From Student Academic to Computer Specialist: Co-construction of Student Identity and a School Computer-Network

by

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Abstract

This study explores how student participation in the development of a school computer-network (SCN) motivated students to learn and promoted service and collegial relationships in the school. Students participated in a Technology Leadership (TL) community and engaged in activities that were central to the development of the SCN. The research examines the co-evolution of the SCN and student activities and the relationships between TL students and the school.

In the study, data on students' experiences in the TL program came from non-participant observation, conversations, semi-structured interviews and document analyses. Using a sociocultural perspective of identity construction and informed by Lave and Wenger's notion of participation in a community-of-practice, with actor-network approaches, the analysis of the data showed that student level of engagement increased when the activities were relevant to their in-school and out-of-school technology experiences, or to their future career goals. Program participants provided technical support to the SCN and taught what teachers and students wanted to learn at a time when they needed to know it. In so doing, these leadership students moved towards greater technical expertise, improved interpersonal skills and increased leadership responsibilities as demonstrated by the availability of improved technical support services in the SCN.

As newcomers to the TL community gradually advanced to full participation and old-timers became computer consultants to the school before they eventually graduated, the TL community was subjected to a continual process of renewal in

terms of participants. With progressive student participation and with translations of diverse technology actors, the services the SCN provided to the school improved.

Over time, the SCN's technical character changed and the relationships of service and collegiality between TL students and the school were enhanced. Thus, both participants and the school realized educational value. The implication for curriculum and pedagogy of discipline-based courses is that if students are to be attracted to school initiatives and retained, the curriculum and its delivery need to increase opportunities for students' changed relationships with the school community to take place, and for student participation in a relevant community-of-practice that is responsive to students' future aspirations.

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CHAPTER I

THE PROBLEM

1.1 Introduction

Engaging students in the sciences, for example, is a critical and perennial challenge for science educators (e.g., AAAS, 1993, 1989; NRC, 1996, 2000). While science reform standards stress selecting curricula "to meet the interests, knowledge, understanding, and experiences of the students" (NRC, 1996, p.30), in secondary schools, science education forms a talent pipeline that quickly develops leaks (Seymour & Hewitt, 1997). Lee (2002) showed that the greatest loss occurs when Science, Mathematics and Engineering (SME) bound students, who are initially well-motivated students of above-average ability, decide not to major in an SME discipline before or when they enroll in college.

It has been suggested (Aikenhead, 1996; Barton & Yang, 2000; Brickhouse, Lowery,& Schultz, 2000) that student participation in discipline-based courses is problematic because these curricula and their delivery are unattractive to many students. Student pursuits of science, for example, often do not fit with student perceptions of themselves, their lives outside of school, or their personal, family, or cultural beliefs. The studies point to personal relevance and related constructs such as future goals, career goals, and student interests as positively influencing student engagement in the learning process (Shernoff, Schneider & Csikszentmihlyi, 2001; Cothran & Ennis, 2000; Covington & Wiedenhaupt, 1997; Hidi, 1990).

Lave and Wenger (1991) have observed that motivation to learn depends on the availability of a context in which an "identity encompass[es] the activity in which newcomers participate and [a] field of mature practice [exists] for what has been learned" (p.112). Lave (1992, quoted in Brickhouse et al., 2000) proposed that we can think of learning as an apprenticeship where students forge identities in communities of practice:

> Learning is, in this purview, a process of coming to be, of forging identities of activity in the world. In short, learners becoming certain sorts of subjects with certain ways of participating in the world . . . Subjects occupy different locations, and different interests, reasons and understandings of who they are and what they are up to. (Lave, 1992, p.3, quoted in Brickhouse et al., 2000).

In other words, to understand learning, we need to know how students are engaging in an enterprise and how this is related to who they think they are (what communities of practice they practice in) and who they want to be (what communities of practice they aspire to). As students participate in new communities of practice and transform their identities, the requisite knowledge and skills for being a part of the new communities are learned. Identities then become mediational forms that enable newcomers to these communities to think about themselves and where they are headed in the future: their *possible selves* (Markus & Nurius, 1987).

Lave and Wenger (1991, 1998) used identity to describe relationships within communities of practice in a useful way and Nespor (1994) suggested that the notion of identity is also important to describe relationships that extend beyond the bounds of a particular community of practice. Drawing from Wenger's (1998)

sociocultural perspective of *identity*, from Lave and Wenger's (1991) notion of *community-of-practice* and from some elements of *Actor Network Theory* (Latour, 1986; Callon, 1987), this dissertation explores impact on identity of student participation in the maintenance and development of a SCN. Student activities in the SCN were organized and supported under a Technology Leadership program where program participants were specifically encouraged to deliver technical support services to teachers and students in the community of the school as the students themselves furthered their own technical understandings through participation in the Technology Leadership community.

1.2 Communities-of-practice

This section looks at the concepts employed in the analysis of students' participation in a Technology Leadership program that was constructed to support a SCN. In it, I discuss the notion of learning in a community-of-practice and I discuss how communities-of-practice could be inter-linked, using Actor-Network Theory (ANT), to account for the influence of other communities-of-practice on the community under investigation.

The idea that learning involves a deepening process of participation in a community of practice has gained significant ground (Wenger, 1998). Lave & Wenger's (1991) model of situated learning proposed that learning involved a process of engagement in a 'community of practice'. 'Legitimate peripheral participation,' as they named it, describes how individuals over time can progress

from the periphery of some socially organized activity (e.g. tailoring, SCN maintenance) to becoming fully-fledged and productive members of the community in question (e.g. tailoring, SCN maintenance). The basic argument made by Jean Lave and Etienne Wenger is that communities of practice are everywhere and that we are generally involved in a number of them – at work, school, home, or in our civic and leisure interests. Communities of practice consist of groups of practitioners who share similar goals and ways of achieving them. Coming to be a full practitioner entails coming to share, at least to some extent, the goals, the knowledge, tools, values and ways of interacting associated with that community-of-practice. The movement of a participant in a community-of-practice towards becoming a full participant is not so much a change within the individual as it is a change in the individual's relationship to the community's activities (of service) and with the social group (of collegiality).

According to Etienne Wenger (1998), a community of practice defines itself along three dimensions:

> What it is about – its joint enterprise as understood and continually renegotiated by its members.
>
> How it functions – mutual engagement that bind members together into a social entity.
>
> What capability it has produced – the shared repertoire of communal resources (routines, sensibilities, artifacts, vocabulary, styles, etc.) that members have developed over time.

A community-of-practice involves much more than the technical knowledge or skill associated with undertaking some task. Members are involved in a set of relationships over time (Lave & Wenger, 1991) and communities develop around things that matter to people (Wenger, 1998). The fact that they are organizing around some particular area of knowledge and activity gives members a sense of joint enterprise and identity. For a community of practice to function it needs to generate and appropriate a shared repertoire of ideas, commitments and memories. It also needs to develop various resources such as tools, documents, routines, vocabulary and symbols that in some way carry the accumulated knowledge of the community. In other words, it involves practice: ways of doing and approaching things that are shared to some significant extent among members. The interactions involved, and the ability to undertake larger or more complex activities and projects through cooperation, bind people together and help to facilitate relationship and trust.

The community-of-practice focus is supported by a sociocultural theoretical perspective (e.g. Lave, 1988; Lave & Wenger, 1991). However, sociocultural literature tends to be most concerned with participation within communities and does not usually account for the role of the larger social context in shaping the activities and identities of community members (Nespor, 1994). Because the social context usually remains unaccounted for, sociocultural theory usually neglects the influence of outside groups or communities on practices within a particular community. In the case of the Technology Leadership community of practice, these

outside groups include school administration, teachers, parents, and other students in the school – some of the groups with a stake in this particular community.

Actor Network Theory (Callon, 1986; Latour, 1987) extends sociocultural theory so that the roles of the other groups and communities can be accounted for in school initiatives, for example, without limiting the scope of research to the particular community. Actor-network theory (ANT), therefore, provides a way of taking the larger social world into account that enables the important contributions of sociocultural theory to remain in place while permitting the limitations created by the bounded community focus to be overcome. Although this theoretical position has mainly been used by researchers in the area of sociology of science and technology to study the relations between actors linked together in techno-scientific projects, a few inroads have been made into studies in education. Nespor (1994) used ANT in the area of Curriculum Studies to investigate how the disciplinary areas of physics and management are structured in a way that allows them to initiate new students into the disciplines. Fountain (1995) utilized ANT to examine students' discourse of socioscientific issues and Hepburn (1996) explored the introduction of a new applied physics course into high school. More recently, Rafea (1999) has used ANT to explore issues around manifestation of power in curriculum making and to highlight some of the strategies that actors used to maintain or reconstruct power relations.

Actor-network theory emphasizes the ways that human and non-human *actors* are linked to other *actors* as projects aimed at producing new *tokens* are

undertaken. When these tokens are first developed or put forward, a diverse group of actors is linked together in support of the project. These linked actors form a network; the more stable this network becomes, the more likely it is that the token will be successfully advanced. Actors who are interested in advancing the token construct networks. The network-builders enroll other actors, translate other actors' interests into ones that are consistent with those of the project, and mobilize other actors in such a way that the project can proceed. In a similar way a network has to be constructed when an initiative is launched in a school and introduced to school actors. It is the subsequent evolution of such networks in one school that is the focus of this research.

Exploring the relationships in the construction of student identity with technology and through student participation in the development of a SCN consisting of other actors – such as, the learning technologies teacher, Technology Leadership program activities, the leadership of the school, the teachers in the school and the groups in the community with a stake in the Technology Leadership community – is the focus of the analysis of the data in this research.

1.3 The Study

One of the most visible changes in Canadian schools today is perhaps the massive deployment of computer infrastructure in schools. Statistics Canada, in one of its bulletins, *The Daily* (2002), reported that Canadian students rank among the highest in the world in terms of access to computers both at home and at school.

Driven by a demand for a visible presence in the new global economy (Cuban, 2001) and by an increasing pressure from business and industry to better prepare students for the world of work (Hepburn & Gaskell, 1998), school stakeholders have pushed schools to be "wired" and Internet-ready. In addition, we need technology in every classroom and in every student and teacher's hand, the argument goes, because it is the pen and paper of our time, and it is the lens through which we experience much of our world.

In one school in the Lower Mainland, that I will, in this dissertation, refer to as *Pal Secondary School*, deploying and maintaining computers in the school was conceived to promote technology use among teachers and students, and to broaden student participation in school activities. In conjunction with the School Administration, members of the School Technology Committee took decisions about computer maintenance, upgrades, and networking. A dedicated Network Support Technician to oversee the running and maintenance of school computers was not hired. As a result, the School Technology Committee worked closely with teachers, students and community groups to construct a SCN that would meet the instructional and learning needs of the school. Teachers and students that were keen on computers spent countless hours tinkering with various computer accessories, and deciphering manuals, exploring ways and means of troubleshooting, and adapting and innovating within the SCN. Over time, many students got interested in the technology activities in the SCN and were drawn to participate in them.

The school administration moved to formally recognize student participation in the project by locally-developing an Applied Skills credit course, named 'Technology Leadership', with credit to accrue toward student graduation. Prior to the recognition of Technology Leadership courses or programs, Information and Communications Technology (Info Tech, or IT) 11 and 12 courses, together with Computing Science 9 and 10, were the only mandated credit courses in the Learning Technologies Department.

In the school hallways, students were visibly excited and could be heard buzzing about their participation in Technology Leadership program. Being a teacher in the school, I noticed that the program was rapidly becoming very popular with both teachers and students. Were it not for their contemporary interests in computers, most of the students drawn to actively participate in the program could have, for instance, been classic science students. As a teacher in the school, it seemed to me that students who would traditionally have performed at the top, or near the top, of discipline-based courses such as mathematics and science, were opting for this technology pathway.

This new and popularized project struck me as unusual for its seeming meteoric rise to prominence in the community of the school. It sparked my interest to try to understand what lay at the heart of the enormous student excitement about the program. I believed that there were issues about the program that could be of interest to the wider community of the school and specifically to future and similar efforts in the school and elsewhere. Being a mathematics and science

teacher, I started contemplating whether there could be specific lessons, orientations, or organizational approaches that the teaching and learning of mathematics and science subject areas in the school could learn from this 'Technology Leadership' initiative.

This dissertation describes student participants' experiences in the Technology Leadership program and examines how the SCN, in responding to student interest in, and commitment to, working with computers, in turn, evolved to construct student identity with technology through student involvement with it. During a year-long focused ethnographic engagement with the project, I explored the relationships among participants in the Technology Leadership community and between the diverse actors in the SCN. Gaining an in-depth understanding of the relationships resulting from student participation in the development of a SCN and drawing implications for learning are the objectives of this dissertation.

I collected data on students' experiences in the Technology Leadership program using a variety of methods including semi-structured interviews, non-participant observations, conversations, field notes, and analysis of documents. The following over-arching question guided my research on the Technology Leadership program:

- How do student identity and the school computer-network co-construct each other?

More specifically,

- In what ways do students' identities in the Technology Leadership program develop as they participate in program activities?
- How does the school computer-network's technical character change with Technology Leadership students' progressive participation in it?
- How does the *student identity – school computer-network* relationship shift over time to adequately respond to the changes in student identity and in the SCN?

The first part of the sub-questions seeks to understand the community-of-practice setting for constructing student identity with technology, where participation of newcomers to the community-of-practice shifts from the periphery to that of full participation of old-timers (Lave & Wenger, 1991). It explores the various dimensions of student identity and examines how students, in the course of their interactions in the Technology Leadership program, forged a technology community-of-practice. The purpose is to look at how student identity with technology develops and to examine its dimensions as students interact with diverse actors in the SCN. The reference of the term *actors* in the dissertation applies to both the human and nonhuman participants in the SCN. The *human actors* are the individuals or groups that are enrolled in the network. The term *groups* is used to refer to any identifiable group, for example, the discipline-based departments such as Social Studies and Science, but may also be taken to refer to the communities organized around particular activities such as the School Yearbook

and other events in the school. The *nonhuman actors* are artifacts, processes or materials that are utilized in some way in the SCN.

The second sub-question examines the approaches the SCN adopted to identify and promote technology use in the community of the school. Because of the dimensions of student identity with technology and because the community of the school recognized and embraced its stake in student involvement in the Technology Leadership program, the SCN was constructed to advance school interests in the implementation of learning technologies in various aspects of school operations. This sub-question takes a look at the way the SCN was constructed to lend itself to a kind of flow to integrate computer use in learning and instruction in the school especially in the recognition of Technology Leadership students' participation in the implementation of technology in the school. The question looks at how the SCN responds to external forces in terms of the technology that is available; how the group selects and uses diverse resources situated outside the community of the school to support student computer use and to cater to school information and communication needs with technology.

In the third sub-question, I examine the relationships developed between student identity with technology and the community of the school, over time. The purpose is to gain an insight into how the practices of the SCN change as novices join the Technology Leadership program and bring new interests, and how those changes manifest themselves as the identity of the newcomers develop. The intention is to understand how the dimensions of student identity, or variables

within those dimensions, shift over time. With individual student identity shifting and with individual aspects of the SCN shifting, this sub-question examines how the whole look of the SCN, or of the student community-of-practice, develops and changes over time in terms of the kinds of service it provides and in terms of the influence these changes exert on similar initiatives and groups in the community of the school.

1.4 Contributions of the study

This study uses Lave and Wenger's (1991) notion of "Legitimate Peripheral Participation" to understand student participation in a community-of-practice and draw implications for learning. The study enables us to situate student school participation in a community-of-practice as arising not only from student simultaneous memberships in diverse communities, but from how personally relevant the activities in those communities are to student needs and aspirations. By exploring student participation in the program, we gain insights into how students relate to each other, how students interact in a community-of-practice of which they are members, and how they participate meaningfully in various initiatives in an institution. In developing an account of the co-construction of student identity and the SCN, this study makes a contribution to the development of a more informed basis upon which to proceed in the analyses, implementations and support of school initiatives, and in the promotion of student participation in schools and in institutions of learning. An understanding of such efforts carries

implications for the general way we develop and implement school initiatives and curricula, and to the general way we organize education.

Just as importantly, this study makes a contribution to the community-of-practice literature. The results of this study will show that contrary to the perception in the literature of communities-of-practice having skill-sets and membership patterns that are relatively stable, the memberships and practices of the community-of-practice that Technology Leadership students organized and forged in the SCN around technology do, in fact, shift over time. Unlike Lave and Wenger's (1991) case studies of apprenticeships in organized and stable technical settings, the work/learning being analyzed in this study explore the nature of collaboration and how to set-up and maintain a collaborative technical environment. Most Technology Leadership students were engaged in computer technology activities prior to becoming active participants in the program. Within he program, the nature of the technology activities were such that in order to retain expertise, what needed to be learned by both the newcomers and old-timers was not only constantly changing but was continually being updated. Program participants' technical skills were only as good as the technology at their disposal. Digital technology dictates are such that practitioners continually shift their technical understandings to learn how to learn new technologies. Thus, the Technology Leadership community-of-practice had a shifting technical character to its practices. Its entire membership and their technical expertise were subjected to a continual process of renewal as members negotiated changed relationships within the community-of-practice.

1.5 Limitations of the study

Although this study aims to account for the relationships between participants in the Technology Leadership program and the school computer network, choices had to be made about which groups in the SCN to collect data on and which relationships to explore in relative depth. The choices that I made resulted in an emphasis on the relationships the program participants struck with the students and teachers in the school and placed less emphasis on those between program participants with other actors (e.g. parents and the business community) that related to members of the Technology Leadership community. These choices meant that less emphasis was placed upon a detailed accounting of the relationships between groups that were fairly removed from day-to-day activities of the Technology Leadership program (e.g. the school board). The development of a thorough account of the participation of every actor in the SCN was not possible in this case due to limitations of time and resources. This limitation is difficult to avoid in the study of complex actor-networks but can be overcome through further research or multiple, overlapping investigations. It is also likely that a complete account is not worthwhile as, to some point, the effort expended is likely to be met with diminishing returns in terms of the usefulness of the additional data.

By virtue of my location in the school, another limitation of this study has to do with a lack of a critical perspective that explores relationships between actors in the SCN. As a teacher-researcher priviledged by certain power relations, it is quite possible that I was not as critical of the power relations between actors in the SCN

as I ought to have been. It was challenging to maintain appropriate distance between the researcher and the phenomenon under investigation since I was an interested party to the research outcomes. Although this aspect of power relations is not totally ignored in the data collection (for instance, by choosing to be 'a fly on the wall') and data analysis, it is an important topic that is not explored to the extent it warrants. Hopefully, this limitation will be redressed in future research.

1.6 Organization of the chapters

In Chapter II, I map out the theoretical framework used in the analysis of the data. I review the concept of identity as an analytic lens and I discuss the sociocultural perspective for identity development. This perspective views identity construction as emanating from cultural possibilities and limitations available to an individual within a given context. Thereafter, I also explore Lave and Wenger's notion of a community-of-practice and I outline tenets of Actor Network Theory.

Chapter III discusses the research methodology and Chapters IV, V and VI are the analyses chapters that discuss the research data in an effort to answer the research questions. Chapter VII provides the conclusions from the research, their implications, and recommendations for further research.

CHAPTER II

THEORETICAL FRAMEWORK

2.1 Overview

This chapter presents an overview of the literature on the construction of student identity and on student participation in a community-of-practice. It describes a perspective of identity construction that is fluid, dynamic and recursive where the shift in participation in the community-of-practice goes from the periphery to full participation. The chapter discusses the notion that within a community-of-practice perspective, the community itself experiences change over time as new members join, bringing with them new interests and resources, and the idea is that change in the community-of-practice occurs as the identities of participants within the community develop. Tenets of Actor Network Theory are also outlined to account for the participation of communities external to the student technology community-of-practice.

2.2 Constructing student identity

The literature on identity construction provides the beginning of a theoretical approach that is used in this research to explore student participation in a technology initiative to construct and maintain a SCN. While identity can be a "valuable lens" (Gee, 2000/1) to use in educational research, it is a complicated construct with many definitions and interpretations. Wenger (1998) points to five

salient aspects of identity. First, identity is related to one's personal history. Second, one's identity is related to one's experience as negotiated within the context of existing cultural practices. Third, identities are related to membership in communities. Fourth, Wenger recognizes that people are members of multiple communities and thus one's identity is at the nexus of these multiple memberships. And, fifth, he argues that one's identity in the moment is an interaction between the local and global contexts. Thus Wenger's formulation provides a way to bridge the intensely personal nature of learning to its very public and cultural aspects, noting that:

> The concept of identity serves as a pivot between the social and the individual, so that each can be talked about in terms of the other. . . . The resulting perspective is neither individualistic nor abstractly institutional or societal. It does justice to the lived experience of identity while recognizing its societal character—it is the social, the cultural, the historical with a human face. (1998, p. 145)

From this perspective, the concept of a pivot implies the centrality of identity construction to the study of learning. In addition, one's identity is related to, and interacts with, an overall sense of self as well as other types of memberships in various communities of practice.

As mentioned above, identity lies at the intersection between ones' personal history and individual psychology on the one hand and one's cultural history and community-of-practice on the other hand (Enyedy et al., 2005). Because identity is directly linked to both one's history and one's membership in multiple communities of practice, one's identity is always both in progress and dependent on the particulars of the context (Wenger, 1998). Researchers vary in their emphasis in

what shapes and creates a person's identity. Some believe that external forces such as culture or other people's opinions shape a person (Gee, 2000/1). Others believe that a person's identity is an essential part of the individual and not changed (Cerulo, 1997). And still others believe that culture and individual agency work together to create a person's multiple identities (Holland, Lachicotte, Skinner, & Cain, 1998).

My view of identity stems from a sociocultural perspective in which a person's identity is shaped and negotiated through everyday activities. In this perspective, emphasis is placed on the role society plays in shaping the course of an individual's identity over time. I believe identities are fabricated, that is, they are both invented and constructed. They are never finished products. They are stitched together out of discontinuous forms and practices and that identity construction is a fluid, dynamic, recursive, discursive process in which statements about actions (e.g., incorporating hands-on activities) are translated into statements about states (e.g., *being* a technician), and vice versa. The representation of identity is an ongoing process, undertaken on many levels, in different practices and sites of experience.

2.3 Identity as an analytic concept

In the literature, the use of the word *identity* is rarely preceded by any explanations. No conceptual preparation seems to precede sentences such as "Learning . . . implies becoming a different person [and] involves the construction of identity" (Lave and Wenger, 1991, p.53), or "The experience of identity in practice is

a way of being in the world" (Wenger, 1998, p.151). A few defining attempts in the recent literature may be a promising beginning. For instance, Gee (2000/1) says: "Being recognized as *a certain 'kind of person',* in a given context, is what I mean . . . by 'identity'" (p.99). However, the talk about "being a certain kind of person" implies that one's present status is, in a sense, independent of one's actions. Sentences built around the idea of "being a kind of person" sound timeless and agentless. As such these sentences seem to be saying that there's a thing beyond one's actions that stays the same when the actions occur, and also that there is a thing beyond discourse that remains unchanged.

Sfard and Prusak (2005) have characterized such a vision of identity as untenable and harmful. Untenable because it leaves us without a clue as to where we are supposed to look for this elusive "essence" that remains the same throughout the person's actions. It is potentially harmful because the reified version of one's former actions that comes in the form of nouns or adjectives describing this person's "identity" acts as a self-fulfilling prophecy. They also argue that as agents of continuity and perpetuation, the descriptors that outlast action exclude and disable just as much as they enable and create. From this standpoint, these interpretations cannot be barred as long as the words "being a kind of person" remain the centrepiece of the definition of identity. The question to confront then is how identity should be defined so as to make the notion operational, immune to undesirable connotations and in tune with the claim that identity is constructed and collectively shaped, rather than given.

The definitions of identity set forth by Gee (2000/1) and Holland et al. (1998) link the notion of identity to the activity of communication, conceived broadly as self-dialogue – that is, thinking. Together with many others (e.g. Hall 1996; Gee, 2000/1; Gonzales, 1999), this study embraces the idea of identity-making as a communicational practice, and thereby reject the notion of identities as extra-discursive entities that one merely "represents" or "describes" while talking. Identity-talk makes us able to cope with new situations in terms of our past experience and gives us tools to plan for the future.

Sfard and Prusak (2005) reason that with the narrative definition of identity, human agency and the dynamic nature of identity are brought to the fore, and most of the disadvantages of traditional approaches seem to disappear. The focus of the researcher's attention is now on things said by identifiers, and no essentialist claims are made about narratives as mere "windows" to an intangible, indefinable entity. As stories, identities are human-made; they have authors and recipients, they are collectively shaped even if individually told, and they can change according to the authors' and recipients' perceptions and needs. As discursive constructs, they are also reasonably accessible and investigable.

Despite these obvious advantages, one may claim that "reducing" identity to narratives undermines its potential as a sense-making tool. Story is but text, and identity is predominantly an experience, the critic could say. Perhaps the most outspoken proponent of this position is Wenger (1998), who says that identity "is not, in its essence, discursive or reflective." And he adds: "We often think about our

identities as self-images because we talk about ourselves and each other – and even think about ourselves and each other – in words. These words are important, no doubt, but they are not the full, lived experience of engagement in practice" (p. 151).

Wenger (1998) suggests that we experience identity in practice: it is a lived experience in a specific community. We develop identity by looking at who we are in relation to the community in which we are practicing members. Although identities originate in daily activities and in "the experience of engagement," it would be a category mistake to claim that this fact disqualifies the narrative rendering of identity. Indeed it is our vision of our own or other people's experiences, and not the experiences as such, that constitute identities. Rather than viewing identities as entities residing in the world itself, the narrative definition of identities presents them as discursive counterparts of one's lived experiences.

As to whether the narrative-definition of identity can be useful in research in spite of the fact that different identity-builders do not tell the same story, it is important to clarify that it is the activity of identifying rather than its end product that is of interest to the researcher. The focus is not on identities as such but rather on the complex dialectic between identity-construction and other human activities. Thus while letting others be guided by the narrative vision of identity, it is not worth being afraid of missing anything that is "out there" or of not being able to pin down the "true referent of the term "identity." Narratives that constitute one's identity, being an important factor in shaping this person's actions, will be useful in

research even if they communicate one's experiences only as well as human words can tell.

2.4 A Sociocultural perspective of identity

There are generally five theoretical frameworks by which identity is currently being studied among social scientists. These frameworks include: a historical focus, addressing conditions that have precipitated a contemporary concern with identity; a structural stage approach, which addresses changing internal structures of ego development through which one interprets and gives meaning to one's life experiences. A narrative approach stresses how people tell stories about their lives in order to bring many diverse elements together into an integrated whole and to provide some sense of sameness and continuity to these life experiences. A sociocultural approach emphasizes the role society plays in shaping the course of individual identity over time and, finally, a psychosocial approach seeks to integrate the roles played both by society as well as an individual's psychology and biology in developing and maintaining personal identity. All frameworks have their strengths and limitations and there are critiques of each framework (see Kroger (2007) for an in-depth treatise). For an organizing framework in this dissertation, I have selected the sociocultural approach to identity construction because of the context of this study and because of its compatibility with many of the attributes of Actor-Network Theory, the other framework utilized in the analysis of the data.

Research in identity construction over the past decade has typically emphasized the way that identity is a problem for individuals and individual development (Penuel & Wertsch, 1995; Curelo, 1997; Stryker et al., 2001). The way that identity is constructed as a coordination of perspectives, in which other's images of one's self and one's own self-images are brought into harmony, supports researchers in their moves to fold the sociocultural processes involved in identity into structures of individual cognition. When criticism has been levelled against this kind of identity research, it has focused on the way sociocultural processes are marginalized in accounts of identity construction (Penuel & Wertsch, 1995). Cote & Levine (1988), for example, have criticized research on identity status for emphasizing too much the role of the isolated individual experience in identity construction. Rather, a sociocultural approach to identity construction emphasizes that human action is situated in the context within which it occurs and cannot be separated from it if action is to be understood. It views the poles of sociocultural processes on the one hand and individual functioning on the other as existing in a dynamic, irreducible tension (Wertsch, 1991). It considers these poles of sociocultural processes and individual functioning as interacting moments in human action, rather than as static processes that exist in isolation from one another.

The focus on action, allows us to look at how the questions pertaining to one dimension of action relates to others; how, for example, identity as a self-chosen description of the person takes place within action. Taking human action as a unit of analysis, it is possible to provide a more coherent account of identity, not as a

static, inflexible structure of the self, but as a dynamic dimension of action, that may in fundamental ways change from one enterprise to another.

Another point about identity pertains to the unit of analysis. The focus on the inner sense of coherence though, poses problems for research and for a more comprehensive account of identity construction that recognizes the central role played by sociocultural processes in shaping identity. Penuel & Wertsch (1995) have pointed out that it is difficult to assess or describe, without using some mediational means, what this inner sense of identity is. Surveys and language all must employ some form of language to get at what presumably this inner sense of coherence is. For some, this situation poses a genuine difficulty beyond questions that may be raised about the sincerity and trustworthiness of participants' responses because their view is that such mediational means as language and sign systems transparently express what is taking place in the mind of the individual. The question for them, then, is the best way to access the sense of identity felt and to discover whether it is coherent.

Taking mediated action as the unit of analysis, however, allows us to ask a different set of questions about the way individuals use cultural tools to form an identity. By focusing on meaningful human action, rather than either inner states of individuals, or sociocultural processes considered in isolation, language and other signs that people use to describe themselves in the course of action are not then an impediment. By speaking and listening to others, the claim may be made, the signs as incorporated into the flow of action actually construct, or build up, the sense of

self by providing terms to individuals they may employ when talking about themselves to others. While identities are built in conversation, the sociocultural framework asks us to focus on specific questions about the mediational means or cultural tools, such as language, that people employ to construct their identities in the course of different activities and how they are put to use in particular actions. When identities are seen in this framework as shaped by mediational means or cultural tools, questions arise as to the nature of the diversity of cultural tools and why one, as opposed to another, is employed in carrying out a particular form of action.

To understand such variation in the context of identity construction, it is important to concern ourselves with how we select, choose, and commit to different people and idea systems in the course of their activities. This selecting and choosing process is of utmost concern to the problem of identity, even as sociocultural processes shape it. It is for this reason that Penuel and Wertsch (1995) suggest that identity be conceived as a form of action that is first and foremost rhetorical, concerned with persuading others (and oneself) about who one is, and what one values, to meet different purposes. It is always addressed to someone who is situated culturally and historically and who has a particular meaning for individuals. The most basic point about identity that Penuel and Wertsch (1995) make from this approach is that identity is about realizing and transforming one's purposes, using signs to accomplish meaningful action. Specifically, they direct identity researchers to study identity in local activity settings where participants are actively engaged in constructing their identities; to

examine the cultural and historical resources for identity construction and to take mediated action as a unit of analysis.

In a classroom context, not only does a sociocultural perspective theorize that knowledge that the student brings is central to the enterprise, but also that this knowledge is always developed in the context of social interaction. For sociocultural researchers (e.g., Cole, 1985; Lave, 1991; Lave & Wenger, 1991; Penuel & Wertsch, 1995; Wenger, 1998; Wertsch, 1998), students and teachers are viewed as constructing educational contexts through human activity which operate in social contexts that are larger and are closely linked to one another. As these individuals participate in the activities, they impact the environment that is, in turn, impacting and changing the way they see themselves within the world. The larger school and district culture impact this classroom activity, which is, in turn, affected by the larger city, provincial, national and global culture. In these ways, students' academic identities are constructed as a coordination of perspectives, in which others' images of oneself and of one's own self-images are co-constructed. The situated and constructed nature of identity suggests that these sociocultural processes permeate into structures of individual cognition (Penuel & Wertsch, 1995). Analysis, then, must take into account both the acting individuals and the context within which they are acting (Lave & Wenger, 1991; Wertsch, 1991). Both of these elements are accounted for with the concept of community-of-practice.

2.5 A Community-of-practice setting

According to Lave and Wenger (1991), a community-of-practice is taken to refer to an identifiable group within which there are general ways that participants relate to each other and do things, ways that everyone in the group either is or is becoming familiar with. It is a special type of informal network that emerges from a desire to work more efficiently or to understand work more deeply among members of a particular speciality or work group. These communities of practice can be either professional groups or other groups that have developed historical means of participating in a particular activity. At the simplest level, communities of practice are small groups of people who have worked together over a period of time and, through extensive communication, have developed a common sense of purpose and a desire to share work-related knowledge and experience.

Lave and Wenger's work (1991) directs our attention away from the individual and toward the social nature of learning. Their idea of individuals learning in and through communities of practice, in collaborative relationships where all participants are teachers and learners, sheds light on the characteristics of the Technology Leadership program setting, the research focus of this dissertation, that make it such a powerful learning community. The path the students in the program carve is not an individual one that takes them from what they do not know to new knowledge. Rather the path develops as they participate in a social context and see how they can use what they already know in collaboration with others, and how that collaboration may in fact change their

practices. The idea of social practice (Lave and Wenger, 1991, p.43) as the context for learning directs us to consider the notion that Technology Leadership students' learning experiences are based on their engagement and participation with other learners in a work/learning context.

Coming at the issue of identity from the angle of community, Lave and Wenger (1991) offered a view of learning that encompasses a vision of the present and future self: *legitimate peripheral participation*, or "a way to speak about the relations between newcomers and old-timers, and about activities, identities, artifacts, and communities of knowledge and practice" (p. 29). This points out that from their first day of participation, novices are important players. So "by participating in communities of practitioners, the knowledge and skill of newcomers increases as they move toward full participation in the sociocultural practices of the community" (p.29). Taking their definition of learning, or legitimate peripheral participation further, the authors suggested that new kinds of people with changed, mature identities emerge from the learning process:

> As an aspect of social practice, learning involves the whole person; it implies not only a relation to specific activities, but a relation to social communities—it implies becoming a full participant, a member, *a kind of person*. . . Activities, tasks, functions, and understandings do not exist in isolation; they are part of broader systems of relations in which they have meaning. These systems of relations arise out of and are reproduced and developed within social communities, which are in part systems of relations among persons. The person is defined by as well as defines these relations. *Learning thus implies becoming a different person with respect to the possibilities enabled by these systems of relations. To ignore this aspect of learning is to overlook the fact that learning involves the construction of identities* (p. 53, emphasis mine).

Here, the emphasis is on the process of learning through actions and relations within a community, and the new identities – that is, how individuals view and understand themselves and also how they are viewed and understood by others (Giddens, 1979) – that develop as a result. The community-of-practice is a type of activity and social system that both acquires persons and is acquired by persons.

The idea that newcomers may usefully participate in a community from day one is especially apt in the case of Technology Leadership students, approximately half of whom, at the start of a school year, are new to the program. Indeed as Lave and Wenger point out, in this participatory learning process not only do "newcomers" learn from "old-timers," but old-timers may also learn from newcomers. Learning that occurs among newcomers in their informal daily interactions in the Computer Lab is powerful. Finally, interactions within and between old-timer and newcomer groups can also work to continuously transform the nature of the program. While participation of new students may initially be peripheral, it rapidly becomes more centrally located, especially with the increased interaction. The speed with which the transition from newcomer to old-timer is expected to occur magnifies the conditions that support (or possibly derail) learning that occurs in a community-of-practice.

It is worth noting that changing the participation of actors in a community involves developing a new identity. There is an important difference between identity construction for newcomers and one for more experienced participants who produce new practices in a community. The sorts of relationships that characterize

actors in particular socio-historical communities predetermine the general sort of identity a newcomer will develop. In cases where new practices are being developed, new relationships must be negotiated, ones that are not set out by the historical community. These new relationships could only arise as a result of an outward movement away from the relationships that are associated with central practice within the community. The larger social world beyond the community must be included in the analysis to account for these new relationships. Contesting community norms, however, is a complex process because many other considerations come into play, such as varying influence of different practitioners and the strategies that individuals use to effect change. For an individual or group to bring about change in a community, a degree of negotiation is required so that they can both act differently and still be part of the community-of-practice upon which their identity is based.

Nevertheless, as important as Lave and Wenger's work is in setting out how learning occurs through collaborative efforts of newcomers and old-timers, the cases they describe in their study and mine differ in several ways. The first is in the type of work/learning that is analyzed. Lave and Wenger build their ideas about the development of skilled practice from case studies of apprenticeship in (mainly) technical settings. Those kinds of settings are rather dissimilar examples from the context of high school students questing for technical expertise, where the nature of collaboration and how to effectively set-up and maintain a collaborative technical environment is of central concern.

Second, apprentices in Lave and Wenger's case start as relative newcomers and the initiated practitioners generally agree on what the apprentices need to learn. In contrast, Technology Leadership students have initially been exposed to computer technology, where in order to retain expertise, what needs to be learned by both the newcomers and old-timers is not only constantly changing but is continually being updated. Tailors, to take one of Lave and Wenger's examples, focus on a relatively specific set of tasks and skills.

Third, Lave and Wenger build their cases of selected communities of practice largely from participant observation. However, in contrast to Lave and Wenger's cases, this study draws additionally on data collected from ethnographic interviewing of a cross-section of students who were either enrolled in the Technology Leadership program and had taken an in-school or out-of-school technology course, or who previously were enrolled in the program and had left the program. Details of the selection of participants, interview questions, and other relevant considerations in the study are discussed in the methodology chapter.

2.6 Contemporary identity considerations

According to Penuel and Wertsch's account of theories of identity, choosing commitments is the first and most basic process of identity construction. They describe these choices in terms of Erikson's principle of *fidelity* which is the "ability to sustain loyalties freely pledged in spite of the inevitable contradictions of value systems" (Erikson, quoted in Penuel & Wertsh, 1995). For Erikson, fidelity is the

cornerstone of identity. The search for fidelity involves becoming committed to a group of people and to a set of ideas one can trust, a process of active seeking and searching. Interpreting the actions of youths at this time who struggle with fidelity requires sensitivity to adolescents' "seeming shiftiness". Adolescents exploring their identities look for an opportunity to decide to whom and to what they will be faithful; they resent any attempts by others to impose a set of values or practices on them. When the youth come to experience a sense of fidelity, they do, in fact, regenerate societies through their individual selection of commitments from among those ideals and virtues provided by their parents' generation.

Ideologies, in this stage of development, play an important mediating role in defining the terms by which adolescents will make commitments to others and their ideas. Coherence is achieved ideologically when the ideology chosen is one that "provides a convincing world image" and provides hope for an "anticipated future" (Erikson, 1968, quoted in Penuel & Wertsch, 1995). If ideologies provide the foundation of ideas for hope of an anticipated future, then the choice of occupational goals grounds this hope in actuality, allowing youth to come to see themselves as having coherent identities in terms of a career. In adolescence, society asks youth to define for themselves what they will do – what path of duty and service they will take as adults who must make a living for themselves and produce as a society's goods. At this point at least, for the youth who is truly exploring possible identities, "the choice of an occupation assumes significance beyond the question of remuneration and status" (Erikson, 1968, p.129, quoted in Penuel & Wertsch, 1995). The choice of an occupation becomes wrapped up in the larger need for

coherence and sameness that defines identity. Making a choice of a career makes the "promises" of an ideology and of continuity in life more actual. Having a career provides a trajectory by which the roles and expectations from childhood of youth's creativity or intelligence find fruition in the choice of a career that is consonant with one's own desires and with what others recognize as a genuine potential for success. Taken together, commitments to others whom one can trust, to an ideology that promises a place in the world with a hopeful future, and to a career choice that can actualize those promises, form the three important domains of identity construction.

For many, one of the most important insights of Erikson's theory of identity construction is the status he gave to the cultural and historical context of youth in constructing a coherent identity. For Erikson, life history "intersects" with the historical moment in which all youth find themselves. The artifacts, images, and myths that are part of the environment of children growing up are traces of a culture's history that, over time, become internalized to a greater or lesser degree by youth who grow up in that culture. They are historical, in the sense that they persist over time, and are not created by youth themselves, but are created by previous generations or by their parents' generation. They live, in Erikson's sense, in the lives of youth who grow up hearing myths, enjoying art, learning the sciences, engaging in drama, viewing cinema, reading fiction, or as in this study, immersed in computer technology activities. In each of these acts, history and historical processes find their way to the core of individual identity.

Similarly, cultural tools in identity construction may have spin-off effects in that their incorporation into different activities may have unforeseen consequences for others and for the individual. In this connection, it becomes clear how the purposes of individuals in using cultural tools may direct action but not determine their outcomes. Moreover, the situation of cultural tools in particular contexts means that the meanings of these tools have been used by others in other places and at other times (Wertsch, 1991). Identity may be conceived as formed when individuals choose on particular occasions to use one or more resources from a cultural "tool kit" to accomplish some action.

2.7 Tenets of Actor Network Theory (ANT)

Actor Network Theory provides a powerful basis for investigating the shifting of identities as a process of network building. Like many sociocultural theorists, Lave and Wenger (1991) tend to concentrate on the reproduction of communities of practice, and in doing so, have less to account for other different communities. It is when the focus is placed upon the production of a new practice that the need to account for the different communities beyond the immediate community-of-practice becomes most apparent. Actor-Network Theory (ANT) provides a way of doing this that enables some of the important contributions of sociocultural theory to remain in place and, at the same time, allows the limitations created by the bounded community focus to be overcome.

In ANT, Latour (1987, 1996) follows scientists and engineers to develop an account of the network constructed in the production of technological artifacts called tokens. The token being disseminated is either ignored, or taken up by people who see their interests translated within it. In the process of shaping it to their interests, these people usually modify the token. Not only is the token continuously transformed as links with other actors are established but so are the other actors. As they take up and use the token, their actions and patterns of practice change with the possibilities the token presents. Those associated with the token form a network through links with the token. The token defines the network, but the network also simultaneously defines the token – the actors and the network together co-evolve, and accordingly, co-construct one another.

In his book *Aramis, or the Love of Technology*, Latour (1996) investigates the failed development of a new guided transportation system in Paris. He shows that for this project to be undertaken, networks of actors had to be constructed. The actors that must be linked in the network of the project Latour describes range from the technological artifacts that will become part of the train, to the customers and politicians who must support the project if it is to continue. Managing a project like this requires actors who have a strong interest in the success of the project to become network-builders so that the actors whose participation is required can be convinced to participate in the network. Actors must be enrolled into the project and mobilized in such a way that allows the project to proceed. To enroll actors, their interests must be translated by the network-builders so that they become consistent with the goals of the project. Actor-network theory concentrates on the

process of building and maintaining networks; it is a "study of methods of association" (Latour, 1986, p.264) and looks upon linkages between actors in the network as "ongoing accomplishments" (Nespor, 1994, p.12)

The actors in ANT are hybrids that create their own "actor-worlds." As such, the actor is not an entity to which human intentional behaviour can be attributed but a more abstract term that can either refer to human or non-human entities. It is not a specific unitary entity but rather a product of a more or less stable relation between various effects that together form an "actor-network." An actor-network exists when there is an interrelated set of entities that have been successfully enrolled by an actor that can thereby act with their support, or on their behalf. The inter-related group of entities generated by the actor-network is referred to as an "actor-world." The process by which an actor enrols other entities is referred to as the "process of translation."

Network building, which is the focus of ANT, involves linking human and nonhuman actors. As network-builders construct or maintain the networks in which they participate, several strategies are employed. One of these is the *enrolment* of other actors. Actors are enrolled as they are woven into the actor-network (Nespor, 1994). Enrolments are accomplished through a process of *translation* where the interests of actors that are to be enrolled are interpreted by network-builders in a way that makes the actors' interest consistent with the interests of the network (Latour, 1996). The network-builders try to reconcile the interests of the actors they want to enroll with those of the network by convincing

the potential actor and/or changing the position of the network to match that of the potential actor. As network-builders enroll actors, they are also engaging in the process of *mobilization*. Mobilization refers to "making a maximal number of allies act as a single whole in one place" (LatouLr, 1987, p.172) and in support of the positions of the network.

2.8 Summary of the chapter

Identity has been described as the "kind of person one is recognized as being, at a given time and place" (Gee, 2003, p. 99). Said differently, identity is who a person is interpreted to be in a given context. In using this definition of identity, one must recognize the significance of the interpretation process that serves as the subtext of identity. As individuals signal meaning that seeks to help others identify them as a particular kind of person, their identities are socially constructed. For example, those individuals who seek to be seen as technically savvy (actively or passively) must engage in activities (including their use of language) others interpret as "technical." In this sense, identity reflects a broad set of symbols that are constructed in moment-to-moment interaction, over local time, and over a broader socio-historical context.

Against the theoretical demands on identity as an analytic concept, the sociocultural perspective to identity construction, in conjunction with Lave and Wenger's notion of a community-of-practice and Latour's Actor-Network Theory are the theoretical frameworks of this study. In this chapter, I have discussed the

perspective on identity construction that focuses on social groups and their overt or covert means of impacting identity choices of those residing within the community of practice. The perspective adopted throughout this dissertation is that identity is fluid, dynamic and recursive and that its representation is an ongoing process, undertaken on many levels, in different practices and sites of experience or communities-of-practice. Accordingly, the dissertation explores what ways student identities develop in the context of the Technology Leadership community as program participants take part in its activities. How does the SCN's technical character change with students' progressive participation in it? And how do the relationships between the technology actors in the community of the school shift over time to adequately respond to the changes in program participants' identities and in the SCN? These are the questions that I explore in the next chapters. The following chapter gives a description of the methodology and the context of the study. Thereafter, I provide the analysis of the data and conclusions of the study.

CHAPTER III

METHODOLOGY

3.1 Overview

The chapter describes the methodology employed to explore the co-construction of student identity and the school computer-network (SCN). I begin with a description of the context of the study by providing some background information about the school. Next, I situate myself both as a researcher and as a practitioner in the research setting. I show how certain aspects as a researcher coincided with, or related to, my role as a practitioner on site in a manner that enhanced both roles. And as a rationale for choosing a qualitative research method for this study, including data collection and analysis, I reference Filstead's characterization of this method:

> Qualitative methodology refers to those strategies, such as participant observation, in-depth interviewing, total participation in the activity being investigated, field-work, etc. which allow the researcher to obtain first-hand knowledge about the empirical social world in question. Qualitative methodology allows the researcher to 'get close to the data,' thereby developing the analytical, conceptual and categorical components of explanation from the data itself. (1970, p.7)

Finally, in the context of the study, I discuss the research design, including a description of student and teacher respondents in the study, and methods of data collection and analysis.

3.2 The Context of the study

The school in which I conducted this study is located in the suburbs of the Vancouver Lower Mainland, Canada. *Pal School*, as I call it, is an urban school of slightly over one thousand (1065) students. The school first opened its doors in 1950 and has played a central role in the community for over 50 years. It boasts a predominantly urban mix of students of middle-class backgrounds from various multicultural backgrounds. The community is diverse and multicultural with about 47 per cent of the families reported as speaking a language at home other than English. *Pal School* has a reputation of being a safe and caring school. Staff, students and parents speak of belonging to the "Pal family". Some students are from families whose parents and grandparents graduated from *Pal School*. It is also not uncommon to find a number of students that have been living in Canada for only a few months.

The relatively small number of students in the school makes for a safe, close-knit, community-minded environment that encourages students to strive for excellence through academic, creative and extra-curricular pursuits. The school prides itself in its extensive involvement in, and interaction with, the local community. It encourages its students to promote the spirit of giving to the community and has local partnerships with Children's Funds, the Greater Vancouver Food Bank and the Variety Clubs in the community. The student population excels in many sports such as Soccer, Volleyball and Basketball at both junior and senior levels and for both boys and girls. Its Drama and Arts programs

are very innovative and are much anticipated punctuations in the course of each academic year. The students perform well on the grade 10 and 12 provincial examinations and regularly participate in numerous mathematics, science, and writing contests. A high percentage of students earn honour-roll standings and are recognized through a Work Ethic list of Distinction.

Pal School prides itself on its ability to offer a comprehensive program of studies and extracurricular activities. The students take part in a number of enrichment activities and programs including drama, music and visual arts, athletics and academics. *Pal School* has well-developed Honours and Advanced Placement programs, an outstanding Career Program, as well as programs in Applied Skills and the Arts. A flexible and supportive environment for students allows success across a wide range of learning styles and challenges. Its Growth Plan documents the school's belief that all students can achieve success and that the school is able to facilitate their learning. The school's success is directly attributable to the dedication and skill of its staff and students.

Participation is important to the *Pal School* Community. The school encourages students to take a balanced program that includes core academic courses as well as Visual and Performing Arts, Career Program and Work Experience, and Applied Skills (Business Education, Home Economics, Technology Education, and Senior Physical Education). Students in all grades are encouraged to serve their school and community through volunteerism; many students receive service recognition for their contributions.

With its strong Business Education Department, students are able to operate not just one, but three, school stores. The School Newsletter is a complete student production, written and produced for students and by students. The school has a highly successful Visual Arts program. Student artwork has been chosen to appear in gallery exhibits near and far. In addition, several students have earned Advanced Placement course credits in diverse post-secondary programs. The student population has a tradition of regularly organizing trips to various parts of the world in its Annual Spring vacation itineraries; students have travelled to Asia and Europe. They have also travelled to Quebec as participants in language exchange programs.

Student leadership is a focus and strength. The student leadership program is particularly impressive, with the various Student Councils working hard to make school more than just a place to learn, but a place to grow. *Pal School* has an elected Students' Council, Graduation Council, Sports Council and Fine Arts Council. Over 100 student leaders attend two school sponsored student leadership retreats each year. There are many opportunities for students to develop skills and to put leadership theory into practice. Whether a student's strength lies in calculus, acting, soccer or event planning, this school strives to bring out the best in everyone. In the words of the Principal: "We have a strong academic record, a broad co-curricular and extracurricular program, dedicated and well-qualified teachers, wonderful students and an involved and supportive parent community."

Pal School has a strong and vibrant Parents' Advisory Council (PAC); meetings are well attended. There is an active electronic network, which supports frequent communication among PAC members. Parents and the community support the school by volunteering in the school, attending school events and performances, and participating in school focus groups as part of the development of the School Growth Plan.

3.3 Locating the researcher

I came to the research with particular interests and commitments that shaped my choice of topic and approach. I made choices as the research progressed which also contributed to the research account that I am reporting in this dissertation.

When I started this research, I had gained about nine (9) years of teaching experience, primarily from teaching in *Pal Secondary School.* I taught Mathematics and Physics for the same length of time and I was very familiar with how traditional discipline-based courses such as mathematics and science were approached in the school. Being a teacher in the school, I had been involved in various strategic planning sessions to introduce computers and to launch a SCN in the school, among others. I had, however, not directly been involved with the actual implementation of the program.

I became interested in conducting this research after I started noticing that students of diverse abilities in mathematics and science were being drawn to

participate in Technology Leadership activities and were increasingly devoting considerable time to the program's projects to the exclusion of work from almost all of the other timetabled courses.

There is a running story in the Mathematics Department of a Grade 12 student who was scheduled to write an end-of-unit examination. The student sat down to write the examination and within fifteen (15) minutes, claimed to have completed the examination and requested that the teacher grant him permission to leave the room. When the teacher inquired what the matter was, the student replied that he wished to use the remainder of class time to complete a programming project in the Computer Lab. On trying to persuade the student to finish writing the examination, the student replied that the work that he had written was enough to earn him a score of fifty percent (50%) that he desired. This story illustrates that the students who were active in the Technology Leadership program were obviously very capable academic students whose interests had been peaked by the activities in the technology program. Subsequently, these students were devoting increasingly large amounts of time on computers.

Positioned in the same school as a teacher and in a department that was fairly removed from day-to-day technology activities, I was able to gain entrance to the Technology Leadership community and maintain, albeit occasionally, ongoing conversations with many of my major data sources. I was able to check back with them regarding their involvement and thoughts on school events and on their own activities, in the course of the research. In addition, I returned the analysis

chapters to the participants so that they could decide whether the data were a fair representation of the events, conversations, and interviews. In so doing, credibility, taken as a match between my interpretation of the data and the ways that my sources claimed they saw things relating to the dimensions I was researching, was enhanced through prolonged engagement and persistent observation (Guba & Lincoln, 1989). The years I spent embedded in the research setting before and after data collection, immersed in the community of the school as a member of the teaching staff, afforded me several opportunities to increase the credibility of the data.

3.4 Collection and analysis of data

To address the research questions guiding the study, I employed a qualitative research methodology and used multiple data sources and collection procedures for cross-validation and comparison of information. I used a questionnaire to gather background information about the students and about their participation in the Technology Leadership program. This approach helped to elicit student understandings of the program and of their contribution to technology use in the school. I made observations and took field-notes of different student activities in the school Computer Lab and around the school. These observations, together with the issues that I learned from the questionnaire and from my conversations with groups in the community of the school, formed the basis for framing semi-structured questions in the interview phase of the research. The interviews explored

understandings of student program participants and of teacher interpretations of the Technology Leadership program and of its value to the SCN.

The interactions that I made of program participants activities and participations were of a non-participant nature. I maintained an arms-length relationship with primary participants of the Technology Leadership program so as to afford enough distance to observe, yet hold a critical stance, about the relationships program participants were constructing in the community of the school. I did not actively participate in the Technology Leadership community as I might have if I were conducting a naturalistic ethnography. My position as a math teacher in the same building – a position of power in the SCN and a member of a community that was interacting occasionally with active members of the Technology Leadership community – carried with it responsibilities that dictated that I position myself as 'a fly on the wall' of the Technology Leadership culture. In this sense I conducted a non-participant ethnography.

There are many forms of ethnographic research but ethnography primarily refers to a particular method or set of methods. In its most characteristic form it involves the ethnographer "participating, overtly or covertly, in people's daily lives for an extended period of time, watching what happens, listening to what is said, asking questions – in fact, collecting whatever data are available to throw light on the issues that are the focus of the research" (Hammersley & Atkinson, 1995, p.1). Essentially Ethnography is a form of research focusing on the sociology of meaning through close field observation of sociocultural phenomena where the ethnographer

focuses on a community, selecting informants who are known to have an overview of the activities of the community. Accordingly Hammersley and Atkinson further explain that, in this research tradition, such informants are asked to identify other informants that are representative of the community, using chain sampling to obtain a saturation of informants in all empirical areas of investigation. Informants are interviewed multiple times, using information from previous informants to elicit clarification and deeper responses upon re-interview. This process is intended to reveal common cultural understandings related to the phenomena under study. These subjective but collective understandings on a subject are often interpreted to be more significant than objective data.

The participants in this study were identified on the basis of their association, or familiarity with, the Technology Leadership program. I interviewed program participants that members of the Technology Leadership community had recommended to me. Student interviewees were enrolled in the Technology Leadership program, were enrolled in IT and Computer Science courses and had taken courses in the Learning Technologies department and were no longer taking courses in the department. Of the twelve (12) student participants willing to speak with me about their experiences in the program, articulating who they were and what they expected to get out of the program involved explaining their understandings of present technology trends.

Data were collected continuously from the start of the school year in September 2003, to the remainder of the 2003-2004 school years. The Tables below

give a summary of student respondents by courses offered in the LT Department, by grade level and by gender. There is also pertinent demographic information about the teachers that were referred to me and that interviewed for the study.

Table 3.1 **Distribution of student respondents by IT courses**

Courses offered	**Number of respondents**
Information Technology (IT) 11	2
IT 12	2
Technology Leadership (TL) 11	3
TL 12	3
Computer Science 12	1
Computer Science (Graduated)	2

Table 3.2 **Distribution of student respondents by grade level**

Grade level	**Number of respondents**
10	4
11	3
12	5

Table 3.3 **Distribution of student respondents by gender**

Gender	**Number of respondents**
Male	6
Female	6

Table 3.4 **Summary of student respondents' demographics**

Name	Gender	Grade	Course	Course(s) prior
Caroline	F	10	TL11	IT11
Eli	M	12	–	IT11, AP Comp Sc in Grade 10
Elizabeth	F	11	IT11, IT12	Comp Sc. 9/10
Eric	M	12	AP Comp Sc. (correspondence)	Comp Sc. 9/10, IT11 (no IT12 – conflict)
Gordon	M	11	TL11	IT11
Irene	F	10	TL11	Comp Sc. 9/10
James	M	11	TL12	TL11, IT12
Jennifer	F	10	IT11	Computer Sc. 9/10
Jessica	F	10	IT12	IT11
Josephine	F	12	–	IT11 (9), IT12 (10)
Scott	M	12	TL12	Computer Science 9/10, IT11, IT12
Ted	M	12	TL12	TL11,

Although I held formal interviews with two (2) classroom teachers and one (1) administrator, I had numerous informal conversations with different teachers, parents and staff in the school about their experiences and work with members of the Technology Leadership program. Many teachers informally shared their experiences about the program, with me, but showed peripheral understanding of the program's organization. I have selected to represent the views of various members of the school through the voices of the teachers named in the table below because they were articulate, their views were representative of the groups outside

of the Technology Leadership program and because these teachers showed a working understanding of the Technology Leadership program's relationship with the community of the school. Below is a summary of demographics of the teacher participants in the study.

Table 3.5 **Summary of teacher respondents' demographics**

Name	Responsibilities in the school
Ms. Leeza	Principal, Pal Secondary School
Mr. Leonard	Department Head, Social Studies Department
Mr. Ceena	Department Head, Learning Technologies Department

The documents I collected included the School Technology Plan that the school community developed in conjunction with the School District and the Parent Advisory Council. It is this document that guided the discussions of the School Technology Committee around technology issues in the school. I was also able to get copies of the Information Technology (IT) and Technology Leadership course outlines and copies of students' assessment rubrics of their ongoing projects in the Technology Leadership program. The Learning Technologies Department Head also showed me a copy of the department's inventory that included, digital cameras, DVD recorders, laser printers, computer hardware and various software programs. It was from the inventory that I learned the importance of the "A+ Certification" to

the Technology Leadership program – an aspect of the program that was popular with the more experienced members.

From these various data sources, I developed an interview guide with several narrative points in mind. I prepared questions of an exploratory nature to elicit participants' responses about their experiences within the Technology Leadership program. In the course of the study, I interviewed each respondent at least twice: at the start of the school year, in the middle and towards the end of the school year.

During the interview, whenever a respondent made generalizations, I encouraged the participants to narrate the past experiences that embedded their abstractions and demonstrated how the abstracted meanings emerged through experience (Holstein & Gubrium, 1995). I considered the participants as constructors of knowledge in collaboration with the interviewer (Schwandt, 1999). I devoted the opening part of the interview to gathering background information of the participant, and left the last discussion open to elaborate on earlier aspects of our conversations and to carry out member checks. Here I tested and discussed time-in-the-field ideas, interpretations, and conclusions with participants, allowing them to react, and thereby enhance the credibility of the study (Lincoln & Guba, 1985).

The design of the interview questions encouraged participants to structure their responses around the topics that emerged as the interviews unfolded. These responses addressed particular facets of the participants' experiences as they participated in the Technology Leadership program and situated their experiences

in the wider technology practices in the SCN (Rossman & Rallis, 1998). I did not impose any *a priori* categories that would limit the field of inquiry (Fontana & Frey, 1998). Instead, I probed the intentions, motives, and meanings, contexts, situations, and circumstances embedded in the participants' responses (Denzin, 1988).

In the course of the study, I analyzed observation field-notes and interview transcripts to construct a qualitative schematic of student understandings of their experiences in the Technology Leadership program and of their involvement in the SCN. I individually transcribed, read, coded, and analyzed each data set to derive a formal coding structure. All interviews were audio-taped for transcription and later analysis.

Post-field analysis involved a range of analytic procedures ranging from highly structured to the more open-ended (Rossman & Ralis, 1998). With the exception of documents that were already in the print format, the data were in the form of audiotapes or hand-written field notes. The audiotapes of interviews and conversations were transcribed verbatim with only minor editorial changes made to improve the readability of the responses. As close to the time that they were taken as possible, the hand-written field notes were typed in a more organized and focussed format. In addition to the typed version of the filed notes, I created analytical memos that were notes about emerging themes and events that helped me to identify issues that needed to be followed up at some later point.

Following the transcription phase of data transformation, I analyzed the participants' responses thematically to uncover themes that articulate and illustrate the everyday meanings of the experiences of the participants in the Technology Leadership program (Riessman, 1993) in a manner that maintained their integrity. Presenting the participants' original accounts in a manner organized around themes allowed me to capture the richness and detail of their experiences, compliment the participants' individuality, and highlight themes that emerged through the reading of the data (Cole & Knowles, 1995). Following Coffey and Atkinson (1996) I used these themes to explore how the respondents framed and made sense of particular sets of experiences. These themes constituted analytic points of departure from which I re-read and explored the data in more detail, with attention paid to the events and happenings central to the participant's experiences. From both general and detailed readings, Kvale (1996) suggested that finding the storyline within and between responses provides them with unity and coherence. Thus, the narratives that I provide develop the themes and the themes provide a coherence that acts to organize the individual responses into a richer, more condensed and coherent identity. Although responses from the more articulate participants appear to dominate in the analysis, it is these responses, constructed from quotes and evaluative third person narratives drawn from the participants' own words that are presented as the data in the study.

3.5 Issues of dependability and validity

According to Guba and Lincoln (in Mertens, 1998), dependability is the qualitative research equivalent of reliability and is concerned with the quality and appropriateness of the research protocol. Research that documents the research process in detail so that it can be tracked and publicly inspected is considered to be dependable. I have in my exposition of the research methodology of this work attempted to do just that.

In addition, Guba and Lincoln (in Mertens, 1998) equate internal and external validity with credibility and transferability respectively. McMillan and Schumacher (1997) describe internal validity as "the degree to which the interpretations and concepts have *mutual meanings* between the participants and the researcher" (p.404). I used a number of strategies to build internal validity or credibility into this research including prolonged and substantial engagement in the research setting, member checks, triangulation, peer debriefing, participant language, and mechanical recording of data. For example, following each interview transcription, I asked each respondent to read through the transcript and ascertain whether the transcript reflected, to the best of their recollections, the information or experiences that they intended to convey, and whether there were ideas or observations that they wished to add to or omit from the transcript.

Whereas external validity has to do with the degree to which the researcher has provided for "extension of the findings" (McMillan and Schumacher, 1997, p.411) to other settings, I do not in this work attempt to generalize the results of the

study. Rather I provide detailed description of the study that allows the reader to decide how closely the context of his or her own situation resembles that of the study. These thick descriptions also serve another purpose. They attempt to address issues of dependability and validity through a detailed description of the purpose, context, and design of the study. Additional strategies used to enhance the validity of the research include:

1. *Substantial engagement*: I deemed at least two forty-five minute interview sessions at the start, in the middle and towards the end of the school year a reasonable amount of time for investigating the strategies participants had employed to define their participation in Technology Leadership program activities.
2. *Mechanical recording of data*: Audio-tapes of interviews provide an accurate record of events.
3. *Participant language and verbatim accounts*: Transcripts of excerpts from interviews help elucidate participant meaning.
4. *Member checks*: Paraphrasing participants' statements and then asking participants to verify my understanding of these statements verified researcher interpretations. In addition, interviews served as a check of my perception of events in the SCN, as I asked participants if they noticed the same things that I did. Of course it is possible that participants voiced agreement with my perceptions even though these perceptions could not have reflected their own.

5. *Triangulation*: I used multiple data sources to check for consistency and reliability across data sources.
6. *Peer debriefing*: I engaged in several conversations with my colleagues who had shown interest in the interview sessions throughout the study. These conversations helped to broaden my perspective. At the end of the study I presented my findings to my colleagues who again offered useful feedback.
7. *Field notes*: I kept a reflective field journal that documented my thoughts, reactions, questions, and decisions throughout the study.

Although separate, issues of dependability and validity both rely upon detailed description of the research context and design. While it is my responsibility to provide this description, it is ultimately the reader that decides the authenticity of the study.

3.6 The Analysis chapters

The analysis of the data is provided in the next three chapters. Chapter IV outlines how the school technology committee was set-up to oversee and support various aspects of the SCN and, particularly, to liase the SCN with the community of the school. It explores the dimensions of student identity with technology. Chapter V focuses on the role of students in influencing the technical character of the SCN and of the kinds of changes that manifested themselves in the context of a community of the school that had benefited from the technical expertise of student

participants in the Technology Leadership program. Chapter VI discusses how the relationships that developed in the community of the school between Technology Leadership students and the SCN shifted over time to adequately respond to the changes in student identity and in the SCN.

CHAPTER IV

DEVELOPMENT OF STUDENT IDENTITY

4.1 Overview

The *Pal School*'s Accreditation report of 1999 underscored the need for the community of the school to begin to take advantage of new learning technologies. A School Technology Committee was subsequently struck and efforts to construct a SCN began. Working with the leadership of the school, the Committee set out to construct an organic and purposeful SCN – one that was adaptable to changing technologies and addressed student learning and teacher instructional needs. In addition to overseeing the purchasing of computer hardware, software and peripherals such as printers, cameras and scanners, the School Technology Committee decided that encouraging, organizing and supporting student participation in school learning technologies would be pivotal in cultivating and perpetuating a technology culture in the school.

In this dissertation, I use the phrase "learning technologies" to refer to the "hard" infrastructure of wiring, desktop computers, software applications, and computer peripherals such as digital cameras and laser printers. Learning technologies also include the "soft" infrastructure of technical services in the school to support all computer equipment. These technical support services were organized under the Technology Leadership program. Together, the "hard" and "soft" infrastructures constitute the SCN. It is the experiences of student

participants in the Technology Leadership program (hereafter, referred variously as program participants, Technology Leadership students and members of the Technology Leadership community) that are the focus of this analysis chapter.

4.2 Forging a technology community-of-practice

Technology artifacts are increasingly distributed and interactive such that students are exposed to computers and computer technologies at a much younger age. Students routinely employ these technologies in their entertainment and are increasingly demanding its use in their learning. In addition, educational and business communities are demanding that students develop functional technical skills in their schoolwork that will prepare them to fully participate in the technological work-place of tomorrow (Cuban, 2001). The sections that follow describe aspects of program participants' experiences that enabled them to engage in new technology practices in the SCN and made it possible for these students to forge a Technology Leadership community of practice.

4.2.1 Participants' similar technical backgrounds

Having similar technical backgrounds was an important aspect of program participants that tended to forge a sense of community among students. Most students enrolled in the Technology Leadership program sought to work with computers at a much younger age. Scott was in his third year of program involvement and he explained that:

> I guess how I got started with computers would be, when I was young, we didn't have cable TV, we didn't have TV at all, but we had a computer. So I spent a lot of time on that computer. And then my Dad bought a newer and better computer over the years. Then I think, at about grade 7, I started fixing computer problems at my old elementary school (Scott).

Similarly, Josephine related her technical skills to the fact that she started exploring computer technology at an early age:

> Well, I had a Website so I already knew ahead of time, right from grade 7 when the Internet started, which was like the big buzz, and then I started doing websites and then I liked it (Josephine).

Students were genuinely intrigued by the continually changing nature of technological advancements and by technology's perceived unreliable nature. Student intrigue seemed to draw students to experiment with computer technologies in order to enjoy their "fun" features and to learn to fix technical glitches when they occurred. Ted, one of the experienced members of the Technology Leadership program, observed that:

> I think it all began when I was really frustrated with my IBM PS/1. It kept on messing up on me and I was getting irritated. So I asked one of the teachers and then he started to explain it, then my brother went to Simon Fraser University (SFU) and was taking Computer Engineering, and he helped me along and basically the process peaked my interest (Ted).

Most students reported that, during their explorations, they encountered many computer problems and that they had been frustrated by the lack of technical solutions available to fix the technical glitches. Not many people around them were, for the most part, familiar with computers enough as to offer meaningful solutions. Many of the students reported that they had, for the most part, devised

technical solutions to the problems they encountered through tinkering, from seeking out solutions over the Internet, or from consulting with each other.

> Most of the time, I usually learnt from the things that I messed up on in my computer that I had to fix, or else I would have lost everything (Ted)

Participants in the Technology Leadership program reported that they experimented, explored and continually sought information on computer glitches outside of class time. For many students, this component of the program drew them to enroll in the program. Not surprisingly, those who had been in the program longer seemed to have considerable command of common technical and troubleshooting solutions. Some program participants associated their expertise to their own individual effort. Gordon, a newcomer to the program, said that he had mainly accumulated his technical skills on his own:

> I got my first computer when I was in grade 5. So ever since then, like, every time my computer breaks down I try to fix it on my own, or whenever people come in to fix my computer, I would always watch them and I'd learn (Gordon).

For many students in the program, they learned about computers on their own or from other students through observation and tinkering.

The presence of family or friends, even while they did not possess the necessary technical expertise, influenced student exploration and acquisition of technical skills.

> My Dad always kept joking about how one time, cobwebs, got inside the computer and they ended up ruining the whole system and they had to rebuild everything. He was kind of laughing about the whole thing. He has these jokes about how it took almost an hour trying to calculate some equation that you can now just punch into a small calculator (Ted).

Technology Leadership students also made friends with others who were interested in music, video games and Internet game rooms, but who were not generally intrigued by the technical side of computers. Maintaining friendships with students who were not as technically inclined as themselves was important to program participants because the friendships widened the contexts within which they interacted with technology and increased opportunities where they could apply their understandings.

> I have a lot of friends who are into technology and most of them are usually in the game room because I like playing them [games] online with friends. It makes it more enjoyable (Ted).

Occasionally these friendships were cultivated with students who were knowledgeable in other areas of computing and served to complement students' learning needs. Because of the multi-faceted nature of computer technology, it was practically impossible for even the old-timers in the program to be equally knowledgeable in all aspects of computing. For example, Ted who was in his third year in the program observed that he recognized how good some students were in certain aspects of technology and that he consulted with them and learned from them as regularly as he could.

> Yes, I am currently working on programming for *JAVA* and I know a friend who is really really good at it and I ask her questions and I ask for certain ways to approach certain problems (Ted).

Technology Leadership students also received encouragement, or felt encouraged, to pursue aspects of technology, from various courses that they had taken in elementary or secondary school. The activities or projects from those

courses had made students' outlook on technology and of the place of technology in society, favourable and they felt they needed to understand more about technology.

> Well, I have taken all the technology courses and I have since developed a strong feeling that I would like some dealings with technology. I like learning about new things . . . whatever job I will go into, technology is going to be a big part of it (Scott).

Program participants also reported that teachers who worked with computers in an "awe-inspiring way" or teachers who had a unique perspective on technology influenced their interests.

> Actually in grade 10 or grade 9, I don't remember exactly, there was a teacher who I was talking to and he did a lot of interesting things with technology so I kind of enjoyed it. So I decided to take technology courses till Grade 12 (Ted).

As to what students said about their progress in the technology community-of-practice since joining it, Ted said:

> Actually, before I took TL11, I didn't really know much about computers. When I decided to take TL11, I decided to learn more about the structure, basic data coding and programming. And then once I learned the programming and understood the hardware itself, I decided to try doing more advanced things like creating pictures from models, like a projection and then tried to grow more advanced by creating a landscape of the area I live in (Ted).

While technology greatly contributes to a cultural milieu, which encourages student participation at a much younger age, the manner in which students galvanized their technical skills with computers was seemed to be common. Family and friends influenced students. Students learned individually, they learned collaboratively, and they learned from seeking information from diverse sources. The Technology Leadership program provided a unique setting for like-minded

students in technology to gather and explore their interests as a community. Their common interests helped them to begin to forge a community of practice. Those who had been in the program longer accrued an assortment of common troubleshooting techniques that appealed to newcomers and drew them to participate in program activities.

4.2.2 Organization of the program

To many students in the program, technology served a hub-function in their educational and professional aspirations; they saw technology being an important link between their schoolwork and their future aspirations. Although many students did not see themselves working as a computer specialist in the near future, they did not particularly envision themselves practicing in a profession that was devoid of technology. According to Jenny, for instance, having functional technical knowledge affords one the luxury of accessing numerous opportunities in the workplace of the future.

> It would benefit your future if you were going into any computer or technology related thing in the university. It will help you go in because you have more than background knowledge in that area. It will create a great opportunity for you (Jenny).

I observed that Technology Leadership students' increased use of technology in their learning helped to improve the quality and commitment that students brought to bear on project work in the courses in which they were enrolled. The extent to which the commitment and quality of work was a factor depended on the

interests and experience of individual participants and on the amount of time they invested in improving their technical knowledge. Ted put it this way:

> I try to combine some new ideas that I get from may be, let's say, from watching some interesting special effects that I just saw from a movie. I will try to recreate that in my computer to see how they did it, how they designed it, just to learn more (Ted).

The time individual students invested in learning about computer related-work depended on the students' duration of enrolment in the program. Students who had been in the program longer commonly spent considerable time exploring and trying different technology concepts. Students spent more time on an aspect of technology if it interested them, if it propelled their expertise in that area and, for the most part, if it served to invite other students to collaborate with them. Finding a program participant who claimed to be spending between "six to twelve hours maybe, in a week (Ted)" on an aspect of the program was not uncommon.

It is important to point out that, in their interactions in the program, participants routinely organized and re-organized themselves into groups of three or four students according to gradations in expertise on a specific task and according to their interests and need for program expertise in that area, and not particularly according to the age or grade level of participants.

> Generally, it was more of a group thing. We would work in groups of 2 or 3 or larger and so Mr. Ceena [the Learning Technologies teacher] would in Terms 1 and 2 say, like, "Oh, this teacher needs a computer. Can you hook up this?" And then we would form a group to carry out that task (Scott).

The more experienced students in the group not only mentored those who were less experienced, but depending on group specializations and task demands, the experienced students were usually consultants to other groups in the program and were consultants to the entire community of the school. Newcomers to the program were very appreciative of this aspect of program organization – organization around interests and experience of participants in each group such as computer software, Yearbook, and hardware repair and upgrade. Carolina, a new participant in the program, observed that:

> They (program participants) are very nice. So if I say I want to fix this, even if it is advanced, someone will sit beside me and watch me fix it and tell me what I am doing wrong and how to finish fixing it and everything. It makes me feel very welcome; like, as if I am not left out. So they actually try to teach me (Carolina).

Carolina felt that her presence in the group was appreciated and that allowing her to participate in certain activities that were fairly advanced, made her feel that her group members valued and respected her contributions; it made her feel that she belonged.

Technology Leadership participants were familiar with the practices of the SCN. Returning program participants understood the procedures for carrying out assignments, or knew whom to consult on certain aspects of the SCN. They had little difficulty recognizing when two or three individuals could complete a task, or when more than three students were required to complete an activity. Because they usually worked in small groups, old-timers in the groups usually guided newcomers during certain activities as to even act as their teachers.

> Most of the time, we knew what to do and we taught those who did not know. Some of them (program activities) were pretty basic but if we had a problem, Mr. Ceena would help us with his expertise. Or in some cases, we would look it up in the A+ Certification books to see how you should properly do it (Scott).

The 'A+ Certification' is a technician's certification to repair computers and manage computer networks. 'A+ Certification' is the basic certification towards being a network administrator. Students who had been enrolled in the program for over two years were preparing for the 'A+ Certification' examination.

Responsibilities for program activities were allotted without specific regard to age or grade level but according to the depth and breadth of experience with technology. Program participants valued the progression in responsibility and the recognition that was accorded to the more experienced members of the program. Program activities were problem-based, hands-on and relevant to student personal experiences with technology; they varied in the degrees of difficulty and nuance. Activities, such as computer programming, networking, and graphic design, were designed so that they were goal-oriented and encouraged active exploration and advancement in the specific area of expertise, according to participants' interests. Sometimes even the most experienced members of the program felt challenged and sought more information and continued to explore the continually changing aspects of computer technology.

4.2.3 Importance the program accorded to service

Technology Leadership students were responsible for using technical knowledge and software knowledge to help support the community of the school. These students were required to be available to assist teachers or other members of the school with technology whenever they needed it. Members of the school community were aware that Technology Leadership students were recruited to the program not only for being technically sound, but also for being able to communicate technical information clearly and in a timely fashion. It was standard practice in the program that if a member could not offer an immediate solution to a technical problem that they were to direct the problem to someone in the program who could answer it.

The technical support that Technology Leadership students offered to the SCN was very valuable to the community of the school. According to the Learning Technologies teacher, Mr. Ceena, the Technology Leadership program was modeled on the premise that:

> . . . if students were given, in terms of that leadership role, only their own projects to develop, you don't build a sense of community. . . They may focus on what they are interested in, but in terms of service and community for the school, helping them (Technology Leadership students) do things for others is just as valuable (Mr. Ceena).

The organization and delivery of services to the community of the school was based on the understanding that in the workplace one was never going to be isolated as to choose exactly what they wanted to do. They were going to be collaborating with

others and to be responsible for providing technical support to others. In making service an important component of the program, students understood that everything in the school that was related to technology was their responsibility. To Mr. Ceena, this was the pillar on which the Technology Leadership program was built.

> When we go out and learn to fix or support people or help them, we are not only learning how to fix that technology, we are also learning the process in which to teach that technology, or to troubleshoot that technology. So when you are in any environment where you have to deal with people, you don't just deal with the machine . . . You deal with people that deal with technology. The goal for that aspect which has always been here every year is to get students to be involved not just with computers but also with the people-side, or the human-side of the program (Mr. Ceena).

These students' involvement with the technology in the SCN went beyond troubleshooting, advising, and fixing problems computers; they were also involved with the creative and implementation aspects of the technology in the school. Ms. Leeza, the School Principal, observed that:

> Our Technology Leadership students, for example, do our Web Page. The Digital Yearbook is largely done by our Technology Leadership students. Our Technology Leadership students are sometimes called to elementary schools to help with software or to help with the ideas that they are trying to implement in the classroom (Ms. Leeza).

In the excerpt, Ms. Leeza referred to the outreach component of the program that program participants developed and maintained with feeder elementary schools. Technology Leadership students provided technical supports to school technology initiatives in order to broaden student experiences with technology in the community and to promote the school's technology program in elementary schools.

The idea was to have elementary school teachers and students begin to purposefully and collaboratively use technology. Program participants helped in Web Page design and in troubleshooting and computer repair activities in the elementary school. Mentoring was done in the hope that when elementary students eventually enrolled in *Pal School*, they would be fairly familiar with the Technology Leadership program and they would be easier to recruit. Josephine, a graphic designer for the Yearbook recalls Technology Leadership students paying them a visit in elementary school:

> There were a group of students who came to our school. It was just for a month and then there was a group of us and basically we were supposed to learn more about technology. And then some of the leadership students from *Pal Secondary School* (PSS) were supposed to teach us. I can't remember a lot. It is vague; it was like grade 6. I remember we were supposed to do our elementary school's website (Josephine).

A related component of the program's outreach work in the community of the school oversees Technology Leadership students participating in programming an interactive database of neighbourhood businesses and posting it on the Internet. The students also designed or revised WebPages of individual businesses around the school and take advantage of recent technology advancements in Web Page design. This way Technology Leadership students interacted with the community of the school was new to the school community.

The diverse aspects of service that program participants offered to the community of the school not only sought to extend participants' involvement with technology, they guided students to extend their technology repertoire into different

spaces and places technical support was needed. Most of all, the purpose was to enable program participants to construct common experiences, develop shared references about the technology in the community of the school and help students forge a technology community of practice.

4.3 Construction of student identity

Constructing a learning environment that enriches a child's experiences from the early years of education is a great challenge for educators and parents. The important identity-defining commitments that need to be constructed early in a child's development such as technical skills and technology career aspirations are fluid because technology is continually changing. Be that as it may, some students in the program groomed their computer and technical skills from an earlier age; they had immersed themselves early in technical exploration and had advanced their technical skills. Such students were drawn to participate in Technology Leadership activities because, very often, they knew much more than any other student and teacher in the school. However, not all such students joined the program and realized full participation. Some students joined, learned program expectations such as time commitments, and learned the inner workings of the program, and in the end, opted out.

In the next sections, I will show how in the context of the Technology Leadership program student involvement with the SCN helped to consolidate and

advance student experiences with technology and helped to construct student identity.

4.3.1 Individuals groomed their technical skills

At the outset, it is instructive to observe that student involvement with computers did not commence after their enrolment at *Pal School.* Students had access to learning technologies and computer resources from their homes and from the communities in which they lived. A few students sought opportunities early in elementary school or from home to the extent that when they enrolled in *Pal Secondary School* they had amassed considerable technical skills and could confidently participate in the advanced courses in the Learning Technologies department. Josephine was one such student enrolled in the Information Technology 11 course – a course parallel with Technology Leadership and focused on computer applications. In grade 9, she used this course as a platform for pursuing her interests in graphic design.

> I did Information Technology 11 and Information Technology 12 when I was in grade 9 and 10. I did it really earlier on and basically I started because I liked Art too and I wanted to do Graphic Design because I was interested in it (Josephine).

Because the Technology Leadership program did not prescribe any pre-requisite courses, students joined the program largely because they were comfortable with computers and because they showed strong interest in supporting and contributing to the technology in the school.

> I think it was allowed because in Information Technology 11, you don't need any pre-requisites. So I think it is allowed because I asked for it. The Technology Department Head allowed me because in grade 7, before I came to grade 8, I was on some technology program where the grade 7 students come to PSS to do computer work (Josephine).

That experience exposed Josephine to designing WebPages and had led her to create and manage a Web Page for herself. I asked Josephine what out-of-school experiences she had been exposed to that peaked her interest in Web Page design and graphic design.

> I had a computer at home and then we got Internet. Back then it was still dial-up; so I waited about 30 min to log-on. And then, my brother was a big user; and my brother is in Computer Science now. So he has always been a computer person – software – but I am more like a Graphic Designer – not really as much into software programming (Josephine).

At the inception of the Technology Leadership program, not many members of the community of the school were familiar with computers, and personal computer ownership was not widespread in the community. Prior to the campaign to establish a functional SCN in the school, Ms. Leeza noted that, prior to the program . . .

> . . . Technology Leadership students were often called to classes to show teachers how to use the technology. That does not happen so much any more. Technology Leadership students would come to, were asked to come to help explain software use, or they would come to look at a hardware problem, they were asked to if something didn't go on. They would come in, check the cords, and check the things that the teacher was not comfortable with (Ms. Leeza).

Technology Leadership students were mainly responsible for teaching the elementary aspects of computing and Computer Lab behaviour. Progressively, and

with widespread computer use in the community, students in the program have significantly contributed to the elevation of technology use in the school and many students now maintain presence on the Internet through personal WebPages, *Blogspots* and in other Internet community sites such as *Facebook* and *Myspace*.

> I think it was just that we were exposed to it at home and so then there was that part of it and sometimes it was just a hobby. After a while you get addicted to the Internet because it is fun; you can do a lot of stuff with it. So when I get home, I am always on the Internet; even my parents are on it. My Dad is into the Stock Market and then everything we do now is on the Internet. . .because it is so convenient (Josephine).

Increasingly, students were encouraged to participate in the community of the school through volunteer activities as a way of acquiring work experience. Many students were choosing to volunteer or participate in computer-related activities. The technical skills that students acquired from participating in Technology Leadership program activities and from participating in activities outside of school were invaluable to the SCN in enhancing the quality of students' work in the program and in other coursework.

> I'm a grade 12 student. My division is Computer Science. I wrote Advanced Placement (AP) Computer Science in grade 10. Before that I had volunteered at BCIT (BC Institute of Technology) in a computer summer class as a Counsellor (Eli).

Eli had a course conflict in grade 10 and he could not fit the IT11 course in his timetable. He opted, instead, to take an AP Computer Science course. Commenting on the level of difficulty of the AP Computer Science course, he said, "I just tried the course, and it was a piece of cake." This was following his volunteer work at BCIT

(a local technology post-secondary institution) as a computer counsellor in their Computer Science summer program. A computer counsellor supervised children's projects and advised children on various computer activities. And as *Eli* put it, "if you have some expertise in programming, it was helpful." As evidenced in the quote above, Eli's involvement with British Columbia's Institute of Technology (BCIT) summer program demonstrated that not only were elementary school children accessing opportunities to gain computer experience at an earlier age, they were doing so outside the regular school calendar.

The school recognized this aspect of student technology involvement in the community and awarded them credit towards the Applied Skills component of their graduation requirements. This move by the school served to recognize the contributions to school technology of students who were not participating in Technology Leadership program activities because of course conflicts early in the school year but had studied computers on their own and were heavily involved with supporting school learning technologies. Eric's experience was another example.

> I have taken two technology courses in school: Computer Studies 9/10 and Information Technology 11. Those are the only ones required in school (Eric).

Eric did not take Information Technology 12, nor did he take Technology Leadership 11 or 12 like most students who completed Information Technology 11. Rather, he said, "I am taking Advanced Placement Computer Science, right now, online," at his own time, saying: "I was planning to take Information Technology 12 but due to scheduling, I couldn't take it." Like most, Eric's enthusiasm for

computers emanated from being exposed to in-school and out-of-school activities. Eric contended that, ordinarily, he did not have ready access to a computer at home.

> From a fairly young age, from probably grade 6, I was trying to find out information about things. I didn't have that much access to a computer. My Dad was always opposed to it. He would always come home from work every so often, at that time, and deny us to use it. It wasn't until grade 8 when we had a computer all the time, access to it. The more I was able to use a computer, the more time I spent on it (Eric).

From talking to students in the program, it was apparent that the easier students' access to computers, the more proficient students became at using and experimenting with different computer applications. Students used a broad range of resources to support their curiosity and experimentation with the software and hardware in the school. They talked to teachers, they accessed technology programs within the neighbourhood of the school, and they consulted with each other.

> I'd say I have a pretty broad range of access like here at school with the *networked* computers and Mr. Ceena, who's certainly very knowledgeable on almost every subject, but I wouldn't say I have too much support outside of school (Scott).

Students who groomed themselves developed more advanced computer skills than their peers. After enrolling in the Technology Leadership program, these students discovered that the program permitted, if not encouraged, them to further their interests in computers outside of regular program activities. The fact that they were eager to collaborate with others of similar technical expertise, or that they sought to advance their technical skills in the neighbourhood of the school, is evidence of these students' quest to be technically sound with computers. Even

students who could not be initially enrolled in the program due to timetabling conflicts earlier in the school year felt included in the technology culture of the program because the program sought out those kinds of students and incorporated their technical skills into the supervision of, for example, Computer Labs during the lunch-hour and after school.

4.3.2 Hierarchy in program activities

The program was constructed to allow for pronounced flexibility in project choices for members of the Technology Leadership community and to permit them to pursue those aspects of technology that they were most curious about. Often students chose to pursue at school those aspects of technology that they were unable to access at home because of the high individual cost associated with the materials, or because of the large networking environment required.

> Mr. Ceena allows us a lot of flexibility. He gives us the ability to take or create one project every term, allowing us to focus on a program such as Adobe Photoshop or 3D Studio Max, to try to create something with a purpose because, he says, without purpose there's no use for it (Ted).

The A+ certification is an example of a specialized component of the Technology Leadership program that prepared program participants to manage local area networks (LAN). Once a student attained this certification, (s)he could make house-calls to repair computers and could offer technical support over the telephone. To achieve this certification, a student studied certification materials that the school purchased, and wrote an external certification examination.

> Yes, this is the first year we have had A+ Certification.
>
> When Mr. Ceena talked to us about it, I said, "Well, I'd like to try to get that certification."
>
> A few are going for the test. I know Ted is going for the test; and I'm going to probably take the test too. No one owns the certificate yet (Scott).

I asked about the resources such as high-end computers and specialized software that students in the Technology Leadership program had at their disposal and how these were acquired.

> If we want to pursue any of our high-end projects, say, for all [3D] rendering, we need high-end computers and so Mr. Ceena put that request in for us and then it was approved and the computers were bought (Scott).
>
> Another thing about Technology Leadership is, if we say we want to learn about something, the school will help to pay for it. Like the A+ Certification books, the school paid for them. They were quite expensive. They were about $90 each (Scott).

With the prominence of technology in the community of the school and because of the technical support services provided in the SCN, Technology Leadership students enjoyed respect and admiration among students, teachers and other members in the community of the school.

> I have had a few students come up to me and ask me about computer problems. Then I'd say, "Why not!", and then I'd give them the best advice I could.
>
> They see us as Specialists in technology (Scott).

Program participants took pride in their service and derived great satisfaction from being able to help not only the students but also the teachers.

> It's just going into a classroom and fixing a computer problem in 1 or 2 minutes and walking out and having the teacher being so grateful (Scott).

I asked whether being of service to the community of the school was partly what drew them to enroll in the Technology Leadership program, Scott's comment is again appropriate:

> It was very appealing to me to be able to learn whatever I wanted and be able to give support to the school from that. That was very appealing for me and that was probably the main reason why I signed up for it (Technology Leadership program) (Scott).

Technology Leadership students were encouraged to aspire to and attain proficiency in the many facets in the program. The A+ Certification, use of expensive software and developing abilities that demonstrated leadership in the network, for example, were openly encouraged among program participants. A few students in the program persevered and rose to levels of excellence in various technology strands. By supporting the activities of the Technology Leadership program, the School Technology Committee provided leadership in the construction of the SCN. This support helped to set up a hierarchy of skills that program participants aspired for and excelled in. Program participants felt continually challenged to attain exemplary skills with technology in such enrichment activities as "A+ Certification" examination and in their individualized and focused project selections that they developed in greater depth.

4.3.3 Participating at the program's margins

Some technically sound students opted not to enroll in the Technology Leadership program. Jenny, for example, believed that she could easily have joined the Technology Leadership program on the account that she liked computers, she loved to work on her own and she knew a great deal about how to fix computers.

> I thought about it but I don't think I am even going to take it next year because (already) my schedule is full with other courses (Jenny)

Her understanding of the Technology Leadership program was that students in the program . . .

> . . . basically fix computers around the school and they set up computers that need upgrades. . . It is a neat thing to have students do that in school so the teachers don't get too busy trying to fix computers (Jenny).

Students who were not enrolled in the program were still permitted to offer help in the Computer Labs as Lunch-Hour Monitors and Helpers and they received volunteer hours for their work. Such students felt that it was important to volunteer somewhere in the school. To these students, technology was an area in which they felt comfortable volunteering because they possessed the skills and they felt they wanted to help.

Some students did not enrol in the Technology Leadership program because they were uncomfortable with the leadership responsibilities that direct participation in the program entailed, yet they felt they could continue to contribute to the activities of the SCN in some fashion. Jessica, for example, felt that

Technology Leadership activities tended to overshadow the contribution that information technology courses were making towards the improvement of general students' technical skills. She felt strongly that had Information Technology (IT) activities received the publicity in the community of the school comparable with Technology Leadership (TL) activities, that the school community would have been amazed at what students in IT courses produced:

> If there are students who have taken Information Technology and they tell their other friends about it then possibly they would take it again next year as one of their courses. But as for the school, I don't really think we advertise enough for Information Technology. Some people don't even know what we do in Information Technology, but then when they actually get to see what we actually do in Information Technology, I think some of them are pretty impressed (Jessica).

I asked Jessica what she knew about the TL program and whether she had considered enrolling in it:

> That would be good as well but there are things in Information Technology that you don't get in Technology Leadership. Well, basically in Technology Leadership, it is kind of a smaller group than Information Technology. In Information Technology you get to see other people's work as well as your own. You get to work with a wider variety of people as opposed to Technology Leadership. You can work as a group as well unlike in Technology Leadership. I am just saying there are just many different people you can talk to in IT classes (Jessica).

Apart from differences in set-up and in the numbers, it was important to Jessica that she was involved with a program that emphasized collaboration on project work and that promoted discussions of project elements with friends both inside the classroom and outside of school. According to Jessica, such opportunities were

seldom available to Technology Leadership students because those students worked on advanced projects that were individualized.

> Well for Information Technology courses, I guess everyone has to do his or her assignments. In Technology Leadership, you have to be very motivated to do projects because if you are not motivated and you are doing all this by yourself, it is not an easy job (Jessica).

In addition, it was important for Jessica to work in an environment where discussions and consultations on projects was encouraged because she could easily and freely offer help to her friends and she could also as equally receive help when she needed it:

> Well, if I can help other people, they then can create what I can create. If they can create things that I can create then there would be one more person who can do what I can do and be interested in what I am interested in (Jessica).

Adding that:

> Yes, some of my friends want to know how. I said that if they want to, I could just give them a few pointers here and there. I know this one girl, she was interested in it (my project) and she didn't know very much and then well throughout the years we (me and my friends) have explored different types of computer programs to make better WebPages and I think she also has grown with us along the way (Jessica).

There were also students who did not want to be part of the program any longer because they felt the program demanded a disproportionate commitment of time than they could offer. Josephine observed that she felt she had become extraordinarily busy in her graduation year.

> I had a Website so I already knew ahead of time (about computers), right from grade 7 when the Internet started, that was the big buzz then, and then I started doing Websites and I liked it . . .. It is kind of like, I don't make time for the Internet, it just comes along. It is not as important as my other things [anymore]. It used to be because it was a hobby because I had to update my website regularly but now I'm kind of retired from it (Josephine).

Josephine felt that work on Web Page designs and Web Page updates needed continuous research because information about new techniques were continually introduced and updated.

> I have had to give up some of the things that I used to do on the Internet because it is a lot of work to maintain a Website because you have to keep up. You have to do a lot of research and stuff. I don't have as much time now than I had before to actually read (Josephine).

Josephine joined the school in grade 8 when she was already experienced in graphic design. She was only in grades 9 and 10 when she enrolled in IT11 and IT12 courses. This was possible since IT courses did not impose pre-requisites in their course offerings. A student was free to enroll in any IT courses if they had amassed the necessary technical skills. In her grade 11 year, Josephine's excellence in graphic design proved invaluable to the school when she led the design team and graphically designed an award-winning cover for the school Yearbook.

> I had to do a graphic design for the Yearbook; I make Layouts, basically. A layout is just a design on the page. Our Yearbook is much different from the other Yearbooks because it is more graphically designed and we wanted to dedicate most of our Yearbook to *PAC Quality*, it looks nicer. Because there are many pages inside and there are very few designers, I spent most of the time doing it around the time of the deadline because I had become really tied up, preparing for the Advanced Placement (AP) Exams (Josephine).

Most of the graphic design work in the Yearbook was done outside of class time. Students who were doing graphic design for the Yearbook had opted out of the Technology Leadership program and preferred to work on their design projects after school and, usually, from home.

> I wouldn't be spending hours on it if it were work for credit because for something you have to do, you would be like, "Ooh well, I'll do it in four hours." But for these kinds of things, I just do it whenever I have free time, and because I enjoy it (Josephine).

They considered graphic designing a hobby and they did not mind that their involvement with the Yearbook did not earn them credit. They claimed that they were merely doing what they enjoyed doing and that their volunteering in the school was its own reward.

Students who participated at the margins of Technology Leadership program activities did so for varied reasons. A few students had course conflicts at the beginning of the school year but underlying their decisions to withdraw from the Technology Leadership program was the belief that they preferred to work with the regimen of Information Technology (IT) assignments because they emphasized collaboration. They felt that it was important to disseminate information about IT courses in the community of the school and they felt obligated to continue supporting this component of the department. They also felt that the regimen of activities that Technology Leadership students were engaged with left one with little time to participate in graduation-related activities. Besides, they felt they

could still continue to contribute to the department (and therefore to the SCN) without having to fully participate in the Technology Leadership program.

4.4 Dimensions to student identity

In this section, I describe the dimensions of Technology Leadership students' identity. I will show that students' quest to access the leadership opportunities, the technical expertise, and to learn at their own pace and to learn what they were interested in were influential to students' decisions to enroll in the Technology Leadership program. In seeking and demonstrating corresponding qualities, program participants provided technical support services to the SCN and brought changes to the practices of the SCN that reflected student interest in technology. Students who enrolled in the Technology Leadership program gained appreciable technical expertise, moved towards greater participation with time and advanced to the heart of Technology Leadership program. To the old-timers in the program, the career promise of living the life of a computer specialist while in high school was a great draw for active engagement and full participation in program activities.

4.4.1 Student need for technical expertise

At the outset, students who opted to enroll in the Technology Leadership strand of the Learning Technologies department demonstrated a keen understanding of the organizational differences between Information Technology (IT) and Technology Leadership (TL) courses. Students understood that

participating in the TL program involved active explorations, independent determination of technology components to learn in greater depth, and engagement in activities that were supportive of the SCN. James, one of the students enrolled in the TL program, contrasted the two courses, saying:

> IT12 is rather passive: you sit on a computer, you are given an assignment and then you work on it; you are taught the curriculum that the teacher has given you. But in Technology Leadership, it is more open-ended, it is more you have your own project and you help out in the school. If there is no task (in the SCN) then we work on our own projects. And you work on a component of computing or technology that you want to learn. The teacher will help you out and you usually would use the Internet to find out more about it (James).

Differences, perceived or otherwise, between IT and TL courses influenced students' decision to enroll in the TL program. Specifically, the aspect that the TL program supported students as they explored technology concepts in relative depth, concepts which students actually wanted to learn and, often, wanted to learn on their own.

> I have always wanted to learn about programs such as Sound Editing, in particular, but IT never really presented that opportunity (Scott).

Having taken both IT11 and IT12 courses before enrolling in the Technology Leadership course, Scott felt confident that the TL program allowed him to explore a specific aspect of technology in appreciable depth and distinguished his participation in the program, saying "right now, we are doing it with purpose; we are the Sound Editing team and we are making a movie."

It is noteworthy that even when students wanted to work on their own projects, it was not surprising for students to take part in occasional, albeit

mundane, tasks such as replacing a computer cable, or participate in more technical tasks such as retrieving data from a corrupted computer disk.

> In Term 1, we kept logged-up doing stuff around the school and we didn't get too much time for our own projects. But now for Term 2, in this movie, we've had a lot of time and we've done a lot of work on it. We've learned a lot about Sound-Editing (Scott)

Because of their skill level, these students were aware that they would be called upon, from time to time, to carry out,

> . . . a whole bunch of things. Basically redistributing, or distributing computers to the various teachers, networking everything, re-imaging computers in the network; basically, setting up the infrastructure (Scott).

At the start of the school year, Technology Leadership students inherited many unique computer problems. Most of the computers were outdated, some were malfunctioning and a number of them needed constant upkeep because of insufficient computer resources such as Random Access Memory (RAM).

> Mr. Ceena suggested and we said, "Yeah that sounds pretty cool". And we said yeah, may be we should do that. We were getting all these calls all the time, right? We felt like we should get one image that fixes all computers whenever there's a problem with the school. The Library, the entire Computer Lab was messed up. Half the computers were not working and we went down there, first, we brought out one computer, connected it, got it done, and they all started working towards making them the same image (James).

Upon enrolling in the program, Mr. Ceena, the Learning Technologies teacher told Technology Leadership students that the SCN was obsolescent and needed routine and time-consuming maintenance work to be carried out.

> Term 1 was pretty much all about helping-out in school. The whole school's network was a mess. A lot of computers were outdated. Some were not working. So we had to do a couple of things: we had to re-image all the computers, give them a basic structure and we had to network the school. We had to fix all the computers that had bugs and viruses (James).

I asked James to describe what 're-imaging a computer' was about. According to James, re-imaging a computer was a process where they . . .

> . . . came up with a structure, put it together on one computer and took the image and copied it onto a little disk and just installed it into another computer. We then hooked up the computer onto the network and it was online (James).

According to James, the purpose of re-imaging the computers in the school was:

> . . . so they all looked the same, worked the same. The idea was to make the running of the network more effective. So it would be easier to deal with if there's a problem. Well, over the years of use, people were getting computer bugs on their data, some parts were outdated, some parts were not working and in almost every part of the school, there were parts where the network was not working. So we had to go to different parts of the school every single day to attend to computers (James).

In addition to 're-imaging' and re-distributing computers in the school, Technology Leadership students performed regular maintenance work on the SCN. They made sure computers in the SCN were *defragmented* and that all the accessories such as mice and computer speakers were in good working order. So 're-imaging' computers was a technical, yet a uniquely and locally conceived solution to up-date and make all the computers in the SCN faster to repair and upgrade because all computers in the SCN would have an identical structure.

The tinkering and hands-on activities with which Technology Leadership students were engaged at the start of the school year were very beneficial for all students and beneficial for the technology in the school. Program participants were exposed to the practices of troubleshooting computers; they learned different technical aspects of hardware upkeep and software installation and learned technical strategies and solutions that were only initially accessible to a select few in the Technology Leadership community. Students worked alongside other members of the program and confronted similar technical problems as Technology Leadership students and, as a community, crafted solutions to the problems they encountered. Most of all, program participants learned to rely on each other; they learned to be associated with the SCN and to see themselves as a Technology Leadership community. The range of maintenance work on the SCN served students' need to acquire technical expertise helped to define the depth and breadth of student involvement in the program and helped to forge their identity in the school community.

4.4.2 Student interest in learning on their own

It is interesting to note that, most Technology Leadership students felt that learning occurred only during or following a hands-on activity, and when results from such learning were immediately demonstrable. In my conversations with Technology Leadership students, these students usually said of learning, that

> Basically if you can't put it to *practical use*, I don't consider it learning. It would just be something that you remember and not something that you have learnt. If

> you *learn it*, you have to actually be able to *use it to do something*; be able to do it. If you can't do it, it is just memory, like some fun thing you remember from your childhood (Ted).

This interpretation of learning served as a basis for contextualizing their participation in program activities. Technology Leadership students said that meaningful learning only took place when one's engagement in the activity was purposeful and self-directed. The idea was that learning took place when the task in which they were engaged contributed to meaningful learning on the part of the student and when the service they provided was deemed valuable to the recipients. A meaningful learning experience took the form of an artifact – something you have done by hand, something practical. It challenged a student who had learned something to demonstrate that learning by teaching it to someone else.

> It is like, if I can turn in a very fine piece of work, and I can say I learnt how to do that; how to make that (Ted).

> My personal opinion is to, like, do it by hand. But to just look at it, you just don't remember it (Ted).

Selection of student projects seemed to also be guided by students' hand-on interpretation of learning and of the premise that learning was closely tied to how purposeful the activity was. The Learning Technologies teacher defined meaningful student projects as those that were carried out with a clear purpose. According to Ted:

> Basically he would ask us a set of questions and ask our interests and what we want to do in future and he will try to create a project that will help us in the future (Ted).

One such project involves an attempt by students to re-wire one of the Computer Labs to allow more computers to conveniently access the SCN.

> Actually, we were trying to create a hub for computers in the library and we were kind of frustrated how we were going to wire the system. And we found out that there is actually a way of using the power lines. That there is a power-lines adapter that could actually allow you to use power lines, to create a network through the power lines. We were kind of surprised; it scared me. That means that even if my computer is not plugged into the Internet, people could now come into my computer and get into it (Ted).

For the most part, students chose projects that they believed had an immediate application to the SCN. I observed that participants in the program were particularly elated when the project that they had chosen was novel to the group and when it presumably had the potential to further students' specialized understanding of certain computer programs. A project was particularly valued if it showed potential for widespread use in the school. In this respect, program participants were at the forefront of devising technical solutions to the recurrent technical problems in the SCN. They installed and maintained computers, operated a variety of hardware, and managed diverse computer software in the SCN. As alluded to earlier, these students would research, design and test new systems, and they would modify existing systems as well to make them boot and run faster. From their program activities, they would make recommendations to the School Technology Committee on which purchases were necessary, immediate and cost-effective and from where to make the purchases.

Program participants repeatedly said that what they particularly liked about the program was the latitude it granted to its members to work on their own and to learn what most interested them. They said they were pleased that program activities were challenging, unpredictable and represented real-life needs of the SCN. They were pleased with the way the program was set-up, organized and supported. Many program participants commented that there was no need for close teacher supervision during project work, or after program activities had been assigned in the school. While they attributed their initial interests in computer technology to various influences, many of them said that they did not need continued motivation and supervision as they worked.

4.4.3 Leadership opportunities in the program

Another dimension to student identity was the leadership that they showed in almost all matters of technology. Students were cognizant of the pace of technological innovation and of the technical challenges that they often posed for consumers. Scott, for example, had interesting observations about the changes that had occurred within the SCN since the advent of the Internet and since computers in the SCN were made.

> I remember when we were in Computer Studies 9/10, I remember we had these old computers that only ran *Windows 3.1* and they were using those big old, clunky things for printers. And then when I moved onto IT11 in grade 10, we got to go to the Computer Lab upstairs and to the computers there and I think they were *Pentium 2s*. And then at IT12, there were much the same in the Lab; there were upgrades with memory. But now in Technology Leadership, we have a

> bunch of computers. We have *Pentium 3s* and we saw to it that all computers in both Labs had been upgraded and ran the current operating system. And then we also have a few *Pentium 4s* that we can use for our own projects. We have about 5 of them (Scott).

Most program participants said that the onus of keeping up with technical innovations rested on the individual but they felt that it was a societal responsibility to embrace new technologies. They said that the technologies that were routinely introduced into society usually unveiled techniques and approaches that were refined, simpler and, perhaps, cheaper. In addition, new technologies tended to serve up a menu to keep us all engaged in life-long learning.

> Well, I guess it is good that it (technology) is always advancing. There are new, easier and better ways or techniques, but I don't mind that you cannot fully learn all there is. I look at it, say, in other courses such as Biology; the same thing is there. You probably couldn't learn everything that there is to learn. There's probably something that you do not know.
>
> I think it is probably good that it keeps you on your toes, avoiding your mind from stagnating (Scott).

At the beginning of the school year and as mentioned earlier, Mr. Ceena, the Learning Technologies teacher, was emphatic about the importance of each program participant selecting a technology project that they would pursue for, possibly, the entire school year. The project had to be pursued with a purpose and needed to potentially be of value to the wider school community. Program participants needed to know that, as they worked, they were advocates of their own projects and that they were responsible for explaining their work to the community of the school. This placed significant responsibility on program participants to

select projects that were interesting to them, were purposeful and could be pursued in relative depth. Mr. Ceena explained that:

> If it (a project) is beneficial to more than just ourselves then it is visible to the school. If it is visible to the school then it is recognized. When people recognize something, then they are likely to value it. It is the value that is important (Mr. Ceena).

Irene, a newcomer to the Technology Leadership community, said the project she chose was:

> . . . basically to work with the school yearbook. In Term 3 (of last year), I started to use [Adobe] *Image Ready for PhotoShop* and I am building my own Website with it now. I know how to use PhotoShop but I haven't really expanded to [Adobe] *Image Ready*, which is a function in PhotoShop, so, it is pretty new (Irene).

Irene's ability to incorporate these skills into designing the Yearbook and into enhancing the school website was invaluable to the SCN. Utilizing skills or techniques that had been learned was challenging for students, and encouraging students to seek out sites of application for their skills was innovative in program design in the school. When I asked Irene about her contribution to the program, she said:

> I suppose it would be the Image Ready part, the way of designing a Yearbook because it enhances my designing skills for what I might do [later in my career]. . . I would say my part was more about doing little things, things more related to the design of Websites like 3D Design and a new Layout for the *Pal School*'s website (Irene).

Eric was another student whose skills were self-taught and had an infectious enthusiasm for program activities.

> I am involved in lots of things: I'm in the Student Grad Council, and I've worked with the Yearbook Club for a couple of years. I worked on the student section and the staff section. I organized with my group of friends; we have been doing that every year for the last two years (Eric).

He had surrounded himself with students who, working with the Yearbook, had developed technical skills that were complementary to each other. I asked Eric to comment on his friends' assortments of skills and he observed that:

> Some of my friends are interested in computers, such as Ted. He is very interested and so is Eli. Both of them are applying to Computer Science at SFU. I have known Eli since grade 4 or 5, in elementary school and Ted, just for a couple of years, here at *Pal School*. Eli was actually the first person to go to Summer Camp at BCIT and he told me about it and that got me interested and as a result I went the next year (Eric).

As students who were in the same grade level and who were close friends, they were involved with most of the computer activities in the school. I observed that these students were at the forefront of technology initiatives in the school. They could be seen inside classrooms working with teachers and students, explaining and demonstrating subtle aspects of software in the Computer Lab.

Teachers were appreciative of having knowledgeable students in technology in the school and were quick to be thankful for the technical assistance that they often received from these students as demonstrated in the quote below from Mr. Leonard, the Social Studies teacher:

> Yes, there have been some students that have come-by and done some work. I had a situation where one of my computers was not restarting properly and had a sort of system-error and I just said, "Richie, this is not working. Do you know how to solve this?" He says, "Oh, let me take a look at it." Five minutes, he had solved the problem. So there are many students who have more skill and aptitude with the hardware and the software than I do. So I am quick to be thankful when students can help out in that way (Mr. Leonard).

Over the school year, these Technology Leadership students' presence and responsibilities in the SCN increased and were pivotal in inspiring other students in the school to become more knowledgeable, or to seek out technical information when they encountered computer problems in their work. Mr. Leonard pointed out that the value of their presence influenced how other students in the school interacted with technology, particularly in the completion of assignments.

> Yeah, I think they (Technology Leadership students) have a leadership role to play in the school and they can be models, they have interest and aptitude with computers that then rubs off onto other students. I know of students who were working on a video project that I had assigned. It could be one student in a group of four or five that have strong computer skills but then you could notice three or four other students that are working in that group. They too begin to acquire and learn some skills that their peers already have. It is one of the best ways to learn how to use computers and software: to sit down with someone who knows how to do it already and they sort of walk you through the program, walk you through the process (Mr. Leonard).

Technology Leadership students could also be seen in the hallways at the lunch hour or after school coordinating technical aspects of student drama sketches that they needed to capture digitally to exhibit at the school's year-end Award Ceremonies.

Allocating project work to students in the program so that each student carried responsibility for his or her own project-work, learning and application of that learning to the activities of the SCN was innovative in the organization of the program. It conferred upon each student a leadership responsibility rarely seen in a school-learning environment. The fact that the Technology Leadership program emphasized this aspect of student participation in its organization was empowering for participants. To that extent, students in the Technology Leadership program were able to provide technical support and guidance to fellow students, to teachers, and to other members in the community of the school.

4.4.4 Technology-oriented careers

Student engagement in program activities seemed to match students' interest in pursuing technically oriented careers. Program participants were non-committal on the level of technological expertise that they wished to reach, however, when I asked about the careers that they were preparing to pursue, they continually changed their ideas out the extent to which technology was going to play a part.

> I was not really sure. I was thinking of creating or designing WebPages in the beginning, and now I am trying to move on to be a Network Director where you manage a company's networking and keep it running all the time. It pays well and seems kind of challenging (Ted).

For their careers, students highlighted the desire to work with technology in an environment that was challenging and financially rewarding. The most challenging aspect of computers that students reported was keeping up-to-date with the rapidly

shifting technologies. To most students, the opportunity to work either directly with the development of technology, or to incorporate technology in their careers, was the main reason for their early interest in working with computers.

While students understood that technology would be prominent in their careers, students were hesitant to say which technical aspect they wanted to pursue for a career.

> One career-option right now is nuclear medicine . . .CAT-scans require a lot of work with computers. So having computer know-how would be valuable. All my experience from Technology Leadership might go into my work when I go into that job. Also since in Technology Leadership my project was about Sound Editing, I was also looking at another career opportunity. I want to be a Sound Designer for a computer company (Scott).

The students that I interviewed said unequivocally that computer technology was transforming the character of the today's workplace, and because technology was bound to prominently feature in every workplace in the future, by mastering technical skills early in their education, they were strategizing on the opportunities that technical understanding will present.

4.5 Summary of the chapter

In this chapter, I have explored how the construction of student identity with technology happened. It was precipitated by the fact that the school was able to articulate its technology goals to the wider community of the school during the mandated School Accreditation exercise of 1999. To realize those goals, a School

Technology Committee was struck and the Committee constructed a SCN. It constructed a Technology Leadership program to encourage students to meaningfully participate in program activities that support the SCN. Students who enrolled in the program constructed a vibrant technology community-of-practice that was responsible for the provision of technical support services to the community of the school. Assigning students the responsibility to contribute to technology in this way was new to student experience. Technology Leadership students learned on their own, they collaborated with each other, and they shared their understandings with the community of the school. The more they participated in program activities, the more they explored and shared their understandings with the school community, and, in the process, they motivated each other to learn and constructed student identity in the SCN. Program participants realized technical expertise and took on increased responsibilities within the Technology Leadership setting. This spirit of sharing and service in the SCN helped to raise the level of technical service available in the school and elevated computer use in the school.

In the next chapter, I explore the changes in the technical character of the SCN that resulted from Technology Leadership students' participation in the SCN. The Technology Leadership program valued students' experiences from their technical involvements outside of the classroom and, consequently, promoted students' abilities with technology in the school, thereby urging teachers to challenge student technology experiences in the work they assigned. In the course of the school year, the technical character of the SCN changed.

CHAPTER V

CHANGES IN THE NETWORK'S TECHNICAL CHARACTER

5.1 Overview

This chapter describes changes to the school computer-network's technical character with progressive student participation. Technology Leadership students' participation in the maintenance and development of the SCN precipitated a reconfiguration of the organizational practices of the SCN. To develop a relational account of this reconfiguration, I describe how the SCN enrolled and used diverse technology actors inside and outside its constituency to meet school technology goals. Because of student technology leadership and because of student technology expertise, the SCN was constructed to cater to both the school's technology goals and to cater to Technology Leadership students' technology and educational needs. Thus, as program participants forged an identity with technology in the context of their memberships in the Technology Leadership community, the school's SCN, in working to support student participation and meet its technology goals, was constructed and strengthened.

5.2 From a department focus to school-based

What the school administration decided, and what greatly helped to direct the development of the SCN, was the move to default decisions about all technology in the school to the School Technology Committee. The Committee was charged

with the responsibility of coordinating all requests for technology repair, upgrade and acquisition in the school and was asked to revisit and articulate school technology needs and goals to the community of the school. The Committee comprised of representatives from every department in the school, the Learning Technologies Department Head and one school administrator. According to Mr. Leonard, the Social Studies Department Head, this constitution provided:

> . . . an opportunity for all departments to have a say of how money [ear-marked for technology] is allocated, and the decisions are made collaboratively, based on consensus and need, although, I would see Mr. Ceena, the Learning Technologies guru, having an intricate part of guiding our decisions because he has a better sense of what we need and what areas, in terms of technology upgrades, that he thinks will benefit the school (Mr. Leonard).

In addition, most teachers, not particularly known to be keen technology trend-watchers, found it convenient to defer recommendations about technology acquisitions and purchases to Mr. Ceena, the Learning Technologies Department Head. Ms. Leeza, the School Principal, pointed out that:

> Moving from each department seeking technology on its own to having a core Committee in our school to develop a plan for how that would be done was a major change, and I think that served us well (Ms. Leeza).

Mr. Ceena's position in the SCN became central to the development of the technology in the community of the school. Ms. Leeza said that it was an administrative decision to try to make the process of technology replenishment in the SCN clearer, more transparent and more consistent.

> I went to the Finance Committee (FC) and asked the FC for the use of $15,000 of our school revenue generated by our Cafeteria Funds and 'Pop' Funds and

> Vending Machine Funds to be allocated to the Technology Committee each year for 4 years. So we had something to finance our requests (Ms. Leeza).

Ms. Leeza recalls that prior to the mechanism, technology issues in the school were handled very differently:

> When I think back to our initial meetings, five years ago, we had requests for technology hardware coming to the School Finance Committee, coming to me as Principal for equipment replacement, coming to our Parents Advisory Committee (PAC) for Casino Grant Applications. There seemed to be a helter-skelter approach; let's fund it this way, if this way doesn't work, we will find another way (Ms. Leeza).

She said it was standard practice for members of the school to presuppose that the school needed at its disposal more and more Computer Labs and, probably, for a school of about one thousand (1000) students, that it needed at least four (4) or five (5) Computer Labs. But the Technology Committee had noted that the basic technology needs of the school could be met with the software and the hardware available in the SCN. The Committee, of which the school administration's contribution and support was pivotal, was set on redefining the way members of the community of the school related to the technology in the school.

> We have shifted away from the use of Computer Labs to using computers as a tool as you would a textbook, or as you would a reference book, so that we could have access to one computer in a classroom that could be used by several students; in a sense have access to a computer pod (Ms. Leeza).

Ms. Leeza also noted that:

> We still need more equipment. We need to upgrade our computers, we need to update our technology, but most of our usage, most teacher-usage, most administrative usage can be done on the equipment that we have because most of

> us are not technically adept at using complex programs. Most of us use word-processing software, spreadsheets and use the Internet to do our searches. And most of them can be done on a basic Pentium and most people have access to that (Ms. Leeza).

The Committee pointed out that it was important to shift the focus in the SCN away from acquiring and using computers to promoting access to and use of information. This was to prove a significant technical shift in the character of the SCN. Only a few years earlier, many students didn't have a computer at home. Technology courses in the school were designed to teach students how to use computers, how to maintain them, and how not to be afraid of the technology.

> I think we are at a transition point in our technology use in this school. When we first started using computers, the focus was on the computer, the focus was on programming. The focus was on getting comfortable using the technology and now the technology is becoming more invisible. It is not about the technology any more. It is about information you can gather using a computer. I can see that switch over the last 5 to 10 years that we started to integrate technology into the classrooms (Ms. Leeza).

Computer technology had become more distributed, at affordable prices, and most students now had computers in their homes and were available in the community as well. Students who were unable to readily access computers at home could easily access them in community libraries, community centres, or community schools.

Besides setting up the School Technology Committee, the leadership of the school also did some deliberate planning to enroll the School District to set up a Learning Technologies Department Head position. This was a new position in the

school and carried with it a unique job description as Mr. Ceena, the Learning Technologies Department Head, noted:

> Yes, the position really had, when I was hired, as a mandate, responsibility for increasing awareness, the development of technology, the development of teachers and technology. The position also harbors the hardware side which is fixing of outdated technology, maintenance of the technology . . . I think something that gets lost sometimes in the position is really being hands-on with more on the teacher-side than the student-side (Mr. Ceena).

Setting up this position within the school enabled the school to have one person within the school premises who was very conversant with learning technologies and who was able to champion the technology interests of the school. Ms. Leeza observed that:

> We have been very fortunate to have an outstanding Learning Technologies Department Head. When we develop our annual technology plan, he is part of that and he is able to talk with us to let us know a vision that is broader than we have as caucus and we are able to suggest some things to him from the educational point of view that broadens it as well (Ms. Leeza).

The position required the Learning Technologies Department Head to work with teachers in various subject-areas and look after their learning and instructional needs with technology.

> For example in the Social Studies Department right now, they are looking at purchasing an NEC Multimedia Projector because they are finding that students are using presentation software quite a bit now because it is convenient and fast. I guess that, presentation cannot be done with a computer with a presentation screen. So they come to me asking for where to buy the projector, what the District Policy in purchasing that type of equipment might be, and given the budget, what the best brand to buy. So that is maybe an example of that type of responsibility (Mr. Ceena).

The responsibilities of the Learning Technologies Department Head also included:

- Looking at the type of technology in the building, in terms of hardware. The type of thing, apart from computers, anything in which technology plays a role for both the teacher and the student.
- Looking at the learning technology in development, getting teachers to learn how to use the technology, or better ways in which technology could be used in their area, etc.
- Teaching the senior Information Communications Technology courses (Mr. Ceena, Department Document)

Following the appointment of the Learning Technologies Department Head, the department placed more emphasis on being technically sound with the technology and being able to communicate technical knowledge effectively to members of the school. The hub-function of the Learning Technologies Department within the SCN was widely recognized in the community of the school. Mr. Leonard, a teacher of Social Studies, put it this way:

> As a member of the Technology Committee, I see their [LT Department's] financial needs and requests don't just affect students in their Department, it has a ripple effect in the rest of the school in so many ways, be it in the Annual (Yearbook) Club, or in many of the student Councils. Students have access to the Computer Labs and are doing things that are helping other students in a wide variety of ways. Yeah, I would see the Learning Technologies Department as having a real hub function in the school. They link the school and the different departments through their technical expertise and through the hardware that is up there in that department – whether it is Digital Cameras or PhotoShop and all the different programs – those are very valuable to all students in the school (Mr. Leonard).

Following its constitution, the School Technology Committee hatched a plan that identified, improved access and maximized the position of the SCN as a vital

technology resource. Consequently, many critical decisions were taken that improved the performance and accessibility of computers in the school. As Ms. Leeza recalls, when:

> we developed a plan to cascade computers so that the new technology would go into the labs or classrooms that needed the most complex computers. And the ones that were second would go into a classroom that needed an upgrade but not as complex and then those in that room would go to classrooms where they would be used for word-processing, spreadsheets and the Internet. So we developed a plan on how to cascade those machines (Ms. Leeza).

Working with computers in a networked environment in this way was new to the community of the school. The most visible aspects of the plan included, for example, the placement of networked printers of good quality at strategic places in the building where several computers could be networked to a single high-end laser printer and was accessible to more students and teachers in the building.

> That was a good move for us because in the long run it created much more access to the printers. It was easier to maintain because we had the same kind of printers in each area and it was better technology than we would have had had we randomly used a variety of different kinds of small Ink-Jet printers in each department (Ms. Leeza).

Another visible aspect of the Committee's decision included designating one Computer Lab to be the high-end lab in the school where technology classes, for the most part, met. Only courses that needed the very top of the line technology were given access to this lab: "That was a deliberate choice rather than, perhaps, spreading them (high-end computers) around in different places (Ms. Leeza)."

It was also deliberate planning on the part of the Technology Committee to have one Computer Lab as a cross-curricular lab that would be housed in the School Library. This general-purpose Lab allowed all departments to have access to computers: Applied Skills courses used it for research; Career and Personal Planning 11 courses and other planning courses used it for their Career Planning activities. Science classes used this Lab extensively for Web Quest activities. It meant that the Labs were stocked with software that Technology Leadership students had evaluated and recommended, yet were in line with School District technology guidelines.

> The School Technology Committee decided that software would not be purchased with school funds unless it (the software) was School Board Approved, met certain standards and was curricularly-related. We don't have a huge number of software programs, but we have very high quality programs that match very well with our curriculum and are able to be used together because they are similar formats, on similar platforms. So those things were deliberate (Ms. Leeza).

To implement these decisions at the school level, the School Technology Committee worked closely and constructively with the School District Technology Committee:

> We were able to convince our School Board to let us look at the lease-return computers. Our School Board did previously not accept that. That allowed us to replace one whole Lab and cascade those down. So in one year we had a great increase in the number of computers in the school (Ms. Leeza).

While the leadership of the school was proactive in defaulting decisions about the technology in the school to the Technology Committee; it was mainly responding to

student pressure to upgrade the technology resources in the school to a level where technology could seamlessly be integrated in student learning and instruction.

In summary, the leadership of the school set-up a School Technology Committee and supported its decisions about the most cost-effective way of using the technology in the school. The Technology Committee was pivotal in advancing the participation of Technology Leadership students in the SCN and in altering the focus of technology from computer acquisition to promotion of access and use of information. These decisions and the support mechanisms that the leadership of the school put in place to support the technology in the school were instrumental in shaping the technical character of the SCN.

In the next section, I describe the process and efforts to enroll diverse technology actors and translate their interests to those of the SCN. The intention was for the leadership of the school to render the implementation of technology in the school and the integration of technology in student educational experience a community responsibility.

5.3 Broadening to include community partners

From my conversations with the school principal, it became clear that the progress the leadership of the school had charted in the course of constructing the SCN was a result of a concerted effort on diverse technology stakeholders in the community of the school.

> I think it is the synergy of people working together that beats (shapes) the plan; I don't think it is Policy. I don't think it is one person's vision. I think it is sitting around this table and talking about what might be. It is one of reading about something that a school is doing some place else in the area of technology and wondering whether we can do it here. It is looking at the goals that we have as a school and asking how technology can support those goals (Ms. Leeza).

By collaborating with diverse technology actors in the community and by eliciting community input into school technology goals, new proposals and plans emerged that no one member had individually conceptualized. The synergy of people working together collaboratively helped to shape participants' goals for the technology in the school. In this regard, translating the interests of school technology actors into those of the school and mobilizing them was a result of holding discussions and staying focused on building a SCN. Ms. Leeza described the process this way:

> One of the goals of our school is to increase our communication with parents. So we are looking at ways in which technology can help us. We are looking at ways that parents can go to a website, put in an access code and get access to a child's attendance record. A parent can then have a conversation through e-mail, through our website with a teacher about the progress of a child, or something that is going on. So we are asking not how we can improve technology but how we can improve our school and use technology as one of the ways to do that (Ms. Leeza).

To improve school functioning, the Technology Committee, in which diverse technology actors in the community of the school were represented, routinely explored strategies where technology could be employed to attract students to the school and to keep those enrolled in the school engaged and interested. This was an aspect of school functioning that was not conceivable prior to the construction of the

SCN. Ms. Leeza's comment demonstrates the potential for the improved technical capability of the SCN to not only increase student participation in the school but to keep students in the school actively engaged in the school and in the community.

> We are exploring some possibilities of offering some special programs in our school related to technology. It is still very much in a proposal stage so I don't have a lot of details that I can share with you, but it would be looking at offering some unique programs in the district that would be housed in our school, that would use some technology where a group of students in our District who are interested in taking part and that are very keen in that [program] would come here for, be it every other day, or every day, we are not sure (Ms. Leeza).

Among the proposals tabled and discussed was using the SCN's infrastructure to coordinate a centralized program housed in *Pal Secondary School* but accessible to all students from across the school district. These proposals were evaluated on the understanding that there were many students presently enrolled in various schools in the district whose needs were not fully met by the structured 75-minute, 28-student and one-teacher arrangement in operation today. As Ms. Leeza pointed out,

> . . . the question is: is there a way we can use some of that technology to maintain contact and offer programs to students whose needs are not met by the regular structure that we have within classes? (Ms. Leeza).

The intention was to find ways to meet the needs of students inside and outside the building, to "try to take down walls of the classroom." According to Ms. Leeza, the present reality of student participation in the school was:

> We have students who are here one day and are working on their apprenticeship at VCC (Vancouver Community College) on another day. They are working on

> plumbing; they are working on a variety of activities. It is a new program, yes. I think we have four or five students now doing that. They go to school one day, they go there the other day. They get school credits for it and they are so excited about it. It is really working well. . . We have one student who works here on Day 1 and on Day 2 is doing research at the University of British Columbia on Alzheimer's proteins. I don't understand the technology, but he is doing that (Ms. Leeza).

It was partly because of Ms. Leeza's leadership in promoting community involvement in the affairs of the school that the school SCN received the support of diverse technology actors in the community. She envisioned having up-to-date technology in the SCN that served to promote student learning and instruction but also served to improve communication with parents for the good of all students in the school.

> I think we have an intention to continue to utilize the best technology of the day that we can afford. That is, the intention is to keep up, to not be still, to look ahead, to continue to work on how we best use technology as an instructional tool and a community tool in our school. So the intention is to keep moving forward (Ms. Leeza).

Ms. Leeza felt strongly that the community of the school was bound to continue to support school technology goals. She believed that the community of the school realized that there was value in using the advancements in technology to improve the school and in using technology to improve communication between parents and teachers in the school.

Apart from the support the SCN received from the community of the school, injection of funds from the Ministry of Education enabled the much needed upgrade to the wiring of the school building to be made so that there was an Internet outlet in

every room in the school and so that each room in the school received an electrical upgrade. For a fifty (50) year-old building, this renovation was helpful to the SCN and made it possible for technical work that was previously inconceivable, to be carried out in the SCN.

> That enabled us to have wide access to the Internet but it also enabled us to "image" [school computers] so that we could troubleshoot thirty (30) computers at a time instead of the Technology Leadership person having to go and put a disk in computer 1 and get that set-up and then go to computer 2. That networking possibility was a huge support for our school (Ms. Leeza).

Moreover, in an unprecedented move to support school technology initiatives, the School District granted the school immense latitude to make decisions locally on the funds that the school generated from Cafeteria sales and from Vending Machine sales.

> Putting about $15000 a year into the School Technology Plan account has really helped us. And in some school boards, schools don't have that school decision-making authority over school funds. You have to consider it to be district funds. So that was helpful (Ms. Leeza).

The school also received a financial contribution towards the school technology plan from the Parent Advisory Committee (PAC).

> PAC was a big help in funding. And also we have made presentations to our PAC on our technology plan and our Learning Technologies Department Head has met with them. We brought PAC into our Computer Lab to show them what we can do (Ms. Leeza).

In addition, the school received a sizeable donation of computer equipment following a recommendation from one of the parents.

> We actually had donations of equipment from a private school. A person [who works] in a private school, whose child goes here (to this school) called and asked us if we would like fifteen (15) computers because they were replacing their Computer Lab; that was a bonus from the community (Ms. Leeza).

Underlying the community's support for the school technology plan was the realization that technology had dramatically revolutionized today's workplace. From the business perspective, the expectation was that, high school students were, upon graduation, required to be functionally literate in technology.

> When we talk to business people, when we talk to people who are our work-experience companions [in the community], when we talk to local businesses, they expect that our students will leave [our school] with a particular level of technology skill sets. It is really an important expectation (Ms. Leeza).

The thinking was that apart from possessing an ability to engage constructively with appropriate technologies, high school graduates were, upon graduation, required to participate meaningfully in the application of learning technologies to the workplace of tomorrow.

While the process of enrolling and translating the interests of diverse technology actors in the community of the school was daunting, the school received strong encouragement and significant financial support from the school's Parent Advisory Council (PAC), from the School District and from the Ministry of Education. The intention was to promote access to technology in the school to benefit student learning, to integrate technology in instruction and to improve communication between members of the community of the school. Going forward, the intention was to develop a SCN whose infrastructure could also be used to

coordinate the activities of varied programs that were accessible to all students in the school district, yet were housed in *Pal School* building.

5.4 Change in student technical responsibilities

When school computers were being networked, students in the Technology Leadership program were often called upon to various classrooms to demonstrate to teachers how to access and use the instructional resources in the school computer-network. The assignments included, but were not exclusive to, access to individual teacher online storage space, access to specific simulation software and access to course-based databases. With time, this no longer happened as frequently and as widely as before. There was a noticeable school-wide shift towards an increased level of technical competency with computers, a result that was directly attributable to the increased participation of Technology Leadership students in the SCN.

The school computer-network had evolved to an extent that mundane activities, such as checking computer cords, troubleshooting hardware problems and explaining software use which preoccupied Technology Leadership students considerably were now infrequent. As Ms. Leeza once observed on one of her visits to the Computer Lab:

> Our technology students are [now] working on projects that are on the leading edge of technology which they then share with IT11 and IT12 students. You know, I was in one of the Computer Labs and a grade 12 student was working to learn a particular program and showed me some of the things that he had learned in that program and then he was teaching even the Learning Technologies Department Head what he had learned and the other Technology

> Leadership students and they were sharing some of that information with IT11 and IT12 students (Ms. Leeza).

In other words, the role of the Technology Leadership students had become less of a person with a wrench – a person who knew how to put equipment together – to one of being a resource for other students and to the school. Technology Leadership students, as far as the technical services in the SCN were concerned, were resident consultants in the community of the school. They helped with digital electronics, with organizing and presentation of multimedia products, with the use of instructional technology in the school and in the promotion of technology use in the neighbouring elementary schools.

In its new and redefined role, student involvement in the SCN was widened and made pivotal to the technical support of learning technologies in the SCN. Students routinely monitored the computers in the SCN for peak performance and regularly consulted with computer-users in the school about computer use. When I asked Ted, a student in his third year in the program, to describe his responsibilities in the SCN, he replied:

> Basically we try to fix computer problems throughout the school. We try to save people's work if something goes wrong and also try to find efficient ways of doing things. We tried to set up the Lab in the Social Studies wing to allow more students to get on the Internet, to be able to do work there. The idea was to make it possible for students to have access to the Internet from anywhere in the school (Ted).

Because of the increased Internet traffic at peak-hours, or because of conflict in computer usage patterns, the Internet servers occasionally went down. In those

instances, students and teachers would have been distraught over the possibility of unrecoverable work, save for Technology Leadership students. Ted explained that their active participation and involvement with the program made the act of fixing computer glitches in the school less of a hassle.

> Well, I think the advantage to the SCN is that we can pinpoint most problems easily. If there's a computer glitch and the server went down, most of the time, we can actually find exactly what port the computer error occurred in. So we can go there, fix it quickly and the network will be back and running in no time. So we make it simple . . . (Ted).

Recruitment of students into the Technology Leadership program went on throughout the school year. Students in grades 8, 9 and 10 who demonstrated exceptional dexterity in technology were encouraged to participate in the program, or were asked to think about what they could do to support the technology in the school. Such students were introduced into the program through fairly trivial and routine activities. They were, for example, asked to find ways to contribute to prominent activities in the school such as help with the Yearbook. They were asked to take digital pictures or photographs of school events, or capture vignettes of student work in the course of the school year.

> You know often students can handle projects on their own, with minimal teacher support. They bring you something and you are amazed. I think that is when we often learn that that kid has that nature (technological disposition) (Mr. Ceena).

So it was not that all students who were good with technology – good programmers or good graphic designers – made good Technology Leadership students. Mr. Ceena, the Learning Technologies teacher, explained that:

> The key is to look at those students that when they are at a point where they are finished their work, they like helping others; they like supporting others. They can step back and see a problem a bit differently. They don't get frustrated, they understand that there's always a way to figure out a problem. And if there isn't a way then someone must know. That is also a kind of entrepreneurial-type attitude (Mr. Ceena).

He believed that a potentially good candidate for Technology Leadership recognized when (s)he had encountered a problem of a technical nature that was beyond his or her own capability and sought help. To Mr. Ceena, "a good smart attitude" was important because, in the end, these students worked with him and that he related to them as though they were his colleagues in the SCN. In addition, he viewed his role among Technology Leadership students as that of a mentor because, to him, these students were being groomed to mentor others in the community of the school.

> I model my behavior [among Technology Leadership students] in the way I deal with people and how I deal with technology. They can look at that and say, "Uum, I like the way he dealt with solving that problem" and incorporate that into their ways. And at that point I can remove myself from that situation, and let them handle a problem whether it is with someone with technology, or with implementing new ideas (Mr. Ceena).

Students in the program viewed the Technology Leadership program as a type of in-school work experience that exposed students to a life of a computer technician before they could actually opt to pursue technical work for a career. Mr. Ceena, explained that:

> Because in the end, they work with me and I treat them very similar to a colleague in terms of trying to get work done but I act as their mentor and they are looking to mentor others too. I think I act like a model (Mr. Ceena).

As to how students felt about the Technology Leadership program in the school and how it was run, one student put it this way:

> Mr. Ceena allows us a lot of flexibility. He gives us the ability to take or create one project every term, allowing us to focus on a (software) program, for example, *Adobe Photoshop* or *3D Studio Max*, to try to create something with a purpose because, he says, without purpose there's no use for it (Ted).

Adding that:

> I think this course is far less structured in itself. It is more run on a day-to-day basis. Sometimes a teacher will call us to go fix something and then we won't be able to do our project ourselves and other times we would have all the time in the world. I like the randomness of the schedule. I guess it kind of inspires creativity (Ted).

Distinctive to the program as well was the importance attached to student reflection on program experiences– getting students together to talk about the individual progress on projects and on program activities of the day or week. Usually these sessions took place at the end of the school day, after the other students had been dismissed.

> Basically everyday he [the Teacher] asks about the status of our projects; always keeping track of things, and he also at the end of class or after school, he usually talks about or asks each person what they learned and how they understand things (Ted).

The teacher usually conducted these sessions and asked students to talk about what had happened, what they had learned, what difficulties they had encountered, which problems they were able to solve, and which they had not been able to solve.

> Yes, every time. I think every time when we hit a problem and maybe one of the students figures an idea out, I always review the steps we took to get to that point because, I think, it is quite important that when we walk to a dead-end, is that something we wasted time on? Was it something necessary for us to find for ourselves? (Mr. Ceena)

Occasionally, student leaders encouraged members of their groups to verbalize their points of contention, difficulty or confusion. To many students, this component in student work set the program apart from other courses, or programs, and served to forge cohesion and cultivate meaning-making among participants, and were collegial in nature. Ted spoke of the program fondly, saying:

> I think it is better than sitting in a desk, writing notes and just listening to the teacher all the time. I think I like the hands-on approach and the help you often receive (from members and the teacher) after school (Ted).

Artifacts of student technological work were widespread in the school community. They ranged from the bimonthly documentation of various school events in the form of a School Newsletter, to the School Yearbook and to digital documentation of various student activities during the school year that would later be encoded and packaged as the Digital Yearbook. While in the process of producing a School Newsletter, the Ms. Leeza, the School Principal, observed that:

> I work with students to do the school newspaper. I do not know how to do what they do. I sit with them. They do their wizardry with PhotoShop and other software programs that allow for the layout and they show it to me. I make some suggestions and they go do the work again. So students have become teachers to other students and also to our staff; [in addition] teachers are not fountain of all knowledge in technology (Ms. Leeza).

I asked students to talk about their participation in digital productions of student activities in the school and in the school community.

> I know for a few members of the group: Kelly, Caroline and Richard, the first part of their project was to create the Digital Yearbook – the digital form of the Yearbook – that was their Term 1 project. And if you want, you can also choose to work on the Annual as one of your projects for Technology Leadership (Scott).

Technology Leadership students brought an assortment of technical skills into the creation of digital artifacts. Without active student input into these school endeavors . . .

> . . . we'd be waiting a lot longer for our periodicals [Yearbook, Newsletters, or Drama Productions]. They (Technology Leadership students) certainly do help out quite a bit with their technological expertise (Scott).

In addition to being active members of the school community, Technology Leadership students routinely engaged in such activities as taking digital pictures and capturing videos of student work during the school year. These were then made available to students at the end of the year in the form of a digital Yearbook. These technology additions to student school experience were invaluable to the culture of the school.

By Ms. Leeza's comments during one of our conversations, student participation in the SCN elevated the service relationship between students and teachers in the school as to make teachers realize that it was important to know when to suggest the use of the *HELP* key and when to occasionally sit with a student to try to work out what the *HELP* features directed. By elevating program

participants' responsibility in the SCN, teachers no longer possessed the sole responsibility to know how to use all of the technology available in the school. Students had a significant contribution to make to the SCN. With regard to technology, this marked a shift in educational behavior and a shift in the technical character of the SCN.

5.5 Keeping-up as a learner in the network

Keeping up as a learner in an educational environment of fluid technical skills was a challenge for teachers and students. The teachers with whom I spoke seemed to agree that it was challenging to remain technically literate about the new technologies because these technologies were continually being churned into the public technology domain. It was just as challenging to keep up with the new instructional methodologies that the new learning technologies demanded for use in the classroom. As Ms. Leeza reflected,

> Methodologies have changed so much. I have been in this for 30 years and the methodologies that I was taught are no longer applicable. The world is no longer the same. We know so much more about learning. We know so much more about technology. We know so much more about collaboration and working with others and the importance of that that I have had to continually learn new instructional tools, learn new ways of working with people, learn new technologies. And it will always be a challenge because our lives as teachers are so busy and that it is such a difficult job to add keeping up with things. It will be a challenge, we will do it, but it will be a challenge for us (Ms. Leeza).

Ms. Leeza further observed that, presently, in operation in our classroom, was an industrial model that may have worked well in the 1940s and 1950s but does not seem to work well anymore.

> A short time ago when people did their Master of Education Degrees, they did a residency in a University and their cohort met face-to-face. Now you can get a Master's Degree and meet people in the summer but talk with them every week online, and exchange ideas and thoughts, and not see them again possibly until the next summer. And the learning is still very good. I think in some ways the learning may be better because there is the interaction. Certainly you can learn by listening to a lecture, but when you respond to that lecture, by conversations and dialogue with another person, your learning is extended (Ms. Leeza).

This perspective prompts interesting questions to be asked: if we were able to provide this level of instruction at a Master's Degree level, could the same be done at a Bachelor's level? Could it be done at school level? Would we offer Advanced Placement Chemistry, for example, online through one teacher with 90 learners, in cohorts of, say, four? Why not? The possibility seems to exist.

> One thing that has to change is that responsibility for learning has to be more student-centred rather than teacher-centred because if you are going to explore a concept, . . . then you have to identify what it is that you need to learn. Then identify how you might learn that and who might help you. And so as an individual, you are responsible for doing a lesson plan, for setting your outcomes . . . . students would have to learn how to inquire, how to discover, how to prioritize, how to do conceptual planning. A bit of hard work! (Ms. Leeza).

New technologies present enormous opportunities for teachers and students to engage meaningfully with each other because these technologies present educational opportunities for learning and instruction.

> I think some of the possibilities – the possibilities of being connected – having conversations with virtually any one. This is mind boggling for me. To think that if we were looking at multiple intelligences, that we could call up Gardner and talk to him online, to see his face, to see him and have him talk with us, is just mind boggling. The fact that, I can, as a learner, go online and do a keyword search and find all those different resources without having to go to the Library and find four books is exciting. To have access to information, to pictures, to sound, to music through the Internet is really fascinating. The ways that we can use that as learners and to help students learn is very exciting. I am sorry I don't have another 30 years to teach (Ms. Leeza).

It certainly depends on students' passion and curiosity for learning, on their interest in the subject matter and on the context that this learning occurred. To a large extent, it depends on how the technology facilitates that learning and furthers the learner's participation in communities of learning. Just as important is how people in positions of responsibility facilitate that communion. Inevitably, learning styles would need to evolve to be more adaptable and self-directed. However, by strengthening the SCN and through progressive student participation in it, the possibilities for student learning in the school began to appear.

5.6 Sustaining the technology community-of-practice

As the school technology committee cogitated over ways and means of addressing contemporary problems in the community of the school with the help of technology, the list of such challenges seemed to grow even longer. The introduction of the Ministry of Education mandated graduation portfolios into schools, for example, directed that every student graduating from high school, beginning at the Grade 10 level needed to complete a graduation portfolio that

showed that a student had met specified aspects of learning. The School Technology Committee was confronted with aspects of school planning that potentially utilized technology for easier management of graduation portfolios and that would simplify and encourage community involvement. Ms. Leeza reflected on how technology in the school could be utilized in the management of graduation portfolios, saying:

> In thinking of how we might do that as a school, technology is one of the things that we are questioning. Can we have an electronic portfolio? Can we have a place where students can submit slides of their artwork, or pictures of a cabinet they built, or examples of them (students) working in a Day Care Centre to show that they have done a community experience. Can they do that electronically such that it can be interactive so that the advisor, whoever that is . . . would be able to make a comment, or would be able to inquire, ask the student some questions that would probe the students' thinking. So that is a huge area where technology may help us with one of the goals that we have (Ms. Leeza).

Another challenge that the School Technology Committee addressed was the desire among members of the school to introduce video-conferencing into the school computer-network and 'bring the world into the classroom'. The idea was to find ways for students to participate in coursework that was not directly taught in the building yet was available in the district, within the province, or on the Internet. Ms. Leeza was a strong proponent for using technology to improve student learning and community involvement in the affairs of the school.

> I would like to see students here being able to take advantage of Web Casting. And yes, we tried it in the building . . .. We have a thousand students with all interesting needs and we can't offer a course in everything that those students would want to take. But why couldn't a student go to some place in a building and tune in to a lesson in Japanese that is being taught at another school and

> take part in that lesson? We can do that now. I think we need to find creative ways in our school to get on a scale that is larger. We don't have any video-conferencing here; I want it desperately, here.

With video-conferencing, she said, students could be connected with any person in the world in a personal way to do research or to have a conversation.

> I have been part of some videoconferences where someone from OISE in Toronto deals with a group of us. He is in Toronto but we could see him, we could hear him, he can see us and it is like carrying on a conversation with him at the table but instead of it costing $5000 to fly him here for the day, put him up in a hotel, fly him back to Toronto, pay his wages for the day, we pay him for that hour and he is in the same room with us (Ms. Leeza).

Such was the passion with which ideas were cultivated and pursued in this school community. I have to admit that the leadership of the school was enthusiastic, collaborative and results-oriented. Referring to a neighboring school, Ms. Leeza said:

> . . . because they have video-conferencing, students there have talked to Paul McCartney's wife about landmines. They have talked to Astronauts; they have talked to scientists. They have talked to politicians because the technology is there and there is someone on staff who is very interested and keen in that and is able to contact people and get them to volunteer their hour to work on a video web-cast. So I think that when we talk about taking down the walls of the school, we are letting the students out; we are bringing the world in. So I think I would like to be a student again.

Looking ahead, issues of continued funding for the SCN were a concern. While technical planning was still at the initial stages, the challenge was to seek assurances that the school would continue to enjoy similar levels of cooperation and

financial support from community actors similar to those at the early stages of the SCN's construction.

> I think the challenge will be not getting hung-up by the finances. We can adapt the idea that it is too expensive to keep with technology and, therefore, we cannot do it, which I think is a poor choice. I think we have to find the most important things we can do using technology as a tool, to help learning, and then find ways to do those most important things (Ms. Leeza).

The school was also bound to confront the unintentional consequences of technology use in society. For example, the challenge to use technology responsibly and the challenge to maintain personal contact when using technology were issues that arose in my interviews and conversations with various members of the school community.

> There must be some ways that we can do some things through technology that will keep students connected as well because we have students who can do the work, who like to do the work and they come here to do it. And there needs to be something that is interactive and personal, be it electronic, or a one-on-one instead of a correspondence course where you write down things, put in an envelope and never have a personal connection with the people (Ms. Leeza).

Although this aspect of technology was not unique to the technology in the school, it was interesting to note that the School Technology Committee mulled over its wider implications to learning and to school culture.

5.7 Chapter summary

The leadership of the school deliberately sought to enroll diverse technology stakeholders and translate their positions to support the school using technology,

and specifically, using the SCN. Students were actively recruited into a Technology Leadership program that oversaw the provision of technical support activities to the SCN and their participation in technical activities was encouraged. This was a major change to the traditional technical support accorded school undertakings with technology where alongside such initiatives a certified computer technician was provided. With technical support easily accessible from Technology Leadership students, members of the community of the school were challenged to keep their technical skills current – teachers were no longer deemed the custodians of all knowledge. Traditional instructional practices were challenged, and students sought technical understanding from the Internet and from each other. Opportunities for continued expansion of technological infrastructure to support students, among others, whose interests could not easily be accommodated in the traditional model of school, also emerged. Thus, with vision of the leadership of the school and with progressive participation of Technology Leadership students in program activities that were supportive of the SCN, the technical character of the SCN changed.

CHAPTER VI

SHIFT IN STUDENT IDENTITY – SCN RELATIONSHIP OVER TIME

6.1 Overview

This chapter discusses changes in relationships between student identity in the Technology Leadership program and the school computer-network's technical character, over time. I will show that the changes to the technical character of the school computer-network (SCN) happened gradually. As students joined the Technology Leadership program at the beginning of the school year bringing with them new interests and abilities, they participated in various activities in the program that helped to construct their identity in the Technology Leadership program and in the community of the school. In the course of the school year, the services available and the collaborative relationships in the SCN improved and increased. Even students who did not want to be part of the Technology Leadership program were caught in the service and collegial relationships in the SCN between members of the Technology Leadership community and the community of the school and participated in technical activities that were supportive of the technology in the school.

6.2 A Relationship of co-dependence

Faster computers of high quality are increasingly available. As the school computer-network evolved, it acquired new learning technologies such as digital

display systems and computer products such as Internet servers to meet increased demand for efficiency in information access, presentation and storage. The nature of those technologies was such that they created a perpetual need for technical expertise in the SCN, which expertise was essential for sifting through information on technology upgrades and maintenance, and for continually monitoring how new artifacts in the SCN either met school technology needs or enhanced the effectiveness of the existing artifacts. Students that were enrolled in the Technology Leadership program were uniquely positioned to provide leadership in this area because their technical knowledge was current, they were self-directed, and they were experienced in handling similar technologies.

Student enrollment in the Technology Leadership program was voluntary. However, registrants were actively recruited on the basis of their demonstrated understanding of technology, or on the basis of their interests in developing their leadership and technical skills. On the other hand, keeping up with the technological advancements in various digital artifacts was an aspect of technology that program participants underscored to be the most interesting, yet most challenging.

> I read up online; I talk to other people about technology, read the news – online news, magazines, both. If there's an article in the Vancouver Sun, if I'm interested in it, I'll read that (Scott).

> I try to keep up by reading new books. Have you heard about these books entitled "for dummies"? I think the person who writes those books is really intelligent. They are kind of funny, so you kind of learn while you laugh (Ted).

Ted's response shows that these students' commitment to not only embrace the learning opportunities that computer technology presented, but to also embrace the responsibility entailed in keeping pace with new technologies. A strong part of that responsibility seemed to directly or indirectly demand students to keep their understandings of new technologies and of technological artifacts current.

Comparatively, unlike knowledge about learning technologies in schools, knowledge that was accessible because students could decipher it from manuals and from other media sources – knowledge that was current and applicable to the latest of digital products – school science does not seem to engender the same level of excitement, accessibility or visual appeal, nor does it wrestle with the practices, techniques or products of frontier work at high school level to quite the same extent as learning technologies.

Most Technology Leadership students had worked with computers since elementary school and had, over the years, witnessed vast technological advancement in computer technology. These students had witnessed the evolution of computer operating systems from the *Windows 3.1* Operating System through the period of faster Pentium computers that ran the *Windows XP* Operating System. At the same time, they had seen the processing speed of computers increase as progressively computer hardware came preinstalled with the *Pentium 2s* to the *Pentium 4s* chips. Mr. Ceena, the Learning Technologies Teacher, explained that:

> We purchased four high-end computers to support our students; and those are from research done by students. (Program participants had asked themselves.) What is the best thing we can put into these computers at a price that is

> available? And again we don't know what is possible but we are looking at what is happening about 2 or 3 years down the road (Mr. Ceena).

As to how the LT Department, and by extension, the SCN, filled its hardware and software requirements, Mr. Ceena explained that it was the Technology Leadership students who drove, directed and determined what was possible in the SCN.

> And you know it is the kids that drive most of what is possible. And it is up to me to play a devil's advocate sometimes and say, "Really? Can we do that another way?" It is up to them to prove it. If they can prove it, proving it just means trying. Why would you want anyone to try? To try to leap to something, it is failure that creates success. It is failure that leads to create a path. I would say, "Look, that path didn't work. Let's try to create another way!" (Mr. Ceena).

Mr. Ceena further explained that the Learning Technologies Department merely recommended the purchase of computer materials (be it hardware or software) that it considered curricular-related and that it deemed useable in creating artifacts of value to the entire SCN.

> The reality is, it (acquisition of equipment) is not driven by saying, let's get more and more and more. It is driven by: *Can we use it for a purpose*? And the purpose is: If it beneficial to more than just ourselves then it is visible to the school. If it is visible to the school then it is recognized. When people recognize something, then they value it. It is the value that is important (Mr. Ceena).

Because of the Learning Technologies department's privileged position in the school, it commanded influence in the school over matters related to technology. The many services it offered to the SCN and the extensive resources at its disposal were available and easily accessible to the entire community of the school. In realizing this expertise, students in the Technology Leadership program and those who had participated in Information Technologies course activities, in part, taught

themselves, or tutored each other through the Technology Leadership program to use different computer amenities in the school. As Mr. Leonard, Social Studies teacher, noted:

> I see more students learning on their own and having their computer skills developed from home, or from programs in the LT Department. They are picking-up and acquiring skills and they can use those skills to make more creative projects. For instance, tomorrow, I have a student who wants to build a digital timeline of the building of the Canadian Pacific Railway (CPR). The standard project would be to have students create a poster project. He came in and said, "Look, I want to use *Flash*. Can I create a *Flash* Timeline that would be interactive and students can click on buttons and look at the construction of the CPR." And I said, "Great, that sounds like an awesome idea." (Mr. Leonard).

Most of the software in the SCN easily found application in English, Social Studies, or Science project-work and presentations. Mr. Leonard observed that the skills that students in the program acquired benefited everyone in the school; they benefited students working on class projects, and benefited members of the school community that participated or watched a drama production, sports competition or school Award show.

Regarding general student technical know-how, Mr. Ceena pointed out that nurturing the expertise of students in the network was intentional. He said that while Technology Leadership students could focus on what they were interested in and performed well in those undertakings, he, as a learning technologies teacher in the school, made an added effort to remind students in the program that "in terms of service and in terms of the community of the school, helping others was just as valuable."

Mr. Ceena said that he was aware that students in the program were academically oriented and could just as easily have excelled in any subject of their choice, if they were not doing so already. So when he saw students in the early grades of computer studies that were really good with the technology, he encouraged them to contribute to the SCN. He talked to them about supporting technology in the school by encouraging them to get involved with activities as the school yearbook. Through 'little' projects that run in the course of the school year, he is able to identify students who perform with minimal supervision, could engage creatively in problem solving with technology and could encourage others. Mr. Ceena was impassioned by what he believed were the attributes of a good technology-leadership student.

> When you see a kid who can think in that way, we are now looking at a possible leadership potential because that student can not only work independently, they have the potential in being a leader, to also motivate others and give some direction or collaboration with others. That is the second side of leadership that we are looking at. So I don't think everyone who is great at technology – the kids who are great programmers, great graphic designers – are going to be great leadership students (Mr. Ceena).

In the course of the school year and throughout their years in high school, students with those qualities were encouraged to take on more responsibility in the network. Mr. Ceena repeatedly emphasized that, in this day and age, one did not need to know everything.

> Intelligent people, I find, accumulate knowledge, smart people know where to get it when they want it. You combine a little bit of intelligence with a good smart attitude, that's what we are looking for: kids with that capability (Mr. Ceena).

Student involvement with technology did not start nor stop at the Computer Labs in the Learning Technologies Department. Teachers of Science and Social Studies, for example, often encouraged students who were interested in technology to use their computer skills to complete and present their class assignments. They often encouraged knowledgeable students to help those others who needed help in advancing their technical skills and there were many such students. I observed that most student projects were completed and presented in a format of students' own choosing, and that the choice was driven by student interest and student abilities with technology. In some courses, however, students were required to put together their presentations using specific computer software such as *PowerPoint* or *Flash*. It helped that the computer software usually suggested for project presentations was widely accessible in the school and that students working on such projects could easily access the expertise of Technology Leadership students and Computer Lab Monitors during the lunch hour and after school. To this extent the services that the Technology Leadership program offered to the SCN and the needs of students and teachers in the school were complementary. The latitude of such interactions grew even stronger towards the end of the school year when many projects were due and project-presentations were rampant. Mr. Leonard made an even stronger point about the complementarity of students' technical skills:

> I know kids benefit from the software they learn to work with and from their ability to manipulate the hardware they have at their disposal. All those skills, they are learning in Information Technology can then be transferred to say Socials and Science and English classes because I don't have the expertise in computers to do that (Mr. Leonard).

The key to student involvement in the SCN and incorporation of technology into students' education was extended and led to meaningful engagement and support with technology. Program participants were purposefully learning technical skills, leadership skills and social skills so that they could support each other's learning and support the learning and instructional practices in classrooms. Concomitantly, the school community realized educational value over time from these students' sustained engagement in the Technology Leadership program and sought to support them in terms of the resources available and in terms of replenishing their numbers.

6.3 Expanded student responsibilities

The technology goals pursued in the school, while supported by diverse technology actors in the community of the school, were driven by student educational need and inspired by Technology Leadership students' technical expertise. Students developed personal skills to the extent of being able to supervise students who were working in the Computer Labs in groups.

Over time, program participants developed skills to direct students in their coursework and to manage technology use in the school and at community level as evidenced by the school Web Page and the database of business profiles in the neighbourhood of the school. Students routinely practised their technical understandings on projects that were near professional quality as demonstrated by Josephine's award-winning Yearbook cover design, mentioned earlier. Students'

exposure to and aspirations for industrial standards of professional work, such as magazine cover graphic-designs and Web Page designs, was not uncommon. Students reported that they sought to contrast their work with those of professionals.

Progressively, these students got involved in activities that advanced the technical knowledge and skills of the school. They mentored the students who joined their project groups; they mentored them to engage in activities in the following year that were similar to their own because they deemed their projects beneficial to the school community.

> In Term 2 we had more of the kinds of things we had before – fixing the Internet . . . We also did a lot of our own projects. I am working on a software package called PHP and it is like a web-based Database program. I am currently working on the school website. It was about ¾ into Term 2 that we actually started doing that and we noticed that we needed to have started at the beginning of the year so we are thinking of doing PHP again in grade 12.
>
> The school web page is pretty good as it is but we want to make it very good, like immaculate, above all the schools. We couldn't do that now, it would take too much of school time. So we decided to drop it for now (James).

Technology Leadership students understood that working with technology also meant that they needed good interpersonal skills to work well with computer-users when equipment malfunctioned.

> An example is when we were working in the Library. We had to explain quite a bit to the Librarian because she didn't want all the computers re-done. We had to explain to the Librarian that we were going to upgrade one computer for the time being, then the others afterwards. We argued that from this one computer, an image is copied and installed onto the others. So we had to make educated

> explanations and, yeah, be patient with her. We cannot be, like, "We have to take it now." No, no. You have to be careful how you relate to them (computer users) (James).

Clearly, the services that program participants provided were indispensable to the SCN. It was important for the School Technology Committee to project these students' visibility in the school community and for the services that theses students provided in the community of the school to be valuable. These students were technology leaders in the SCN and the School Technology Committee understood that the support services they provided were vital to the functioning of the SCN. This was an important relationship that developed between program participants and the community of the school over time.

> The Technology Leadership students now are involved with using computer knowledge, technical knowledge, and software knowledge, to help support the whole school . . .. Our Technology Leadership students are sometimes called to elementary schools to help with software, or to help with the ideas that they are trying to implement in the classroom (Ms. Leeza).

With the prominence that the School Technology Committee accorded to technical support services in the SCN, Technology Leadership students found themselves occupying a special space in the community of the school. They were revered for their technical expertise and they commanded respect by the selflessness with which they worked. Technology Leadership students were pivotal in promoting technology use in learning and in instruction in the school. Thus, the community of the school realized enormous educational value from these students' technical competency and leadership in technology.

6.4 Increased student involvement with technology

While the SCN was in its infancy, students, working independently of school supervision and resources, set-up and launched among the first high school websites in the Vancouver Lower Mainland. This was a remarkable achievement for the technology in the school in the face of meager technical resources available at the time. It launched school and community interest in getting students involved with the technology in the school. Josephine recalls that:

> . . . my brother started our first school website. I think it was just that we were exposed to it at home, and so then there was that part of it and sometimes it was just a hobby (Josephine).

Launching the school website, among other technology initiatives, was an important step towards molding the Technology Leadership program in the school. It paved the way for school advocacy for increased student participation in technology activities in the school and served as a significant reference point for student involvement with the SCN.

Students reported that they invested considerable time into understanding and working from online computer resources so as to advance each other's technical competency. As Josephine pointed out, "You kind of have to read all the time . . . You have to go through a lot of information." Learning on their own and teaching each other what they had learned enhanced the quality of these students' assignments and projects and added the "wow" factor to their classroom presentations. Again, Josephine:

> I incorporated my computer skills into my other assignments and I think the teachers liked it – they like something different. And also in my projects, I try to use the Internet for resources, so technology has helped me along the way, really (Josephine).

> Yeah. Now you can even read books. You can download a whole book because things are getting really advanced. And it is way more convenient to find things. You just type in a word. You don't want to read the whole book if you just want to find a specific line. You just type it [the word] in and it [the computer] will find it for you in a second (Josephine).

Use of computers was visible in various facets of students' lives: from putting together class presentations and constructing personal WebPages, to filming and editing vignettes of project-based out-of-class activities. Josephine's commentary is noteworthy:

> I had done a lot of projects using *Macromedia Flash* presentations in videos. In science projects and social studies projects, mostly social studies projects, I had a video for almost every Socials project I have done because when we give presentations, we can take advantage of the technology. Where we don't have to give the presentation live, we can even pre-tape the presentation on video because it is more convenient. And also I wanted to do something interesting instead of like giving a report on a piece of paper. It is more interesting when people see it, plus it captures the attention of the class because a lot of people are bored when there's like a 20 min. presentation and people are just talking (Josephine).

According to Josephine, a multimedia presentation is more engaging; they reinvigorate what are otherwise dull and mundane presentations in the classroom and, most of all, these kinds of presentations are more convenient in student exposition of project ideas.

> Yeah. I always want to do something new. That is why I like to do video but they are very hard to do because you actually have to have a team that actually works well, and then there is a whole process of editing and then I always include a part on photographic design as well.
>
> This year I did my last technology project and that was in English. So I did it in English and it was on George Orwell's book: 1984. We did a presentation on it and then I used *Flash* again. Well, I could have used *PowerPoint* but then *Flash* is more fun – like it has more graphics (Josephine).

It is important to note that students in the program and others in the school increasingly viewed and interacted with technology more as a tool in their learning than as a separate course in the Learning Technologies Department. The push to incorporate technology in various aspects of the curriculum, in part to respond to the abundance of technology in students' everyday lives, served up a menu for students' expanded interaction with technology. It meant that the technical skills and experiences that students acquired from outside of the classroom readily found application in student coursework and project-work. Because school curriculum recognized this aspect of student experience and moved to meet it, the relationship between the school as an institution and students was enhanced. Students could see how their out-of-school experiences were being utilized in their schoolwork and could relate with how their out-of-school experiences were valued in the school.

6.5 Shift in the SCN's practices

The innovations in technology and the subsequent abundance of technology artifacts in society have had wide-ranging implications to the way educational services are delivered in the classroom. While technology continues to impact

various aspects of student learning, the educational community is grappling with devising responsive approaches to educational planning and delivery that are responsive to student experiences with technology. Ms. Leeza, the School Principal, said it best when she said:

> When you look back the last 10 years and how far we have come as a society in technology, it is hard to believe. My first computer was a Vic 20 and it had a cassette-tape and that was its memory. I had to put this little cassette-tape in and I could do word-processing with it and that was about it. I thought it was just outstanding. Now I have more memory and more capability in my Palm Pilot that I carry around, for just a calendar. So I wonder what it will be like 10 – 15 years from now and what schools will be like (Ms. Leeza).

The extent to which students carried out research for course projects, for example, was dramatically enhanced with the availability of technical support for, and therefore increased access to, the Internet in the school. While students still needed to gauge the authenticity of the information collected from the Internet, the nature of that information required students to be more analytical in their interpretations and presentations. Blending such information together required familiarity with different media systems and applications, and called for technical adeptness in the preparation of the information. Mr. Leonard, the Social Studies teacher, observed that:

> There is a large list of ways in which they (students) demonstrate their knowledge and learning and it can incorporate lots of different mediums, and so, by all means, they are having to be exposed to the Internet, to the news on TV and even on the radio, at times, newspapers, the articles that may come off files, and services like the Associated Press, but also editorials – and looking at the different types of information and being able to interpret that and understand it,

> and contextualize it. That is an important part of what we do [in Social Studies] (Mr. Leonard).

Mr. Leonard observed that in Social Studies, it was important to have easy and reliable access to real-time local and global information. This could be facilitated by a state-of-art Internet connection, a digital display system, and a reliable technical support service in the SCN. In addition, students in the school would benefit more when the computer infrastructure and support services available in their learning at school favorably compared with those at home. However, school technology facilities always played catch-up with what students were exposed at home.

> I have had students, in the last few years, put together a video presentation of their material; they created their own documentaries. Now that more and more students and families have digital cameras, something ten years ago was harder to do. Students working in groups can create their own mini-documentaries. Students enjoy doing that kind of thing – it is creative and it is a different format for showing information (Mr. Leonard).

Students would also be well served when the format in which they encoded information at home was compatible with what was available in school for presenting information. According to Mr. Leonard, one of the items on his department's wish-list was a portable multimedia display system that met the learning and presentational needs of his students and met the instructional needs of teachers in this department.

> I have submitted a request for a laptop computer – a high-end laptop computer that will have a capability of allowing students to use different types of presentation software. Our computers do not have DVD players. A lot of students now have DVD players or DVD-burners [at home] and they put their projects onto DVD. These are larger files because students tend to include audio

> and video-clips in their presentations. Very quickly projects can become quite demanding in terms of digital memory (Mr. Leonard).

Besides a display system that played audio and video files, the presentation system needed to display information streamed from the Internet.

There were four Computer Labs in the school and not all of them were stocked with up-to-date software or with high-end computers. There were two computer rooms in the School Library that were being utilized for general word-processing and Internet searches and there was a Computer Lab that was equipped with some fairly new computers for student use during and outside of class time. The Computer Lab was a confluence for students that were working on coursework or that needed to learn how to use particular computer software.

> Last year my students frequently went to that Lab, to the computers there, to edit some of the video that they had recorded. And so they are learning some skills there from the IT courses, then they could transfer those to Socials Courses. There is a bit of bridging between the different courses because the Learning Technologies department has hardware, software and have technical expertise in that area to help the students do what they need to do to produce a good quality presentation (Mr. Leonard).

Students from the Technology Leadership program worked from the technology Computer Lab and were readily available to consult with students in the computer rooms in the Library. I observed that many students' technical questions were readily addressed in the Computer Lab by fellow students in their collaboration groups, or by students in the Technology Leadership program, thereby enhancing just-in-time learning.

Because of the technical expertise available, students in the school were able to design their Social Studies or Science presentations using the infrastructure of the SCN. According to Mr. Leonard, the number of students who owned and, in the course of the school year, utilized digital peripherals such as scanners, cameras, DVD recorders and burners in the preparation of their presentations, increased.

> Since technology has come into the school, it has become more utilized on a regular basis. For instance, I know in Geography, over the last few years, I've had my students write an environmental research paper and they will put together a presentation using *PowerPoint* or *Flash* – the other presentation software – take the key points of their paper and then present it to the class in a short presentation. So they have been doing that. So that is quite an effective and powerful way because it incorporates visual components and it forces students to synthesize their information, distil it down to what are really the important points then they can talk about in front of the class; back it up with statistical data or some of the graphics, whether it be maps or aerial photographs or any charts or data they have collected. They can use it more effectively using that type of program. So we have seen that happen (Mr. Leonard).

I observed that students, in general, became more confident in planning and devising technical solutions in their coursework presentations over time, and were able to design rich, interactive classroom presentations with time. Mr. Leonard's comment on this aspect of student presentation highlights differences in the way students made use of technology in their presentations:

> Some students are just starting out. Maybe this is the first time they have used *PowerPoint*. For instance, in the Comparative Civilization 12 course, students did comparing East and West civilizations. They were looking at ancient China and Greece, comparing, say, architectural styles. Some of the students did a really good job with their presentations. Others were barely average – just basic and simple. . . . Others, however, did a really, really, outstanding job in terms of

> putting together a creative type of presentation. Some were using *Flash* which is more interactive and that made things to be of better quality (Mr. Leonard).

However, it was easy to see that end-of-year presentations, while flashy, rich and admirable, also challenged teachers' grading of course assignments. Mr. Leonard addressed this point, saying:

> I think that down the road, I would like to see more students exposed to how to use that software so that there is a level playing field for students. For some students who have a lot of experience, or quite a bit of experience, it is quite unfair that they are being evaluated on a presentation for which students do not have a similar technical background. So I have to be careful when I am evaluating their work to consider those things (Mr. Leonard).

Because student technical competency improved from experiences mostly gained outside of the classroom, there was noticeable incongruence in comfort levels with computer use. The assortment of student presentations in the classes that Mr. Leonard describes above reflected the non-uniformity in student technical levels. To attempt to standardize student presentations, many research-intensive courses, such as Social Studies, strongly encouraged the use of some form of presentation software. *PowerPoint*, being the most accessible and user-friendly software, seemed to be the presentation mode of choice by many students and teachers.

> Again, I like to encourage students if they have an interest in computers to use their computer skills to present information they are learning in Socials. So often it is student driven, and although in some of the courses, I do require students to put together presentations using software. For instance, *PowerPoint* is software I'm fairly comfortable with. I have worked with it quite a bit. So I can show students how to use *PowerPoint*, how to create a presentation. It is intuitive; it is user-friendly. I have played with it enough and I can create my own presentations because I know how to use it (Mr. Leonard).

Although *PowerPoint* was widely used in student presentations, there were students who preferred some other software with which teachers had little or no expertise. For such software, students who had taken IT courses, or students who were enrolled in the Technology Leadership program, were the main tutors and consultants. These students' influence in supporting and inspiring the wider community of the school was admirable.

> *Flash*, however, I don't have the expertise of how to create something using *Flash*. So there I rely more on students' knowledge or what they are learning in the IT classes, so there Mr. Ceena would be helpful. So I think it is happening both ways. In some ways I am encouraging students to use some software but I don't have the expertise in say, digital video editing, to play with those programs to learn, to be confident enough to share that information with students (Mr. Leonard).

The relationships of service and collegiality developed in the school in the course of the school year were adaptable and responsive to the technology needs of the community of the school. Even when some students were initially uncomfortable with technology, the practices that evolved in the SCN, in support of student and teacher use of technology, were innovative and were inspired by student progressive participation in the SCN. These enhanced relationships in the community of the school were a significant improvement in the technical practices in the SCN.

6.6 Sustaining the program's value

My conversations with Mr. Ceena, the Learning Technologies Department Head, were wide-ranging. Mr. Ceena's appointment happened at a stage in the SCN's development where there was urgent need to re-define school technology objectives and re-orient school technology goals. We talked about his involvement in the program and his personal and professional influence in it. We also discussed the increased access to technical and human resources that he had witnessed over time and we discussed his vision for the Technology Leadership program.

> As you have seen, we do a lot of the maintenance by ourselves on the technical stuff. I think we save quite a bit of money. I think, technology and the visibility of technology in the school is now necessary in any department. I think if you are planning something, anything, . . . I think you have to start very small and build a purpose for it. And the purpose is: if it is beneficial to more than just ourselves, then it is visible to the school. If it is visible to the school then it is recognized. When people recognize something, then they value it. It is the value that is important (Mr. Ceena).

It certainly helped that the Learning Technologies teacher possessed a progressive and business-like outlook on technology. It provided the philosophical impetus to advocate and acquire the technology resources the SCN desperately sought. Energizing Technology Leadership students with this orientation set the Technology Leadership community apart from the other subject areas in the school. I found that the students in this community-of-practice were thoughtful, articulate and self-directed. To me, Mr. Ceena was not only educating these students in their technical understandings of technology but he was teaching them the business of technology as well. For instance,

> if people value the DVDs and the Yearbook, then yeah, that is something they will pay for. That money just came back into our system. I bought more cameras; I bought a new digital video camera. So it has kind of recycled itself (Mr. Ceena).

Recognizing the necessity to renew computer equipment in the SCN and being creative about the computer technologies in the community of the school was vital for continued relevance of the program and of the department in the school. Mr. Ceena's experience and foresight with the technology in the school was one of the main reasons for the success of the SCN.

> I think for the past few years, and with one computer, I've made a DVD, I have done Video Editing Solutions, a digital Yearbook, I have done a tonne of things. I think I have built a reputation with the kids. And I think that is what led to the possibility of buying these computers – based on need – because more and more students in the school want to try to use that kind of stuff (Mr. Ceena).

It helped that Mr. Ceena championed the very qualities that he demanded from the students in the Technology Leadership program. It was easy for him to mentor them because his technical expertise was extensive and that members of the school community respected and admired his dedication to the program. He was very generous with his time, he worked extraordinarily hard, and he was very knowledgeable in the technology business. Most importantly, Mr. Ceena was an astute technical problem-solver who was acutely business-minded in his approach to technical solutions.

> Being an entrepreneurial-type person, I combined technology and those things to create purpose, to create value and with that, we could buy anything we needed. If you could combine those two things, there's nothing stopping you from doing anything you want (Mr. Ceena).

It is such a philosophical mindset in the midst of a dedicated community that was responsible for the evolution of the SCN. He understood that the only way to preserve and promote program value was to identify and meet student learning needs with technology in the context of school technology goals. Mr. Ceena was a catalyst for the success of the program and was a great inspiration behind the activities and artifacts that the Technology Leadership program had provided to the community of the school. In so doing, the technology community-of-practice that evolved in the Technology Leadership program struck a chord within the community of the school and created educational value for students, for learning and instruction with technology, and for the community of the school.

6.7 Summary of the chapter

The practices of the SCN described in the study shifted over time. Members of the community of the school shifted their practices to account for the evolving student identity with technology and to account for changes in the technical character of the SCN. Student identity in the Technology Leadership program evolved as participation in the Technology Leadership program progressively advanced in the course of the school year and participants in the program realized technical expertise and took on leadership and technical responsibilities in the SCN. In response, new opportunities for technology to be incorporated into student coursework emerged and new technologies evolved. With the introduction of new learning technologies into the SCN, new services were required. The continuum of renewal in terms of participants and technical services elevated the profile of the

Technology Leadership program, and of the SCN, in the school community. Over time, in terms of the variety and quality of services and artifacts that program participants provided to the community of the school and in terms of the individuals within the Technology Leadership program, there was positive change.

CHAPTER VII

CONCLUSIONS, IMPLICATIONS AND FURTHER RESEARCH

7.1 Overview

This chapter outlines the important conclusions reached from the analysis of the data and provides the implications of the work for school curriculum and pedagogy. Conclusions and implications are drawn from the three major research questions that guided the study: (1) the ways that student identity with technology in the Technology Leadership program developed as students participated in program activities, (2) the changes in the school computer-network's technical character with students' progressive participation in it, and (3) the shift that occurred over time in the relationships between student identity and the SCN as the two co-evolved. The last section of this chapter also discusses several areas for further research that could be pursued on the basis of these conclusions.

7.2 Conclusions of the study

In this section, I provide a summary of the conclusions in response to the research questions. Following the underlined re-statement of each of the research questions, individual claims pertaining to that question are given in italics. Each claim is followed by an elaboration of the claim in regular type.

In what ways do students' identities in the Technology Leadership program develop as they participate in this community-of-practice?

This sub-question discusses conclusions about the influence of the technology leadership setting in the construction of student identity in the community of the school. It discusses how students, in the course of their interactions in the Technology Leadership program, forged a technology community-of-practice and developed student identity with technology in the SCN. The SCN comprised the 'hard' infrastructure of computer hardware and the 'soft' infrastructure of software applications. Computer peripherals such as printers, scanners and digital cameras also fell under its constituency.

Participating in the Technology Leadership program to provide technical support services to the SCN increased students' interactions with the technology in the school and helped students to forge a technology community of practice. The leadership of the school established a Technology Leadership program to promote student service to the SCN and to afford increased time for students in the program to explore computer technology in relative depth. Students enrolled in the Technology Leadership program gained considerable technical expertise as their participation in SCN was encouraged, supported and increased. Technical expertise and knowledge became shared skills in the Technology Leadership program. Program participants learned different aspects of the technology in the school individually and learned as a group. Newcomers to the community learned from the old-timers how to coordinate, support, and lead other students to become

responsible managers of their own learning with technology. Newcomers to the community gradually advanced to become full participants and old-timers became consultants to the community of the school on almost all matters concerning technology before they eventually graduated from high school. The Technology Leadership community was subjected to a continual process of renewal in terms of its participants. In the course of pursuing their interests in emerging technologies and to sustain each other's motivation to learn, Technology Leadership students forged a technology community of practice. It is important to point out that the Technology Leadership community was not isolated; it was a community within the community of the school. The Technology Leadership community interacted with such communities in the school as parents, students, teachers, support staff and the leadership of the school. The service and collegial relationships that program participants struck with these other communities in the school encompassed different aspects of learning to which general students were not privy and from which Technology Leadership students benefited. Actor-Network Theory was informative in recognizing these relationships in the community of the school.

Student identity with technology developed within the Technology Leadership community because the program promoted learning that was self-directed, that was hands-on, and that drew from students' experiences with technology. The Technology Leadership community supported a different kind of learning from the traditional discipline-based courses. It offered and cultivated an environment that was supportive and encouraged participants' exploration and responsibility for one's own learning with learning technologies. The activities that program participants

pursued were problem-based and hands-on. The learning opportunities promoted in the Technology Leadership community valued student experiences and allowed students to make contributions to the community of the school on the basis of projects that participants had developed and for which there was anticipated need in the school. The range of activities that students were involved with clearly exposed program participants to novel practices in student school experience that motivated them to forge new identities as technicians in the SCN. To many program participants, the Technology Leadership program offered its members opportunities to experience the life of a technician before they could commit to a technical career in their future aspirations.

Technical activities in the Technology Leadership program were such that technically-sound students participated and the SCN provided opportunities for increased skill development. The way the Technology Leadership program was organized required each program participant to select a technology project supportive of the SCN that would be pursued in greater depth over time, and for, possibly, the entire school year. A project that a student selected needed to not only address program participants' learning needs with technology but needed to cater to the technology needs of the SCN. This meant that it was incumbent on program participants to select projects that were not only purposeful and personally meaningful to their own learning needs, but those that were demonstrative of the project's potential value to the school. Students advocated for their own projects. Thus, each student was put in a unique position in the SCN of championing an aspect of technology that served their individual learning purposes as well as the

technical needs of the SCN. Organizing student project work in the program so that each student carried responsibility for his or her own project's learning and application of that learning to program activities in the SCN was innovative in the organization and administration of a school program. It conferred upon each student a leadership responsibility rarely witnessed, yet desirable, in a school-learning environment.

The Technology Leadership program was adaptable to participants' continual renewal; student participation in the program was voluntary. Program participants groomed their skills with technology from an early age and used those skills to offer technical support to the SCN. The program allowed for a range of ways in which these students could contribute to the SCN. For the most part, students made choices about how their participation in the program best served their own needs. A few students, for example, joined the Technology Leadership community, learned the expectations, time requirements, and inner workings of the community but in the end, opted out of the program. Specifically, graphic designers felt that the regimen of activities that Technology Leadership students were involved with did not leave enough time for them to partake of such graduation activities as academic tutorials and examination preparations. These students felt that they could still contribute to some aspects of the SCN without necessarily participating in the full provision of technical support services as Technology Leadership students; the Technology Leadership made allowance for that level of participation.

To sum up, consolidating and managing technology needs of *Pal Secondary School* through a functional and responsive SCN was a challenge that the leadership of the school confronted. The School Technology Committee recommended that the leadership of the school deliberately recruit, support and encourage the participation of students who had showed leadership promise in technology into a Technology Leadership program to provide technical support services to SCN.

Students recruited into the Technology Leadership program engaged in practices in the community of the school that allowed them to learn individually and learn collaboratively in a Technology Leadership community setting. By participating in this setting, Technology Leadership students became skilled at electronic information management, Internet search, e-mail and netiquette, digital imagery, presentation skills, web page development and digital video productions. In addition, they sought to advance their own technical understandings and interpersonal skills. Students witnessed their technical expertise grow, their leadership skills strengthen and their interpersonal skills improve as evidenced by the improved technical support services in the SCN. Technology Leadership students' active participation and explorations in the context of a community of practice enabled them to engage in new practices in the program. As Wenger (1998) argued, learning in this context was a process of transformation through participation. Student participations in the program activities motivated the students to learn and, in the process, they constructed new identities in the community of the school.

How does the SCN's technical character change with students' progressive participation in it?

Because of student identity construction with technology and because the community of the school recognized and embraced its stake in student involvement with the technology in the school, the SCN was constructed to advance the implementation of learning technologies in the school. This section discusses the ways the SCN was constructed to lend itself to a kind of flow in integrating computer use in student learning and instruction and in the promotion and valuing of Technology Leadership students' participation in the provision of support services to the SCN. The conclusions below look at how the SCN responded to external forces in terms of the technology that was available; how the group selected and used diverse resources situated within and outside the community of the school to support technology use in the school.

The leadership of the school sought to identify and enroll the interests of technology actors in the community of the school to help develop a SCN. Seeking-out and translating the interests of technology actors in the community of the school into those of the SCN was deliberate. Actively representing school technology interests to diverse technology actors in the community of the school was novel as far as the technical character of the SCN was concerned. The result was that the school building received a significant electrical upgrade to its wiring, thanks to the Ministry of Education, so that there was an electrical and Internet outlet in every room in the school. In addition, the school received unprecedented financial

latitude from the school district to access funds generated from Cafeteria sales and Vending-machine sales to support the SCN. The school's Parents Advisory Council (PAC) supported school technology initiatives by donating a significant portion of its earnings from Casino funds towards the development of the SCN. In sum, it was the synergy of working collaboratively with diverse technology actors in the community of the school that helped to shape school technology goals for increased access to learning technologies. To this extent, Actor-Network Theory was useful in recognizing and mobilizing diverse actors in the community of the school and translating their interests to those of the SCN. Maintaining communication with these actors through e-mail, school meetings, Open-House sessions and various student activities that showcased the school was essential to the organization of the SCN. In so doing, the leadership of the school, through the Technology Committee, kept diverse members of the community of the school informed of the school SCN's successes and challenges.

Involving Technology Leadership students in the maintenance and development activities of the SCN was deliberate and initiated change in the technical character of the SCN. Students who demonstrated technical leadership early in their technology courses were encouraged to participate at the heart of the Technology Leadership program without regard to grade level. Technology Leadership students were mentored to use computer knowledge, technical knowledge and software knowledge to support the technology in the school and support the school community in accessing technology in student coursework and teacher instruction. Program participants became a resource to each other, a

resource to other students and a resource to teachers in the school. In essence, they became teachers to members of the school and taught what teachers and students wanted to learn at a time when they needed to know it. Technology Leadership students' involvement in the provision of technical support services to the community of the school reconfigured the relationships between these students and the community of the school to enhance service, collaboration and collegiality in the SCN. From the way technical information was disseminated in the community of the school, it was apparent that teachers were not solely responsibility for managing all aspects of the technology available in the school; students, in general, had a significant role to play in the practices of the SCN. Teachers' identities in the community of the school in relationship to work changed. No longer was knowledge (technical or otherwise) deemed an exclusive domain of professionally trained practitioners. This attitude was new to the community of the school. Student involvement with the maintenance of computers and provision of computer services in the school marked a shift in educational behaviour in the school.

As Technology Leadership students progressively participated in Technology Leadership community, various opportunities for realizing school technology goals emerged. The school technology plan had highlighted the need to improve access to technology so as to increase communication among members of the school community and to use technology to improve the school. Technology was potentially helpful in managing such curricula initiatives in the school as graduation portfolios. Technology Leadership students were seen as instrumental in the implementation of such initiatives. Video-conferencing equipment, wireless networking amenities,

and infrastructure for online courses, though not yet in place in the school, were deemed indispensable additions to the SCN that could be launched with minimum disruption. While it was not immediately clear whether the school would continue to enjoy its present levels of funding, the intention of the leadership of the school was to continue to meaningfully engage with other technology actors in the community of the school to keep their interests and the interests of the SCN congruent. Strategizing on challenges such as acquisition of new technologies, attracting unique technology-based programs to be housed in the school building to serve students district-wide, and diversifying funding sources for the construction of the SCN were initiatives that the school had not witnessed previously and were consistent with the Actor-Network approaches Latour used in the analysis of *Aramis (*1996). Pegging those initiatives on the abilities of Technology Leadership students to provide technical support services to the SCN demonstrated the confidence that the leadership of the school accorded the Technology Leadership program.

To summarize, construction of an accessible, responsive and adaptable SCN lagged students' experiences with technology from outside school. To tap into students' informal understandings of technology and in order to functionally manage the SCN, the leadership of the school constructed a Technology Leadership program. The program lent itself to change as new technology actors were enrolled into the SCN and as the identities of the technology actors in the community of the school developed. The technical character of the SCN changed as actors brought with them new interests and resources. The result shows that computer and

technical services available to the community of the school improved. The school community gained educational value by students' progressive participation in the maintenance and development of the SCN and by the change that resulted in the SCN's technical character.

How does the *student identity – SCN* relationship shift over time to adequately respond to changes in student identity and in the SCN?

This sub-question examined the relationships that developed between Technology Leadership students and the community of the school, over time. The purpose was to gain an insight into how the practices of the SCN changed as novices joined the Technology Leadership program and brought new interests, and how those changes manifested themselves as the identity of the newcomers developed. With individual student identities shifting and with individual aspects of the SCN shifting, this section summarizes how the whole look of the SCN, or of the student community-of-practice, developed and changed over time in terms of the kinds of service it provided and in terms of the influence those changes exerted on similar initiatives and groups in the community of the school.

A relationship of mutual dependence was cultivated and nurtured between the SCN and Technology Leadership program participants. The Technology Leadership program was conceived to meet participants' technology needs while widening student participation in the maintenance and development of the SCN. Students voluntarily enrolled in the Technology Leadership program and actively

participated in program activities because the program facilitated meaningful student involvement with technology. The program furthered student engagement with technology because it provided those aspects of technology explorations that students could not individually access outside of the Technology Leadership community. Students in the program were purposefully learning technical skills, leadership skills and social skills so that they could support each other's learning and support the learning and instructional practices of the school. Thus, both program participants and the school realized educational value from these students' sustained engagement in program activities and from the technical support services they offered.

In the course of the school year, program participants saw their technology leadership responsibilities in the SCN change and increase as the Technology Leadership community developed. Through exposure to diverse technologies and professional standards in the course of the school year, program participants developed an assortment of technical skills that they employed in the administration of various projects in the SCN. Their skills with hardware, software and in working with computer users grew from being individualized at the beginning of the year to being associated with the supervision of groups, from being used in individual students' coursework to being used to provide leadership at school and community levels over time. From the demonstrations and technical support that they provided, Technology Leadership students were pivotal in entrenching technology use in learning and in instruction in the school community. Their inputs into decisions made about school learning technologies in the school

such as which equipment to purchase and from where, and about which skill-sets to develop in the SCN, were informative. In the course of the school year, the community of the school realized educational value from these students' leadership on technology matters and consultations on technology administrative decisions.

As students in the school interacted with technology in their learning and as teachers sought to integrate technology into instruction an adaptive and supportive relationship emerged, over time, between Technology Leadership students and the SCN. Due to increased demand for technology access in the school, program participants increased their involvement with technology and moved towards greater technical competency in the SCN. The push to integrate technology into various aspects of instruction, in part to tap into students' everyday experiences with technology, served up the menu for student continued engagement with technology activities at school and outside of school. Because diverse school curricula sought to draw upon student everyday experience with technology, the relationship between the school as an institution and students' need for technical skill advancement was enhanced. The School Technology Committee principally constructed a SCN where Technology Leadership students became teachers to teachers and taught what teachers wanted to learn at a time when they needed to know it. Technology Leadership students served as a bridge between the school's technical aspirations at the classroom level and the realization of school technology goals. Student everyday experience with technology artifacts and the ongoing effort to integrate technology into school curricula meant that the technical skills and

experiences that students acquired outside of school were easily applied in student coursework and in the maintenance and development of the school SCN.

Over time, participants in the Technology Leadership program championed school technology goals and provided technical support services to the SCN and to the community of the school. It was easy for Mr. Ceena, the Head of the Learning Technologies Department, to mentor participants in the Technology Leadership program because he epitomized the very qualities that he sought to cultivate. Mr. Ceena was very generous with his time. He worked extraordinarily hard and was very knowledgeable in technology. He was also a strong advocate for the program. Most of all, Mr. Ceena was an astute technical problem-solver who was acutely business-minded in his approach to technical solutions. He understood that the only way to preserve and promote the Technology Leadership program's value was to construct and nurture a program that sought to fully meet student learning needs with technology, yet was sensitive to school and community needs. A philosophical orientation he advanced was, for the most part, responsible for nurturing a collegial relationship between program participants and members of the community of the school in the course of the school year. While Mr. Ceena's personality was a catalyst in the construction of the school SCN, construction of student identity was the essential ingredient. Over time, the technology community-of-practice that was constructed in the Technology Leadership program struck a chord within the school community and the community of the school realized educational value and program participants realized value as well.

Over time, the technical character of the SCN changed with progressive student participation in it and with the changing technology available to the SCN. In addition, relationships between program participants and the community of the school developed and improved in the course of the school year. Through widening fields of participation in the Technology Leadership program, newcomers progressed from the periphery of the program to the centre. They progressively took on more responsibility for the day-to-day maintenance activities in the SCN while the old-timers graduated to such higher echelons of program activities as design and consultative responsibilities in the SCN. In the course of the school year, program participants aspired to potential positions of responsibility created by graduating old-timers and potential new student members were continually encouraged to consider enrolling in the program in the next school year. Such progressive student participation in the Technology Leadership program, over time, involved program participants in a continual process of renewal.

How do student identity and the school computer-network co-construct each other?

Construction of student identity in the context of the Technology Leadership community happened partly because the leadership of the school endorsed the participation of students in the maintenance and development of the SCN. This decision encouraged students to assume more responsibility for the promotion of technology use in the school and encouraged support for the SCN in the school community tot grow. The way the Technology Leadership program was constructed, organized and sustained lent itself to change as technology in the SCN

evolved and as new technology actors in the community of the school were enrolled, bringing with them new interests and resources as their identities developed within the SCN. Thus, not only did the school witness increased technology use in student learning and teacher instructional practices, there was an increase in student involvement with technology, in the form of technology-oriented projects, and in increased student participation in technology activities outside of instructional time. By participating in technical activities and practices that supported the SCN, Technology Leadership students advanced their technical expertise, leadership skills and interpersonal skills. Program activities immersed students in the work practices of a computer technician before they could actually opt to pursue a technically oriented career.

Participation within the Technology Leadership community progressed in widening fields of engagement and involved the whole program in a continual process of renewal. Within the Technology Leadership community, student identity developed as members moved from one grade level to the next and graduated, gained technical expertise and took on increased leadership responsibilities in the SCN. The relationships that were cultivated and nurtured between program participants and the community of the school were collegial, service-oriented and collaborative.

The key to student involvement seems to have been sustained, purposeful and meaningful engagement in program activities. Technology leadership students actively participated in program activities that facilitated their own learning, the

learning of those around them and the learning of teachers and students in the school community. Students in the program were purposefully learning technical skills, leadership skills and interpersonal skills so that they could support each other's learning and the learning and instructional practices in the community of the school. Through their exposure to various technologies and various professional standards, they developed an assortment of technical skills that they utilized in managing and supporting diverse technology activities in the SCN. Such skills encompassed electronic information management, Internet search, e-mail and netiquette, digital imagery, presentation skills, web page development and digital video productions. In the course of the school year, these skills grew from being personal skills for managing students' individual needs with technology to skills associated with the supervision of groups, from skills that utilized technology in coursework to those in providing leadership at school and at community levels. Technology Leadership students were pivotal in promoting the integration of technology in both student use in learning and in facilitating teacher instructional practices.

As the community of the school progressively adopted technology as a learning tool and as teachers sought to integrate technology in various curricula, a collaborative relationship between Technology Leadership students and the school community emerged which was responsive to the development of student identity with technology and receptive to changes in the technical character of the SCN. Technology Leadership students were caught in this collaborative channel and moved towards greater technical competency and leadership skill development. To

this extent, a collegial relationship between students and the community of the school was enhanced.

The Technology Leadership program constructed in the context of the SCN sought to meet program participants' learning needs with technology while improving the community of the school using technology. By supporting the provision of the technical support services, the SCN catered to the development of Technology Leadership students' identity with technology. Thus the SCN was responsive to student progressive participation in it and, in the course of the year, it nurtured the service and collegial relationships struck in the community of the school. Improvement in the technical support services in SCN created educational value for program participants, members of the school community and for the technology in the school.

7.2.1 Reflections on the theoretical framework

Technology Leadership students' identity construction in the context of participating in technology activities in a SCN was central in the analysis of the data in this study. While Lave and Wenger's (1991) account of participation patterns in a community-of-practice maps out the movement of newcomers from the periphery of a community-of-practice to being fully-fledged community members, the understanding is that the skill-sets, the work/learning that members are engaged, and the participation patterns of community members are relatively stable. However, the practices of Technology Leadership community-of-practice

investigated in this study progressively changed in the course of the study. Indeed, the membership patterns in the community, the nature of the activity (digital technology) and the relationships struck within and without the Technology Leadership community-of-practice in this study demonstrated that this community was not stable; its technical skill-sets, its membership participations, and its relationships with surrounding communities, shifted over time.

The pace at which technology was changing, for example, was such that in order to retain technical expertise in the Technology Leadership community, what needed to be learned by newcomers and old-timers was not only constantly changing but was continually being updated. Thus, members of the Technology Leadership community constantly negotiated and renewed the service and collegial relationships with various members of the multiple communities (e.g. other students, teachers, parents, administrators) within which they operated. There were many communities, such as teachers, in the neighbourhood of the Technology Leadership community who supported and were interested in the activities and partook of the services of Technology Leadership program, yet were not immersed in the construction of the Technology Leadership program. One productive way of accounting for the interests and influence of these on other communities on the activities of the Technology Leadership community-of-practice was through Latour's Actor-Network Theory. In this sense this dissertation is an elaboration to established community-of-practice frameworks.

7.3 Implications for curriculum and pedagogy

The conclusions above carry important implications for instruction and for educational organization. The Technology Leadership program, constructed to maintain and develop the SCN and to offer technical support to the community of the school, enhanced the relationship between program participants, students, teachers and the community of the school. Encouraging students to participate in the provision of technical activities to the SCN reconfigured student relationships in the school and served to muster increased support for the technology in the school. The research shows that both program participants and the community of the school realized value.

7.3.1 Instructional implications

Most schools are woefully understaffed to provide needed technical and instructional support for teachers and students. Many schools fail to provide, or fail to provide in sufficient quantity, the certified, technology mentors, coaches, facilitators, or hand-holders required to help the majority of teachers effectively utilize technology to support student learning inside and outside the classroom. Schools do not only need to address the technical support issues of learning technologies, many are in dire need of appropriately addressing the instructional support issues that come with technology. Helping teachers use technology effectively in the classroom means far more than simply providing a technician who can keep computers, printers, networks, and content filters working appropriately.

Addressing instructional technology support needs in the context of a school also means:

1. Having the leadership of the school understand the importance of students using technology to not only consume content, but also appropriately access, produce and share content in constructive, meaningful and timely ways.
2. Permitting students to serve as mentors, peer-coaches, demonstration teachers, and hand-holders to other students and teachers less savvy with learning technologies. This is essential but often ignored, or not understood, by budget-challenged school boards and school leaders.

Both of these requirements are essential and are all challenging to find in a school environment. The leadership of the school that is supportive of technology initiatives cultivates a delicate balance of active student participation while catering to student needs to learn in a supportive and productive setting.

7.3.2 Pedagogical implications

Students' explorations of new technologies outside of school settings afforded students opportunities to develop technical skills and gain unique technical insights not commonly taught in school. Students' experimentations with diverse technology artifacts and their tinkering with different computer systems individually, and for the most part privately, permitted them to extend their circles of participation to work groups, to classroom settings and eventually to the practices of the SCN. Galvanizing student technical disposition into a Technology Leadership program

served as a resource for the SCN and a resource for the community of the school, and served the school well.

Program participants advanced their individual technical skills by participating in different and focused activities in the program. They purposefully designed technical activities to support the SCN and directed program activities according to their technical expertise and according to their interests, and not according to their age or grade level. By their increased participation in program activities and through increased interactions with members of the community of the school, these students advanced their leadership and interpersonal skills. They taught each other, they became consultants to the students in the school and they were consultants to teachers on almost all matters of technology. In other words, these students became teachers. They taught in a way that interested teachers and interested students, and they taught what teachers and students actually wanted to learn when they needed to learn. This was revolutionary and it carries important implications for pedagogy. This mode of knowledge acquisition and knowledge propagation promises to challenge the traditional student–teacher relationship and reorient our traditional conceptions of knowledge delivery and curriculum organization.

Clearly, the SCN needed the participation of Technology Leadership students to maintain and develop its services to the community of the school, but these students did not need the SCN to advance their technology understandings. Program participants possessed technical expertise that they developed through

extensive explorations on their own, or from interactions with each other. Acquisition of knowledge in this way challenges the traditional orientation dear to educational institutions where the teacher is deemed the sole custodian of all knowledge and where the teacher directs and regulates all avenues of knowledge propagation. This pattern of technology knowledge acquisition and dissemination among students carries important implications for the way we organize education and for the way we have traditionally understood and imparted knowledge.

7.3.3 Implications for classroom teachers

Organizing students according to their interests and according to their technical expertise served the SCN and the community of the school well. It allowed students to pursue those avenues of technology that motivated them to learn independently, or to learn from each other. To this extent student participation in technology-oriented activities inside and outside of the classroom increased. Program participants purposefully organized themselves into a Technology Leadership community and rose to different levels of participation and constructed differing identities within the community. Although student identity kept shifting within the community, the Technology Leadership community had steady technical representation that allowed the community to serve as consultants to the SCN and consultants to the community of the school.

Purposefully framing student participation, such as described in the Technology Leadership program, benefits students' motivation to learn, increases

the time invested in curricular-related exploration and experimentation, and encourages focused technical, leadership and interpersonal skill development in any educational endeavour. In the case of mathematics and science education, for example, organizing cross-curricular problem-solving sessions and projects relevant to student everyday experience, that incorporate differing levels of expertise cultivates a remarkable resource for students within the classroom, across grade levels and throughout the departments. Such sessions and projects could be framed to increase opportunities for student engagement with the subject matter and provide options for student interactions while pressing them to learn subject matter in greater depth. And such practices engage students in projects that cut across content boundaries and encourage student learning outside the classroom and across grades. Teachers need to realize the potential impact to learning programs because student active participation provides opportunities to bring about changed relationships to learning. They carry the potential to change the relationships between teachers and students and to shift the status of learners from student to contributor.

7.4 Recommendations for further research

The conclusions reached in this study carry important implications that inform curricula and technology initiatives underway in the school district and elsewhere. It is important to note that students who were enrolled in the Technology Leadership program were able to advance their interests in technology while providing valuable service to the SCN. Although this study sought to understand the co-construction of student identity with technology and the SCN through student progressive participation, there were other aspects of learning and instruction that were not been investigated comprehensively. It would be interesting to know what students and teachers in the community of the school actually did when a computer screen lit up. Given the increased access to learning technologies in the school, it would be helpful to know the degree to which teachers who used computers in their classrooms typically maintained, rather than altered, existing traditional classroom practices. Had technology ushered inquiry into their instructional practices in some pronounced way? In other words, to what extent were patterns of infrequent and limited teacher use of computers in instruction, suggested in the literature (Cuban, 2002), prevalent in the school?

Besides, there was practically an Internet drop in every classroom in the school and, computer hardware and computer peripherals were continually redistributed in various sites in the school depending on where they were most needed. Although student access to computers and to other technologies in the SCN had increased, it would be valuable to understand the consistency in technology

usage patterns over time. Going forward, are levels of technical support services in the SCN sustainable? Clearly, there would be variability in the provision of technical services due to rising technical competency of members of the community of the school. Perhaps brought about by loss of lustre of the Technology Leadership program among students; the adaptability of the program to such unpredictable eventualities could be investigated further. There could, for example, be jostling for territory among groups in the school community that may not be well-served by increased access to technology and that are disadvantaged by the increased emphasis on technology in the school.

Students in classes taught by teachers who have become serious users would receive a technology-enhanced academic experience. It would be informative to study innovative and adaptable ways of integrating technology into instruction, and how instructional practices in school curricula incorporate and take advantage of student technology explorations and technical support services. There is enormous potential for improved service, collegial and collaborative relationships in such subject areas as mathematics and science if communities of learning and practice become learning and instructional foci. As pertains to forging different learning communities or communities-of-learners in a school setting, it would be helpful to craft routines and resources that could be invaluable in successfully managing the practices of particular communities. The results of this study demonstrate that contrary to the traditional understanding of communities-of-practice having stable skill-sets and membership patterns, technology communities-of-practice, because of the manner in which digital technology advances, do, in fact, have shifting

practices, have a shifting technical character in their practices and, subsequently, have shifting member participation patterns as newcomers negotiate changing relationships within the communities in which the operate.

In the school community in which this study was carried out, it would be informative to determine whether, from the improved technical support available to the community of the school, there is improved collaboration among members of the SCN and/or whether there is continued quest to advance the practices of the SCN such as the introduction of online computer courses or of wireless Internet access. Moreover, with the projected entrance to the teaching profession of new practitioners, would the number of days allotted to technology professional development, for example, increase or decrease, and would the activities of such days be demonstrably different from previous ones dedicated to technology. Changes in the amount and quality of release time accorded to teachers and administrators for technology professional development, as well as changes in the quality of on-site technical support by designated teachers and their cadre of student-helpers from year to year, provide valuable information for corresponding initiatives in the community of the school.

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Appendix A

Interview Questions

The interview protocol below guided my interviews of Technology Leadership students. The interviews focused on these students' provision of technical support services to the community of the school. They explored students' experiences with technology activities in the program. I sought to understand how program activities sustained student interest in computers and helped to construct students' identity with technology and with their career choices.

These semi-structured interviews were undertaken within one week of non-participant classroom observations.

Student Experiences

- What does Tech Leadership mean to you? What do you understand by it?
- Why did you enroll in Tech Leadership?
- Who or what made you enroll in this Course? Who or what influenced you?
- What kinds of activities have you done since? Are they what you expected when you enrolled in the program?
- What is it about this course that you like, or dislike?
- Could you have done similar activities if, say, you had enrolled in a different course, say, IT11 or 12 (Info Tech 11 or 12)?
- How is Tech Leadership **different** from the courses you are taking right now?

Prompts! *interaction, problem-solving, choice, agency*

- What do you think about the activities in this course?
- What in your opinion are some of the things that have changed for you as a result of your taking this course, about you as a person, or as a student?

Meaningful Learning

- What are some of your favourite courses?
- What courses have you had most success in? Tell me more about that.
- What, in your opinion, **sets this Course apart** from your other Courses?
- What does "**learning**" mean to you?
- What is the best way for you to "**learn**" something?
- Do you consider yourself a good "learner"? Tell me more about that.

Service-Learning

- What do you understand by "**service**" or "**helping out**"?
- Is it important to you?
- Do you think "**service**" is an important part of this course? In what way?
- How has your involvement with this course contributed to your understanding or appreciation of "**service**" to the other students, to the school, or to the community of the school?
- In what ways have your ideas on "service" changed (if at all) since you began the course?

Views on Technology

- How **familiar** are you with computers?
- What got you **started**? How? Tell me more about that.

- Which experiences have particularly been **influential** on your knowledge of and interest in computers?
- Technology by definition is always changing as we asked new questions and seek to answer them. What do you think about this aspect of technology?
- What kinds of things do you do to keep up?
- What is your opinion on **technology**, in general?

Out of School Activities

- What **activities** are you involved with in your leisure (say, after school)?
- Is it important to be involved, anyway? Why?
- What helps you **decide** what you spend your time on?

Career Plans

- What are your career-plans? Can you tell me more about that?
- Have you given this much thought?
- How, in your opinion, will your experiences in this course (activities in this course) help you in your career-plans?
- How much time do you spend with Technology Leadership activities? a day? a week? Why?
- To conclude, what impact would you say this course has had on you?
- In your opinion, where would the school-SCN be without the Tech Leadership class, or without dedicated students like you?
- Would you recommend this course to another student?
- Do you know someone who you think would benefit from taking this course?

Appendix B

Sample student interview transcript

Name:	**Scott**
Date:	**End of year interview**
Grade:	**12**
Course:	**Technology Leadership 12**

Following introductions, explanation of interviewee's rights in the course of the interview and explanation of purpose, the interview continued as follows:

Alfred: Scott, did you take Technology Leadership 11 last year?

Scott: No, I didn't take TL11 last year. Last year I took IT12 and the year before that IT11 and the year before that Computer Studies 9/10.

Alfred: So you have been in the program much longer than most. What would you say is the difference between TL and LT courses?

Scott: Well, Technology Leadership, you really got to choose what you want to learn in technology but in Learning Technology, it is regular, it is very defined what you learn and what not. You go through JAVA, you go through HTML, you go through True Space, you go through all that. But in Technology Leadership, you really get to learn what you want.

Alfred: Was that difference important to you?

Scott: I do, I do because I have always wanted to learn about programs such as Sound Editing programs, in particular, but Information Technology never really presented that opportunity.

Alfred: That means you get to choose your own programs, such as Sound Editing, and you get right into it . . .

Scott: Oh yeah, yeah, and right now, we are doing it on purpose on the Sound Editing team because we are making a movie.

Alfred: You are doing that?

Scott: Yes.

Alfred: When do you choose the project you get to do in Technology Leadership?

Scott: You choose pretty much . . . Every term you choose what you are going to do for that term. You can choose one project or you can choose a bunch of smaller projects. Like Term 1 I wanted to learn more about PHP, Web-design and a little bit of PSS2 and work on my A+ Certification and I did that.

Alfred: And then in Term 2?

Scott: In Term 2, I wanted more PHP and more A+, but for Terms 1 and 2, we kept lodged-up doing stuff around the school and we didn't get too much time for our own projects. But now for Term 2, in this movie, we've had a lot of time and we've done a lot of work on that. We've learned a lot about Sound-Editing.

Alfred: What kinds of things kept you busy in Terms 1 and 2?

Scott: Aah, a whole bunch of things. Basically redistributing, or distributing computers to the various teachers, networking everything, re-imaging computers in the network. Basically sort of setting up of the infrastructure.

Alfred: Was there a need for that? Was it important to get that done?

Scott: Well, before we started distributing computers, not all teachers had computers, or some teachers had older ones. In some ways it was more of an update but or some teachers it was fun having a computer.

Alfred: What other kinds of things did you do in addition to re-imaging and distributing computers?

Scott: Well, we were also in charge of hooking up computers to the network as well, and so we spliced a lot of cable, and after we did that, hooked them to the network and if there weren't enough parts, we would have to hook up a hub.

Alfred: Tell me what you mean by "we".

Scott: Generally, it was more of a group thing. We would work in groups of 2 or 3 or larger and then so Mr. Ceena would in Terms 1 and 2 have, like, "Oh, this teacher needs a computer. Can you hook up this?" And then, like, we would form a group to carry out that task.

Alfred: So were there particular strategies you had to follow to do this?

Scott: Most of the time we already knew what to do. Some of them were pretty basic but if we had a problem, Mr. Ceena would help us with his

expertise. Or in some cases, we would look it up in the A+ Certification books to see how you should properly do it.

Alfred: Describe the A+ Certification books that you are talking about.

Scott: A+ Certification is certification to be a computer repair technician. It is more hardware than software but it is your basic, it is your first level certification on becoming, say, anything computer related.

Alfred: So who offers that certification?

Scott: Well, basically, all we have to do is pass this test that they give. But to do that there is a lot of pre-reading that we have to do.

Alfred: Is this organized within the Technology Leadership course?

Scott: Mr. Ceena offered to give the test if you wanted to give the A+ Certification after completing the Technology Leadership course.

Alfred: This year?

Scott: Yes, this is the first year we have had A+ Certification.

Alfred: Is it a certificate, therefore?

Scott: It is a certificate.

Alfred: So you'd become a Specialist of sorts?

Scott: Uuhu.

Alfred: Would you say this is a certificate that every student in the course would like to own?

Scott: No, I don't think anyone owns it yet. A few are going for the test. I know Ted is going for the test; and I'm going to probably take the test too. No one owns the certificate yet.

Alfred: Would you say you are now skilled enough as to be able to pass the test if you went for it right now?

Scott: I'd say so. I'd say a lot of the work we did around the school did help me on my general knowledge on networking and gave me more experience.

Alfred: Is it something that you were aware of when you signed-up for the course?

Scott: A+ Certification? No, I didn't.

Alfred: So getting this certificate was not one of your goals when you signed-up?

Scott: No, it wasn't. But when Mr. Ceena talked to us about it, I said, "Well, I'd like to try to get that certification."

Alfred: What does it allow you to do that you are not doing already? Does it certify you to run little networks like the one we have here in the school, or does it allow you also to run bigger networks?

Scott: I'd say working with smaller networks like ours and then making house-calls, or offering Tech Support over the phone. It allows you to do that.

Alfred: Now, looking back at the kinds of things that you have been able to do through the year – let's say, to the network, what do you think about the kinds of things that you have been able to do in the school?

Scott: Well, it all depends on your skill level coming into it. I know for Ted, he already knew most of it. For me, I didn't really know too much about networking. So I learnt quite a bit I'd say when I was setting it all up. And I suppose, sometimes, when teachers had a very simple problem, I guess you could consider that a waste of time. Uum, it was an experience nonetheless.

Alfred: What could you say was the lessons you learnt from that experience?

Scott: It did sort of help me work with people. Some people are very vague. If there's a problem with a computer, we had to pry the answers out of them. Sometimes the problems are quite frustrating and we have to pass and do some research on the problem, looking for solutions.

Alfred: That is, from back in the Technology Leadership class?

Scott: Yes, from the Technology Leadership class.

Alfred: So you would actually take a problem back to class and ask each other how to solve the problem?

Scott: Uuhu, either that, or we would ask Mr. Ceena.

Alfred: Was that encouraged?

Scott: Yes.

Alfred: When you come across a problem where you need to figure things out, is it done during class time or outside of it?

Scott: It is mostly in class time, but it is not unheard of to say, "Ooh, let's re-image the whole lab, say, an hour after school just to get it finished? But it is mostly in-class time.

Alfred: What would you say are some of the qualities or features of this program that make it stand out?

Scott: I think it is really good to give students their own time to learn what they want. That is really good because not everyone wants to learn about True Space in Information Technology, or about JAVA. Some people want to learn about other things, or want to go on to other things. And that is what this course offers.

Alfred: So you could actually say that is what makes it different from Math, Science and so forth?

Scott: I think that is pretty much it. It also offers a lot of practical experience in dealing with problems around the school.

Alfred: Let's say if you are interested in becoming a technician at some point, then you could pursue that road and get a sense of what happens before you take it further – a kind of work experience.

Scott: A lot like that, yeah, in school work experience.

Alfred: Now, let's talk about where this is leading to. Ah, have you thought about what you want to do after you graduate?

Scott: Aah, I have thought a bit about it but I have considered what I want to but I haven't decided which one I want to pursue.

Alfred: Do you see technology in the horizon being one of the things that will feature in whatever you want to?

Scott: Yeah, most definitely. One career-option right now concerns nuclear-medicine, sketches, what not. CAT scans requires a lot of workings with computers. So having know-how would be valuable to have. All my experience from Technology Leadership might go into the job if I go into that job.

Alfred: Is that what you are looking forward to exploring further?

Scott: And also since in Technology Leadership my project was about Sound Editing, I was also looking at another career opportunity. I want to be a Sound Designer for a computer company. I was looking at other careers also that sound like a good idea.

Alfred: Are you talking about Electronic Arts?

Scott: EA would be one of them.

Alfred: Have you been there?

Scott: No, I have not. Last year in IT12, I suggested to Mr. Kramer that we go for a fieldtrip to EA but apparently security is very tight there.

Alfred: But I think it is a neat thing to consider. Now, let's talk about what motivates you to pursue a career in technology? The people you know: friends, family, or fieldtrips?

Scott: Well, ever since I have been doing all the technology programs, I have taken all the technology courses, I have felt every year; I have developed a stronger feeling that I would like some dealings with technology. I like learning about new things . . . whatever job I will go into, technology is going to be a big part of it.

Alfred: Let's talk about the technology part. What is your attitude towards technology? In a way, it is always advancing, it is always changing and with that comes the demand for us to keep up with our skills. What do you think about that? Something you can not really get your hands around. It is always slipping away.

Scott: (laughs quietly . . .) Well, I guess it is good that it is always advancing. There are new, easier and betters ways or techniques, what not, but I don't mind that you cannot fully learn all there is. I look at it, say, in other courses such as Biology, the same thing is there. You probably couldn't learn everything that there is to learn. There's probably something that you do not know.

Alfred: It is in the nature of the experience itself. There is always a need to keep up with your skills, one way or the other.

Scott: I think it is probably good that it keeps you on your toes, avoiding what you might say is your mind stagnating.

Alfred: Who were your influences when you got started? How did you get started with computers?

Scott: I guess how I got started with computers ever would be, when I was young, we didn't have cable TV, we didn't have TV at all, but we had a computer. So I spent a lot of time on that computer. And then my Dad bought a newer and better computer over the years. Then I think, at about grade 7, I started fixing computer problems at my old elementary school.

Alfred: So you have been at it ever since?

Scott: I would say so, yeah.

Alfred: Obviously, you have been at this school, now, for 5 years?

Scott: Five years.

Alfred: Being familiar with computers coming in, what is your take on how computer technology has developed?

Scott: I remember when we were in Computer Studies 9/10, I remember we had these old computers that only ran Windows 3.1 and they were using those big old, clunky things for printers. And then when I moved onto IT11 in grade 10, we got to go to the Computer Lab upstairs and to the computers there and I think they were Pentium 2s. And then at IT12, there were much the same in the lab; there were upgrades with memory. But now in Technology Leadership, we have a bunch of computers. We have Pentium 3s and we saw to it that all computers in both labs had been upgraded and run the current system as well. And then we also have a few Pentium 4s that we can use for our own projects. We have about 5 of them.

Alfred: In terms of the Tech Support available for other students, teachers, what has it been like?

Scott: Uum, what do you mean by that?

Alfred: I mean if there was ever a problem with a computer in the Library or lab, was there always a person(s) you could call upon to help out, students, teachers?

Scott: Uum, well, I think I am a wrong person to ask this question because each time I had a problem, I would kind of fix it myself (laughter). So I didn't really . . . I remember in grade 8 or 9, there were a whole bunch of Technology Leadership 8 and 9 students, Technology Leadership 11,

12 and 10 and there would be these grade 8s and 9s going around the school trying to fix the computers as well.

Alfred: Did it occur to you to join this team at the time?

Scott: I was very interested but I was concerned that it wouldn't fit into my schedule so I decided not to.

Alfred: So have you been keen on helping other people?

Scott: Definitely, definitely. So if someone has computer problems, they'd come and ask me. I'd sit down and fix it and help them out.

Alfred: You don't mind doing that sort of thing?

Scott: I don't mind doing that at all.

Alfred: So it is important to you then that whatever you do that that component is built in – the service component?

Scott: Yeah, I'd say so. I do enjoy interacting with people, helping people, fixing their problems. It is very rewarding for me, I'd say.

Alfred: That is like an image that is not typical of computer people (laugher all round).

Scott: Anti-social people have a very narrow view of the world.

Alfred: There's another component to technology that I picked up in my conversation with Mr. Ceena, that is the business angle. From your career-options you have not mentioned any of that. Have you thought about that?

Scott: As in going to business?

Alfred: Let's say entrepreneurship.

Scott: Ooh, yeah, uum. For the Term 2 project, PHP, we added a bit of purchases. We were going to do this thing called "Shop Burnaby." It is a PHP directory of all the shops and all the businesses in Burnaby and then we would get them to pay a little yearly or monthly, not too large an amount, like $5 a month; to have their own website, their own link and map and so on, a picture and say, may be, a few specials that they would have and we worked on that for most of Term 2

Alfred: What do you think about the idea that you are able to put your understanding to a different use?

Scott: I think that is a really nice way to, I guess you could say, money-making application to technology and so I am also interested in pursuing that.

Alfred: What has your experience with technology been like? Have you had an experience outside of school where you are able to engage with other professionals in the form of conferences, forums, or may be just a job?

Scott: No, unfortunately not. I have not been able to have experiences like that. For work experience, I did go to Phase I Computers, Applied Computers.

Alfred: And in terms of forums (for a), do you run a forum? Are you a member of a newsgroup?

Scott: Yes, I do actually participate in a couple of technology forums, on and off, just helping people with computer problems.

Alfred: Have you ever gone to a computer conference?

Scott: I would like to, but no, I have not.

Alfred: So the question then is: How do you keep your understanding current?

Scott: I read up online, I talk to other people about technology, read the news – online news, magazines, both.

Alfred: On a regular basis?

Scott: I'd say on a regular basis. If there's an article in the Vancouver Sun, if I'm interested in it, I'll read that.

Alfred: Would you then say you have a broad range of support, resources that you can access to get a feel for what is going on?

Scott: I'd say I have a pretty broad range of access like here at school with the *networked* computers and Mr. Ceena, who's certainly very knowledgeable on almost every subject, but I wouldn't say I have too much support outside of school.

Alfred: Tying some loose ends, earlier you talked about PHP, what does it stand for, what is it?

Scott: Uuh, uuh, I forget what PHP stands for but basically it is a database code for designing databases and working with databases and that the idea for the Shop Burnaby database would have all the stores listed.

Alfred: Is it also to do with programming databases?

Scott: It is.

Alfred: In conclusion, I would like you to comment on something else, and that is the program itself. Is Technology Leadership the kind of program you would recommend to somebody else?

Scott: Surely if they are interested in technology and they are motivated to learn more, I would definitely recommend it to them. It gives them a great opportunity to explore whatever they want in technology.

Alfred: That freedom, to you, is a big feature of the program?

Scott: It is.

Alfred: You have used another word that we hadn't talked about: learn. When you say, "If they are interested to learn more," what is your understanding of that which drives learning for you?

Scott: There are a few things that you keep in mind when you say, "I want to learn about Math." You have an objective in mind, say, and if you want to learn a human map, that you want to make a skeleton, and so on. It is good to have an objective when you set out to learn something. So like my sound-ware, when I set out to learn about sound editing, I thought the good way to do that was to learn it by making this movie.

Alfred: The hands-on component is there. The objective is an important part of it. How about the other part, which would the result: being able to say, it is good, it is neat. Therefore, I have achieved my objective, I have learnt something.

Scott: It is like, if I can turn in a very fine piece of work, and I can say I learnt how to do that; how to make that.

Alfred: So that is also important: showing or being able to demonstrate; showing that you have actually reached a different level from where you started.

Scott: That's also part of it. If anyone asks me, I'll be able to teach them how to.

Alfred: I couldn't possibly begin to say enough about the credit people are giving to Mr. Ceena.

Scott: He does a lot for the school.

Alfred: That is in addition to his teaching duties. I think next year his responsibilities are going to be heavier because he going to be the only technology teacher. He will teach Learning Technologies courses together with Technology Leadership and that is on top of the things he is doing now.

Scott: Like I'd say the School's Annual (Yearbook), he created a lot of it himself.

Alfred: Ooh, that is the one area we did not talk about: the Annual. Lets cover that briefly. What has been the role of the Technology Leadership students in creating the School Annual?

Scott: I know for a few members of the group: Kelly, Caroline and Richard, the first part of their project was to create the Digital Yearbook. The digital form of the Annual, that was their Term 1 project. And then also if you want, you can also choose to work on the Annual as one of your projects for Technology Leadership.

Alfred: In terms of the skill level required, that Technology Leadership students possess and bring to these projects, what do you think it would be like without these students there?

Scott: I'd say, we'd be waiting a lot longer for our Annuals. They certainly do help out quite a bit with the technological expertise.

Alfred: In terms of being familiar with what happens in the school, and these students being able to identify the sites and sounds for example, the Sound bytes, video vignettes, and then maybe somebody else in layout, maybe image layout. Having all these people there makes for a richer assortment of skills.

Scott: I'd say definitely, they bring a lot of diverse skills to the Annual Club.

Alfred: Would you go as far as saying the Annual Club is run by Technology Leadership students?

Scott: That's a bit of a stretch. They help out, I wouldn't say they lead. The Annual is more, a lot more about Design and not so much about technology.

Alfred: What is your understanding the word "leadership"?

Scott: To my understanding, I won't be leading anyone now. I get to curve out a path. When I do my A+ Certification test and get A+ Certification, the next people coming into Technology Leadership 12 will take a look at all the projects we did and then they will pick one of them and then they will go, "Wow, that's a good idea." And then all the resources will already be there. I haven't mentioned this before, another thing about Technology Leadership is if we say we want to learn about something then the school will also help to pay for it. Like the A+ Certification books, the school paid for them. They were quite expensive. They were about $90 each.

Alfred: So the support from the school is there?

Scott: Definitely.

Alfred: And you talked about new computers, who ordered those new computers? Were they a result of a recommendation from Technology Leadership students, or was it simply the school's choice to buy?

Scott: A bit of both. If we want to pursue any of our high end projects, say, for all [3D] rendering, we would need high-end computers and so Mr. Ceena put that request in for us and then it was approved and bought.

Alfred: Leadership to you then has those components, anything else?

Scott: Aah, I guess it's just, going into a classroom and fixing a computer problem in 1 or 2 minutes and walking out and the teacher being so grateful (laughter all round)

Alfred: So there is that too. Do you find you occupy a special space among students where students are respectful of you because you are a skilled person in school?

Scott: I'd guess so. I have had a few students come up to me and ask me about computer problems. Then I'd say, "Why not!", and then I'd give them the best advice I could.

Alfred: So they see you as a knowledgeable person with technology.

Scott: They see us as Specialists in technology.

Alfred: The same feeling again as walking out of the classroom and feeling the satisfaction.

Scott: (silent laughter) Definitely.

Alfred: Those, I'd submit, are human qualities. One wonders how someone gets into something like this. I wonder whether this is something that you actually sought. Did you seek out to be in this position for what it offered – the allure? In other words, could you have chosen to stay out of Technology Leadership if you wanted to, or were things in Technology Leadership so appealing that you had to get involved?

Scott: It was very appealing to me to be able to learn whatever I wanted and be able to get support from the school for that and that was very appealing for me and that was probably the main reason why I signed up for it.

Alfred: Uum, you did mention being able to do all the other things like the network, offering support, you being interested in learning and at the same time you giving back something to the school by helping out.

Scott: Well, I didn't really know we would be doing a lot of that. I thought we would not be doing things like, . . . we would not be doing so much of it, so since I thought it was such a minor factor that I didn't really consider it when I was signing up.

Alfred: Do you think it is important to have a larger number of students in that program to reduce the amount of work you do in the school?

Scott: I guess it would be a good idea to have a bigger number of students but you kind of don't want too much. I guess it would be a good idea to have more students because of the amount of time saved and it would give us time to spend on our own work on projects.

Alfred: Coming into grade 8, you were actually ready. You have been comfortable with computers for a long time, but in terms of how much you have picked in the course from the beginning of the year, how much could you compare that to what you came to the program with, from, say, September, to now?

Scott: I'd say I learnt a lot, just about from fixing computers, PHP, Sound Sign, all that. I'd say I learnt a lot, yeah, I have learnt a lot since joining Technology Leadership. In Computer Studies 9/10, I didn't really learn too much there. The same as IT11, I didn't really learn too much there. This year, I've learnt a lot.

Alfred: I have posed the same question to others and that's about the same weight they place on the program. Maybe the students who get into

these types of programs are already skilled and they appreciate their being able to sharpen those skills.

Scott: I suppose that's probably it.

Alfred: You came into the program with a foundation already set then at this point you are merely channeling those skills to a particular task.

Well, thank you very much, again. If there's any other question that comes to mind within the next 2 to 3 weeks, I hope we could again sit down and have another meeting, brief meeting.

Scott: That's quite alright.

Alfred: This interview was more about getting the sense of your general experiences with technology. It is really broad, but in our next meeting, if at all, if we need some clarification on a few points or for insights that may crop up. Hopefully we can have another go at his if we need to.

Scott: Definitely.

Alfred: But most of all, I appreciate the time. Thank you. I know you are a very busy person and it was great of you to have spared these minutes.

Appendix C

Sample teacher interview transcript

Again, following the pleasantries, explanation of purpose, and explanations of the rights of the interviewee, the interview proceeded as follows:

Alfred: For the record, what is your name and what do you do in this building?

Mr. Ceena: My name is Mr. Ceena. I'm the Learning Technologies Department Head at *Pal*. First of all, the responsibility of learning technologies is this; first of all, we look at the type of technology in the building, in terms of hardware. The type of thing apart from computers, anything in which technology plays a role for both the teacher and the student. The looking at the learning technology in development, getting teachers to learn how to use the technology, or better ways in which technology could be used in their area, etc. As well, of course, I am teaching the senior IT courses.

Alfred: IT is Information Technology?

Mr. Ceena: Information Technology, that's right. Changing over direction, we named it IT which is the Information Communications Technology to try to incorporate students to not only be technically sound but also be able to communicate what they learned. So of course you see the things I do with the Technology Leadership students!

Alfred: Yeah, it is mainly these students that I would like to talk to you about: the Technology Leadership students and their role in the school. Let's start with the learning technologies part of your job description. Is that a position you are appointed to?

Mr. Ceena: Yes, the position really had, when I was hired, was based on, as a mandate, we are responsible for increasing awareness, the development of technology, the development of teachers and technology, but the position also harbors the hardware side which is fixing of outdated technology, keeping maintenance of the technology and that can demand a lot of time than people realize. So I think something that gets lost sometimes in the position is really being hands-on with more on the teacher-side than the student-side. For me, it is hardware things like the Yearbook, and other projects, they are all drawing away from that initial goal.

In my mind, I still look at school first, my position second and then the district third. Students always come before anyone of those but in terms of my responsibility, the school which is the students, position second and the district is third. Whatever the school needs first, I will finish and whatever my position can handle after that I will take care of it, next the district needs of my position which is collaboration with other learning techies, that's my lowest priority.

Alfred: Good prioritizing on your part.

Mr. Ceena: So in terms of this position, it is mandated, the requirements are to look at, getting involved with teachers in various courses and looking at their technology. For example in the Social Studies Department right now, they are looking at purchasing an NEC projector because they are finding that students are using presentation software quite a bit now and it is more convenient and fastest. I guess that presentation can be done with a computer with a presentation screen so they come to, asking for where there is the best place to buy, what are the policies in purchasing that type of equipment and given the budget, what's the best machine to buy? So that is maybe an example of that type of responsibility.

Alfred: So this position is really supported by the School Board, I suppose, in terms of recognition that technology is important for day-to-day school activities.

Mr. Ceena: Particularly, there's a hierarchy in terms of where I sit. In terms of technology in the building, I could probably be considered at the top of the hierarchy but in a district sense, I am one of a team of people that is supporting the school district. They have an organization called the CSS: the Computer Support Services, that should be handling a majority of technology problems with computers. For example if a floppy drive is broken, a drive is down, or if there's a problem with our wiring, I am supposed to call all those things in and they get set on a queue ordered list and they will come and fix them. A lot of the time, uum, I find it much more convenient for me to take care of those problems. It is typically faster but when it comes to our network, my hands are tied for a lot of issues because in the hierarchy, I am not supposed to be touching anything in the school, even though the reality is, I would probably be more efficient if I did rather than waiting for someone to solve the problem. So they are trying to push us away from doing anything that forms the basic technical side.

Alfred: Is that a recent directive, or has it always been the case?

Mr. Ceena: It is relatively recent; it has evolved to that point where they are trying to homogenize the system, where every school has the same set-up, identical to every other school, the networking being exactly being the same everywhere, where one person can control it and delegate responsibility.

Alfred: But it has never been like that before then.

Mr. Ceena: Before that every school had its way of how things happened which made it inconvenient for one to get help because the technician might say, "OK, how's PAL set up?" or he or she may say, "How's Cariboo set up?" So I appreciate the level that they have organized it. There are benefits to that but there is also a negative side to it in that if we were looking to change anything, things are not going to happen quickly. We have a process that has to be followed. Uum, then again, when you have someone controlling, then some things are not going to happen in that sense. I won't say it is obvious but I could say it can happen. Again the more you are given to do a job, the more time you have to do those kinds of things.

We are moving to a centralized network solution which is important to keep consistent. I am happy that all schools are getting closer to the same level. Our school is not, based on the population, is not looked at, as, uum, it is a smaller school.

Alfred: That is a good point given the priority placed on the number of students in a school. Could you then speak to the role of our Technology Leadership students as relates to the network and to the whole set-up of technology in the school?

Mr. Ceena: Sure. The way the computers are set-up now, the type of software and everything placed in them is based on the image that is created by the district, even though I do my own modifications to it. Once the image is created, then when that computer in the school is down, or has a problem, it will be re-imaged and then put back online, so to speak, very quickly. So originally, students would be responsible for support of those areas in the school where computers would be used or, either programs installed, or re-installation of computer, and find out what the problem was or troubleshoot those issues. Nowadays, it has been made a bit easier by the fact that computers are becoming more identical which means a solution to a problem has a few quick steps to it, so students don't have to do as much tinkering. Now the Technology Leadership students are responsible then in each one of their terms, they get to do things that are school-centered in the implementation of technology, implementation of learning technologies, helping teachers about that technology. And then the hardware solutions: fixing

problems, simple things like a broken floppy drive, up to installing the whole system. All those things are meant to get them learning the process to troubleshoot the problem in a technical environment and then solve that problem, or if there's new software, a new program that needs to be learned, how do you share that information with someone else? So there's a communication side with a technical side as well.

Alfred: So a service side then where they get to help out?

Mr. Ceena: Yeah, that's right.

Alfred: Where you offer explanations as well. Is that something that you stress in the course, in terms of how you deliver the program to the Technology Leadership group?

Mr. Ceena: Yeah, I think if the students were given, in terms of that leadership role, they are given only their own work to take care of, uum, you don't build a sense of community, you don't build a sense of uum, when they are developing their own projects, and things like that. They may focus on what they are interested in, but in terms of service and community for the school, helping them do things for others is just as valuable. In the workplace you are never going to be isolated, to choose exactly what you want to do. You are going to be collaborating with others; you are going to be, maybe responsible for providing service to others. That is why that component is important that they understand that everything in this school is, related to technology, is our responsibility. When we go out and learn to fix or support people or help them, we are not only learning how to fix that technology, we are also learning the process in which to teach that technology, or to troubleshoot that technology, so when you are in any environment where you have to deal with people, you don't just deal with the machine, the machine does not talk back to you. You deal with people that deal with technology. The goal for that aspect which has always been here every year is to get students to be involved not just with computers but with the people-side, or the human-side of the equation, that computers are tools, they are not things in themselves.

Alfred: This is a very interesting principle. Tell me about the students who come into the program.

Mr. Ceena: The kinds of students who come into the program?

Alfred: That is right.

Mr. Ceena: The process is quite rich in terms of how you get into Technology Leadership. Uum, first of all, it is nice to see students in grade 8, 9

and 10 and encourage them to see if they are really good with technology, to think about what can you do, what can you do to support the school, that is, getting involved in things like the Yearbook, get involved in little projects. You know often students can handle projects on their own, with minimal teacher support. They bring you something and you are amazed. I think that is when we often learn that that kid has that nature, very similar to any discipline where you need as much direction, that is, they have that type of discipline in themselves and say, "I need to get this done, how do I get it done?" These are the tools, okay, let's try it. If it fails, how do I fix it, how do I move on? When you see a kid who can think in that way, we are now looking at a possible leadership potential because that student can not only work independently, they have the potential in being a leader, to also motivate others and some direction or collaboration with others. That is the second side of leadership that we are looking at. So I don't think everyone who is great at technology, the students who are great programmers, great graphic designers are going to be great leadership students. The key is to look at those students that when they are at a point where they are finished their work, they like helping others. They like supporting others. They can step back and see a problem a bit differently. They don't get frustrated, they understand that there's always a way to figure out a problem. And if there isn't a way then someone must know. That is also a kind of entrepreneurial-type attitude. If you don't know, find out someone who does. You don't need to know everything. There is no need to fill you mind with everything. Intelligent people, I find, accumulate knowledge, smart people know where to get it when they want it. You combine a little bit of intelligence with a good smart attitude, that's what we are looking for: students with that capability. Because in the end, they work with me and I treat them very similar to a colleague in terms of trying to get work done but I act as their mentor and they are looking to mentor other too. I think I act like a model, to model my behavior in the way I deal with people and how I deal with technology so they can look at that and say, "Uum, I like the way he dealt with solving that problem," and incorporate that for themselves. And that is a point I can remove myself from that situation then they can handle a problem whether it is with someone with technology, with implementing new ideas.

Alfred: So you are very conscious of how you conduct yourself around them. Do you talk about it? Do you step back and reflect with them how a particular incident went?

Mr. Ceena: Yes, every time. I think every time when we hit a problem and maybe one of the students figures an idea out, I always review the steps we took to get to that point because, I think, it is quite important that when we walk to a dead-end, is that something we wasted time on, was

it something necessary for us to find for ourselves. So to give you an example, today, the goal here was to take a VHS cassette and convert to a digital format, into a DVD. First of all, did we have the equipment to do that? Do we have a capture card? Well, there's a part missing to that capture card that would not capture the audio. We could capture the video, but not audio. Now we have a problem, how do we solve that problem? Well, the simplest way to solve that problem was to buy our way out of it. Let's go find an equipment that will fix that problem. Well, that is an expensive solution. So we had to consider, well, how does this mechanism work? And how can you figure out another solution to it? It had to be very simple, or it could be very complex, it is up to us. I mean, if we wanted to solve that problem, time is important. To get done now, maybe buying the solution would be the best choice. If we had a few days on it, now we have more time, that means there are probably more alternatives. So I was working with Ted on this. So the first step was to look at how we record audio. Well, we can record audio through the computer, through the microphone. So let's figure out a way of taking the sound from the VHS or VCR and turn into a microphone form. So we spent about ½ hour looking around the school for devices that could do that for us. In the end, it turns out that there was no actual plug that was available in the school that could do that transfer. So we used a low-tech solution which was, use your microphone, a physical microphone, play it off a TV and just record it from there. Why would that be a good decent solution? Well, the recording in the first place wasn't high quality. So by recording onto a microphone, we weren't going to lose more quality. So when we looked at it, and Ted has been through this process with me many times, and we understand how I work to solve it; he has many ideas as *we* have.

The way I work is I present a problem, I ask how he thinks we are going to solve it and in this case, he is the one who came up with the low-tech solution and said, the only alternative now is to buy that plug, so let's try this low-tech solution. So we tried it. Uum, it worked, but it may not be the quality that may be different from a $3-plug. So we tried it, we know that we have time. We will probably purchase the plug the next day to solve the problem.

Alfred: Whoa! That is amazing because I think, for the most part, you get to see how inspired these students are in problem-solving, information gathering, information-access and how they conduct themselves in handling typical tech environments. But then there's also the other component which is one of balance. Technology is always changing, there are always new techniques cropping up. So how much of that do you emphasize in terms of going out there looking for information that

might be on the Internet or with people outside the immediate campus?

Mr. Ceena: Well, if you look at the way we did this, it is a classic problem-solving technique. First of all, looking at what you know already and trying to base some sort of solution on logic and theory, why things work. For a lot of the things that we are doing now, the smart solutions aren't always the ones we know. It's the ones we don't know and are possible. One example we came across was: we are trying to put PAL TV out in the foyer and if you have some sort of wireless solution to it, you don't have to go to the TV and change everything and change the programming. We could do that over the network. Actually Ted, who did the research on it, found out that, no longer do you need a network cable to connect. You can just use an outlet; a power outlet can act as a network device. It sounds crazy, it doesn't sound like it is possible. The truth is: that power outlet and the power grid that PAL is on can act as a network so that any plug that you see, based on a network box, at a point, we could be plugged anywhere, and we could send it through the network. And to me that is incredible. It is almost scary.

Alfred: Is the technology in operation now?

Mr. Ceena: It is in operation. We could have purchased it to solve the problem. The only reason I chose not to is that I don't want to choose a solution that is gimmicky or may not be valid in a year or two.

Our network has been a solid base; we need to focus. We need to use that as a vehicle, but it is possible. Some of the research they have done to figure that out, we look at what is happening beyond. We purchased four high-end computers to support our students (these ones that are out there). And those are from research done by students. What is the best thing we can put into these computers at a price that is available and again we don't know what is possible but we are looking at what is happening about 2 or 3 years down the road.

Alfred: How much support do you get in terms of affordability of equipment? For example, if you decide that you need something that is perhaps useful in the network here, how much support do you receive in terms of money?

Mr. Ceena: As you have seen, I do a lot of the maintenance by myself on the technical stuff. I think we save quite a bit of money. I think, technology and the visibility of technology in the school becomes necessary as with any department. I think if you are planning something, anything, and I say I would like to try this, an outlet network, I think people will look at it and say, "That is probably a

valid solution." I think you have to start very small and build a purpose for it and I think for the past few years, I think, with one computer, I've made a DVD, I have done Video Editing Solutions, I have done a tonne of things that, I think I have built a reputation for with the students: a Digital Yearbook, etc. And I think that is what led to the possibility of buying these computers based on need because more and more students want to try to use that kind of stuff. I don't think I look at and say, "Ooh, that is great. Let's get some money and buy it." I look at it in terms of purpose. Can we create purpose for what we have? If there's purpose, for example, if you are going to buy an expensive machine, there also has to be, in an instructional set of resources to be able to know how to use it. Whether that be lesson plans or whether that's the area for which to work in. All these things are important. The reality is: it is not driven by saying, let's get more and more and more. It is driven by: Can we use it for a purpose? And the purpose is: Is it beneficial to more than just ourselves then it is visible to the school. If it is visible to the school then it is recognized. When people recognize something, then they value it. It is the value that is important. So if people value the DVDs and the Yearbook, then yeah, that is something they will pay for. That money just came back into our system. I bought more cameras; I bought a new digital video camera. So it has kind of recycled itself. So being an entrepreneurial-type person, I combined technology and those things to create purpose, to create value and with that, we could buy anything we want. If I could combine those two things, there's nothing stopping you from doing anything you want.

Alfred: In terms of being a mentor to the students you work with, that's a great principle right there, where those three are put together.

Mr. Ceena: And you know it is the students that drive some of what is possible. And it is up to me to play a devil's advocate sometimes and say, "Really? Can we do that another way?" It is up to them to prove it. If they can prove it, proving it just means trying. Why would you want anyone to try? To try to leap to something, it is failure that creates success. It is failure that leads to create a path. "Look that path didn't work. Let's try to create another way!"

Alfred: Let me ask you about participation rates – number of students in the program – specifically numbers of boys and girls.

Mr. Ceena: We have 9 students in Technology Leadership. Three of them are girls. Why would I get disparate here? Why wouldn't I have more girls than boys? I think in the case of technology, there are so many facets to it. It doesn't have to be hardware. It could be software; it could be an application-type approach. When you look at technology in that way,

when you are supporting someone, you don't need to know how to fix something for you to understand their concerns with technology and how you can support them with technology. I think a lot of the girls like using technology to solve their problems. One of my students, she's a girl, Jacky, she has been using a video camera quite a bit to do different types of presentations. Her first project she did was: she created a DVD with a full menu system for a Band that went to Disneyland. So they created a DVD that they sent over to Disney and they approved it (their trip) through that DVD. Through that process, she learnt Video-Editing, she learnt how to use a Video Camera, she learnt how to cut the video into the right blocks and then she learnt the third step, which is how to create and alter a DVD. She learnt how to create the menu.

I remember going through the process. She learnt quite a bit from it while she was doing it. Some of the other girls that are involved are also interested in Desktop Publishing type things. There are a lot of graphics, a lot of design, which again is a technical instrument whether it is Video Editing, or using a Video Camera to produce something. Would I say the girls like to do heavy programming? I don't think that is their interest, but it doesn't have to be. A lot of guys don't like to do heavy programming; some of the guys are making Video games with programming. One of the guys is also doing Video Editing. One of the guys is very interested in programming and is building an online-games-scenario that is more text-based. It is like one of these games where you play Dungeon and Dragons, where you make these plays and you get things and that's all database driven online. He is doing a great job with that and that is his interest and I think that is what I am trying to get at.

Alfred: In a sense, you allow them to do their own projects and say, "Well, If it interests you and serves your purpose, it is okay!"

Mr. Ceena: Exactly and the key in what you said is "purpose". All their projects must have a purpose at the end. If they say they just want to learn Photoshop, or they just want to learn this, that's not a valid answer for me. They must learn a program to do something, something we can recognize, easily.

Alfred: Well, thank you very much. If I have a few more questions, I hope I can come by again and pick your brain further. Thank you very much for this round.

Mr. Ceena: Sure.

Alfred: Thank you.