose of this letter is to request your permission for your child's participation in these activities. There are no known risks associated with the procedures we plan to use. Your child will never be mentioned by name in any reports of our research. All of the materials will be restricted to our research group, and will be destroyed within five years of the completion of the study. If at any time your child indicates that he or she does not wish to participate in these activities, he or she will be excused without penalty. You may also withdraw your consent at any time. If you do not wish your child to participate, this will in no way affect his or her status at school.

Please fill out the form below, and have your child return it to his or her teacher, whether or not you wish your child to participate. If you have any questions or comments, you may contact Dr. Ivor Goodson at 661-3716, or Dr. Marshall Mangan at 661-3845. Thank you for your consideration.

Sincerely,

Dr. Ivor Goodson
Project Co-Ordinator

==========

I (circle one) DO DO NOT wish my child,_____
(student's name)

to participate in the activities described above.

_____ _____
(Date) (parent's signature)

Appenndix 1.5:
Facsimile of Revised Participant's Consent Form

"Curriculum and Context in the Use of
Computers for Classroom Learning"

A Research Project Co-Sponsored by
the Ontario Ministry of Education,
the Board of Education for the City of London, and
the Faculty of Education, University of Western Ontario

The student named below is presently involved in a pilot project involving the use of microcomputers in London area high schools. Our research team is assessing the effects of these microcomputers on student's total classroom experience.

In order to assist us in this process, we will occasionally seek feedback from students about their computer use, using short questionnaires and interviews. All students are being asked to complete a questionnaire; a smaller number will be selected for interviews. Interviews will be no more than half an hour in length, and will take place during or immediately after school hours. In order to insure confidentiality, these conversations will take place in a quiet area of the school, away from other students. They may be tape recorded so that we do not miss any of the student's comments.

The purpose of this letter is to request your permission for participation in these activities. There are no known risks associated with the procedures we plan to use. Participants will never be mentioned by name in any reports. All of the materials will be restricted to our research group, and will be destroyed within five years of the completion of the study. If at any time a student indicates that he or she does not wish to participate in these activities, he or she will be excused without penalty. Parents or guardians may also withdraw their consent at any time. Refusal to participate in research activities will in no way affect a student's status at school.

Please fill out the form below if you consent to participate. Students aged eighteen or older may give their own consent. Younger students require the permission of a parent or guardian. If you have any questions or comments, you may contact Dr. Ivor Goodson at 661-3716, or Dr. Marshall Mangan at 661-3845. Thank you for your consideration.

Sincerely,

Dr. Ivor Goodson
Project Co-Ordinator

I hereby give my permission for _____
(Print student's name)

to participate in the activities described above.

_____ _____
(Date) (Signature)

1.7 REFERENCES

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