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An examination of student interaction in an elementary classroom while using computers.

Mary. DeGoey
University of Windsor

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AN EXAMINATION OF STUDENT INTERACTION IN AN ELEMENTARY CLASSROOM WHILE USING COMPUTERS

by

Mary DeGoey

A Thesis

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ABSTRACT

AN EXAMINATION OF STUDENT INTERACTION
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This study was a case study of 32 children in a split grade one and two class. The study examined the link between popularity and interaction at the computers while controlling for grade level, gender and possession of home computer.

A sociometric questionnaire was administered to establish popularity data and videotapes were taken to monitor the actual interaction frequencies.

The results indicated that popularity had little bearing on interaction frequencies. Furthermore, contrary to the literature, boys were not found to be dominant in computer useage.

The evidence presented indicates that in this particular case the social organization of classroom activities of the teacher played a major role in the observed pattern.

DEDICATION

The completion of this thesis
is dedicated to the memory of
my father, Joseph Dippong.

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My deep appreciation goes to my chairperson, Dr. A. Ehrentraut, for his patient assistance and guidance with my study and for his unfaltering confidence in my ability to fulfill the requirements of completing this thesis. Also my thanks to the other members of my committee Dr. G. Booth and Dr. W. Innerd for their helpful comments and support.

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CHAPTER I

Introduction

One of the latest areas to receive attention in the educational field is the realm of computer technology and its impact on pupils within the classroom setting. While a plethora of literature has been generated about the technology itself and the cognitive and psychological dimensions of the learning process in students, a lacuna exists in a very fundamental area -- the sphere of social interaction among students in the context of computer usage within the classroom.

Because computers have permeated every aspect of society they have become virtually indispensable tools in business, industry and education alike. A cultural lag has developed however, because computer technology has outstripped our society's preparedness as evidenced in the educational field.

Although more and more computers are being placed into classrooms this should not be construed to indicate that all logistical problems have been solved and that a consensus has been reached as to the efficacy of computers.

For some school boards computers in the classroom are a contentious issue either because board members feel they cannot justify the cost or they are not convinced that the computer as a teaching tool is a viable alternative to the

conventional methods of instruction. Furthermore, the implementation of any new technology implies that teacher training must follow or precede it. This adds a further cost to the technology and renders it susceptible to teacher backlash because they perceive it as a threat to their autonomy.

Nor is everyone satisfied with the present level of the technology. Nowhere is this more evident than in the area of computer software. There are opposing views as to who should be formulating the software packages and the question of evaluation has arisen.

Microcomputers have not only impacted on pedagogy and the physical arrangement within the classroom, they have also altered its social organization. Since few, if any, classrooms have a computer for each student, the students share computer usage time. This provides for interactional opportunities not found elsewhere in the classroom setting. So far few studies have concerned themselves with the implications inherent in such interactions. This study will attempt to do just that by linking sociometric choices with actual interaction patterns.

CHAPTER II

Organization Theory as it Pertains to the Educational System

Organization theorists are interested in how individual and group behaviour is affected by organizational properties. That is, they look at how behaviour is influenced by the functioning of an organization. Khandwalla (1977) informs us that the domain of organization theory "is the systematic study of the relationship between situational, strategic, structural, behavioural and performance variables" (p.278).

Pugh (1966) suggests that the anatomy or structure of an organization refers to those aspects that are relatively stable such as its hierarchy and technology, while the physiology of the organization (the way it functions) covers aspects that are more fluid, such as interpersonal relations and nonformal communications.

Because organizational theory recognizes that organizations are of necessity comprised of a hierarchy, it becomes self evident that some form of leadership is required. Katz and Kohn (1978) inform us that three basic types of leadership occur in organizational settings:

> the introduction of structural change or policy formulation, the interpolation of structure, or improvisation and the use of structure formally provided to keep the organization in motion and in effective operation or administration (p.536)

Early in this century Weber examined the nature of all organizations and arrived at a number of conclusions. He agreed with Adam Smith's view that division of labour and

specialization were necessary features for productivity. At the same time Weber recognized that this would necessitate a hierarchy of authority. Weber further stipulated that since organizations engage in repetitive tasks that they would require rules and standard operating procedures. He also specified that since competitive capitalism was the norm, organizational roles would be staffed by the technically competent rather than on the basis of kinship or social status (as cited in Khandwalla, 1977).

Schools like other institutions are anatomically structured like Weber's organization typology. They too have a hierarchy of authority, rules and regulations, specialization and so forth.

Weber also believed that there are three types of authority; traditional, legitimated by time; charismatic, legitimated by personality; and the most prevalent type of authority, rational-legal legitimated by rules (as cited in Spencer, 1985).

Weber gave primary attention to the type of authority in the administrative structure that relates superiors to subordinates. He believed that the rational-legal form permits subordinates to exercise greater independence and discretion in decision making than the other types of authority. At the same time he believed that this form provided the basis for a more stable and predictable administrative structure.

Weber theorized that a bureaucracy is capable of handling more complex administrative tasks if it increases independence and discretion among its lower echelons.

Child (1973) in examining organizational structure postulated that organizational complexity was positively predicted by the larger size of the organization, a more integrated and automated technology, a greater range of activities contracted out and the organization belonging to a larger owning group. If we apply these postulates to schools we see that schools have become more complex organizations in their evolution from the little red school house to today's modern structures. Likewise there has been a proliferation and integration of technology. There are more positions contracted out as in the case of social workers, psychologists, and so forth, and although schools are not owned by a larger group they are none the less a part of a school district.

In the educational realm, Robinson (1966; 1967) found that technical competence and specialization were both positively and significantly related. There was also a positive relationship between the following characteristics of hierarchial authority: procedural specification, impersonality and rules for teachers. Robinson concluded that although there tended to be a positive though not significant relationship between bureaucratization and professionalism

there were important differences in the schools along these two dimensions.

Punch (1967) found that organizational dimensions can be relegated to two unrelated clusters. The one cluster which he labelled "bureaucratization" included hierarchial authority rules, procedural specifications and impersonality. The second cluster contained the division of labour specialization and competence dimensions. Therefore, Punch concluded that school bureaucracy is unidimensional when technical competence and specialization are not considered.

Punch did find that the administrator or principal occupies the position found at the apex of the school bureaucracy and that the leader-behaviour style of the principal is the most important determinant of the level of bureaucratization within the school.

Mackay (1964a) in his study of 31 schools in Alberta found that they were neither completely bureaucratic nor completely non-bureaucratic. The schools differed significantly along such dimensions as specialization, rules and impersonality and hierarchial authority. Mackay further found that technical competence was a non-bureaucratic dimension in the schools.

In contrast to Weber's mechanistic model of formal organizations, the human relations model places its focus on the individual. Its concentration is on the interactions within the informed groups of the organizational setting. It

concerns itself with desires, attitudes, values and emotional responses of the individual workers (Martin and MacDonell, 1978).

In examining organization theory McGregor, Argyris and Herzberg espoused the salience of the "human resources" orientation. McGregor (1960) founded his Theory Y on the supposition that all individuals are potentially capable of self-control and self-direction. McGregor proposed that self-actualization could be achieved by setting objectives with the help, but not the supervision of superiors. This does not imply abdication on the part of supervisors. They would still exercise authority within their jurisdiction but only after a full discussion with the subordinates.

Argyris (1964) argued along a similar vein. He felt that the bureaucratic inclinations of organizations frustrate people's needs. Argyris suggested that participative management made happier and healthier employees.

As Dachler and Wilpert (1978) point out:

> These theories assume a basic hierarchy of needs which culminates in a need for self-actualizing or growth. Although what is meant by self actualization is not clear, it includes people being active; independent; capable of self-control through awareness of their potential; engaged in a variety of behaviours; having long-range perspectives; and seeking equality (p.7).

Dachler and Wilpert go on to say that whether participation in the organization has the above mentioned effects depends in part on context. Therefore, participation is expected to increase effectiveness to the extent that

> the issues around which participation occurs are relevant to accomplishing the task, people by participating, get more accurate information about an organizational context which in fact allows real and meaningful positive outcomes to result from effective performance; and effective performance is not largely beyond the control of the worker (p.9).

Herzberg (1968) an industrial psychologist, is noted for his motivation-hygiene theory. He argued that one can observe a fundamental difference between the effects of intrinsic and extrinsic factors. To Herzberg such factors as how challenging the job is; the possibility for advancement; and the recognition one gets are intrinsic. On the other hand, extrinsic factors include company policy, salary, job security and supervision. Herzberg called the intrinsic factors "motivators" and the extrinsic factors "hygiene" factors. He claimed that intrinsic factors or motivators lead to a durable state of motivation.

Small groups theory narrows the focus from the organization as a whole to groups within its boundaries. In that context, the dynamics of group theory have been examined by Merton (1957) who defined a number of people as constituting a group if they:

> 1) interact with one another in accord with established patterns
>
> 2) define themselves as "members", i.e. ...have patterned expectations which are morally binding on them and other members but not on those regarded as "outside" the group
> 3) are defined by others as belonging to the group (pp. 285-286).

Homans developed his exchange theory to explain interaction within small groups. The following propositions shed some light on leadership in a group, patterns of interaction within the group and friendships within the group as cited in Khandwalla (1977).

1) The more frequently persons interact with one another, the stronger are their sentiments of friendship.

2) The higher the rank of a person within a group, the more nearly his activities conform to the norms of the group, and the wider his range of interactions.

3) In a group, a person of a higher social rank than another originates interaction for the latter more often than vise versa.

4) The closer an individual or a subgroup comes to realizing in all activities the norms of the group as a whole the higher will be the social rank of the individual or subgroup.

5) The higher a man's social rank in a group, the larger is the number of persons for whom he originates interaction, either directly or through intermediaries, and the larger is the number of persons that originate interaction for him either directly or through intermediaries (Khandwalla, 1977, p. 101).

Small groups theory further postulates that the status of members is contingent upon their rank, centrality, observability and conformity (Hopkins, 1964). Rank is referred to by Hopkins as "the generally agreed upon worth or standing of a member relative to the other members" (Hopkins, 1964, p.26). Centrality refers to "how close a member is to

the 'centre' of the group's interaction network" (p. 28). Observability implies that "a group structure usually gives some members more and better opportunities to observe the events and conditions in the group than it does other members" (p.29). Conformity may be considered as being "the condition (or degree) of congruence between a member's profile on the relevant norms and the profile of group held norms" (p. 31). Hopkins cautions us not to equate conformity with compliance as they are not analogous. In Hopkin's formulation of conformity the individual may agree with group held norms but may nevertheless for some reason not comply with them.

Groups have things in common and it is these commonalities that are the sources of the group's interactions. Olmsted (1959) informs us that these commonalities include such things as beliefs, tasks, interests, and territory. All groups have several characteristics in common which are: relatively clear objectives, role differentiation, values and norms, criteria for membership and a communications network.

Another generally recognized proposition of small groups theory is that the physical setting is an important factor both in group process and function. As Wolfe and Proshansky (1974) observe:

> Physical environments influence and in turn are influenced not just by the behaviour and experience of individuals, but by groups, social organizations and even larger human systems (p.212).

Another area of organization theory that needs to be addressed is the importance of the technological imperatives operating within specific settings. Just as physical settings can influence interaction through spatial limitations, so too can the tools and props of a given technology. The givens of a technology can hinder, promote, alter or dictate social interaction of group members Meissner (1969).

As applied to the school setting Martin and MacDonell (1978) inform us that: "The organization of the school around departments, timetables and related administrative issues may be an important factor in the development of specific group formation" (p.47).

Cooley (1962) classified groups into primary and secondary. He considered primary groups to be characterized by intimate face-to-face association and cooperation. The secondary group is characterized by impersonal, rational and formal relations among its members. It follows then that within a school a multitude of primary groups may exist and even individual classrooms may constitute a number of primary groups.

Lindesmith and Strauss (1968) refer to a reference group as that "with which a person psychologically identifies himself or in relation to which he thinks of himself" (p. 347). Thus ones reference group may fall into one of the following categories.

1) those in which one holds official membership

2) those to which one aspires, and

3) those to which one does not wish to belong (Martin and MacDonell, 1978, p.48).

In this light the classroom is a complex stimulus environment in which the teacher competes for the students' attention with the behaviour of both the primary and reference groups.

The concept of process central to group dynamics is perhaps best defined by Berlo (1960) when he states:

> If we accept the concept of process, we view events and relationships as dynamic, on-going, ever changing, continuous. When we label something as a process, we also mean that it does not have a beginning, an end, a fixed sequence of events. It is not static, at rest. It is moving. The ingredients within a process interact: each process within the classroom setting is never static as no two days are the same (p.179).

It is generally agreed that all organizations have goals, although these may sometimes be rather vague. Some organizations exist to produce a product, others to maintain public order, while still others to care for patients. Schools on the other hand exist to develop and transmit knowledge. March and Simon (1958) argue that these general goals are not very conducive to guiding the behaviour of participants. However they do feel that they provide a good starting point for the construction of "means-ends" chains that involve: "starting with the general goal to be achieved, discovering a set of means, very generally specific, for accomplishing this goal and taking each of these means, in

turn, as a new subgoal and discovering a set of more detailed means for achieving it, etc" (p.191).

Parsons proposed a typology based on organizational goals that were classified in terms of the "social function" they perform in the larger society. Parsons' model posits that if a social system is to persist it must satisfy the four basic functions of:

Adaptation - the problem of acquiring sufficient resources

Goal Attainment - the problem of setting and implementing goals

Integration - the problem of maintaining solidarity or coordination among the subunits of the system

Latency - the problem of creating, preserving, and transmitting the system's distinctive culture and values (as cited in Scott, 1981:31)

Cyert and March (1972) believe that in practice organizational goals are relatively stable over time because of the existence of precedents. They argue that the continuation of past practices and activities tends not to be questioned.

Khandwalla (1977) has extrapolated a number of factors that account for the variation in consensus on organizational goals. The more an organization indoctrinates its members in its official philosophy the less goal conflict there will be. Also, the more carefully the organization preselects its members whose values and goals coincide with the organization the more consensus there will be. On the other side of the

coin functional specialization seems to increase goal conflict. Furthermore, the more interdependence of subparts the more likely each unit will try to get the other parts to acquiesce.

Perrow (1970) delineated the types of goals that organizations pursue and classified them into five types. He said that serving social needs was one type of goal. A second goal concerns itself with what the output of the organization should be. A third goal concerns itself with the preferences of the managers about what kind of an institution the organization should be. A fourth goal deals with the product-characteristics, that is it looks at the quality and other features of the organization's outputs. The last set of goals are the derived goals - the ones the organization pursues because of its power or surplus resources.

As Khandwalla (1977) points out, the goals of organizations are often vaguely but formally stated and he gives the following reasons for this. Goals are stated to help legitimize the activities of the organization. The law, the government and the "establishment" are watchdogs looking for responsible and ethical conduct. Secondly, goals are stated in broad terms to enable the organization to take advantage of opportunities as they come along. Finally, formally stated goals have a symbolic function for the organization's membership. It helps them to distinguish their particular organization from others.

Meyer and Rowan (1977) concur with Khandwalla that many positions, policies and programs "are enforced by public opinion, by the views of important constituents, by knowledge legitimated through the educational system, by social prestige...." (p.343).

Dowling and Pfeffer (1975) lend further credence to this view by stating that "organizations seek to establish congruence between the social values associated with or implied by their activities and the norms of acceptable behaviour in the larger social system of which they are a part" (p.122).

Thompson (1967) has noted that it is one of the principle functions of individuals on the institutional level to legitimate the organization in the social system of which it is a part.

Dowling and Pfeffer (1975) point out that organizations can do three things to become legitimate. The organization can adopt its goals and methods of operation to conform more closely to the prevailing definitions of legitimacy. Second, through communication the organization can attempt to alter the definition of social legitimacy so that it will conform. Finally, the organization can attempt also through communication to become identified with symbols, institutions or values that have a strong base of social legitimacy.

Legitimacy is seen as a constraint on all organizations (Dowling and Pfeffer, 1975), and it seems likely correct to

assume that it affects some organizations more than others. The reason for this is twofold. First, some organizations are more visible than others and second, some organizations depend more heavily on social and political support. Thus we can see that schools are highly visible and depend on the tax payers as well as government for both financial and political support.

Randall (1973) reiterates this position by stating that:

> For the public organization, development of support is more complicated. It too must deliver a product or service that clients demand but it must also engage in a political process of building support among sympathizers, other organizations, and legislators (p.236).

Freeman (1979) suggests that schools are particularly vulnerable to outside criticism because it is difficult for them to demonstrate their effectiveness.

Furthermore, schools like other organizations, are not self-sufficient communities, but are interlocked with other structures Katz (1963). They are open systems operating in an ever changing environment. As such they are shaped by both external and internal forces. To remain viable and effectively carry out their mandate schools must "coordinate their subparts, recruit new members, determine policy, and maintain their boundaries against outside forces" Mercer and Covey, (1980:134). Baty et al (1971) point out that the variables that presumably affect faculty recruitment are the size of the student population, the student/teacher ratio, the rate of growth the school is experiencing, the prestige of the

school and the geographic location of the school. Of course, when jobs are in short supply this may not apply. The authors also point out that, as open systems, schools pursue specific goals such as the recruitment of human, financial and material resources.

Since every complex organization has as one of its characteristics role expectations, schools are no exception. Khandwalla (1977) defined role as consisting of a range of socially expected behaviours associated with a given status or position. Roles are learned through socialization via the family, the social group one belongs to or aspires to and/or through specific organizations.

Mechanic (1962) tells us that much behaviour is routine and established through learning the traditional modes of adaptation in dealing with specific tasks. Therefore, it is the position an individual occupies in an organization that accounts for much of their behaviour. Roles also serve as mediating forces in influence processes. It is precisely because people know what their roles are that conflict can be avoided.

Role conflict can occur when an individual perceives the demand of multiple roles. However, serious role conflicts are usually avoided because individuals play different roles with different people and in different contexts. Also role conflict is rarer in stable organizations that function in a relatively non-changing environment. However, people do need

to have their roles and status clarified in a manner that is acceptable to them as well as to others within the organization. Teachers, as a rule, have well defined roles and work in a relatively non-changing environment.

Merton (1957) has argued that the personality of an individual may be altered by the nature of the role. He argues that when individuals find themselves in a certain role they tend to develop attitudes that are congruent with the expectations of that role. Because role theory considers behaviour to be shaped by social expectations and the logic of the task, it gives special attention to the social and technical factors shaping behaviour.

Martin and MacDonell (1978) point out that teachers pursue their functions through various more or less situational aspects of their role. These include "being a resource person to pupils seeking information, a referee in pupil disputes, a supervisor to see that rules are kept, a judge for those who have broken the rules, a leader and friend to all pupils" (p.71).

Floud (1962) has noted the moral orientation of the teacher role in the affluent society while Merton (1957a) has pointed out that there are possible conflicting role expectations held for American teachers by their professional colleagues, the school board and community organizations.

Research by Biddle et al (1966) found that there were shared misperceptions among teachers, school officials,

parents and pupils as to what the role of the teacher should be.

On the Canadian scene Friesen (1970:12) found a need to personalize and humanize the teaching profession "in a public way," while Mackie (1972) demonstrated empirically that the public views teachers as hard working and competent. Mackie's study gives support to Blishen's (1967) socioeconomic index for 320 occupations. School teachers ranked twenty-fourth on the list.

Greffen (1969) in his study of compliance tendencies of local and cosmopolitan teachers noted that "cosmopolitan teachers indicated that they would tend to be less compliant than local teachers when in situations of conflict with an administrator or the administration" (p.111). Greffen also found that those high on compliance tended to have the following characteristics: teach in elementary schools, remain in the same community for a relatively long period of time, have no subscriptions to professional publications (magazines, journals) and stay within the same school district even when moving.

In his Canada wide study, Francoeur (1963) found that teacher dissatisfaction with their role was related to the lack of opportunity to participate in policy making. Pallesin (1970) along a similar vein found that a relationship between teacher preference and their actual teaching assignment made

a significant difference to teachers' satisfaction with placement in their jobs.

Cheal and Melsness (1962) found the three main areas of teacher concern in regards to administration were "as a classroom administrator, as a participant in the general administration of the school, and as a consumer of the policy and program decisions of senior administrators" (p. 7). Clearly teachers want more input into administrative tasks as part of their role as teacher.

The role of the school administrator (principal) is seen as twofold; that of educational leader and the pursuing of managerial tasks. Martin and Macdonell (1978) point out that the role of the administrator has undergone a change in recent years. In small country schools the administrator played the role of teacher-administrator while in large schools the role is of professional leader and administrator. This change in responsibilities is not solely due to the increase of school size, however. Greater specialization and the need for coordination have also helped to shape the role of the administrator. Subsumed under the principal's role are now such tasks as keeping school records, making reports, maintaining order and discipline, supervising staff and communicating the school's policies to the community.

In Ontario, Singhawisai (1965) found that teachers and school board members had conflicting expectations regarding the principal's role. He did find however a higher degree of

consensus on the principal's attributes as compared to their performance.

Hoyle (1969c) informs us that the role of the teacher has not changed over the years and that it is twofold. One set of the role "corresponds with the major functions of instruction, socialization, and evaluation" the second is "concerned with motivating pupils, maintaining control, and generally creating an environment of learning" (p.59). However, the ways in which teachers fulfill these roles has changed due to changes in architectural designs of schools and the teaching aids being used in the classroom. Also teachers' own conceptions of their role has changed. They no longer see themselves as the domineering stereotype teacher as a prerequisite for effectiveness. Instead they often try to bridge the social gulf between teacher and student to facilitate communication.

Gross, Giacquinto and Bernstein (1971) did a study where a school board planned to redefine the teacher role. The researchers found that there were five barriers to the successful implementation of this planned innovation: 1) the incapability to perform the new role model, 2) a lack of clear information about the innovation, 3) the unavailability of the necessary materials, 4) an incompatible organizational arrangement, and 5) a lack of motivation to implement the changes.

Carlton, Colley and MacKinnon (1977) suggest that as part of their role truly effective teachers must:

1) have something of substance and interest to communicate

2) be capable of communicating it clearly and accurately

3) be capable of communicating it in a stimulating and exciting fashion

4) base this communication directly on a concern for a sensitivity to the personal welfare and status of each student (p.370).

The authors believe that these characteristics "are two major components of the expertise dimension in instruction: subject matter expertise (or knowledge base) and pedagogical expertise (or teaching skills)" (p.370).

Bidwell (1965) argues that teachers have broad discretionary boundaries within the classroom because they work alone and are relatively hidden from their colleagues. He further states that teachers and principals "usually retain at least some control, often substantial, over curricula and teaching methods" (p.976). Yet he admits that

> school administrators and their subordinates must balance three criteria in determining lines of action: professional norms and standards, public wishes, and fiscal efficiency (p.977).

This line of reasoning coincides with Bernstein's (1970) view that in examining any education issue we must realize that power relationships created outside the school penetrate the institution and shape its ideologies, curriculum and structure. As such, any attempt to determine the learning objectives pursued and the efficacy of the "front line workers" (the teachers), must recognize that their autonomy is

limited by the ideological stance of others in the hierarchy (Moeller, 1964; Stub, 1968; Chippindale, 1978; Warren, 1977; Atherton, 1976; Byrne, 1978).

Gallegos (1987) suggests that pressure to adopt new technologies comes from three fronts. First, educators and school boards feel a need to be in the forefront of whatever is occurring in education. Second, manufacturers, suppliers and publishers use a strong sales pitch for the purchase of instructional materials. Finally, there are the political pressures to "develop educational opportunities in our schools that reflect the technological aspects of the world of work" (p.16).

Parsons (1959) in his theoretical discussion of the classroom tells us that in the elementary classroom the achievement criteria are formed by a combination of cognitive and moral standards. Teachers form their perceptions of their students not only from what the student learns academically but also by his responsiveness and obedience. These standards give the teacher considerable latitude for nurturing interactions with the pupils. Thus the teacher functions as both a surrogate mother and instrumental leader within the classroom.

Holyrode (1971) informs us that "for some years now, the educational world has been on the receiving end of authoritative statements and reports that one of its basic problems lies in its over-dependence upon manpower and its

relative under-capitalization in terms of equipment" (p.139). Educational technology hopes to remedy that situation.

While our first inclination is to assume that educational technology refers to electronic equipment, its true meaning is far more encompassing. Gagne (1968) says educational technology "can be understood as meaning the development of a set of systematic techniques, and accompanying practical knowledge for designing, testing and operating schools as educational systems" (p.6). As Chadwick (1973) points out this definition "emphasizes the broad process meaning of techniques for logically arranging things, activities or functions in ways that could be systematically observed, understood and transmitted" (p.81).

Finn, as long ago as 1960, championed the cause of educational technology when he wrote:

> The educationalist, in considering the effect of technology on the instructional process must remember that, in addition to machinery, technology includes processes, systems, management and control mechanisms both human and non-human, and above all...a way of looking at problems as to their interest and difficulty, the feasibility of technical solutions, and the economic values - broadly considered - of those solutions. This is the context in which the educator must study technology (p.8).

Finn clearly wanted to impress upon educationalists that their legacy was a triad consisting of humans, processes and machines.

Finn further stipulated that technology relates to education in the following three ways.

> First, in a society in which science and technology are primary...the society requires that the educational system ensures an adequate supply of scientists and associated technicians.... Second, as a society becomes more and more technologically oriented and controlled, the question of the general education of all citizens is raised.... Third, because of the tendency for technology to have no limits and constantly to extend into new areas, it is inevitable that, in an advanced technical society, technology should begin to extend into the instructional process itself (pp. 10-11).

Dieuzeide (1971) informs us of what an uphill battle educational technology has been waging in terms of receiving funding. Even in the U.S. where new techniques are more developed than anywhere else in the world "less than 4% of educational expenditure is devoted to educational materials, including textbooks, laboratories and teaching materials of every kind" ... (p.170). The reason for such low expenditure may be twofold. First, those who control the purse strings are not fully appraised of the impact new educational technology can have on education and secondly, teachers themselves may be afraid of embracing the new technology for fear of losing their jobs to machines.

MacKenzie (1970) lists the following barriers to innovation. Educational technology seeks admission into the education arena via its repertoire of hardware rather than seeking to illuminate how it would be beneficial to the student. This approach makes its benefits seem low and its costs high. The tradition of teacher training maintains the status quo structure and innovations fly in the face of this

formal structure. There is a deep seated suspicion on the part of educators that the new machines and their innovators have nothing to offer to human learning. Finally, the equipment is often poor in quality, expensive and not linked to curriculum needs.

Hunt (1977) points out that the instructional value of a mediating device lies not within the device itself but with those who bring the device to the classroom. It is how the teacher incorporates it into the classroom repertoire that makes the difference. In fact, Tobias (1966) Dodge et al (1974) found that teacher attitude to the media affected pupil performance.

Hunt (1977) defended teachers for not making more use of technological equipment by saying that they have neither the time to hunt for appropriate resources nor do they have quick and easy means to integrate the material into the classroom setting. Hunt also suggests a change in teachers' role to realize the potential of these learning resources. He suggests a shift from the traditional fountain of knowledge to that of a learning supervisor.

Dieuzeide (1971) maintained that the increased use of technological innovations in the primary classroom is due, for the most part, to the initiative of individual teachers. It is the teachers who feel comfortable with the new technology that bring it into the classroom in order to foster a new relationship between themselves and their pupils. He further

states that investigation has proven that these devices have helped "in clarifying concepts, stimulating group and individual activities, developing a collective critical awareness, changing attitudes, imposing a new structure or organization on certain subjects, and encouraging originality and creativeness" (p.171). This may have been the case when main frame computers were being used, but may no longer be true today since micro computers have been introducd into the classroom. Dieuzeide also suggests that teachers need not be apprehensive about the new technology because rather than instigating a decline in the teachers' role it frees the teacher from mundane mechanical tasks enabling her to devote herself to the irreplaceable functions of stimulation of interest, motivation and advice.

Blumenfeld et al (1979) provides us with an alternate view by stating that teachers were comfortable with the old technology because it provided them independence, self-sufficiency and autonomy. By contrast the new technology "makes teachers dependent and subordinate to computer operators, programmers, and machines" (p.187). The authors further stated that they found teachers to be unwilling to give up control of the teaching process. Teachers were willing to use computers for drills and practice material but were not interested in sending the students to some other part of the school to work with the computer. The teachers perceived this as losing control.

Hawkridge (1974) points out that "fundamental to any computer-managed learning system that attempts to match objectives and materials to learner characteristics and needs are analyses of each of these: learner characteristics and needs, learning objective, and learning materials" (p.33).

Rich (1983) points out that "the Canadian educational system, like most others, is struggling to come to grips with the impact computers are having on society" (p.167). He points out that although education is a provincial responsibility local school boards have a significant degree of discretion when it comes to the financing of education. As a result there is no true "national" educational policy. Rich further points out that although there is increasing use of computers in elementary schools they provide drill and practice and remedial work. He points out that computer assisted instruction is limited to a few projects and that this may be as much because of a lack of software equipment as from a lack of interest. Rich also points out that supporters of computer literacy and training believe that all students should receive this type of training because it is a basic skill needed to survive in business and industry. Rich goes on to say that "the final area which has seen significant provincial policy interest and much local activity is in teacher training relating to computers. All provinces have identified the lack of training of teachers in the use of computers in education as being a major issue" (p.171). The

province of Ontario, and perhaps others, have attempted to address this issue by providing computer courses as part of their teacher training curriculum.

Good computer software is relatively hard to find and as Dieuzeide (1971) pointed out this is because "it requires about one hundred hours of collective work by specialists to prepare one hour of programmed teaching material and anything up to two hundred hours of work by a team to produce one hour of computer teaching material" (p.180).

Locke (1970) reports that although education companies have produced most computer programming, they are not particularly suited to do so. He believes that this function should be undertaken by universities and/or by organizations devoted solely or largely to research. However, he does feel that industry has the capability to apply research findings to experimental product development.

Roblyer (1983) has examined the case of teacher-developed courseware and has concluded that there are both positive and negative reasons for teachers doing so. He feels that a lot of teachers are producing courseware simply because people expect them to be involved in this way. Furthermore, teachers producing their own courseware can save money and fill the courseware gap. On the other hand producing microcomputer programs is both a laborious and difficult activity "requiring a fairly high level of programming ability and several other kinds of expertise as well" (p.16). Roblyer argues therefore,

that many programs produced by teachers are of inferior quality. He further believes that because teachers work in isolation to create virtually the same product they are kept busy with reinventing the wheel.

Hartley (1985) believes that educational psychologists and teachers need to become more knowledgeable and provide more input into the design of computer software. Otherwise programs might be designed that take insufficient account of education and its goals and thus leave the equipment and techniques outmoded.

Stewin and McCann (1987) point out the pitfalls when the needs of the students are not identified or ignored when it comes to computer technology. Their concerns are twofold. First, is the needs of the technology itself. They are afraid that technology implementation will focus on the attributes of the technology itself and attempt to maximize the use of its unique characteristics. Stewin and McCann fear that this is tantamount to asking what can computers do best rather than dealing with what the educational system needs. Second, since computers can be used as management tools for monitoring and evaluating employees there is a danger that these needs will supersede the needs of students.

Hubbard (1976) argued that "there is very little evaluation or assessment of the impact of technology-based programs where they are now in operation" furthermore "virtually no validation of the materials is being performed"

(p.54). On the positive side, Hubbard felt that technology whould remove some of the cultural and economic barriers that spell inequality of education. He believes that by simply making higher quality materials more available their is the possibility for aiding the disadvantaged, compensating for learning disabilities, deprived home environments, and so forth.

Braun (1981) believes that the most important characteristic of the new computers is their price. He points out that the reduction of price now puts computers within reach of virtually every school board. Dede (1981) suggests that although there is an initial investment in the purchase of computers this will be off-set by allowing for higher student/teacher ratios with the machines assuming some of the responsibility of the teacher. Dede further believed that educational technology would not so much alter jobs as to shift employment to educational agents other than schools.

Waldrop (1984) suggests that the computer motivates students in the following ways. First, students have control over some aspects of the program. Second, students are rewarded by the use of the technology itself. That is they find the interaction rewarding. Third, students are extrinsically rewarded through peer group support and beliefs about the computer.

Brown (1986) tells us that the computer has been instrumental in ushering in a new social organization within

the classroom. He has extrapolated four main role models in the computer-related organization. These include the computer wizard, the computer hog, the team player and the computer catchup. Brown suggests that "the computer wizard has the highest status role and is recognized as a brain" (p.29). The wizard may not be a good student in other subjects but his/her expertise and intelligence is recognized by the other students when it comes to computer work.

The computer hog is also a good computer student, but as the name implies, likes to hog or dominate the keyboard and likes to work alone. Because the computer hog works in isolation he/she misses out on the student to student interaction and learning. Also the computer hog is often resented by other students.

The team player is one who is interested in working with others and works well with a partner. In a partnership what one partner doesn't comprehend the other frequently does and in the act of explaining the explainer learns too.

The final role model is the computer catchup who is always behind both in comprehension and knowledge. He/she is always begging for help and either the teacher or a team player comes to the rescue.

Salisbury (1984) suggests that before computer usage is implemented in the classroom the following questions must be asked (p.22).

1) What student performance gaps exist?

2) What functions need to be performed in order to close the student performance gaps?

3) What alternatives are available to perform the needed functions given existing constraints?

Eggers and Wedman (1984) fear that because the price of computers has gone down and because many schools have purchased computers for their classrooms many other schools suffer from the "computer band-wagon" syndrome. That is they purchase computers without having a specific purpose for them, their teachers are unfamiliar with computer operations, teachers have no concept of how to integrate computer technology into the curriculum/classroom and there is little awareness of the problems associated with computer usage. Eggers and Wedman believe that "no amount of price reduction will offset the loss resulting from unused (or poorly used) hardware and software" (p.28). They believe that schools can avoid low utilization by considering these preplacement questions.

1) What educational objectives will be served by the computers?

2) Which students will be served by the computers?

3) Which faculty member(s) will be responsible for computer utilization?

4) What additional resources (e.g. software, electrical outlets) will be required to best utilize the hardware?

5) What time commitment is needed to accomplish the objectives? (Eggers and Wedman, 1984:28)

Eggers and Wedman further suggest that where schools require students to interact with computers they also need to take

into account the amount of time students interact with each other. When measuring the computer competence of students the human interaction competence of students must also be monitored.

Bozeman (1984) in examining computer-based educational technology found that the higher the centralization of power the lower the rate of program change. Bozeman claims that centralization discourages individuals from being creative and innovative. He further claims that formalization negatively affects program change. Finally, Bozeman suggests that morale and job satisfaction among teachers are low and that this hinders the rate of program change. Since this is an American study it is difficult to say whether the same holds true for the Canadian counterpart. Canadian teachers do enjoy a better pay rate than their American colleagues and this alone may alter morale and job satisfaction significantly. Drawing on the results of several studies Bozeman delineates the factors in operation within schools that affect program change. He suggests that any major change is sensitive to budgetary control; that the principal is the key educational agent within the school; that a dynamic educational leader is a prerequisite for a significant educational change; most educational changes span several years; local schools do not engage in major changes in isolation but use as reference points larger educational organizations for ideas and resources and that schools that make successful change utilize

both systematic adoption and situational adaptation to implement the changes effectively.

Bear (1984) looked at the characteristics of effective teachers and how these could be transferred to effective use of computers. He found that effective teachers allocate more time for academic tasks and felt that academic computing time could likewise be a critical factor. Effective teachers matched the students' present achievement levels and the difficulty levels of their assigned tasks. Those students who experience high success rates have teachers who monitor each student's individual progress and provide feedback. Effective teachers maximized efficient learning environments. When integrating the computer into the classroom this means a number of things. First, "the physical arrangements for microcomputers must be conducive to learning and not distracting to others in the classroom" (p.13). Second, students should know what software they are to use and be skilled in operating the computer. Third, teacher assistance should be minimized. Finally, "a scheduling system should be employed that maximizes computer usage and minimizes classroom disruptions" (p.13). Bear suggests 15 minute sessions with usage predetermined by seating arrangements as optimal.

Sales (1985) examined the design considerations for a computer classroom. He pointed out that the special needs of a computer facility affect the "acceptance, use, teaching and learning" (p.7). Poor designs mean that teachers must modify

their instruction to accommodate the design while students may be cramped and need to twist and turn. Sales reminds us that the lighting, size and shape of the room are all significant and should be taken into consideration before setting up the equipment. Sales suggests that computer equipment should have its own circuit, that devices to protect equipment from irregular power supply be installed and that the number of electrical outlets be increased. Walls should be covered with low gloss finishes to reduce glare and overhead lighting should be recessed for the same reason.

Lees (1986) suggests that schools form a "central pool of equipment from which faulty equipment can be temporarily replaced while it is undergoing repair" (p.115). This would eliminate a lengthy disruption when problems arise and it would help ensure that teaching with computers would not be relegated to the periphery of the curricula.

Elder et al (1983) suggest that when teachers are siting the microcomputers they should ask themselves the following questions.

> Do I want to be able to see the screen from my desk? Do I want to shield the screen/pupils from the rest of the class? What are the major traffic patterns in the room? Would the micro get in the way? Are there any easily disturbed pupils? Ought I to change the seating in the class? Do I have room for a table to hold additional materials? ....Will the micro screen be in full sunlight? Can it be seen easily? (p.70)

Hoth (1985) has identified the areas for faculty development regarding the computer. First, teachers should

experience "hands-on" training to familiarize themselves with the basic operations and a variety of software. Second, teachers should learn the basic computer terminology. Third, they should be given instruction in defending against software piracy. Fourth, they should be introduced to the principles of instructional design and finally they should be taught "in various levels of computer application in instruction" (p. 39). Hoth believes all these components are necessary prerequisites for faculty members to be competent to teach with microcomputers.

Steffin (1983) has identified nine requisites of instruction which he feels should be provided within computer assisted instruction (CAI). These requisites are:

> providing for attention and motivation; providing the learners with instructional objectives; providing for the utilization and recall of prerequisite entry level skills; providing stimulus materials; providing learning guidance; eliciting performance on the part of the learner; providing feedback and confirmation to the learner; and providing for the retention transfer of learning to other events (p.20).

Hartley (1985) informs us that computer programs that merely give the correct answer are "little better than crude mechanical drills"... (p.142). He points out that for a program to be successful it must be able to "compose remedial tasks on-line from a pupil's errors"... (p.142). In other words it is not sufficient for a program to simply tell a pupil that the answer given is wrong it must be able to provide appropriate feedback to help the student attain the

right answer. It is the appropriate feedback that is motivating to the student.

Since this paper will be examining computer usage and student interaction the author did an extensive search of the literature to see what other researchers have found. A thorough search of the literature revealed that this area of research is uncharted territory. Only one piece of research could be found linking student interaction with computer useage, however, considerable scholarship exists that illuminates how and by what means interactions are influenced within the classroom setting.

For example, Huston and Carpenter (1985) suggest that male and female activities are predominantly defined and influenced by the culture in which they take place. That is both "boys and girls (on the average) play with toys and games that are culturally defined as appropriate for their gender" (p.144).

Wynn and Fletcher (1987) postulate that children seem to recognize what we consider to be traditional sex roles and that they consider these roles as binding. That is, children by themselves do not seek out androgynous activities or experiences. Wynn and Fletcher believe however, that educators can promote cross gender as well as a non-sexist curriculum. Speaking of this issue Wilkinson and Marrett (1985) inform us that:

> Much research proceeds from the assumption that gender inequalities and

> sex role stereotypes are likely to persist in the absence of cross-sex interaction...and given the long term significance of cross-sex interaction, it is perhaps not surprising that studies of peer interaction centre especially on the extent of sex segregation and the conditions under which it might be discouraged (p.7).

Cahill (1986) suggests that males and females learn and develop different interpersonal skills during their preschool years and Cahill attributes this to their self-imposed sex segregation.

Brophy (1985) expresses the view that a shift in research has occurred. The focus has now shifted from the poor reading performance of males to the under participation and under achievement of females in the fields of mathematics and science. Does this mean that researchers and perhaps educators alike feel that reading performance does not warrant as much attention as poor mathematics or science performance because it is not as important in the technological age? If so, what implications does such a perception have for teaching computer skills in the classroom?

Webb and Kenderski (1985) found that males were more successful in obtaining help and that females were more responsive than males in giving help.

Mackie (1987) suggests that in mixed sex groups males do more of the talking and are more likely to interrupt females.

Furthermore, males enjoy more status and influence than females.

In examining classroom interactions Morine-Dershimer (1985) informs us that she found that peer classroom interaction was "associated with classroom differences in instructional-management systems" (p.246).

Hollander (1981) suggests that there are four well established differences between the sexes. These consist of verbal ability (with females scoring higher) and visual/spatial, mathematical and aggressive activity (with males scoring higher). Although "aggressive activity" cannot be truly labelled an ability it never-the-less impinges upon academic and social performances.

Hollanders work prompted Nassr-Charlesbois (1990) to ask the following questions.

> a) Does the software encourage competitive or cooperative behavioral responses? and b) Do computer tasks give males an advantage over females because of presumed or real differences in visual/spatial and mathematical abilities? (p.37).

Blumenfeld (1983) pointed out that teachers may be operating with an imbedded gender stereotype which colours the teacher's conception of the student's role. That is teachers may unconsciously be biased towards thinking of computer tasks as being within the male domain.

Finally, Johnson (1981) points out that "most educational strategies are dominated by individualistic and competitive learning experiences" (p.5). This does not auger well for

pedagogical methods implementing expressive experiences. It seems likely that pedagogy would favour the instrumentally inclined individuals who are generally perceived as males.

The prevalence of computers in the classroom can no longer be ignored nor even taken for granted. We must recognize that there is a place for this tool and that it impacts on any organizational setting in which it is found. The physiology of any environment is altered once the computer is introduced. An organization must of necessity make decisions surrounding computer usage: how will the technology be obtained, where will it be located, who will use it and for what purpose.

CHAPTER III

Computer Education on the Micro Level of the Classroom

While the previous chapter examined some of the macro aspects of organization theory and how they may impinge on the individual classroom, this chapter will narrow the focus down to the micro level of the individual classroom setting. This chapter will focus on actual computer useage.

Since computers are being used ever more extensively in classrooms it behooves us to recognize their relevance in the education field. By now it is generally acknowledged by educators, school boards, parents and students alike that computers are a viable teaching tool. This technology deserves widespread careful consideration.

A wide range of studies has examined the impact of computers on the dynamics of interaction. Researchers recognize that computers affect dyadic couplings, group learning, choice of teaching methods and peer tutoring as well as classroom social interactions.

A substantial number of studies has examined the effectiveness of group learning. Among them, Sharon (1980), concluded that this method emphasized cooperation, eliminated competition and had a "more positive effect than whole-class instruction" (p.266). Lazarowitz et al (1980) and Ryan and Wheeler (1977) found that team learning eliminated unequal status interaction among students. Pupils' cooperative behaviour skills were shown to transfer to: their interaction

with their peers who were not members of the same learning team/setting and their behaviour in social situations not structured by the teacher (that is, in other than classroom settings). Webb (1982) concluded in her research on group behaviour that giving and receiving help are beneficial to achievement, and studies by Gall and Gall (1976) found that group members learn new information and can more easily reshape their ideas if they receive group feedback and are able to share resources. In a similar vein Hyleton and Quellmalz (1974) and McGee et al (1977) reported cognitive gains while Steinberg and Cozden (1979) have reported affective benefits for both tutors and tutees. Ellis and Rogoff (1982) and Rothenberg and Orost (1969) demonstrated the effectiveness of peer as compared to adult teachers.

Conceptualizing certain types of peer interaction, several authors have examined tutoring. Jason, Feorne and Soucy (1979) found that 50% of their subjects incorporated their tutoring skills during non-project times, suggesting that the tutoring skills had generalized to other settings.

In their study of conservation training, Rothenberg and Orost (1969) found that peer tutors could "communicate in more meaningful terms" and achieved better results than the adult experimental teachers. The researchers speculated that:

> the small age difference between the two children probably made it possible for the younger S to reasonably strive for something (i.e., conservation of number) attained by the older child in contrast to being presented only with adult expectations as the standard for achievement (p.723)

Christopolos (1973) and Lippitt (1969) have suggested that tutoring not only enriches the tutor's learning but that it fosters cooperative attitudes, thereby improving peer relationships. Harris et al (1972) found in their studies that the unstructured tutoring condition was superior to both the control group and independent study group conditions. Thelan (1969), in discussing the advantages of tutoring, listed a total of fourteen points, among them the enhancement of self-esteem of both tutors and tutees and establishing learning as a common goal.

An examination of the literature also identifies the importance of teacher's style as suggested by Paris and Morris (1985).

The early fears that classroom computers would reduce social interactions and produce a cohort of socially isolated introverts have proved unfounded. Recent studies by Piestrup (1981), Muller and Perlmutter (1983) and Paris and Morris (1985) indicate that positive social interaction occurs via computer usage in the classroom.

The importance of teacher training and preparation in promoting computer usage by students was demonstrated by Sheingold, Kane and Endreweit, 1983; Howe, 1970; Levin, 1982; and Miller, 1982. These researchers found that adequate teacher preparedness was a prerequisite for effectively utilizing the medium in classroom settings.

In their review of the literature, Lawton and Gerschner (1982) concluded that the computer's popularity as a teaching medium was due to the following children's perceptions. They found computers to: have infinite patience; never get tired; never get frustrated or angry; never forget to correct or praise; individualize learning; be self-paced; not embarrass students who made mistakes; give immediate feedback; and be impartial to ethnicity.

Hawkins et al (1982) also found that: computer screens can be more easily viewed by anyone in close proximity as compared to paper work on the desks and thus invite joint activity; children can observe what steps other children are employing to execute their programs and can judge by the outcomes whether to use the same system or opt for a new strategy; computers are a relatively new phenomenon and like a new toy at Christmas may capture the child's attention but only until the novelty wears off; children may rely on each other for help while they are all novices together but as soon as a certain level of expertise is reached they may decrease their collaborative efforts.

Condry and Keith (1983), in examining both the educational and recreational uses of computers, report that proponents of "computer based instruction" (CBI) such as Gerard (1967) and Lepper (1982), provide us with the following arguments on behalf of CBI. It provides more efficient, and at the same time more individualized learning; it provides

richer materials and more sophisticated problems; it allows personalized tutoring; it lessens drudgery and repetition; it provides automatic measurement of students' progress, it allows more time for meaningful personal contact between students and teachers.

Research demonstrating that peer teaching occurs through microcomputers has been carried out by Levin and Karee (1980), Papert et al (1979) Sheingold et al (1981) and it indicates that in each classroom a few pupils become expert resources to their peers.

A number of studies have focused on the computer impact on the social life of students in the elementary classrooms, including Hawkins et al (1982) and Sheingold, Hawkins and Char (1984). These studies all concluded that student/student interaction is different when occurring in conjunction with computer usage than when viewed within the framework of the regular classroom setting. All agreed that interaction is more frequent and spontaneous within the computer context.

Because students often share computers, interaction takes place of necessity and as Paris and Morris (1985) point out it is perhaps the social and physical context of the technological imperatives that foster cooperation and support.

No other technological tool in the classroom engenders as much interaction among students. Software packages often require the simultaneous participation of two students and

what one doesn't know the other does and is usually quick to be helpful with.

Research in Programmed Instruction (PI) and Computer Assisted Instruction (CAI) have demonstrated that the student variable of "personality" influences both interaction and achievement. Doty and Doty (1964) and Traweek (1964) found that the students who did poorly under the PI system were those who had intense social needs. Traweek found that the PI and CAI methods seemed most beneficial in transmitting learning when the student was a highly anxious subject. Traweek postulated that the impersonal teaching method helped to alleviate the students' anxieties. Along a similar vein Sutter and Reid (1969) found that when subjects scored low on test anxiety measures but high on sociability they scored better when using the computer in pairs.

An issue raised by Hawkins et al (1982) in regards to the dyadic composition of computer users suggests that careful attention must be given to student pairings, for if one student is very dominant the other may become passive and a large discrepancy in computer skills can occur between the two students. The teacher must be vigilant to organize her student pairings to eliminate or at least neutralize such detrimental interactions.

Burke (1986) in discussing the social organization around computers advocates equal opportunities when he says:

> There are always children who try to monopolize the equipment because of enthusiasm, interest and

> ability. The teacher must ensure that all children have equal opportunities to use these materials (p. 123).

Nemka (1987) reiterates the importance of pairing. He found that the work of the brighter children declined when they worked with a slower child rather than the slower child's work benefitting from the mixed pairing. He also found that the children were more frustrated in the mixed-ability pairs. Nemka did find however, that pairing increased on-computer time for the pupils.

Noyes and McAndrew (1968) have argued that our schools are run almost totally without reference to the needs of the population that they seek to serve. Instead, Noyes and McAndrew claim that the what, when and where of teaching is too often based upon the whims of administrators and the convenience of the schools.

In Ontario similar themes are echoed by Canadian scholars. The Ministry of Education, cognizant of the role computers may play in the future, commissioned several reports to learn more about this technology in the context of the classroom. The report by Larter and Fitzgerald (1983) identified salient variables and attempted to put them into perspective. The report by Carmichael, et al (1985) was the more ambitious of the two. Both reports were predominately impressionistic in that they relied on anecdotes and direct quotes to inform readers of the present situation vis-a-vis

the computer and students perceptions, interactions and accomplishments.

For example, Carmichael quotes a teacher as saying

> Social interaction is good. Pupils are really getting to know each other. They are starting to form respect for pupils based on the computer rather than other school activities....(p.78)

To say that "social interaction is good" tells the reader very little. Does the teacher mean that the quantity or quality of interactions have improved? Furthermore, without statistical analysis how can we be sure that it is the computer and not some other intervening variable that is raising the respect of pupils. Even if we assume that the teacher's observation is correct we find ourselves wondering just how much did the respect go up. Carmichael states that

> The computer activities, therefore, became a powerful medium for exploring social skills, communication skills, and problem solving skills based on real needs not on hypothetical situations that had no bearing on the students' immediate interests.(p.80)

This statement opens up a Pandora's box of possibilities. For instance, in the area of problem solving skills we are not informed whether these skills pertain to solving a mathematical equation, learning how to complete a sentence or the logistics of who will use the computer first.

Carmichael (p.82) took a brief look at computer partnerships and stated that "Most partnerships, at all grade levels, tended to be of the same gender. Boy-girl partnerships that did exist tended to be of short duration"

She reported that the six students who were asked, gave the following reasons for this phenomenon: that the boys were computer hogs, that the boys wanted to do "boy stuff" and they ignored their girl partners or called them crazy when they made suggestions. While a trend seems to be developing in the answers, the sample is small and further exploration in this area, including statistical analysis to substantiate or refute students' claims, would have afforded a valuable tool to teachers, who because of limited computer availability, must of necessity pair students.

Carmichael claimed that one variable that had an impact on the general confidence level of students was "the manner in which access to the computers was arranged" (p.104). She cites a number of different arrangements but apparently felt no need to pursue this issue further vis-a-vis which arrangement seemed best. Yet earlier in her report she had alluded to teaching style as an important component of classroom organization. Since teachers want to maximize their impact on students it is important for them to know which method of computer access is best.

Although Carmichael whets the appetite by parading numerous variables before us she leaves the reader dangling because of her failure to follow through and reach some definitive conclusions.

Rosen and Waniewicy (1982) reporting on the Provincial Committee on Computers in Education established by the Ministry of Education found that the rapid growth of computers in classrooms necessitated first, the need for establishing methods of indexing, cataloguing and evaluating educational software. Second, they established that there is an unmet need of suitable standards for both software and hardware and finally the need to support software specially designed for Ontario schools.

These same authors in a second study Waniewicy and Rosen (1982) found that schools are experiencing a number of problems with computer usage. Among them, mechanical problems resulting from too many students using too few computers resulting in the micros being out of the classroom for extensive periods of time. Teachers felt that a micro for every two students would be ideal. They were concerned that the shortage might cause some teachers to give up in frustration. Teachers also felt that funding for microcomputers was difficult to obtain because some administrators, trustees and parents were not convinced that micros are a valid teaching tool. Teachers also complained that at the elementary level only 25% of the classrooms have access to a printer. Also at the elementary level 70% of the teachers have difficulty finding suitable software.

All of the above mentioned research demonstrates in one way or another that computers are indeed impinging on the

classroom setting and on the students utilizing this modern technological equipment. After having reviewed the literature this author decided to pursue an area that has not been touched upon in any of the preceding research, namely the link between student popularity as demonstrated by sociometric choices and actual interactions. Accordingly the following hypotheses were formulated.

Hypothesis 1: The children who were chosen on the sociogram as being the ones the other students will turn to for help on the computer will be asked for help most often with computer assignments.

Hypothesis 2: The children who were chosen on the sociogram as being the ones the other students would play with during and after school will be chosen more often than others as helpers on computer assignments.

CHAPTER IV

Methodology

The above criticisms constituted the point of departure for this paper. In the context of the larger study by Ehrentraut, Signorile and Stewart, videotaping of student interaction while using computers was undertaken at a county school.

This particular school was chosen because the classroom environment was significantly different from other classrooms. While in other classrooms the teacher allowed the students to use the computer as a reward or for having completed their desk work early, this teacher ensured that all her students received time at the computer by making computer usage compulsory. This strategy has implications for organization theory in that it presents a different setting in which the various interactions take place. In this setting every student was given the opportunity to hone skills while in other classrooms only the quickest or brightest students had this chance.

As mentioned previously, computer usage was compulsory for all grades one and two students. Information on sociometric choice and interaction was obtained.

The computers were situated on one side of the classroom in a bank. The consoles were placed high enough so that the students needed to stand up to access them. Students were sent in pairs to designated computers and worked on their

project till completed. A microphone was attached to one of the computers to pick up the students' conversations.

The pool of students consisted of 17 grade ones and 15 grade twos. There were 13 males and 19 females. Seven males and five females had computers in their homes. The teacher's evaluation of computer competency for each student was based on use of equipment, level of interest and number of finished products produced. Nine students were reported to have very good use of the equipment, thirteen had good use and the remaining ten students had satisfactory use. Eleven students were found to have a high interest level, seven had a medium high level, eleven had a medium level and three had a low interest level.

Students could interact with their immediate neighbours on their right and left from where they stood in front of their console. If they wished, they could walk over to one of the other consoles and interact with the students there. Students were encouraged to help one another whenever they could. The teacher made short periodic checks to offer words of encouragement or advice. One student was often recruited by other students to act as a peer tutor. The teacher also requested this pupil to help other students on a number of occasions.

Students accessed the keyboard on the assigned days until each individual student had completed his/her assignment. Filming was therefore done on a continuous basis for each

filming segment until all students had finished their computer assignment. Thus on each day's filming, every student appears once while working on his/her project, but may appear at other times, if recruited by other students for help. Filming was done on seven different occasions from January, 1987 to June, 1987.

Filming was done from behind and slightly to the side of the bank of computers by one of two graduate students. Each filming segment was differentiated from previous ones either by voicing over the date and time on the film or by filming a hand held sign that stated the date and time. On a number of occasions students were asked to hold the date/time sign to be filmed and at other times the sign was taped to one of the consoles and then filmed.

At the beginning, there were instances of both inhibited and exhibitionistic behaviour because of the camera presence. These responses were balanced out over time as the students habituated to the situation so that they were judged to be a sufficiently reliable and valid record of task performance and interaction rates. The filmed record will be analyzed in terms of the number of interactions that took place.

A one page sociometric questionnaire was administered to each of the students individually after all videotaping sessions had been completed. Because four students were absent from class that day a total of 28 questionnaires out of a possible 32 were obtained. The questions asked the students

who they played with during and after school, who they liked to sit next to, who they wanted to work with on the computer and who they would go to for help on the computer.

The independent variable of social status was then obtained by counting how often a child was chosen by peers in the classroom. These sociometric choices are conceptualized as indicators of the patterns of interaction and friendship as delineated by Homans (1974).

The dependent variable to be examined is "interpersonal interactions". These interactions are subdivided into the three categories of "helping", "mutually helping" and "being helped" behaviour. The schema was codified and used to quantify the independent variable.

Although the interpersonal interactions were conceptualized as falling into the above mentioned three categories, a review of the video tapes has illustrated the necessity of adding a fourth category, "seeking help." Although at first glance one might reason that seeking help is the other side of the coin "being helped," an inspection of the tapes revealed that this was not always the case. There were numerous instances where a student sought help but did not receive it, thus that interaction sequence would be lost if it was not categorized as a separate entity.

The author compared relationships between the dependent variables and independent variable while controlling for gender and grade.

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CHAPTER V

Findings

Prior to presenting quantified data it seems appropriate to present a description to help the reader visualize the types of interactions that took place. The children are given pseudonyms to protect their identity. On this illustrative occasion the children are busy transcribing a story they have written on a sheet of paper. Four computers are in use simultaneously with one child at each. Two males and two females are using the computers and interacting with each other. Kevin is on computer one, Stephanie on computer two, Charlie on computer three and Mary on computer four. Part way through this scenario a third male, John, is assigned by the teacher to help one of the males who is lagging behind in his work. Lena replaces Mary on computer four part way through this scenario after Mary has completed her work.

Stephanie pulls Kevin by the arm over to the computer and manipulates a few keys for him. She then steps over to her own computer and Kevin begins to work with the keyboard.

Mary is stumped and after looking at her screen for awhile decides she needs help. She calls fairly loudly, "Stephanie." Stephanie leaves her computer and goes to Mary. She looks at the screen then manipulates a few keys. This seems to have gotten Mary back on track and as Stephanie leaves she again works the keyboard.

Charlie then taps Stephanie on the shoulder and says, "He makes a big arrow." Charlie makes a noise like a fire engine and says, "Five, four, three, two, one. Blast off! Blast off!" Charlie then says, "I'm not even done yet." Charlie manipulates a few keys, shifts from one foot to the other and looks around. He leans over to watch Stephanie at work and then goes back to manipulating his own keys. Stephanie leans over Charlie's computer and unasked manipulates a few keys. Charlie asks no one in particular, "Do we skip lines, cause this skipped. What should I do?" Mary leans over and explains something inaudible to Charlie about the paper he is holding in his hand. Charlie says, "I'm on number 14." Mary leans over to look. Charlie says to no one in particular, "I'll have to bring it all the way down. How did I get it all the way up there? I'll put it all the way up there. Now I'll put it down. Neat, eh." Mary shifts to one foot and watches Charlie.

The teacher comes along and checks the childrens' work. She stops at Charlie's computer and says to John who has been assigned to help. "What he needs to do here is explain how the fish got into the water." John who is now standing behind Charlie tells him how to spell the word fish. "F - I - S - H." John takes Charlie's paper and reads it. He then begins to spell out the next word Charlie needs in his sentence. "F - E - L - L." Mary calls out, "Stephanie" and the two of them go over to the printer. John continues spelling for Charlie

and Charlie hits the appropriate keys. "W - A - T - E - R." John spells the word "I - T." Charlie asks, "It?" John says, "Finger space." John continues with the spelling by spelling "W - H - E - N." Charlie repeats the letters as he hits the keys "W - H - E - N."

Mary comes over and whispers something into Stephanie's ear and Stephanie goes over and manipulates Mary's keyboard. Stephanie then goes back to her own computer and Mary carries on at hers. Charlie asks John, "Am I done?" Charlie tells Stephanie, "I did all this." Kevin comes over to Charlie's computer and runs his fingers along the sentences on the screen as he reads and then returns to his own computer. Charlie says, "Return." John says, "Oh, ya, stupid me I goofed."

John asks Kevin, "Do you need any help with this?" Kevin ignores John and continues to manipulate his keyboard. John points to the screen and reads what Kevin has typed.

Charlie crumples his paper and gives John a tug on his arm. John looks to see what Charlie's problem is and spells "A - L - L." Charlie types as John spells. John says to Charlie, "Spell that. It's right on your paper. Make it all go backwards then erase it all." Charlie manipulates the keyboard and says, "I've erased it all." John checks Charlie as he types and says, "No, no don't erase that. Put a period right there."

At this point Charlie decides to play with the microphone taped to the top of his computer. Lena who now occupies the computer on his right hits him on the arm. John looks at Charlie's work and asks in resignation, "Are you finished Charlie?" Charlie responds with "Where do I put my period?" Lena leans over and puts the period in for Charlie. John asks Lena, "What are you forcing him to do?" Lena answers defiantly "nothing." Charlie pulls John by the arm and makes an attempt at explanation, "It all began when ...." John walks away before Charlie has finished his explanation so Charlie pulls him back by the arm with his plea, "Help me." Charlie says in dismay, "I'm not even touching it and its moving." John manipulates the keyboard while Charlie talks to Lena. John says with satisfaction, "O.K. I've put the period right there." Charlie looks at the screen and exclaims, "There are two periods." The teacher comes back to check the children's work and suggests to Charlie, "Tell how he got to the lake or river to go fishing."

The students continue to interact this way until each has completed his or her assignment. Upon completion of their assignments the students return to their seats and other students come up to the computers to work on their project. The teacher makes several forays into the computer area to offer words of encouragement and advice.

This description illustrates examples of helping as when John spelled out a word for Charlie, of seeking help as when

Charlie pulled John by the arm to get his attention. An example of being helped occurred when Stephanie manipulated a few keys for Mary. There was no example of mutually helping in that segment of the videotape that was reviewed for this purpose because this type of interaction occurred infrequently.

For coding purposes, an interaction was thus defined as helping when either verbal suggestions or physical manipulation of the keyboard took place. Likewise, mutually helping was considered to have occurred when these interactions were reciprocal in nature. Seeking help was defined by a verbal question or by any other means of securing the student's attention, such as a gesture, for the purpose of receiving help. All instances of interaction were coded into one of the four categories of "helping", "being helped", "seeking help" or "mutually helping". The individual categories were divided into time frame durations ranging from 5 seconds to 20 minutes. The length of the time frames was extrapolated after viewing the videotapes themselves. The author originally felt that the length of interactions might be of some value but this did not prove to be the case because it was simply the type of interaction that proved significant. A check mark was placed in the appropriate square for each interaction and was then counted to obtain the actual interaction frequencies.

Student Interactions

The study attempted to test the relationship between sociometric popularity and actual interaction. As will be recalled, it was hypothesized that the children who were chosen most often on the sociogram would also be chosen most often as helpers on computer assignments.

All the tables reporting on the hypothesized relationships have had their interaction frequencies collapsed so that the reader can see at a glance just what the table is attempting to explain. The actual frequency distributions will be found in Appendix A. Because of the wide range of scores between tables, tables 1 to 4 had their scores collapsed individually. The collapsing methodology will be explained previous to each table.

Table 1, which reports the frequencies for seeking help from other children had its range collapsed in the following way. Low levels consisted of 0-2 interactions, medium from 3-7 and high from 8-22. This table demonstrates that over half of the students, 56.3%, scored low in seeking help behaviour while approximately one third scored in the medium range and less than 10% scored in the high range.

Table 2, which reports the frequencies for students helping each other, had its range collapsed as follows: low interactions consisted of 0-6 instances, medium from 7-20 and high from 21-110. This table shows that almost two thirds, 62.5% of the students scored low in helping others while an

equal percentage of students had a medium or high score in this category.

Reporting on "Being Helped Interactions" Table 3 had its range collapsed according to low equals 0-9 instances, medium 10-18 and high from 19-38. This table demonstrates that exactly half the students scored low in being helped while the remainder fell into the medium and high categories.

Table 2," Helping", and Table 3," Being Helped", indicate that just over 18% of the students scored high on these two dimensions. Yet, Table 1 reveals that just over 9% of the students scored high on seeking help, which indicates that sometimes students were given help even if they had not sought it, as was already illustrated in the thick description.

Table 4, reporting the frequency of students being mutually helpful shows only two types of responses. Low interactions consisted of zero interactions and the medium range consisted of 1 interaction. This table indicates that the majority of the students, 75.0%, fell into the low range of mutually interacting with the remaining students falling into the medium range. There were no high interaction scores.

Tables 1 through 3 indicate that approximately half of the students scored low on the interactions while Table 4 had the majority of students scoring low. These tables indicate that although interactions took place they were not of a high frequency.

While Tables 1 through 4 dealt with the interaction frequencies, Tables 5 through 9 look at the responses to the sociometric questionnaire.

These latter tables again show frequencies collapsed into the following categories. None indicated 0 selections, few equalled 1 to 2 selections and several indicated 3 to 4 selections.

Table 5, reporting on who the children would play with at recess shows that almost half of the children were never chosen for play, while also almost half were chosen a few times, with the remainder falling into the "several" category.

Table 6, reporting on who the children played with after school, indicates that slightly over half of the children were never chosen as playmates, while approximately one third were chosen a few times and the remainder several times.

Table 7, reporting on who the children would like to sit next to, shows that over half of the students were never so chosen, while approximately 40% were chosen a few times. Only two students were chosen several times.

Table 8, reporting on who the children liked to work with on the computer, shows that almost half of the students were never chosen to work with on the computer while almost half were chosen a few times. The remaining two students were chosen several times.

Table 9 had its selection frequency collapsed into the following ranges. None meant 0 selections, few meant 1 to 3 selections and several meant 4 to 15 selections. This table had its frequencies collapsed independently from the other tables because its "several" category had a considerably higher frequency range than the other distributions. Table 9, reporting on who the children would go to for help, demonstrates that almost three-quarters of the students were never chosen as being asked for help on the computer. One quarter of the students were chosen a few times and only one student was chosen several times.

The popularity score for Table 10 was obtained by adding all the responses for each student for the five sociometric questions. The frequency selection was collapsed in the following way. None meant 0 selections, few meant 1 to 3 selections and several meant 4 to 27 selections. The" several" category encompasses such a wide range of scores because there were numerous empty cells at the low end of this category. Table 10 showed that a little under one quarter of the students were never selected while the majority, almost three quarters, were selected a few times, with only two students being selected several times.

In general the pattern of response for Tables 5 through 8 indicated that approximately half of the students were never selected. This rose to almost three quarters of the students not being selected in Table 9. The reason for non selection

being considerably higher in Table 9 was that one student was selected by almost half of the class. In Table 10 where the sociometric information was combined, the "none" category dropped to approximately one quarter of the students, indicating that selection was made for a variety of reasons.

Table 1: Seeking Help Interactions

Levels of interaction	N	%
Low	18	56.3
Medium	11	34.4
High	3	9.3
	32	100.0

*For the raw frequency distribution see Appendix A

Table 2: Helping Interactions

Levels of interaction	N	%
Low	20	62.5
Medium	6	18.75
High	6	18.75
	32	100.0

*For the raw frequency distribution see Appendix A

Table 3: Being Helped Interactions

Levels of interaction	N	%
Low	16	50.0
Medium	10	31.4
High	6	18.6
	32	100.0

*For the raw frequency distribution see Appendix A

Table 4: Mutually Helping Interactions

Levels of interaction	N	%
Low	24	75.0
Medium	8	25.0
High	--	--
	32	100.0

*For the raw frequency distribution see Appendix A

Table 5: Of All The Children In The Class, Who Do You Play With Most At Recess?		
Selection frequency	N	%
None	15	46.8
Few	15	46.8
Several	2	6.3
	32	100.0

*For the raw frequency distribution see Appendix A

Table 6: Of All The Children In The Class, Who Do You Play With Most After School?		
Selection frequency	N	%
None	19	59.4
Few	10	31.3
Several	3	9.3
	32	100.0

*For the raw frequency distribution see Appendix A

Table 7: In Class, Who Would You Like To Sit Next To Most?		
Selection frequency	N	%
None	17	53.2
Few	13	40.5
Several	2	6.3
	32	100.0

*For the raw frequency distribution see Appendix A

Table 8: Who Do You Like To Work With Most At The Computer?		
Selection frequency	N	%
None	15	46.9
Few	15	46.9
Several	2	6.3
	32	100.0

*For the raw frequency distribution see Appendix A

Table 9: If You Needed Help At The Computer, Who Would You Ask Or Get Help From Most?

Selection frequency	N	%
None	23	71.9
Few	8	25.0
Several	1	3.1
	32	100.0

*For the raw frequency distribution see Appendix A

Table 10: Popularity Score		
Selection frequency	N	%
None	7	21.9
Few	23	71.8
Several	2	6.3a
	32	100.0

*For the raw frequency distribution see Appendix A

The next step in the analysis sought to establish three distinct categories of popularity. The previous sociometric data were therefore summarized into an expressive and an instrumental score and a combination of these two into an overall popularity score. Resultant frequency distributions were collapsed into three selection categories of" none", "few" and "several" because there were so many empty cells at the high end of the scales. These are reported in Tables 11 through 13.

The expressive dimension was collapsed according to, 0 equalling non selection, few consisting of a selection frequency of 1 to 4 and several consisting of a selection frequency of 5 to 8.

The first of these, Table 11, dealing with the expressive dimension of choice, combines the three questions asking: " Of all the children in the class, who do you play with most after school?"; " Of all the children in the class, who do you play with most at recess?"; and "In class, who would you like to sit next to most?" The table shows that almost one third of the students were never selected, with a little more than half being selected a few times, while the remainder were selected several times. A possible reason why so many students fell into the "none" category of being chosen may be that since these students lived in a rural area, their classmates may

have lived too far away from them to be playmates after school.

Table 12 combines the responses to the questions "Who do you like to work with most at the computer?" and" If you needed help at the computer, who would you ask or get help from most?" These two questions were combined in an effort to gauge the instrumental aspect of the sociometric data. The instrumental dimension was collapsed according to 0 equalling non selection, few consisting of 1 to 5 selections and several consisting of 6 to 19 selections. The table reveals that over one third of the students were never selected while over half were selected a few times. Only 3.1%, or one student was selected several times. This phenomenon expresses the reality that one student had been assigned by the teacher to be a roving helper and consequently this student was most frequently asked for help.

Table 10 combined the expressive and instrumental elements of the sociometric data into the overall popularity score. The popularity scores were collapsed according to 0 equalling non selection, few consisting of a selection frequency of 1 to 8 and several consisting of a selection frequency of 9 to 27. This table showed that even when the elements are combined approximately one quarter of the students were never selected while slightly under three quarters were selected a few times. The results of this table suggest that students did not make their choices by picking

peers strictly according to the expressive or instrumental categories. Students apparently felt both categories were of importance when it came to making choices.

Table 11: Expressive Scores		
Selection Frequency	N	%
None	10	31.3
Few	18	56.2
Several	4	12.5
	32	100.0

*For the raw frequency distribution see Appendix A

Table 12: Instrumental Scores		
Selection Frequency	N	%
None	12	37.5
Few	19	59.4
Several	1	3.1
	32	100.0

*For the raw frequency distribution see Appendix A

Using information from the previous tables a number of Analysis of Variance Tables were run to establish the amount of variance due to the different tested variables. The first six tables examined the expressive and instrumental dimensions as well as the overall dimension of popularity and then looked at these same dimensions after recoding. The independent variables utilized were, grade level, gender, and possession of home computer.

It will be recalled that it was hypothesized that interactions would be influenced by both expressive and instrumental popularity. To test these hypotheses, analyses of variance were run on the interactions, using the same aforementioned variables together with the expressive, instrumental and overall popularity variables.

All the analysis of variance tables have been summarized for ease of reading. The full ANOVAs can be found in Appendix B.

Table 13, the Summary of Analysis of Variance in Popularity Scores, showed that grade level was significant at the .022 level. Both gender and possession of home computer were insignificant but when the two were combined they were slightly significant at the .046 level. The total explained variance was significant at the .037 level and the multiple R squared showed that the variables accounted for 22% of the variance in the popularity score.

Both the expressive and instrumental dimensions as well as the overall popularity scores were collapsed from the raw scores and recoded into the three categories of " none", "few" and "several" and then run against the interactions.

Table 14, the Summary of Analysis of Variance in Recoded Popularity Scores, indicated that grade level was again slightly significant with a p of .009. In this table, neither gender and possession of home computer, nor the combination of these two variables, proved to have any significant influence. However, the total explained variance was more significant at the .025 level. The multiple R squared indicates that the variables accounted for 31% of the variance, up from the 22% in the previous table.

The Summary of Analysis of Variance in the Expressive Dimension as reported in Table 15 demonstrates that grade level was just barely significant at the .047 level. None of the other variables proved significant and the multiple R squared demonstrated that the variables accounted for only 16% of the variance in the expressive scores.

Table 16, Summary of Analysis of Variance in Recoded Expressive Dimension indicates that grade level was now highly significant at the .005 level. Although none of the other variables was significant, the total explained variance was now quite significant at the .021 level. The recoding thus doubled the multiple R squared, which now shows that the

variables accounted for a substantial 31% of the variance in the recoded expressive scores.

Table 17, Summary of Analysis of Variance in Instrumental Dimension demonstrates that grade level is again significant, this time at the .024 level. None of the other variables was significant and the total explained variance just missed being significant at the conventional .05 level. Still, the multiple R squared indicates that the variables together accounted for 22% of the variance.

Table 18, Summary of Analysis of Variance in Recoded Instrumental Dimension indicates that recoding has created a substantial difference in the significance of grade level. It was now highly significant at the .002 level. While none of the other variables became significant, recoding increased the total explained variance to .035 level. Recoding has also increased the multiple R squared, which shows that the variables now accounted for 31% of the variance.

Overall, the two instrumental analyses of variance explained slightly more of the variance than the expressive ANOVAs, an indication perhaps that the students made their sociometric choices slanted towards the instrumental portion of the sociometric questionnaire. A more likely explanation is that one student skewed the results. As already mentioned, this one student was chosen more often than all the other students combined for the question "If you needed help at the computer, who would you ask or get help from?"

In tables 13 through 18, grade level was always significant. Conversely, gender and possession of home computer were never significant and the interaction between gender and home computer was just barely significant once.

Tables 19 to 21, the Summary of Analysis of Variance in Seeking Help Interactions with the popularity scores and recoded expressive and instrumental dimensions, shows that none of the variables was significant. The total explained variances in each table were also not significant. Not surprisingly, the multiple R squared showed that the variables accounted for 16%, 12% and 12% of the variance in seeking help behaviour respectively. Thus none of the background variables, including gender, appeared to have any noticeable effect on this form of behaviour.

The Summary of Analysis of Variance in Helping Interactions With Popularity Scores Recoded as reported in Table 22, indicated that grade level was significant at the .015 level. Again none of the other variables was significant but the total explained variance was significant at the .037 level. The multiple R squared indicates that the variables accounted for 36% of the variance in helping interactions.

Table 23, Summary of Analysis of Variance in Helping Interactions With Expressive Dimension Recoded shows that grade level was significant at the .024 level. None of the other variables was significant but the total explained variance was highly significant at the .008 level. The

multiple R squared shows that the variables accounted for a very substantial 43% of the variance in helping interactions.

The Summary of Analysis of Variance in Helping Interactions With Instrumental Dimension Recoded as reported in Table 24 demonstrates that grade level was barely significant at the .046 level. None of the other variables was significant but the total explained variance was significant at the .014 level. The multiple R squared indicates that the variables accounted for a substantial 39% of the variance in helping interactions.

Tables 22 through 24, examining the helping interactions, demonstrate that grade level was significant in all three tables. However, none of the other variables, nor the interactions between them was significant, thus indicating that popularity whether measured as expressive, instrumental or overall popularity, had little effect on the actual incidence of helping.

Table 25, Summary of Analysis of Variance of Being Helped Interactions With Popularity Score Recoded indicated that grade level was very highly significant at the .001 level. None of the other variables proved significant but the total explained variance was significant at the .016 level. The multiple R squared shows that the variables accounted for a very substantial 44% of the variance in being helped interactions.

The Summary of Analysis of Variance in Being Helped Interactions With Expressive Dimension Recoded as reported in Table 26, shows that grade level was very highly significant at the .000 level. None of the other variables was significant, however, the total explained variance was very significant at the .006 level. The multiple R squared indicates that the variables accounted for a very substantial 45% of the variance in being helped interactions.

Table 27, Summary of Analysis of Variance in Being Helped Interactions With Instrumental Dimension Recoded showed that grade level was extremely significant beyond the .001 level. None of the other variables was significant, however, the total explained variance was significant with a p of .005. The multiple R squared indicated that the variables accounted for a substantial 45% of the variance in being helped interactions.

Tables 25 through 27 show that grade level was highly significant. However, none of the other variables was significant with the multiple R squared hovering around the 45% mark in all three tables. Thus it can be concluded that popularity, no matter how it was defined did not play a large part in being helped interactions.

The last three tables, tables 28 to 30, looking at Summary of Analysis of Variance in Mutually Helping Interactions with the different variables of popularity score recoded, expressive dimension recoded and instrumental

dimension recoded, revealed that none of the variables nor the total explained variances was significant. The multiple R squared were 5%, 3% and 7% respectively, indicating that the variables accounted for a fraction of the variance in mutually helping interactions.

Overall, the variable that was most frequently significant was grade level, being significant in 11 out of 18 ANOVAs. Surprisingly, neither popularity score, expressive dimension nor instrumental dimension proved significant in any of the interaction ANOVAs.

Furthermore, neither did gender nor possession of home computer prove significant . The total variance explained by all the independent variables together varied widely from a compelling .006 to an ineffectual .637. Likewise, the multiple R squared ranged from a weak 3% to a substantial 45%.

Table 13: Summary Analysis of Variance in Popularity	
Variables	Significance of F
Grade level	.022
Gender	.639
Possession of home computer	.198
Gender/possession interaction	.046
Total explained variance	.037
Multiple R squared	.222

For the complete Analysis of Variance Table see Appendix B.

Table 14: Summary Analysis of Variance in Recoded Popularity Scores

Variables	Significance of F
Grade level	.009
Gender	.327
Possession of home computer	.293
Gender/possession interaction	.150
Total explained variance	.025
Multiple R squared	.313

For the complete Analysis of Variance Table see Appendix B.

Table 15: Summary Analysis of Variance in Expressive Scores

Variables	Significance of F
Grade level	.047
Gender	.360
Possession of home computer	.903
Gender/possession interaction	.214
Total explained variance	.167
Multiple R squared	.159

For the complete Analysis of Variance Table see Appendix A.

Table 16: Summary of Analysis of Variance in Recoded Expressive Scores

Variables	Significance of F
Grade level	.005
Gender	.081
Possession of home computer	.719
Gender/possession interaction	.280
Total explained variance	.021
Multiple R squared	.308

For the complete Analysis of Variance Table see Appendix B.

Table 17: Summary of Analysis of Variance in Instrumental Scores

Variables	Significance of F
Grade level	.024
Gender	.421
Possession of home computer	.153
Gender/possession interaction	.144
Total explained variance	.060
Multiple R squared	.215

For the complete Analysis of Variance Table see Appendix B.

Table 18: Summary of Analysis of Variance in Recoded Instrumental Scores

Variables	Significance of F
Grade level	.002
Gender	.784
Possession of home computer	.627
Gender/possession interaction	.830
Total explained variance	.035
Multiple R squared	.308

For the complete Analysis of Variance Table see Appendix B.

Table 19: Summary of Analysis of Variance in Seeking Help Interactions With Popularity Scores Recoded

Variables	Significance of F
Grade level	.251
Popularity Score Recoded	.559
Gender	.805
Possession of home computer	.334
Gender/possession interaction	.283
Total explained variance	.378
Multiple R squared	.159

For the complete Analysis of Variance Table see Appendix B.

Table 20: Summary of Analysis of Variance in Seeking Help Interactions With Expressive Scores Recoded	
Variables	Significance of F
Grade level	.252
Expressive Dimension Recoded	.876
Gender	.845
Possession of home computer	.283
Gender/possession interaction	.264
Total explained variance	.446
Multiple R squared	.117

For the complete Analysis of Variance Table see Appendix B.

Table 21: Summary of Analysis of Variance in Seeking Help Interactions With Instrumental Scores Recoded

Variables	Significance of F
Grade level	.202
Instrumental Dimension Recoded	.825
Gender	.911
Possession of home computer	.279
Gender/possession interaction	.252
Total explained variance	.446
Multiple R squared	.115

For the complete Analysis of Variance Table see Appendix B

Table 22: Summary of Analysis of Variance in Helping Interactions With Popularity Scores Recoded

Variables	Significance of F
Grade level	.015
Popularity Score Recoded	.776
Gender	.142
Possession of home computer	.152
Gender/possession interaction	.285
Total explained variance	.037
Multiple R squared	.364

For the complete Analysis of Variance Table see Appendix B.

Table 23: Summary of Analysis of Variance in Helping Interactions With Expressive Scores Recoded	
Variables	Significance of F
Grade level	.024
Expressive Dimension Recoded	.134
Gender	.065
Possession of home computer	.135
Gender/possession interaction	.640
Total explained variance	.008
Multiple R squared	.428

For the complete Analysis of Variance Table see Appendix B.

Table 24: Summary of Analysis of Variance in Helping Interactions With Instrumental Scores Recoded	
Variables	Significance of F
Grade level	.046
Instrumental Dimension Recoded	.146
Gender	.178
Possession of home computer	.230
Gender/possession interaction	.362
Total explained variance	.014
Multiple R squared	.386

For the complete Analysis of Variance Table see Appendix B.

Table 25: Summary of Analysis of Variance in Being Helped Interactions With Popularity Scores Recoded

Variables	Significance of F
Grade level	.001
Popularity Score Recoded	.704
Gender	.390
Possession of home computer	.776
Gender/possession interaction	.625
Total explained variance	.016
Multiple R squared	.444

For the complete Analysis of Variance Table see Appendix B.

Table 26: Summary of Analysis of Variance in Being Helped Interactions With Expressive Scores Recoded

Variables	Significance of F
Grade level	.000
Expressive Dimension Recoded	.225
Gender	.286
Possession of home computer	.684
Gender/possession interaction	.714
Total explained variance	.006
Multiple R squared	.445

For the complete Analysis of Variance Table see Appendix B.

Table 27: Summary of Analysis in Being Helped Interactions With Instrumental Scores Recoded

Variables	Significance of F
Grade level	.000
Instrumental Dimension Recoded	.321
Gender	.180
Possession of home computer	.782
Gender/possession interaction	.578
Total explained variance	.005
Multiple R squared	.447

For the complete Analysis of Variance Table see Appendix B.

Table 28: Summary of Analysis of Variance in Mutually Helping Interactions With Popularity Scores Recoded

Variables	Significance of F
Grade level	.817
Popularity Score Recoded	.769
Gender	.516
Possession of home computer	.589
Gender/possession interaction	.112
Total explained variance	.550
Multiple R squared	.052

For the complete Analysis of Variance Table see Appendix B.

Table 29: Summary of Analysis of Variance in Mutually Helping Interactions With Expressive Scores Recoded

Variables	Significance of F
Grade level	.579
Expressive Dimension Recoded	.930
Gender	.715
Possession of home computer	.640
Gender/possession interaction	.124
Total explained variance	.637
Multiple R squared	.031

For the complete Analysis of Variance Table see Appendix B.

Table 30: Summary of Analysis of Variance in Mutually Helping Interactions With Instrumental Scores Recoded

Variables	Significance of F
Grade level	1.000
Instrumental Dimension Recoded	.361
Gender	.670
Possession of home computer	.564
Gender/possession interaction	.111
Total explained variance	.468
Multiple R squared	.066

For the complete Analysis of Variance Table see Appendix B.

Chapter VI

Discussion

The discussion in this chapter will focus on four variables: grade level, gender, possession of home computer and popularity.

The organizational variable of grade level was the only variable that was frequently statistically significant. In all of the analysis of variance tables examining popularity, whether measured by the expressive or instrumental dimension, or a combination of the two, grade level was significant. This seems to indicate that students very frequently based their sociometric choices on the grade their peers were in. Grade level was again significant in the "helping"and "being helped" analysis of variance tables. It may be concluded that the grade two students did the helping and the grade one students were the ones being helped. A review of the actual raw interaction scores substantiates this claim.

Surprisingly, grade level was not a significant factor in "seeking help". It will be recalled that students seeking help did not always receive it. Although students of both grades sought help it appears that the student helping was selective in who received it. Since more grade one students received help it appears that the helping students felt that these students' pleas for help were either more legitimate or for some other unknown reason more deserving of help.

The "mutually helping" interactions also proved insignificant and this may be perhaps because their were so few cases of this occurring. There was no significant relationship between the variables grade level, gender and possession of home computer and mutually helping. As the data indicate, students appear to have given/received help more frequently than mutually helping each other. This again may be related to the differences found between grade levels.

The most surprising result found in this study was the revelation that gender was insignificant in all popularity analysis of variance tables and all interaction analysis of variance tables. The literature reviewed in the earlier chapters does not support this finding. On the contrary, the literature indicated that because of their instrumental inclination boys dominate computer usage. On the analysis of variance tables examining the instrumental dimension, gender was not even found to be slightly significant. The insignificance of the interaction between gender and who the students went to for help and who the students wanted to work with on the computer appears contrary to what one might reasonably expect from the literature discussed.

For example, Mackie (1987) suggested that males enjoy more status and influence, yet in this study the student the teacher assigned to help fellow classmates was a girl. Conceivably this may have had an inhibitory effect on the boys causing them to be less computer dominant.

Furthermore, although Hollander (1981) speaks of the male/female differences such as verbal ability versus spatial/mathematical ability it is not at all clear whether computer useage lends itself more to one sphere or the other. Nassr-Charlebois' (1990) question "Does the software encourage competitive or cooperative behavioral responses" has not been definitively answered.

Blumenfeld's (1983) work pointing out the possibility of teacher bias is also worth considering here. Because research points to males being instrumental leaders we assume that if teacher bias exists it will be in favour of males versus females using the computer. But suppose a teacher is not biased in this direction,, or even perhaps biased in favour of females, would this not slant the outcome of computer interaction towards females in general?

Johnson (1981) alludes to the fact that educational strategies seem to stress the competitive learning experience. But it is possible that the teacher in this study has set up the computer curriculum to favour cooperative learning experiences. If that is the case, then cooperation and not competition would be the favoured experience possibly neutralizing the boys' dominant inclinations, if these indeed exist as a collective attribute.

Possession of home computer, likewise, was found to be insignificant on all of the analysis of variance tables. A possible conclusion would be to assume when students were

asked on the questionnaire who they would like to work with on the computer and who they would turn to for help on the computer, they would choose fellow classmates with computers at home, the explanation being that students who have computers at home would be more computer competent or knowledgeable than those without and thus more likely to be chosen. However, it may be students were unaware of which fellow classmates had computers at home and thus this variable did not influence their choices.

It will be recalled that the hypotheses predicted that popularity, whether expressive or instrumental, would be a significant variable in interaction frequencies. However, there was no evidence found to support either hypothesis. Neither the expressive nor instrumental dimension proved significant in any of the analysis of variance tables. Even when the two dimensions were combined into an overall popularity score it remained insignificant. It appears that the structural variables of grade level and more broadly of classroom organization had such a profound effect that all other variables were rendered insignificant by comparison.

Chapter VII

Conclusion

It will be recalled from the review of the literature that Homans in his exchange theory postulated that the higher the rank of the individual within the group, the wider his range of interactions. This theory was supported in this research study. The student chosen the most frequently by peers, a total of 27 times on the sociometric questionnaire, also had the highest number of helping interactions, a total of 110. It should be noted that no other student scored highly on both the sociometric questionnaire and the interaction frequencies.

Olmsted (1959) pointed out a commonality found in groups is a communications network. The fact that one student was chosen by so many other students on the questionnaire seems to indicate that the exchange of information between students took place in this classroom.

Like Sharon (1980) who concluded that group learning emphasized cooperation and eliminated competition, this study found a similar pattern of interaction. Christopolos (1973) and Lippit (1969) suggested that peer tutoring fosters cooperation and improved peer relationships. While an actual count was not kept of other behaviours than those coded, a review of the videotapes demonstrates that cooperative behaviours far outnumbered competitive ones.

This study has also validated conclusions drawn by Levin and Karee (1980), Papert et al (1979) and Sheingold et al (1981) that indicated that in each classroom a few pupils become expert resources to their peers. In this particular study one pupil shone as the expert resource. It was to her that the other pupils turned to for help most often. They recognized her expertise when it came to computer usage.

In the literature, authors expounded on the salience of the teacher variable within a given classroom. They noted that teacher efficacy is reliant in part on the teacher's role conception and that teachers perceived themselves as both an instrumental and expressive leader.

Furthermore, whether the teacher favours her expressive or instrumental dimension may influence how she structures her classroom environment. That is, a teacher with highly developed instrumental characteristics may perceive her role as developing students' cognitive skills at the expense of generally creating an environment of learning.

Teacher training can be an important antecedent to classroom interactions for three reasons. First, training may influence a teacher's expectations, perceptions and decision making processes whereby she may make decisions conducive to gender differences. This may be one reason why the literature is replete with gender differences which were not found in this study. Second, teacher training may actually influence whether a teacher establishes a traditional or structured

classroom versus a non-traditional or unstructured one. This will influence the students' locus of control. Those within the unstructured setting will have their locus of control grounded internally while those in the structured classroom will have their locus of control grounded externally. This may have a profound impact on the cognitive and social development of a child because of both the type and quantity of interaction allowed. As Nassr-Charlesbois (1990) pointed out, in her research in the same school system "classroom organization has a significant impact on the kinds and quantity of interaction permitted" (p.209). Nassr-Charlesbois demonstrated that the unstructured environment produced "high levels of interaction, higher grades and higher interest levels" (p.210).

Third, teacher training by its very definition is supposed to prepare a teacher to teach. Since computers in the classroom are a fairly new phenomenon, it is conceivable that some teachers have not been adequately prepared to use this new technology. Where this is the case it is possible that teachers will structure their students' use of the media differently than a teacher who is both familiar and comfortable with the new technology.

How a teacher organizes her classroom is a crucial organizational variable and bears further scrutiny. For example, whether a teacher sends same sex pairs or opposite sex pairs to the computer will influence the development of

social relationships and may modify or in some other way alter interactions. Also, how students access the computer can affect interaction outcome. For example, computer access as a reward for good work theoretically should produce different results from computer access given to all pupils equally regardless of the quality of the rest of their school work. By its very nature, reward access will allow interaction among the brightest students only, whereas equal access will allow everyone, regardless of scholastic aptitude, to participate and interact.

Because the classroom teacher in this study gave equal access to all her students, the results were the elimination of the possibility of the computer hogs referred to by Brown (1986). However, the other role models mentioned by Brown, computer wizard, team player and computer catchup, were evident in reviewing the videotapes.

Equal access also ensured that there would be no differential usage along gender lines. While the literature suggests that society in general perceived computers as a male technology and that males, because of their instrumental traits, are more prone to make use of computers, equal access, in this case, eliminated or at least negated, any male tendencies to usurp the females' time with the medium.

In fact, in this study, the student chosen as most knowledgeable about computers and the one with the most "helping" interactions was a female. Equal access may be a

partial explanation for this phenomenon. A second explanation however, may be that instrumental traits in boys may not be sufficiently developed in six and seven year olds to be significant in this study. Perhaps studies that found differential computer usage among boys and girls examined an older age group. A longitudinal study would be useful to determine just when instrumental traits manifest themselves to a significant degree with respect to computer usage.

Looking now to the issue of computer technology and how the teacher incorporates this new technology into the classroom and how comfortable she is with it, it is clear that these factors impinge on the students' perception of the new medium, their learning style and interactions. We must recognize that the introduction of computers operates as a constraint at the classroom level. For example, spatial limitations may make it necessary to use computer labs in one school while at another decentralization has occurred and computers can be found in every classroom.

Work done in computer labs may vary greatly from work done at individual computer settings. Generally, work done at computer labs is structured and plodding where the whole class works on the same thing and has to wait for the slower students to catch up before moving on to the next phase. In comparison, individual computer settings allow for more diversity and a personal rate of progress. Also, whether a classroom has a few or many software packages is a

technological imperative that can hinder, promote, alter or dictate social interaction of group members. Whether the software package is a simple game, a language arts package or a math drill may greatly influence the interactions taking place around the computer and thus by its extension introduce variability within classrooms. Indeed when examining interactions the type of software being used should be treated as an intervening variable expressing another critical fact of the organization of the classroom.

This study supports Morine-Dershimer's (1985) contention that the organizational variable of classroom management or instruction influences peer interaction. The autonomy of the teacher in structuring the classroom environment is an important variable in classroom interactions.

As Pugh (1966) pointed out, the very structure of an organization influences how it will function. The hierarchy within an organization will dictate the roles of the different players. In the case of schools the hierarchy consists of the board, principal and finally the teacher. Punch (1969) tells us that the principal is an important ingredient in the school bureaucracy. While the board may dictate in very broad and general terms what and how to teach, it is really the school principal that enforces the board guidelines or allows teachers to use their own discretion as to how strictly they will adhere to board pronouncements.

While it is the goal of all schools to transform and impart knowledge, socialize their student population and so forth, how the schools do this is contingent upon the individual teachers. Weber favoured decentralization among bureaucracies because it gave individuals in the lower echelons power. In the case of schools decentralization at the administrative level has given the lowest echelons, the teachers, considerable autonomy. Decentralization allows teachers to be creative and innovative. The very decentralization of the system maximizes the variation between classrooms within a school system and even within individual schools and classrooms. What may permitted or even encouraged in one classroom may be prohibited in another.

Decentralization makes it impossible to predict what computer usage looks like in Ontario. Therefore it makes it imperative to select a statistically representative sample of classrooms for future studies to see how this organizational variable affects computer usage and interactions.

APPENDIX A

Table 1A: Computer Interaction - Seeking Help			
Interaction Score			
Value	Frequency	Percent	Cum. Percent
0	6	18.8	18.8
1	5	15.6	34.4
2	7	21.9	56.3
3	4	12.5	68.8
5	3	9.4	78.1
6	3	9.4	87.5
7	1	3.1	90.6
12	1	3.1	93.8
14	1	3.1	96.9
22	1	3.1	100.0
TOTAL	32	100.0	

Table 2A: Computer Interaction - Helping

Interaction Score

Value	Frequency	Percent	Cum. Percent
0	10	31.3	31.3
1	1	3.1	34.4
2	4	12.5	46.9
3	1	3.1	50.0
4	1	3.1	53.1
6	3	9.4	62.5
10	1	3.1	65.6
15	1	3.1	68.8
16	2	6.3	75.0
18	1	3.1	78.1
20	1	3.1	81.3
22	1	3.1	84.4
33	1	3.1	87.5
40	1	3.1	90.6
43	1	3.1	93.8
46	1	3.1	96.9
110	1	3.1	100.0
TOTAL	32	100.0	

Table 3A: Computer Interaction - Being Helped

Interaction Score

Value	Frequency	Percent	Cum. Percent
0	3	9.4	9.4
1	1	3.1	12.5
2	1	3.1	15.6
3	2	6.3	21.9
4	4	12.5	34.4
5	2	6.3	40.6
8	1	3.1	43.8
9	2	6.3	50.0
10	1	3.1	53.1
11	2	6.3	59.4
13	2	6.3	65.6
14	2	6.3	71.9
16	1	3.1	75.0
18	2	6.3	81.3
20	1	3.1	84.4
24	1	3.1	87.5
25	1	3.1	90.6
26	1	3.1	93.8
33	1	3.1	96.9
38	1	3.1	100.0
TOTAL	32	100.0	

Table 4A: Computer Interaction - Mutually Helping			
Interaction Score			
Value	Frequency	Percent	Cum. Percent
0	24	75.0	75.0
1	8	25.0	100.0
TOTAL	32	100.0	

Table 5A: Of All The Children In The Class, Who Do You Play With Most At Recess?

Selection frequency

Value	Frequency	Percent	Cum. Percent
0	15	46.8	46.8
1	10	31.3	78.1
2	5	15.6	93.7
3	2	6.3	100.0
	32	100.0	

Table 6A: Of All The Children In The Class, Who Do You Play With Most After School?

Selection frequency

Value	Frequency	Percent	Cum. Percent
0	19	59.4	59.4
1	10	31.3	90.7
2	3	9.3	100.0
	32	100.0	

Table 7A: In Class, Who Would You Like To Sit Next To Most?

Selection frequency

Value	Frequency	Percent	Cum. Percent
0	17	53.2	53.2
1	5	15.6	68.8
2	8	25.0	93.8
3	1	3.1	96.9
4	1	3.1	100.0
	32	100.0	

Table 8A: Who Do You Like To Work With Most At The Computer?

Selection frequency

Value	Frequency	Percent	Cum. Percent
0	15	46.8	46.8
1	10	31.3	78.1
2	5	15.6	93.7
4	2	6.3	100.0
	32	100.0	

Table 9A: If You Needed Help At The Computer, Who Would You Ask or Get Help From?

Selection frequency

Value	Frequency	Percent	Cum. Percent
0	23	71.9	71.9
1	6	18.7	90.6
3	2	6.3	96.9
15	1	3.1	100.0
	32	100.0	

Table 10A: Popularity Scores.

Selection frequency

Value	Frequency	Percent	Cum. Percent
0	3	9.4	9.4
1	5	15.6	25.0
2	3	9.4	34.4
3	3	9.4	43.8
4	3	9.4	53.2
5	3	9.4	62.6
6	4	12.5	75.1
7	1	3.1	78.2
8	1	3.1	81.3
14	1	3.1	84.4
27	1	3.1	87.5
99	4	12.5	100.0
	32	100.0	

*99=missing cases

Table 11A: Expressive Scores.

Selection frequency

Value	Frequency	Percent	Cum. Percent
0	10	31.3	31.3
1	5	15.6	46.9
2	4	12.5	59.4
3	4	12.5	71.9
4	5	15.6	87.5
5	2	6.3	93.9
7	1	3.1	96.9
8	1	3.1	100.0
	32	100.0	

Table 12A: Instrumental Scores.

Selection frequency

Value	Frequency	Percent	Cum. Percent
0	12	37.5	37.5
1	10	31.3	68.8
2	6	18.8	87.5
4	1	3.1	90.6
5	2	6.3	96.9
19	1	3.1	100.0
	32	100.0	

APPENDIX B

TABLE 13B

* * * A N A L Y S I S O F V A R I A N C E * * *

POPSCR
by GEN gender
HOME possession of home computer
with GL grade level

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	132.893	1	132.893	6.065	.022
GL	132.893	1	132.893	6.065	.022
Main Effects	38.505	2	19.252	.879	.429
GEN	4.956	1	4.956	.226	.639
HOME	38.492	1	38.492	1.757	.198
2-Way Interactions	97.595	1	97.595	4.454	.046
GEN HOME	97.595	1	97.595	4.454	.046
Explained	268.993	4	67.248	3.069	.037
Residual	503.972	23	21.912		
Total	772.964	27	28.628		

Multiple R squared = .222

TABLE 14B

* * * A N A L Y S I S O F V A R I A N C E * * *

POPREC
by GEN gender
HOME possession of home computer
with GL grade level

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	2.893	1	2.893	8.011	.009
GL	2.893	1	2.893	8.011	.009
Main Effects	1.250	2	.625	1.731	.199
GEN	.362	1	.362	1.002	.327
HOME	.419	1	.419	1.159	.293
2-Way Interactions	.802	1	.802	2.221	.150
GEN HOME	.802	1	.802	2.221	.150
Explained	4.945	4	1.236	3.423	.025
Residual	8.305	23	.361		
Total	13.250	27	.491		

Multiple R squared = .313

TABLE 15B

* * * A N A L Y S I S O F V A R I A N C E * * *

POPI
by GEN gender
HOME possession of home computer
with GL grade level

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	18.640	1	18.640	4.319	.047
GL	18.640	1	18.640	4.319	.047
Main Effects	4.701	2	2.351	.545	.586
GEN	3.737	1	3.737	.866	.360
HOME	.066	1	.066	.015	.903
2-Way Interactions	6.996	1	6.996	1.621	.214
GEN HOME	6.996	1	6.996	1.621	.214
Explained	30.337	4	7.584	1.757	.167
Residual	116.538	27	4.316		
Total	146.875	31	4.738		

Multiple R squared = .159

TABLE 16B

* * * A N A L Y S I S O F V A R I A N C E * * *

PI
by GEN gender
HOME possession of home computer
with GL grade level

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	2.906	1	2.906	9.206	.005
GL	2.906	1	2.906	9.206	.005
Main Effects	1.060	2	.530	1.679	.205
GEN	1.036	1	1.036	3.282	.081
HOME	.042	1	.042	.133	.719
2-Way Interactions	.384	1	.384	1.217	.280
GEN HOME	.384	1	.384	1.217	.280
Explained	4.351	4	1.088	3.445	.021
Residual	8.524	27	.316		
Total	12.875	31	.415		

Multiple R squared = .308

TABLE 17B

* * * A N A L Y S I S O F V A R I A N C E * * *

POPII
by GEN gender
HOME possession of home computer
with GL grade level

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	56.500	1	56.500	5.749	.024
GL	56.500	1	56.500	5.749	.024
Main Effects	22.362	2	11.181	1.138	.335
GEN	6.557	1	6.557	.667	.421
HOME	21.293	1	21.293	2.167	.153
2-Way Interactions	22.278	1	22.278	2.267	.144
GEN HOME	22.278	1	22.278	2.267	.144
Explained	101.140	4	25.285	2.573	.060
Residual	265.328	27	9.827		
Total	366.469	31	11.822		

Multiple R squared = .215

TABLE 18B

* * * A N A L Y S I S O F V A R I A N C E * * *

PII
by GEN gender
HOME possession of home computer
with GL grade level

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	4.149	1	4.149	11.588	.002
GL	4.149	1	4.149	11.538	.002
Main Effects	.167	2	.084	.234	.793
GEN	.027	1	.027	.076	.784
HOME	.086	1	.086	.242	.627
2-Way Interactions	.017	1	.017	.047	.830
GEN HOME	.017	1	.017	.047	.830
Explained	4.333	4	1.083	3.026	.035
Residual	9.667	27	.358		
Total	14.000	31	.452		

Multiple R squared = .308

TABLE 19B

* * * A N A L Y S I S O F V A R I A N C E * * *

CISH ci seeking help
by GEN gender
HOME possession of home computer
with GL grade level
POPREC

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	74.619	2	37.309	1.533	.238
GL	33.822	1	33.822	1.389	.251
POPREC	8.583	1	8.583	.353	.559
Main Effects	32.472	2	16.236	.667	.523
GEN	1.519	1	1.519	.062	.805
HOME	23.799	1	23.799	.978	.334
2-Way Interactions	29.487	1	29.487	1.211	.283
GEN HOME	29.487	1	29.487	1.211	.283
Explained	136.577	5	27.315	1.122	.378
Residual	535.530	22	24.342		
Total	672.107	27	24.893		

Multiple R squared = .159

TABLE 20B

* * * A N A L Y S I S O F V A R I A N C E * * *

CISH ci seeking help
by GEN gender
HOME possession of home computer
with GL grade level
PI

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	44.817	2	22.408	1.015	.376
GL	30.265	1	30.265	1.371	.252
PI	.552	1	.552	.025	.876
Main Effects	34.948	2	17.474	.792	.464
GEN	.864	1	.864	.039	.845
HOME	26.538	1	26.538	1.202	.283
2-Way Interactions	28.819	1	28.819	1.306	.264
GEN HOME	28.819	1	28.819	1.306	.264
Explained	108.583	5	21.717	.984	.446
Residual	573.886	26	22.073		
Total	682.469	31	22.015		

Multiple R squared = .117

TABLE 21B

* * * A N A L Y S I S O F V A R I A N C E * * *

CISH ci seeking help
by GEN gender
HOME possession of home computer
with GL grade level
PII

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	45.372	2	22.686	1.028	.372
GL	37.867	1	37.867	1.716	.202
PII	1.107	1	1.107	.050	.825
Main Effects	32.881	2	16.440	.745	.485
GEN	.280	1	.280	.013	.911
HOME	26.999	1	26.999	1.223	.279
2-Way Interactions	30.324	1	30.324	1.374	.252
GEN HOME	30.324	1	30.324	1.374	.252
Explained	108.577	5	21.715	.984	.446
Residual	573.892	26	22.073		
Total	682.469	31	22.015		

Multiple R squared = .115

TABLE 22B

* * * A N A L Y S I S O F V A R I A N C E * * *

	CIH	ci help
by	GEN	gender
	HOME	possession of home computer
with	GL	grade level
	POPREC	

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	3994.136	2	1997.068	4.916	.017
GL	2800.698	1	2800.698	6.895	.015
POPREC	33.815	1	33.815	.083	.776
Main Effects	1393.045	2	696.522	1.715	.203
GEN	943.453	1	943.453	2.323	.142
HOME	894.219	1	894.219	2.201	.152
2-Way Interactions	488.061	1	488.061	1.201	.285
GEN HOME	488.061	1	488.061	1.201	.285
Explained	5875.241	5	1175.048	2.893	.037
Residual	8936.866	22	406.221		
Total	14812.107	27	548.597		

Multiple R squared = .364

TABLE 23B

* * * A N A L Y S I S O F V A R I A N C E * * *

	CIH	ci help
by	GEN	gender
	HOME	possession of home computer
with	GL	grade level
	PI	

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	5036.666	2	2518.333	7.515	.003
GL	1920.153	1	1920.153	5.730	.024
PI	801.048	1	801.048	2.390	.134
Main Effects	1532.663	2	766.332	2.287	.122
GEN	1241.706	1	1241.706	3.705	.065
HOME	797.371	1	797.371	2.379	.135
2-Way Interactions	74.835	1	74.835	.223	.640
GEN HOME	74.835	1	74.835	.223	.640
Explained	6644.164	5	1328.833	3.965	.008
Residual	8713.305	26	335.127		
Total	15357.469	31	495.402		

Multiple R squared = .428

TABLE 24B

* * * A N A L Y S I S O F V A R I A N C E * * *

	CIH	ci help
by	GEN	gender
	HOME	possession of home computer
with	GL	grade level
	PII	

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	5025.029	2	2512.514	7.157	.003
GL	1544.274	1	1544.274	4.399	.046
PII	789.411	1	789.411	2.249	.146
Main Effects	902.692	2	451.346	1.286	.293
GEN	671.867	1	671.867	1.914	.178
HOME	531.348	1	531.348	1.513	.230
2-Way Interactions	301.849	1	301.849	.860	.362
GEN HOME	301.849	1	301.849	.860	.362
Explained	6229.570	5	1245.914	3.549	.014
Residual	9127.899	26	351.073		
Total	15357.469	31	495.402		

Multiple R squared = .386

TABLE 25B

* * * A N A L Y S I S O F V A R I A N C E * * *

	CIBH	ci being helped
by	GEN	gender
	HOME	possession of home computer
with	GL	grade level
	POPREC	

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	1167.500	2	583.750	8.323	.002
GL	997.217	1	997.217	14.219	.001
POPREC	10.357	1	10.357	.148	.704
Main Effects	78.996	2	39.498	.563	.577
GEN	53.853	1	53.853	.768	.390
HOME	5.797	1	5.797	.083	.776
2-Way Interactions	17.248	1	17.248	.246	.625
GEN HOME	17.248	1	17.248	.246	.625
Explained	1263.744	5	252.749	3.604	.016
Residual	1542.970	22	70.135		
Total	2806.714	27	103.952		

Multiple R squared = .444

TABLE 26B

* * * A N A L Y S I S O F V A R I A N C E * * *

CIBH ci being helped
by GEN gender
HOME possession of home computer
with GL grade level
PI

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	1209.088	2	604.544	9.538	.001
GL	1158.335	1	1158.335	18.276	.000
PI	98.044	1	98.044	1.547	.225
Main Effects	120.024	2	60.012	.947	.401
GEN	75.081	1	75.081	1.185	.286
HOME	10.731	1	10.731	.169	.684
2-Way Interactions	8.703	1	8.703	.137	.714
GEN HOME	8.703	1	8.703	.137	.714
Explained	1337.815	5	267.563	4.222	.006
Residual	1647.904	26	63.381		
Total	2985.719	31	96.314		

Multiple R squared = .445

TABLE 27B

* * * A N A L Y S I S O F V A R I A N C E * * *

CIBH ci being helped
by GEN gender
HOME possession of home computer
with GL grade level
PII

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	1175.228	2	587.614	9.362	.001
GL	1044.688	1	1044.688	16.644	.000
PII	64.184	1	64.184	1.023	.321
Main Effects	158.598	2	79.299	1.263	.299
GEN	119.233	1	119.233	1.900	.180
HOME	4.928	1	4.928	.079	.782
2-Way Interactions	19.924	1	19.924	.317	.578
GEN HOME	19.924	1	19.924	.317	.578
Explained	1353.750	5	270.750	4.314	.005
Residual	1631.968	26	62.768		
Total	2985.719	31	96.314		

Multiple R squared = .447

TABLE 28B

* * * A N A L Y S I S O F V A R I A N C E * * *

	CIMH	ci mutually helping
by	GEN	gender
	HOME	possession of home computer
with	GL	grade level
	POPREC	

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	.053	2	.027	.133	.876
GL	.011	1	.011	.055	.817
POPREC	.018	1	.018	.088	.769
Main Effects	.217	2	.109	.540	.590
GEN	.088	1	.088	.437	.516
HOME	.061	1	.061	.301	.589
2-Way Interactions	.552	1	.552	2.743	.112
GEN HOME	.552	1	.552	2.743	.112
Explained	.823	5	.165	.818	.550
Residual	4.427	22	.201		
Total	5.250	27	.194		

Multiple R squared = .052

TABLE 29B

* * * A N A L Y S I S O F V A R I A N C E * * *

	CIMH	ci mutually helping
by	GEN	gender
	HOME	possession of home computer
with	GL	grade level
	PI	

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	.066	2	.033	.178	.838
GL	.059	1	.059	.316	.579
PI	.001	1	.001	.008	.930
Main Effects	.102	2	.051	.274	.763
GEN	.025	1	.025	.136	.715
HOME	.042	1	.042	.224	.640
2-Way Interactions	.470	1	.470	2.532	.124
GEN HOME	.470	1	.470	2.532	.124
Explained	.638	5	.128	.687	.637
Residual	4.830	26	.186		
Total	5.469	31	.176		

Multiple R squared = .031

TABLE 30B

* * * A N A L Y S I S O F V A R I A N C E * * *

	CIMH	ci mutually helping
by	GEN	gender
	HOME	possession of home computer
with	GL	grade level
	PII	

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	.219	2	.109	.615	.548
GL	.000	1	.000	.000	1.00
PII	.154	1	.154	.865	.361
Main Effects	.140	2	.070	.393	.679
GEN	.033	1	.033	.185	.670
HOME	.061	1	.061	.342	.564
2-Way Interactions	.484	1	.484	2.719	.111
GEN HOME	.484	1	.484	2.719	.111
Explained	.842	5	.168	.947	.468
Residual	4.626	26	.178		
Total	5.469	31	.176		

Multiple R squared = .066

APPENDIX C

SOCIOGRAM DATA

School----------Name----------

1. Of all the children in the class, who do you play with most at recess? ----------

2. Of all the children in the class, who do you play with most after school? ----------

3. In class, who would you like to sit next to most? ----------

4. Who do you like to work with most at the computer? ----------

5. If you needed help at the computer, who would you ask or get help from? ----------

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Vita Auctoris

Mary (Dippong) DeGoey was born in Molidorf, Yugoslavia December 27, 1943. After fleeing the communist regime the family immigrated to Canada and settled in the Leamington area. She graduated from the Leamington District Secondary School in 1961. After her marriage to Neil in 1962 they purchased her fathers' farm and subsequently had three children: John, born in August 1963, Michael, November 1968 and Anna Marie, March 1971.

After raising her family and being involved in numerous volunteer activities, she became a part-time student at the University of Windsor, majoring in sociology and psychology, graduating with a B.A. in 1987. She then was admitted to the Faculty of Graduate Studies and Research at the University of Windsor. As a graduate student she was a teaching assistant for two years and completed the requirements for her M.A. in sociology in 1992. She is presently employed as a continuing education instructor with the Essex County School Board.