Teacher Professional Growth in an

Authentic Learning Environment

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Submitted in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

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Abstract

The last several decades have been marked by tremendous changes in education – technological, pedagogical, administrative, and social. These changes have led to considerable increments in the budgets devoted to professional development for teachers with the express purpose of helping them accommodate their practices to the new realities of their classrooms. However, research has suggested that, in spite of the emphasis placed on encouraging sustained change in teaching practices, little has been accomplished. This begs the question of what ought to be done to not only reverse this outcome, but contribute to transformational change. The literature suggests some possibilities including: a) considering teachers as learners and applying what is known about cognition and learning; b) modifying the location and nature of professional development so that it is authentic, based in the classroom and focusing on tasks meaningful to the teacher; c) attending to the infrastructure underlying professional development; and d) ensuring opportunities for reflective practice. This dissertation looks at the impact of each of these variables through an analysis of the learning journeys of a group of teachers engaged in a program called GrassRoots in one mid-sized school board in Ontario. Action research was conducted by the researcher in his role as consultant facilitating teacher professional growth around the use of Web sites as culminating performance tasks by students. Research focused on the pedagogical approach to the learning of the teachers involved and the infrastructure underlying their learning. Using grounded theory, a model for professional development was developed that can be used in the future to inform practices and, hopefully, lead to sustained transformational school change.

Acknowledgements

in the GrassRoots Program and be the subjects of my study. Needless to say, I had wonderful support from my wide circle of friends who never stopped asking how I was doing and when I might be done. I would finally like to acknowledge the love and support of my wife, children, and parents who suffered silently my swings of emotion and my constant hiding in my office and being at my computer while I struggled to reach the end goal. To all these people who shared my journey, I say thank you from the bottom of my heart.

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CHAPTER ONE: INTRODUCTION TO THE STUDY

Much of the current educational literature refers to the nature and process of change. These references explain how changes that have occurred in society at large have led to numerous calls for reforms affecting schools and schooling, as well as teaching and learning (Lieberman, 1995). With so many individuals both inside and outside the educational system calling for reform, there is tremendous pressure to implement change. Indeed, the only constant in our educational system now seems to be change. Fullan (1999, 2001) suggested that changes have been implemented in too many directions at once. He argued further that the result has been an apparent lack of constants in education which makes it appear to be chaotic to many of its stakeholders, most importantly teachers. He saw the destabilization of education and the lack of any unifying paradigm as both an opportunity to examine the entire process and a necessity on the road to its revitalization. The challenge, as he and others (Mitchell & Sackney, 2000) have suggested, is for the various stakeholders (administrators, principals, elected officials, classroom teachers, etc.) to learn not just to deal with constant change, but to evaluate, make revisions where necessary, and then sustain the deserving reforms.

Little (1993) theorized that these expectations to implement change can be encapsulated into five strands of reform that have an impact on the educational sector:

1.   Reforms in subject matter teaching, standards, curriculum, and pedagogy;

2.   Reforms centered in the problems of equity;

3.   Reforms in the nature, extent, and uses of student assessment;

4.   Reforms in the social organization of schools; and

5.   Reforms in the professionalization of teaching.

The research reported in this dissertation constitutes an attempt to make a contribution to the last strand, focusing on the classroom teacher and his or her professional growth.

Teachers graduate from pre-service programs knowing little about the craft of teaching (Wideen, Mayer-Smith, & Moon, 1998). The process of learning to teach is complex and occurs over a professional lifetime (Beynon, Geddis, & Onslow, 2001). This research suggests that new teachers begin at individual points along a continuum of knowledge, competency, and skill and they further develop these skills during their years of classroom practice. Over time, teachers acquire both experience and expertise (Berliner, 1987). They continuously learn new strategies which they add to their repertoire of classroom behaviours. Sometimes they make substantial pedagogical adaptations over time and sometimes they do not.

It is the fact that some teachers make few changes over time that concerns researchers (Hargreaves & Fullan, 1992). Hargreaves (1992) partially explained this by suggesting that the quality and flexibility of teachers' classroom work is closely tied up with the course of his or her professional growth, the way he or she develops as a person and as a professional. For many reasons, the course of such development varies greatly from one teacher to the next. Little (1993) suggested that one reason professional growth for teachers is problematic is because of the immediacy of the classroom. Specifically, day-to-day events make it exceptionally difficult for progress to be made by the teacher towards his or her own learning goals. For teachers, the day is filled with responding to the needs of their students, as well as the needs of their administrators, but not to their own professional learning needs. This immediacy of the classroom environment and the demands this puts upon any teacher's time does not sufficiently account for the gap in

expertise between the teacher who makes considerable changes and the teacher who does not (Sykes, 1999).

Professional development activities have, in the past, been scheduled by administrators to work around the classroom timetables and needs of teachers (Guskey, 2000; Guskey & Huberman, 1995). This resulted in a wide variety of opportunities for teachers including after school and evening events as well as seconded time during the school teaching day. However, short and intermittent periods of in-service that rely on teachers to go back to their classrooms, and, in isolation, to implement that with which they have been presented with during their professional development activities have yielded few positive results (Darling-Hammond, 1997). In a 1996 longitudinal study of the teaching profession, Darling-Hammond revealed the poor quality of teacher preparation and professional development in general. She called for a complete reinvention of the process. This dissertation proposes a model to help define the shape such reinvention might take. However, in order to determine what changes ought to be made, one must first determine the current status of most professional development activities and in what direction the literature points the advocates of reform.

Over time, professional development has been referred to as staff development or professional activities by researchers and practitioners alike. Sparks and Loucks-Horsley (1990) identified a variety of valid and successfully used models of what they referred to as staff development, including individually guided staff development, the use of a process of observation and assessment, and training, among others. All of these were viewed in the context of the whole process of teacher education, from pre-service to in-service, from teacher training to professional growth. However, within a decade, Sparks

and Hirsh (1997) were referring to a paradigm shift in how the research community viewed staff development. Now, the focus was only on professional development and had to be comprised of a clear and coherent plan.

Current teacher development theories put the teacher as learner at their centre Ball & Cohen, 1999; Hawley & Valli, 1999; Little, 1993). Guskey (2000) expanded on this theoretical assumption by suggesting that professional development be seen as an intentional process. It needs to be purposeful and linked to the classroom teachers' needs and practices, not as someone else defines it but as they themselves perceive those needs to be. It needs also to be ongoing and, most importantly, viewed as part of what Hargreaves (1992) called professional growth, which should last one's entire career. Professional development in this view is expected to lead to sustained change in teacher classroom behaviours. Jacobson and Battaglia (2001) suggested that only when there is sustained change will professional development be transformational in terms of teacher practice and pedagogy. They further posit that this measure of success depends upon the teacher being part of the process of setting identifiable goals and working towards them. This begs the question of how professional development for teachers must be structured and executed to ensure that it becomes transformational for those teachers so that it leads to changes in both pedagogy and practice.

Mezirow (1985) has suggested that there are three kinds of adult learning — instrumental (e.g., specific skill development), dialogic (e.g., learning together in search of understanding), and self-reflective (e.g., through self-reflection finding understanding which then leads to change in performance). Staff development efforts in the past focused primarily on the first two kinds of learning. Teachers went to workshops for a

few hours or a few days to learn something specific that had been determined by others that it was important to know or to be able to do (McBride, 1989). The teaching and learning model used for these events was the transmission of knowledge or skills, which was the same approach most frequently being employed in the classroom (Bransford, Brown, & Cocking, 1999). However, there is now a growing awareness that for meaningful change to occur, the emphasis must be on the third kind of adult learning. Teachers must be provided with experiences that encourage and depend upon self-reflection and are part of a continuous process directed toward professional growth (Lieberman & Miller, 2001; McLaughlin & Oberman, 1996). Such experiences might begin with a stimulus to learning directed towards pedagogy, content knowledge, or classroom practice. It would continue with opportunities to implement and practice that which was recently taught. Then there would be the expectation that the learner, in this case the teacher, would reflect upon the process. New knowledge of what works best in the classroom would be acquired in this manner. The literature refers to this process as constructivist knowledge creation (Brooks & Brooks, 1993). These insights concerning the promotion of learning in general must now be applied to the specific activity of the professional development of teachers.

To promote self-reflection, Kolb (1984) and Balsom (1985) have suggested that learning is best perceived as a process that is continuous and grounded in experience. It involves transactions between the learner and his or her environment. Through these transactions and, importantly, upon reflection, new knowledge is created (Sweeney, 2003). Hunt (1987) expanded on this concept and referred to the necessity for professional growth to promote reflective practice, basing his work on the concept of

experiential learning using a constructivist approach to knowledge acquisition. He argued that teachers will, upon reflection, constantly strive for the benefit of their students' success. Such a learner is continuously directing his or her own development. Current theory would suggest this is the path to sustained pedagogical change in teacher practice.

Learning occurs best in context or in experience, in real-life environments, through constructivist knowledge creation processes (Kolb, 1984). Harris and Grandgenett (2002), as well as Dickenson, McBride, Lamb-Milligan, and Nichols (2003), in looking at various school-based initiatives, dubbed this process "authentic" professional development. For the purposes of this dissertation, authentic professional development implies professional development that is grounded in the ongoing work of the classroom.

Statement of the Problem

While there is no lack of carefully constructed theories of teacher learning (e.g., Hargreaves & Fullan, 1992; McLaughlin & Oberman, 1996; Mitchell & Sackney, 2000), there is still a need for further research to empirically validate such theories. Such studies would explore how teachers could be empowered to enhance their learning appropriately and how such professional growth leading to sustained change might be facilitated. It is necessary to explore in more detail the specific components of what is known about teacher learning first before attempting to propose a model for future professional development or construct a methodology for research to validate such a model.

The emergent literature is beginning to suggest what professional development must look like to be most likely to result in positive sustainable changes. A partial picture is being revealed but only in the broadest of outlines. What has not been researched sufficiently is just how such professional development might be facilitated, how it might engage the teachers and facilitate their new learning, how it can support and encourage such professional development, and whether or not such experiences will result in enhanced student learning and growth. Further research to examine and give definition to this new approach to professional development is necessary (Adey, 2004). In addition, since the teacher as a learner himself or herself must be the focus of professional growth for it to be transformational, there has to be research conducted that asks teachers questions about their own professional growth. It is through the asking of such questions that conclusions can be drawn concerning successful professional development. These questions must probe both the infrastructure underlying the process of professional development *and* the pedagogy driving the learning of the individual educator.

This research analyzes the "learning journeys" of teachers looking for both the pedagogy used to motivate their growth and the infrastructure supporting their individual journeys. This analysis will inform what is already known about professional growth and how it might be enhanced to the benefit of teachers and their students (Johnson & Golombek, 2002; Lieberman, 1995). Examining and evaluating these "journeys" as an aspect of professional growth, through the lens of the teacher as learner, is the intent of this research and dissertation.

It is in pursuit of answers to the following two broad questions that this research is therefore directed:

1. What can be learned about the process of professional development from teachers themselves as learners actively engaged in that process?

2. How can practitioners in the field use this information to better facilitate professional development for all teachers?

Brown and Moffett (1999) named the process that teachers take as they seek to make changes to their practice *The Hero's Journey*. In drawing an analogy between the epic journeys of the Greek mythical heroes and the process of change in teacher practice, they saw this process as a challenge to which the teacher, in the role of the hero, rises. The process becomes a journey undertaken with a beginning that comes from a call for change to current practice. It ends in having made the changes that were needed. They saw this as a continuous cycle with the success at the end leading to further challenges and further journeys.

In this study, teachers were asked to tell about their journeys of professional growth in authentic learning environments. The model provided by Brown and Moffett (1999) was used to make sense of the stories teachers told about their journeys. This study therefore uses the model of the hero's journey to examine the processes of professional growth undertaken by a group of teachers as they voluntarily sought to make significant changes in their classroom programming and assessment strategies. The research documented the professional development these teachers embarked on in their own classrooms as their students worked to complete various learning tasks. The specific research questions queried whether the teachers' learning journeys adhered to

the model advanced by Brown and Moffett. This provides answers to the first primary research question above. Teachers willingly undertook their journeys of authentic professional development and, in looking at their journey(s) individually and collectively, answered the following questions:

1. What capacities or abilities do learners/teachers bring along with them on their journey?

2. Why do teachers embark on a path of significant professional growth? Why do they take up the learner's challenge?

3. What conditions are in place that facilitate or detract from their journeys?

4. What do teachers see as the outcomes of these journeys for themselves and for their students?

5. What do these teachers see as their next steps?

The answers found to these specific questions support the notion of classroom-based authentic professional development as one path to sustained teacher growth and change. The second broad research question was to be addressed after all the stories had been analyzed and conclusions reached as to what they tell the research community about teacher professional learning. The hypothesis of the study was that the analysis of successful journeys of teacher growth would suggest ways to enhance the process for others who are perhaps less the heroes and more the journeymen. This hypothesis was found to be productive enough to lead to the creation of a model encompassing both the pedagogy and the infrastructure underlying professional development.

Rationale for the Study in Summary

This chapter began with the description of an educational system constantly bombarded by calls for change or undergoing changes demanded from various stakeholders. It presented the argument that change in education must be sustained for it to be effective and make a positive difference. At the same time, teachers have been painted as the pivotal component in ensuring that this is so (Hord, 1997). They are the people confronted continually by conflicting demands but are the most powerful allies in the move towards enhanced student achievement. In order for them to be able to respond appropriately to this expectation that student achievement goals be improved, there must be opportunities for significant and successful professional development.

At one time, professional development occurred in a top-down format, from the senior educational administration in the system, and was offered in small disconnected bits over short periods of time. It was delivered essentially in a behaviourist modality of teaching and learning (Steffe & Gale, 1995). Today, however, professional development is viewed as continuous and must begin with the needs of the teacher. Professional development must therefore be authentic, occurring in the context of the individual classroom. The teacher must be seen as a learner of new knowledge and the method of teaching the teachers must be constructivist. The literature, it will be shown, reveals little of what to expect of the journeys of these teachers as learners and so this research seeks to provide insight into what those journeys might eventually tell about how to promote and sustain continuous school improvement through teacher professional growth. There is inestimable value in ensuring that teachers are capable, competent, and continuously accepting of the changes that are expected of them.

Outline of the Document

Chapter 2 examines the educational literature in greater detail to provide insight into the elements of current professional development for teachers. These insights will be viewed in light of the model chosen as analogous to the journeys of the learners in this study.

In chapter 3, the reader is provided with the details of a professional development program called GrassRoots, which is the stimulus for the teacher/learners' journeys. GrassRoots engages teachers and their students in specific kinds of constructivist learning tasks. Chapter 3 provides necessary background about those learning tasks so as to contextualize the learners' journeys being explored.

Chapter 4 outlines the process followed to identify the learners to be studied and analyzed and describe how the data were collected in order to begin to answer some of the research questions.

In chapter 5, the journeys of the participants are explored in detail for answers to the questions posed above. The stories the teacher participants tell are examined relative to the model of the hero's journey.

Finally, in the last chapter, the commonalities of these journeys are explored so as to draw conclusions and lead to the proposal of a formal model to guide future programs of professional development. This model, in turn, suggests further directions whereby researchers in the field can continue to search for more effective and efficient ways to move teaching to a profession that is supportive of lifelong learning (within the discipline) for practitioners and students alike. This researcher contends that nothing is

more important to the future success of the education of young people as they confront

an unknown future.

CHAPTER TWO: REVIEW OF THE LITERATURE

Professional development has been one of the most prominent topics of debate in the extant educational literature. It has been acknowledged repeatedly that the path to sustained classroom change in practice lies in finding successful methods of professional development. If the teaching profession is to accomplish the task of reinventing itself so that its members are more likely to grow professionally over the duration of their careers, research must be conducted to discover, from the teacher as learner's point of view, what works and what does not. Research must help illuminate the differences between successful and unsuccessful journeys of professional growth. Much has been written about the processes that help or hinder professional learning, but seldom from the practicing teacher's point of view. This chapter explores what literature does exist to help understand the journeys of teacher professional growth. This literature base will be explored through 5 broad categories: (a) learning capacity and capability for the journey, (b) motivation in taking up the learner's challenge, (c) facilitation of the journey, (d) outcomes of the journey, and (e) next steps -- learning from these outcomes. These categories reflect and elaborate on the questions posed for this study in Chapter One.

Learning Capacity and Capability for the Journey

Current understanding of the process of learning is derived mainly from the teachings of cognitive science (Gardner, 1985, 1991). From research (Caine & Caine, 1991) it is now understood that, from infancy, the brain is continually remaking conceptual understandings of the world. Once engaged in learning something new, the brain assesses the new information and puts it together with what is already there in a newly constructed configuration. This process occurs independently of whatever else is

occurring in the learning environment (Brockett & Hiemstra, 1985; Brookfield, 1985) and can differ greatly from one individual to the next. No two learners are exactly the same nor do they perceive their respective environments exactly the same.

Knowledge is created and concepts are expanded through this assemblage of patterns. Sternberg (1984) called these "components" and envisaged how each builds upon another to create new knowledge. His reasoning followed that of Vygotsky (1978) in pointing out that learning, in whatever form, is experiential. Knowledge is individually constructed through action, and from this particular epistemology is derived the concept and process of constructivism as it is practiced in schools today (Steffe & Gale, 1995). Balsom (1985) helped explain the constructivist process by hypothesizing that there is no learning that does not occur in context, as it were, whether this is cognitive or environmental. Brown, Collins, and Duguid (1989) referred to this process as situated cognition. Constructivist learning, therefore, involves an individual's making sense out of specific learning experiences in a specific context. This places the emphasis on the internalization of learning and on the capacity and qualities of the learner, as opposed to the behavioural view of the learner as an empty vessel waiting to be filled. Behaviourist teaching and learning principles were the almost universally accepted mode of operation at all levels of the educational system in North America for much of the past century (Steffe & Gale, 1995). With the new insights of cognitive science, behaviourism is being replaced by constructivism as the preferred method of knowledge creation.

Constructivist pedagogy acknowledges that teachers, too, are constructing their own knowledge of teaching as they journey through their professional careers (Day,

Calderhead, & Denicolo, 1993; Lieberman & Miller, 2001; McLaughlin & Oberman,

1996). What teachers are learning as they go about the daily business of managing their

classrooms is a working, procedural knowledge of their professional practice or craft

(Yinger & Hendricks-Lee, 1993). They can do this by reflecting on their practice on a

continuing basis and reaching insights intuitively about what works and what doesn't

(Atkinson & Claxton, 2000; Niemi, H, 1997; Nunan & Lamb, 1996). This new

knowledge is assimilated with what is already known about teaching and learning. Not

every teacher benefits to the same degree from the experiences they encounter as they

progress from year to year, school to school, and/or grade to grade. The same theorists

make note of the wide variances in teaching abilities despite equivalent opportunities to

learn.

There are any number of factors and variables determining the nature of the

journey teachers take as they proceed from what Berliner (1986, 1987) refers to as the

postulant stage through the novice teacher stage, and beyond to the expert teacher stage.

Berliner goes on to suggest that not all teachers take the same length of time to become

experts in their craft knowledge or even necessarily reach that desired outcome. There is

tremendous variability in the length and the speed of each teacher's journey. Some

teachers may become experienced but never become experts. Others become experts

without much experience at all. This is no different from what is known of student

achievement in classrooms. Cognitive science has contributed much to the

understanding of this variance and how changes might be made to the learning strategies

teachers employ as a result. At the very least, such understanding reinforces the need for

educational practice to be based upon constructivist rather than behaviourist principles

of teaching and learning (Zemelman, Daniels, & Hyde, 1998).

Not all teachers are able to make the changes to their practice in the manner

identified above (Grow, 1991; Rogers & Babinski, 2002). They do not always possess

abilities commensurate with their teaching responsibilities (Darling-Hammond, 1997).

Atkinson (2000), in another example of variance, reasoned that a teacher's intuitive

decision-making ability in the classroom will be dependent upon his or her confidence in

his or her own judgement. Such confidence is, in turn, dependent upon psychological

characteristics that teachers bring with them as they enter the profession. Atkinson's

work, and the other works referred to above, remind us that the same issues of learning

style, innate ability, and the capacity to benefit from experience and reflection impact on

teacher learning outcomes just as they do on student learning outcomes. Calderhead

(1987, 1993) is only one of the many voices who have called for continued research to

examine in greater detail these differences in capacity and inform and improve practice

as a result. One implication of this might be changes in how an educational system

organizes and provides for the professional development of its staff.

Grow (1991), for example, conducted research into teaching styles and the

development of self-directed learning capacity. He reasoned that there are various

teaching styles, including coach, motivator, facilitator, and delegator. At the same time,

students could be located somewhere on a continuum, from very independent from to

very dependent on the classroom teacher. Different teaching styles have been posited to

work better with different kinds of students. There would, according to this theory, be a

mismatch between a student needing a lot of direction and being extremely dependent

upon the classroom teacher, and a non-directive teacher or delegator. Remembering that the focus of this research is teacher learning, teachers, too, would fall somewhere on the same kind of continuum, from dependent to independent. Their receptivity to and learning from a formal professional development opportunity would be severely limited by their own unique style of learning. Their capacity to function in their own classrooms and learn, independently, from their classroom experiences would be marked by wide variances, one teacher to another. Practices and processes intent on developing teacher capacity to benefit from intuitive teaching and reflective practice must reflect this growing awareness of variance in learning ability and style.

Motivation in Taking up the Learner's Challenge

The wide variance in the capacity of teachers to benefit from reflective and intuitive practice is matched by the substantial differences in the desires of teachers to invest much effort into professional growth (Guskey, 1986, 2000; Hargreaves & Moore, 2000; Zmuda, Kuklis, & Kline, 2004). The insights provided by cognitive science enable one to understand this better.

Caine and Caine (1991) explained that humans are biologically driven to make sense of the world. This is what occurs during the learning process, regardless of the environment, and it involves all the various functions of the brain. Jensen (1998) further suggested that this is also a physiological process occurring when the environment stimulates the brain. Arousal may come from any source, but when it occurs, the physical structure of the brain actually changes through the learning that takes place. States of arousal of any kind are influenced by one's physical well-being and emotions, as well as through conscious engagement or motivation. This is what the literature

suggests is intrinsic motivation (Ryan & Deci, 2000). Sylwester (2000) suggested that emotion is the gatekeeper of attention and needs to be engaged positively for purposeful learning to occur. Pintrich and Schunk (2002) hypothesized that there is a link between emotional variables and the concept of motivation in learning theory, for both teachers and students. If the learning environment is not being attended to, the construction of the knowledge embedded in that environment will not be as meaningful as it might otherwise.

Deci, Vallerand, Pelletier, and Ryan (1991), following a comprehensive review of the literature, concluded that intrinsic motivation can result in high quality learning, conceptual understanding, and enhanced personal growth and adjustment. Locke and Latham (1990) considered why some people work harder than others or perform better than others in a task independently of their ability and knowledge. They advanced the concept of goal-setting as an answer to this question. This construct resonates with the understanding of learning theory as it applies to professional development for teachers. Teachers ask why they must or need to do something, and it is their own volition that impacts on their responses to such challenges (Brophy, 1998).

Why, then, do some teachers benefit from professional development opportunities while others do not? Repeatedly, research has reported that many teachers see current professional development practices as being meaningless and unhelpful to them in their classrooms (Darling-Hammond, 1997; Guskey, 2000). It might well be argued that the reason for this is: There is not sufficient motivation for teachers to learn that which is being taught or appreciate how it is being taught. Grow's (1991) suggestion that there be a match between a student's learning style and a teacher's teaching style

would help explain this lack of success with various attempts at professional development activities. In addition, Hargreaves (1994) painted a picture of teachers being confronted with the demand for change in one way or another and frequently ignoring these calls. Through the process of what he referred to as balkanization, teachers could collectively band together to support each other as they reject pressures to make changes. This strongly suggests a lack of motivation underlying the poor responses to efforts to help teachers grow professionally.

Many other reasons have been advanced for this lack of motivation. Sometimes, it is suggested that it is a matter of time, as Hargreaves (1994) acknowledged. Teachers frequently do not have enough time to deal with all the demands they are confronted with, in and out of the classroom. The immediacy of the classroom severely limits the ability to avail oneself of professional development opportunities. Bellah, Madsen, Sullivan, Swidler, and Tipton (1985) contributed to the understanding of this question of time by putting teachers' personal and professional lives into perspective. There is, they argued, a certain cultural bias towards withdrawing into a private, personal space, as a way of dealing with the complexities of modern professional life. The result is that fewer and fewer professionals contribute to whatever is seen as the public good and retreat behind the needs of their families. The question of time is a simple explanation for the lack of motivation and easily dealt with (Guskey, 1999). The retreat to private concerns and away from classroom needs is a more complicated issue.

Bellah et al.'s (1985) theory of the public and the private space of the individual helps explain the psychological reasons for Hargreaves's (1994) teacher balkanization. The net result is that there is a perceptible lack of motivation to participate in and grow

from professional development opportunities. Palmer (1998) perceived teachers as needing to have the courage to teach, the courage to meet the challenges required by juggling so many different responsibilities and demands. He reasoned that it is not easy to deal with the complexities of classroom teaching and life in the modern world and so teachers need to be motivated to do so. Czikszentmihalyi (1993) added to this by suggesting that some individuals naturally have the ability to see opportunities and are intrinsically motivated to go from challenge to challenge. His concept of "flow" or psychic creative energy contributed to an understanding of why some teachers thrive on professional development opportunities while others do not. This, however, is not the whole of the explanation.

Deci and Ryan (1985) and Ryan and Deci (2000) have done work on the relative contributions of intrinsic and extrinsic motivations. Their findings suggested that intrinsic motivation in learning remains a key to an explanation of behaviour. However, extrinsic motivation, or motivation from an external source, whether it is emotional or physical, can also affect behavioural outcomes. Extrinsic motivations might help overcome the resistance of teachers to make changes. Scribner (2000) also examined this question of motivation and asked why extrinsic motivators do not always affect all educators the same way. He emphasized that the context within which professional learning occurs can play a significant role in the outcome of such a process.

Facilitation of the Journeys

Various researchers have contributed to an understanding of how the context of learning mediates the processes involved in constructivism, the construction of knowledge by the individual. Oldfeather and West (1999) observed that a constructivist

approach to learning focuses on learning as sense-making rather than the acquisition of rote knowledge that exists somewhere outside the learner. Kolb (1984) emphasized that this sense-making is an ongoing process, not an outcome. He drew an analogy between constructivism and the concept of experiential learning. Taking this further, he hypothesized that making sense of reality involves the resolution of a conflict between what is already known and what is being learned. In the ideal situation, new pieces of knowledge are constantly being assimilated into the continuously expanding constructs of the world and the individual's place in it (Jensen, 1998). Sometimes, there must be a struggle mentally to make the new pieces fit into the already existing configuration.

Jones and Idol (1990) introduced another term for essentially the same thing. They defined it as "cognitive or anchored instruction" and suggested that it has three dimensions, regardless of anyone's individual learning style. Experiences must be problem-based, they must engage a multidisciplinary perspective, and there must be sustained thinking. Westwater and Wolfe (2000) suggested that when learning is linked in this way to real-life experiences, the learners retain and apply information in meaningful ways. Brown and Campione (1994) dubbed this process "guided discovery" because, in the classroom, the teacher defines the beginning and the nature of the path. This would apply regardless of the age of the student or the experience level of the teacher. These principles of learning therefore can be applied to the processes of professional development. This process, regardless of the term given to it, reinforces the concept of the professional growth of a teacher as a journey.

Constructivist knowledge creation involves the making sense of something that exists external to the learner. Balsom (1985) built upon this concept and identified the

functions of context in learning and performance. He reasoned that context can be defined as including cognitive, associative, and environmental factors. Lambert et al. (2002) suggested that because of the unique combination of associative and environmental factors, the outcomes of the learning process are often varied and unpredictable. Learning is a social activity that is enhanced through shared inquiry. It also is affected by variables such as culture, race, and economic status, these authors suggested.

Sarason (1982), Schlechty (1990), and Barth (1990) all drew attention to the role of the culture of the individual school as an important element in the course of the construction of knowledge. Hopkins, Ainscow, and West (1994) suggested that the value placed upon staff development, involvement, inquiry and reflection, leadership, coordination, collaboration, and sharing all help define the culture of any school. For example, Peterson (1999) analyzed time as it is used in a school and found its use to be dependent upon what is believed about time by the members of that school community. The value placed on any of the above identified elements defines the context within which any teacher approaches his or her professional growth.

Peterson (1999) argued further that the cultural context of a school can either nurture or wound the professional development of teachers. Niemi, H. (1997), as a result of studies conducted in eight countries, explored the connection between school culture and successful teacher professional development and concluded that:

1. Teachers' meta-cognitive abilities form a basic condition for their own professional development;

2. Teachers' experiences hold powerful potential for their professional development but they have to be able to actively reflect on their experiences; and

3. Many excellent teachers seek out experiential, constructivist learning opportunities, but if the environment they work in does not promote such learning, their motivation to learn will not likely last.

This final finding brings the thread of the argument back to the question of motivation. Teachers must want to engage themselves in professional growth activities because of some internalized desire or motivation. The activities they are engaged in must be meaningful to them and derive from their classroom teaching practice (Brooks & Brooks, 1993). Their efforts at professional growth must be situated in an environment that is supportive and/or empowering.

When the culture of the school is supportive of the learning of the students and the professional staff, that environment then becomes a professional learning community. Many researchers and theoreticians allude to the role such a community is meant to play in promoting, supporting, and sustaining teacher learning and change in an educational setting (Hord, 1997; Louis & Kruse, 1995; McLaughlin & Talbert, 2001). McEwan (2000) listed the following as being the hallmarks of a learning community: equity, tolerance, democracy, respect, morality, support, confidentiality, diversity, and inclusion. Sergiovanni (1996) extended this list to include reflective, developmental, conversational, caring, and responsible. Shapiro (2000) hypothesized that professional learning communities would also be constructivist in orientation.

Hord (1997) especially emphasized the collaboration and interconnectedness of what happens in a professional learning community. There must be collective creativity involving reflective dialogue amongst a group of professionals dedicated to continuous student improvement and teacher growth. The values and the vision of the school must be shared by all in a particular environment and illustrated by both staff and students. Teachers must engage in a sharing of their personal practice, both the successes and the failures, the latter being a condition that compels growth leading to change to begin. While leadership comes from the top, it has to be shared and supportive of the entire staff. One should be able to see the theoretical connection between the presence of a learning community, an enabling school culture, teacher empowerment, professional growth, and enhanced student learning.

Cram and Germinario (2000) reinforced the argument advanced above that, in facilitating opportunities for professional development, teachers need to be involved from the beginning in the setting of their own learning goals. However, they suggested further that professional development activities need to be structured in such a way as to ensure the recognition and celebration of success. This has to be in measurable quantities and teachers must be helped to feel capable. Risk-taking involves a high degree of emotional involvement and professional development of this sort is active and not passive. There must be continuous support for the developing teacher as he or she works towards his or her goals. Professional development opportunities, in this way, will reflect what we know about learning, regardless of the age of the student. Professional learning communities can support such a process but such support must be purposeful, not incidental. Just as a teacher is required to support his or her students as they learn,

so, too, ought a professional learning community to provide support to teachers as they learn.

If attention is paid to these dimensions of learning by both students and teachers, the climate of the school will be considerably different and have a positive impact on the school's culture. It will be denoted by:

- Learning that is social in nature, involving collaboration and teamwork;

- Learners who are empowered to direct their own learning;

- A vision, shared by all, of what is to be learned and what steps to take to achieve those outcomes; and

- A big-picture view of how everything fits together.

This last point is especially important to the research being reported herein. The big-picture view when referring to student learning is what we call curriculum. The outcome of the journey students take as they move from grade to grade, we assume, is what we call an education. What is less clear is the big-picture view when we are dealing with teacher professional growth or who ought to define the course of any teacher's individual education.

Outcomes of the Journey

McNiff (1993) drew a distinction between the training of teachers and the education of teachers. Training is what primarily occurs prior to entering the profession and education is what should primarily happen afterwards. At one time, professional development was seen as essentially an opportunity to train teachers in new teaching strategies, new knowledge concepts, new tools, and new curricula. Joyce and Showers (1980) described in great detail what such "training" ought to have looked like to be the

most effective. This would include theory description, skill demonstration and practice, feedback, and classroom applications through coaching. The approach they describe is in keeping with the behaviourist view of education (Steffe & Gale, 1995).

The behaviourist approach to professional development is confirmed by the research conducted and reported on by the Centre for Educational Research and Innovation of the Organization for Educational and Cultural Development (Centre for Educational Research and Innovation, 1998). The changing nature of pre-service training and professional in-service development was studied in eight countries around the world. The salient differences in practice between countries were the timing of such in-service (before or after school, during term breaks, summers) and whether the directives came from a provincial/state authority or the federal government. Jacobson and Battaglia (2001) refer to such professional development as working on, rather than working with, teachers.

Within the last decade, there has been the beginning of a paradigm shift in the expectations for staff development. There is a growing awareness that we must no longer be thinking in terms of training teachers but rather educating them. Sparks and Hirsh (1997) suggested that the era is long gone when teachers sit passively to be trained by supposedly expert individuals in whatever the skill set or knowledge set is deemed teachers must acquire. The goal of professional development must now be to bring about new learning, resulting in permanent pedagogical change as reflected in teacher behaviour. This, it has been suggested above, is the only way in which student learning will be affected positively and there is any likelihood of sustained change. In such an

environment, paying attention to the lessons of the brain-compatible curriculum as it affects learning becomes imperative.

Hargreaves and Dawe (1990) make this obvious when they draw a distinction between two extremes of professional development activities. At one extreme is the idea of a single event and at the other extreme, the idea of an ongoing process. At one end of the continuum, an expert directs professional development towards the teaching of a predetermined set of skills. At the other extreme, professional development is meant to be empowering and bring about professional enhancement through ongoing collegial discussions directed towards reflective practice. This is what changes in-service into professional development, skill acquisition into knowledge creation.

Next Steps: Learning from These Outcomes

The lens through which the research being described herein has been examined began by identifying the changing paradigm of teacher learning from that of staff development to that of professional development and growth. An attempt has been made to identify the variables that might maximize such professional development and growth. These include:

1. The individual teacher's motivation for learning;

2. The capacity teachers as individuals have for such growth;

3. The school and educational system culture supportive of such learning;

4. The context within which such learning occurs, including the presence of a professional learning community; and

5. The expectation of specific and identifiable positive outcomes by teachers and their students.

Throughout has been the constant identification of learning as being constructivist in nature and approach. New knowledge, skills, and affect are acquired through active engagement with the environment. In the case of the classroom teacher, this means his or her classroom. In such a circumstance, one can reasonably argue that professional development is actually an ongoing process occurring in an authentic environment. Others have referred to such learning in a variety of different ways. Whether it is called "experiential" or "situational" (Kolb, 1984), "guided discovery" (Brown & Campione, 1994), "workplace learning" (Retallick, 1999), "learning along the way" (Sweeney, 2003), or "authentic" (Harris & Grandgenett, 2002), the essential components are the same.

For the purposes of this research, the term "authentic" has been chosen because it captures the essence of what professional growth should be about. It is in keeping with what has been already established about learning by teachers and their students. Harris and Grandgenett (2002) actually used the term authentic to describe the learning occurring by classroom teachers when they participated in collaborative Internet activities with their students. Learning about the Internet was something new for teachers, yet they were allowing their students to participate in projects only available online. Harris and Grandgenett, in turn, borrowed the term from Donovan, Bransford, and Pellegrino (1999), who suggested that "authentic learning allows students to engage in learning and meaningfully construct concepts and relationships in contexts that involve real-world problems that are relevant and interesting to the learner" (p. 1). They go on to suggest that such learning is denoted by:

- Authentic tasks,

- Scaffolded instruction,

- Exploration and inquiry,

- Opportunities for social discourse, and

- A resource-rich learning environment.

Garet, Porter, Desimone, Birman, and Yoon (2001) posed the question of what makes professional development effective. They conducted a comprehensive study of 1,027 mathematics and science teachers. The teachers participated in a wide variety of professional development activities, including workshops, peer coaching, conferences, and professional networks. The researchers were interested in looking at the effects of different characteristics of professional development on teachers' learning. Their findings indicated that (a) a focus on content knowledge, (b) opportunities for active learning, and (c) the coherence with other learning activities all had significant and positive effects on teachers' self-reported increases in knowledge and skills, as well as changes in classroom practice. These findings corroborate the theoretical belief in active learning as being central to teacher professional development. We do not learn how the teachers were recruited for this activity. It is reported, however, that a specific element of the experimental design was to focus on groups of teachers from the same school, same grade, or same division. The authors pointed out in their discussion that little attention has been given, in the past, to an analysis of what teachers actually learn in professional development activities. Indeed, the results reported focused on the process and the structure of these activities, rather than the impact on student growth or teacher pedagogy. Furthermore, little was done to examine the actual journey of the learner. This project makes no real contribution to the pursuit of useful research models. It is,

rather, illustrative of the type of research currently being undertaken and reported in the literature. It validates the assumption that research is necessary to learn just what and how teachers learn in any given professional development activity.

Several other recent research projects confirm the lack of useful models for authentic professional development. Dickenson, McBride, Lamb-Milligan, and Nichols (2003) did not provide enough details of their research design other than the fact that it involved authentic staff development over an extended period of time and it occurred in a single rural school. It was conducted with teachers in their natural school setting and involved learning new strategies for the teaching of Language Arts. Once again, no mention was made of how teachers were recruited or what form their professional development took. Much of the report dealt with an analysis of the outcomes in terms of teacher growth. They concluded that learning by teachers was unequal because many lacked the motivation to learn. There was no relationship between what they were learning and what was happening in their classrooms. Their work did affirm the concept of authentic staff development as involving teachers inside their home schools. However, it focused on the teacher as student, rather than as learner. The authors commented on the content being delivered to the teachers. Again, this is the type of research found to be ongoing at the present time. In each instance of ongoing research reported in the literature, we learn nothing substantial about authentic professional development and sustained change. Most importantly, teachers were never asked to share their learning journeys or to identify what they derived from the experiences they participated in.

Many of the models for research involving any sort of authentic professional development evolved from the findings of studies exploring the most effective ways to help teachers of any age acquire and use technology skills. Micheller (1999), for example, in a project typical of this field of study, reported on research conducted in eight schools in one Cleveland suburb with one technology-rich classroom each. Funds for the hardware, software, and administration were supplied by a combination of federal and state grants specifically earmarked for this type of project. Lead teachers were presented with opportunities to participate in professional development activities and then expected to help other staff members acquire the same skills. Other staff were not actively recruited but allowed to participate when they felt they were ready to meet this challenge. How or when this might have occurred is not addressed at all in the paper. The research does confirm that such an approach resulted in enhanced teacher learning of technology skills by those motivated enough to participate. However, Micheller did not describe the measurement tools used to judge success in this specific citation. How the lead teachers were identified or why they were chosen was also not mentioned, nor were any measures of student success or any comments about either the quality of learning or pedagogical change from the teachers' point of view. The justification for it being labeled authentic professional development was that it occurred in the school, in the teachers' home territory, and on their time. This is another instance of authentic professional development being looked at from the structural and outcomes perspective rather than from the teachers' point of view. While the methodology and the assumptions are beginning to match what the current literature is advocating, there are still significant elements not in place. Most importantly, what is missing is any

description of the journey from the teachers' point of view. If efforts to maximize the success of professional development opportunities are to be realized, more must be learned about those learning journeys.

Herrington, Herrington, and Omari (2002) as well as Harris and Grandgenett (2002) provide two more examples of this specific modality of professional development being used in the acquisition of technology skills. In this case, research focused specifically on the use of the Internet and its impact on the pedagogy of participating teachers. Both research projects identify classroom-based, teacher-oriented professional development as providing significant opportunities for enhanced teacher technology capability and involvement in classroom program delivery. Both, regrettably, do not describe how these outcomes came to be.

Herrington et al. (2002) intended to focus on the use of and access to a Web site with resources and tools to help novice teachers solve realistic school-based problems. Harris and Grandgenett (2002) were interested in exploring how participation by technologically illiterate teachers in Internet projects might affect their technological skill set and pedagogical preferences for such active learning. The focus of both these research projects was the outcomes in terms of teacher attitudes and competency. Neither project asked questions of the teachers in terms of how they became involved, why they became involved, how their schools' cultures affected their learning environment, and so forth. The learning itself was most definitely authentic and active, but nothing of the process of teacher learning was focused on.

In reviewing these several articles, as prototypes of current research studies involving teachers in one sort of authentic professional development or another, the

similarities in findings are more important than the differences in specific project variables. In all these projects teachers were provided with some sort of authentic learning opportunity, most frequently involving computer technology in some way. They were provided with access to supports for their learning in a variety of different ways. All the projects involved hands-on inquiry and exploration. All occurred in environments that were rich in resources, allowing for sufficient ongoing discourse. However, who the individual teachers were that were engaged in the professional development opportunity is seldom identified. Little is mentioned concerning their years of experience or degree of expertise in the subject(s) being considered. Information concerning the professional aspirations of these teachers is never revealed nor were the subjects ever asked why they were engaged in the specific learning opportunities. Details were frequently provided concerning the institutional systemic supports in place to assist them in their process of professional growth. Seldom, however, was anything revealed about their specific schools and what they were like. Readers do not learn much about the outcomes in terms of student growth. Finally, little could be learned about sustained teacher growth from these studies. Did these experiences make a lasting impression on the participants and was that impression enough to possibly lead to sustained changes in classroom programming or behaviour? The role of authentic professional development, as hypothesized in this paper, holds much promise for effecting change but unless it can more definitively provide details such as those identified above, researchers will not be able to replicate the studies in pursuit of sustained change in professional development practices.

Overview of the Knowledge Base

This review of the literature examining the learning journeys of teachers engaged in professional growth reveals much theorizing but little experimentation in support of the theories. Various researchers in the realm of cognitive science have contributed to an understanding of how teachers must be seen as learners when considering professional development processes (Caine & Caine, 1991). Seeing teachers in such a role reminds educators that no two learners are alike in their capabilities or their capacity to learn. Each teacher's journey of professional growth will reflect the personal strengths and weaknesses brought with them from their own days as students (Berliner; 1986, 1987). This knowledge only partially explains, however, why some teachers make considerable changes over the course of their careers while others do not. As well, there is little if any empirical research to support these assumptions.

Since capacity and capability cannot alone explain differences in teacher growth, it is necessary to consider the variable of motivation. There is a considerable amount of research concerning the role motivation plays in learning, but seldom is it applied to teacher learning through professional development opportunities (Guskey, 1986, 2000; Hargreaves & Moore, 2000; Zmuda et al., 2004). The research fully supports the belief that a motivated learner can overcome a significant lack of ability. This review of the literature found nothing speaking specifically to the motivations of teachers to grow professionally. Indeed, Metz (1993) argued that there are so few extrinsic rewards gained by merit or persistent effort in teaching that teachers turn to intrinsic rewards for establishing job satisfaction e.g. student success. It is not at all clear why some teachers are more motivated than others, especially in light of this particular argument. Nor is it

revealed if motivation can change so that previously unmotivated teachers become engaged in professional learning anew. Again, the literature makes assumptions and points in certain directions, but does not support these hypotheses with empirical research.

A great deal has been written about the contribution that can be made by a professional learning community or a supportive educational culture to the individual progress made by teachers in that environment (Hord, 1997; Louis & Kruse, 1995; McLaughlin & Talbert, 2001). Much has been learned about how changes in the school's culture or the presence of a community of learners can contribute to positive teacher growth. However, there has been no attempt to query individual teachers about whether or not either of these contributed to their own learning. Nor has the literature sufficiently explained why teachers otherwise excluded from such a positive environment still manage to grow professionally.

As the literature indicates, many teachers do succeed in professional development activities. Teachers have seldom been asked specifically how they viewed their learning as a result of one intervention relative to a course of professional growth. Countless empirical studies document the success of such activities in making change in teacher practice, over the short term (Garet et al., 2001; Harris & Grandgenett, 2002; Herrington et al., 2002). However, there are not any longitudinal studies to see if such change becomes transformational, nor have teacher learning outcomes been juxtaposed with success in achieving gains in student learning.

Torff and Sternberg (2001) suggest that prospective teachers come to the profession holding fast to outmoded models of teaching despite clear evidence of their

ineffectiveness. They begin to teach the way they were taught, most likely reflecting a behaviourist, transmission model of learning. They often find themselves in schools where this is still the preferred method of teaching (Grimmett & Neufeld, 1994; Zemelman et al., 1998). Perhaps if they become reflective practitioners (Schon, 1986) or are provided with opportunities from which to grow beyond this mind-set (Caine & Caine, 1997), they are likely to adopt newer models of teaching (Zeichner, Tabachnik, & Densmore, 1987). Yet Lambert, Collay, Dietz, Kent, and Richert (1996), among others, have suggested that the most likely path towards improved teaching methods, enhanced student learning, and sustained school change is through the teacher as constructivist leader.

It is hypothesized in this research that one approach likely to hold some promise of success is to change current professional development practices and procedures to make them more learner centred. Guskey (1986) has argued us that the educational community must recognize that change is a gradual and difficult process for teachers. This ought then to translate into teachers being provided with continued support and follow-up to any professional development. Cruikshank and Applegate (1981) posit that reflective teaching is the most promising strategy for promoting teacher growth. In this they would be supported by Schon (1986), who cautioned that this is an area of professional knowledge creation that cannot be easily studied through experimentation, specifically because it deals with internal thoughts and feelings. However, that does not mean there can be no scientific advances in our knowledge of these processes. Adey (2004) saw the intuitiveness of teachers' procedural knowledge as one of the keys to understanding the process of professional growth in teachers. The challenge then

becomes how to encourage intuitive practice, hands-on, experiential knowledge creation, and reflection upon learning. A secondary challenge is being able to judge appropriately the success of such a process

A possible key to the answer to the first question comes from Gass (2003) in a report of an address by Kurt Hahn at the 2002 annual conference of the Association of Experiential Education. Hahn suggested that experiential learning is not linear but rather cyclical. Vygotsky (1978) or Kolb (1984) referred to the single event only as a building block to the creation of knowledge. However, the cyclical nature of experiential learning brings to mind the concept of motivation and the notion that success breeds success (Ames & Archer, 1988). With Hahn, this literature review has come to the same process as identified by Brown and Moffett (1999), the journey of the hero in Greek mythology or the learner's journey, which is the foundational metaphor for this dissertation.

The next chapter will provide the content for these learning journeys by describing a specific constructivist learning challenge in which a group of teachers were invited to participate. This challenge was to become the foundation of an authentic professional development experience for its participating teachers. It will be shown how it embodied all of the elements deemed above to most likely contribute to transformational professional development. The data for the research reported in this dissertation come from the stories told by the teachers participating in this project. The data begin to fill in some of the many gaps in the knowledge base concerning teacher growth beyond their initial professional training.

CHAPTER THREE: THE LEARNING CONTEXT

Depending upon how one dates the massive growth in personal computer-driven communications, the Internet, accessible with Windows 95, was born about 1986. Within the first decade of the Internet as we know it today, SchoolNet Canada was established as an arm's-length agency of Industry Canada. It had as its first goal the linking of all schools across the country through the placement of at least one computer hook-up to the Internet. SchoolNet became one of the Federal Government's stepping stones in its proposed strategy of creating a talented, capable, technologically savvy workforce (Tapscott, 1996, 1998). It was expected to accomplish this through the facilitation of network creation and the encouragement of educators at all levels to engage in Web-based activities and communications using that same network.

Having achieved its primary goal of at least one computer accessing the Internet in every school in Canada in 2002, SchoolNet then sought ways to maximize the benefit to all students of having the Internet in their classrooms. Part of the strategic plan that was adopted was to include the facilitation of special projects designed to bring schools, their staffs, and their classrooms into collaboration with each other, regardless of where those classrooms were geographically. GrassRoots was created as one, but not the only, vehicle to lead teachers in such a way towards the enhanced use of technology.

The primary focus of GrassRoots was the individual classroom and the content-based learning occurring there. In essence, GrassRoots linked the studying of content in any area of the curriculum with the publishing of the students' learning to the Internet. One can conceptualize this as the creation of a virtual digital bulletin board with projects on every conceivable topic from every possible grade from anywhere in the country on

display for all to see. The wide availability of the Internet and the ease with which individuals can now publish their own content to it has proven to be a great attraction to a growing number of teachers.

This notion of using the Internet to communicate new learning in any content area was foundational to the goals of GrassRoots. Students from classrooms that participated would, through their engagement with the task of Web page creation, acquire skills specifically required for success in the knowledge economy of the 21st century as defined by the Conference Board of Canada (Dibbon, 2002; Kitagawa, 2001). These include such hard skills as how to use a variety of information and communication tools like e-mail, audio and video editing, word processing, spreadsheet management, Web authoring, graphic design, animation, and so forth. They also include such so-called "soft skills" as collaboration, leadership, risk-taking, innovation, and teamwork. In every instance, the students would develop greater expertise in these various skills while focusing on learning new content and presenting the results of their explorations through the Web pages they created.

GrassRoots requires teachers to have their students communicate their new learning through the medium of Web pages as culminating performance tasks (Wiggins & McTighe, 1998). Rather than completing a finished product using a traditional method of communication (e.g., posters, written reports, dioramas, etc.), they display their new learning in Web pages that are linked together through a series of hyperlinks into a cohesive Web site and are published to the Internet. The hyperlinks are part of the conceptualization of the content, linking concepts that are repeated or topics that are related thematically. These completed Web sites then become resources easily accessible

by other students in any geographic area and who are interested in and doing research on the same topic since any Web search on the specific topics would conceivably locate these materials. Engagement in such projects must involve both the students and their teachers, so participation builds technological capacity and capability in both. Being able to engage in this type of project work and bring it to a successful conclusion is the learning challenge referred to in the title of this chapter and the focus of the research reported on in this dissertation.

GrassRoots projects are constructivist and problem-based when looked at in relation to the Ontario curriculum. Teachers identify the general area of engagement and research. They choose a subject area like Science or Social Studies and narrow down the specific aspects of the curriculum that are going to be addressed through the completion of a culminating performance task, albeit one using technology. They must actively involve and integrate expectations of student learning from three different subject areas. However, the content displayed on each page is expected to be unique to every student and/or deal with the content from a different perspective. Students are expected to be involved in every step of the process from choosing the topics to be covered on the various pages, to designing their own pages, to pulling all the pages together, to designing what the look of the overall site will be like, to ensuring that all the links between their pages and those of their fellow students work properly. In exchange for participation in Grassroots, classrooms are awarded a small sum of money. GrassRoots draws a distinction between three levels of projects: A, B, and C. The financial rewards for these three kinds of projects are $300, $600, and $900 for each successfully completed project. Each level represents a more complex and skillful Web presence

created by the classroom and a higher degree of collaboration. The highest level of project is reserved for those that represent collaboration between classrooms in more than one school. Such collaboration would be partially or totally facilitated through the Internet.

Dibbon (2002) and Kitagawa (2001) reported on GrassRoots projects and their positive links to the expectations of the Conference Board of Canada and Canada's future in the new century. There is, of course, the opposing argument that such political intrusions into the world of the classroom are damaging to education in general (Barlow & Robertson, 1994). Politicians then define for educators what must be taught rather than leaving such decisions to the specialists. There is a long history of education in Ontario serving the economic needs of the government rather than the learning needs of the students in schools (Gidney, 1999). This research acknowledges that there might be those who question the choice of such a program at first glance. However, that argument is beyond its scope and participation in GrassRoots was agreed to specifically because of the style and the nature of learning it required from teachers and students.

A Managed Process from Start to Finish

Given that GrassRoots was a federally sponsored program in which teachers could participate, there was a bureaucracy involved in its formal administration and a rigorous process of application and reporting and validation in evaluating results. The bureaucracy consisted of a national counsel reporting directly to SchoolNet and accountable to Industry Canada. Each province had its own management team whose specific responsibility was to make sure that the processes detailed below were followed exactly prior to the rewarding of any monetary payment. Each project had to be

approved, completed according to a detailed list of requirements, and then checked for accuracy and suitability prior to signing off on the deliverables in the form of the completed Web site created by each classroom.

As a first step, teachers were required to complete and submit to the provincial office a complex online application form. (See Appendix A for the complete form as posted online at the GrassRoots Web site.) In this they had to:

1. Identify the theme and the subject area(s) of the content their students were going to produce. There was an expectation that at least three subject areas would be integrated in the learning of the students (e.g., Language Arts, Science, Art).

2. Identify the specific curriculum expectations they intended on covering by completing the project. In Ontario, curriculum expectations from each of the three subject areas were required.

3. Describe the students' finished products and how these would be linked into a systematic and thematic whole.

4. Explain how the students would collaborate with each other throughout the entire process. Teachers had to identify the method for each of several different steps (e.g., planning, designing, executing, etc.).

5. Set the timelines within which they would be working, that is when work would commence and when work would end. These timelines had to fit into the annual cycle for GrassRoots Canada for acceptance of, completion of, evaluation of, and payment for project work.

6. Identify the higher order thinking skills their students would be using in order to complete their work. It was assumed that at least some of the higher order thinking skills (Bloom, 1956) would be called upon by all of the students.

7. List the specific technology skills students would be using. These would differ from grade to grade, and from teacher to teacher, depending upon the ways in which the information would be displayed (e.g., word processing, graphic design, spreadsheets, as well as the entry level skills of the teacher making the specific proposal).

8. List the specific knowledge economy skills students would be using. These included teamwork, risk-taking, innovation, etc.

Upon completion of their projects, classroom teachers had to file another report with the national office (see Appendix B for the form as posted on the GrassRoots Web site) in which they reflected back on:

1. What had been proposed,

2. What actually was completed,

3. How students managed their involvement in their projects,

4. What new learning occurred,

5. What the teacher would do the same the next time and what differently, and

6. Why they would do things differently.

If such a report was not filed, no monies for that project were paid out to the classroom teacher.

GrassRoots projects could be initiated and proposals submitted by individual teachers anywhere in Canada independent of any administrators. However, SchoolNet

also enabled a school board to become the intermediary and manage all the projects in-house. When the school board was officially involved, as it most often was in Ontario, then the school board assumed the responsibility to "manage" the process. A government contract was signed between the specific board and GrassRoots, indicating the legal responsibility and fiscal liability of the board for such management. These duties were then expected to become part of the responsibility of an individual in a consultative position. Management tasks included:

1. Assisting teachers in the preparation of their project proposals.

2. Making sure that each proposal met with the national standards.

3. Coordinating the projects from the different schools.

4. Facilitating any requisite staff development.

5. Ensuring the highest quality possible for completed projects.

6. Making sure all reports were filed at the conclusion of each project.

7. Disbursing the money it received for the schools in trust either in the form of cash, or most usually in the form of hardware, software, or print support materials.

8. Ensuring that all of the other management tasks were conducted within the narrow time limits set by the national office each year. Typically this meant applications completed before the end of one term and the projects completed and reported on at the end of the next term, with the third and final term allowed for evaluation and signing off on the Web sites created as the project deliverables.

Recruitment of Teachers for Involvement in GrassRoots

Involvement in GrassRoots began under my leadership in the role of consultant over 3 years ago, in the spring of 2002. At that time, I was a curriculum consultant in a mid-sized Ontario school board. In this position I had responsibility for more than 100 schools and over 2,500 teaching staff. My efforts were focused on helping teachers and their administrators, both elementary and secondary, acquire the skills necessary to integrate the use of technology into their classrooms and offices. This meant, over several years, the provision of a wide variety of opportunities for professional development and growth. There were opportunities to learn specific sorts of software or hardware. There were workshops to facilitate the implementation of programs that were mandated by Board or Ministry of Education personnel. Sometimes there were efforts to encourage and facilitate participation in collaborative Internet projects connecting classrooms from all over the world. All these professional development opportunities invariably included personal interchanges with the participating teachers and listening to their stories about their professional growth or lack thereof. It became apparent to me that, despite my considerable efforts, not much overall change was occurring in terms of the ultimate goals of technology enhancement and integration across our specific school system. This observation was supported by research in the field judging the success of the implementation of the use of computers by classroom teachers everywhere (Cuban, 2001).

Since my specific area of responsibility as a consultant was to encourage teachers to become more technologically literate and to use this literacy in the service of the learning of their students, board involvement in GrassRoots seemed an ideal way to

accomplish both of those goals, albeit with a limited number of teachers at any one time. I approached the GrassRoots office and agreed to become a manager of GrassRoots projects at the local level. I assumed all of the responsibilities itemized above. In assuming this responsibility, I also bound myself to adhere to the time limits as established by GrassRoots. This agreement was itemized in a contract signed between board officials and GrassRoots Canada.

After agreeing to act as manager on behalf of GrassRoots, my first task was to solicit volunteers to participate. I used various communication tools to encourage teachers to become involved. These included flyers sent to schools, articles in curriculum department newsletters, announcements at meetings of one kind or another that brought together educators from large numbers of schools, personal contacts with colleagues who I already knew to be interested in this type of work, and e-mail messages to various interested groups, like principals, curriculum leaders based in schools, and computer support teachers. Whenever I conducted workshops on the topic of Web page creation, I mentioned GrassRoots and I invited teachers to participate. In addition, while serving as a full-time consultant for the local school board, I also, at night, delivered courses offered by the local university to teachers acquiring additional qualifications in computers. These courses had the same ultimate goal as that of my consultancy: the enhancement of computer literacy and its integration into classroom teaching practice. Teachers from my school jurisdiction who took these additional qualification courses were encouraged to use participation in GrassRoots as an assignment in partial completion of their course requirements.

In the spring of 2002, some dozen teachers began the GrassRoots process. Interest was expressed, work began on projects, but no proposals were completed properly online, so they could not be referred to as "completed" projects. Some teachers completed the Web pages, but never in complete agreement with the expectations of GrassRoots. Partially this was because of my own lack of understanding of how to facilitate such new learning by the teachers under my tutelage. Partly this was due to lack of sufficient time to accomplish all the tasks required by GrassRoots. In large measure, though, the work was just too much for the teachers who wanted so badly to get involved. Several of the teachers who participated in that first group of projects, however, returned to complete a project properly in future phases.

The next full calendar year saw continued advocacy and 24 different teachers participating, in varying degrees. The finished products were of a much higher quality. The enthusiasm of the participant teachers for the project continued unabated. Some 10 schools had projects completed according to all of the specifications of the national office. These projects actually went online becoming live and viewable by prospective participants the next year. The existence of these exemplars further enhanced the interest of more than a few teachers in the schools of this jurisdiction.

The GrassRoots project was beginning to gain momentum across the jurisdiction and, through word-of-mouth, as well as the other tools of communication, more and more teachers were becoming interested and aware. It was at this point that my role as consultant and my role as researcher began to become intertwined. As I worked with the teachers engaged in the creation of GrassRoots projects, I found myself involved with my colleagues performing many of the functions a classroom teacher would perform. I

realized my abilities as a consultant had grown immeasurably, as a result of my own professional learning during the GrassRoots project. This led me to realize that there were processes at work in this environment that were worthy of research.

In the fall of 2003, I made a concerted effort to recruit a substantial number of participants from both the elementary and the secondary panel. I did this not just because I wanted to have a successful research project but also because I had been so successful with the teachers who had participated previously. All the same tools of communication were relied upon as before. Project proposals had to be submitted and approved prior to December of that year. Due to several factors, including a growing awareness of the power of the Internet, the increasing ease with which Web pages were created, the time of year at which recruitment was occurring, the existence of the exemplars to facilitate an awareness of what a finished product had to look like, as well as the growing general capacity with technology integration in classrooms, 37 teachers submitted proposals for projects.

This brought the number of teachers volunteering over the 24-month period to a total of 80 from 39 schools, elementary and secondary. It was from this population of GrassRoots teachers that the participants for this study eventually volunteered. Some of the characteristics of these GrassRoots participants are as follows:

- 43 teachers (54%) were female and 37 (46%) were male.

- 27 teachers (34%) began GrassRoots projects more than one time over the 24-month period.

- 69 teachers (87%) completed at least one project within the total span of the project.

- 10 teachers (13%) began more than one project over the 24 months.

- 14 teachers (18%) encouraged someone else to get involved with them in a project.

- 24 teachers came from secondary schools (30%) and 56 from elementary schools (70%).

- 16 schools (41%) had only 1 teacher participating while the other 23 schools (59%) had 2 or more teachers participating.

- 4 schools (10%) had in excess of 4 teachers participating.

These descriptors help to define the group of teachers from whom the research sample for this project was drawn. These were the teachers who were prepared to take up the learning challenge of a GrassRoots project and begin their journeys of professional growth. Not all the projects attempted by these teachers were of equal depth or complexity. Some involved only a small number of students, others several classes of students under the umbrella of one project. Some were completed alone while others were done in conjunction with colleagues in the same school. Some were completed quickly with little effort; others took much longer than was necessary. In considering the various steps in this long and complicated learning process as outlined below it is easy to understand why there was such variability in the projects completed.

My role as manager in my board of the GrassRoots projects required me to accomplish the following:

1. I recruited volunteers to participate in the GrassRoots project. Each teacher who became involved received immediately some free materials for their classrooms

on Web page creation and on the software tools that were going to be used to accomplish their task.

2. Once recruited, I worked with the individual teachers to decide what aspect of their classroom activities would work best for them as student-generated Web pages. This sometimes meant helping to identify the specific Ontario Curriculum expectations that would be addressed, helping to address the integration across three subject areas, identifying what students might be able to accomplish, and determining all the elements required to complete a successful project. Sometimes teachers volunteered, knowing exactly what they wanted to do and why and how. This is not unlike what happens when students in the classroom are presented with a project to complete. Some need their hands held continuously while others have great difficulty even making a start.

3. The next step was to ensure that the conceptualization of a project culminated in a successfully completed project proposal submitted on time. To accomplish this I had to monitor where each teacher was in the process, intervene if there were problems, return to the conceptualization phase as often as required, and answer questions concerning the completion of the project proposal online. This was a time-consuming process and often required visits with teachers at their home schools. Some teachers needed no prompting whatsoever while others required constant encouragement and support, which was provided through a combination of telephone conversations, e-mails, or face-to-face contacts. In this last phase of my work with GrassRoots projects, I had two teachers who never completed their proposals despite continual contact and encouragement.

4. As project manager, I received e-mail notification of the submission of every proposal and access to that proposal. This allowed me to check one final time to make sure that the teacher had accomplished correctly all the details of the proposal process. If they had not, then I had to communicate with the teacher until the proposal errors were corrected. If they had done everything correctly, I was able to approve the proposal formally and enable the teacher to begin working immediately. Sometimes, with some of the more able teachers, this proposal process and the actual work on the project was ongoing at the same time.

5. In order to facilitate the process of conceptualization, in-service sessions were held after school on the skills involved in Web page creation. Teachers were invited to attend any one of a series of workshops (which I led, to either learn or to refine the skills that had been acquired already. In addition, teachers were able to come to the central office, were provided with a light supper, and received support as they worked through the project proposal process. In several instances, this step was crucial to the teacher being able to complete the proposal.

6. During the winter of 2004, while teachers worked with their students on their projects, my responsibilities were to be at their disposal if they needed any help. If they did, I was able to rely on several strategies. Sometimes I visited the school and provided direct support to the teacher. Sometimes, I arranged for a group of students from one classroom to be visited by students from another classroom in another school who already had the technology skills required to create Web pages. These students then acted as tutors to facilitate the acquisition

of the skills necessary to complete the Web work. Sometimes, I facilitated help from another teacher in the same school or another one nearby. Each learning situation required its own particular solution.

7. In the spring of 2004, the individual teachers had to be encouraged to complete their projects within the time limits specified by GrassRoots and then to complete the project report (Appendix B). This required a continuation of a sometimes steady stream of communications in one form or another. To bring the actual physical project to closure, they had to work with me or other central technical support staff to ensure that all the Web sites went live and were published to the Internet and all elements of display navigated properly. If anything was amiss, I had to contact the teacher and work with him or her to correct any and all deficiencies. Occasionally, I had to help the teachers edit the work done by their students and teach the teachers the skills required to bring their projects to closure. This was done at their home school. Again, each project went slightly differently depending upon the skills of the teacher and his or her own unique situation.

8. As project manager, I received notification of the submission of the project final report. I was then able to ensure that all the details had been provided and verify with the teacher that the work was done. If elements were missing, I went back to the teacher yet again to make any and all necessary corrections. One of the most time-consuming aspects of my role as manager was bringing all the projects to this level of completion. This aspect of the overall task would have been easy to let slip and leave the onus on the classroom teacher to either finish or not.

However, the teacher in me wanted to make sure that "my students" finished up the way they had begun and derived the benefit of seeing their labour pay off in student learning and pride of accomplishment.

9. Once the final report was accepted, knowing that funds would be forthcoming to reward the finished product, I facilitated the acquisition of some computer peripherals which the teacher was entitled to in lieu of direct payment. Normally, this last step would not have been done until the following fall. However, I was retiring that spring from my role as consultant and wanted to make sure that all my various projects, GrassRoots included, were brought to complete closure.

10. One of the expectations of GrassRoots participation by a board was that there be some kind of high profile event to showcase the work done by teachers in that particular board in any one year. This required the organization of a presentation to the school board trustees by the students and their teachers. Teachers and their students were invited to volunteer to participate and profile their work. Students did the presenting and their teachers brought them. There were half a dozen schools present at this showcase. This was held with much praise and good feeling, celebrating the accomplishments of so much hard work but directed towards classroom content learning and not just technology.

11. Unfortunately, in the spring of 2004, the Canadian government, as part of its budget-setting process, cancelled the funding for GrassRoots specifically and completely redefined the role of SchoolNet. This meant that even had I continued as consultant for another year, there would have been no external financial supports for classrooms that participated in a GrassRoots type project. Had I not

been retiring, however, I would have been working with these same teachers on their plans to continue with GrassRoots in some form to build on the capacity already developed to such a high degree in my board.

GrassRoots, Authentic Professional Development, and Sustained Change

There were numerous and frequent opportunities for me to work closely with the teachers participating in GrassRoots projects as documented in the outline of my role. My role as consultant and my role as researcher overlapped throughout the last 18 months of my work on GrassRoots. To this has to be added my role as educator, which is different from the too often administrative functions fulfilled by a consultant. I quickly began to realize that my professional and personal interests were overlapping. My work as a consultant engaged in the organization of professional development activities surrounding the use of technology was informed by my reading as a researcher into the processes involved in successful professional development and vice versa. Both roles were informed by my need to be an educator, working with these teachers to accomplish their learning challenge.

The many phases of the project came, in my mind, to be thought of as a learning journey. At its most elementary level, for the classroom teacher, participation in a GrassRoots project provided an opportunity for and an instance of authentic professional development, an area that was of interest to me as a researcher. It was a challenge to risk something new that the classroom teacher had accepted for himself or herself. This made me realize the importance of the question of motivation. Such professional growth fits perfectly into the research paradigm I had been formulating in my own mind: a process that involves teacher-initiated professional development; support from the

administration to provide the structural supports; and the opportunities for interpersonal collaboration, reflection, and dialogue, all facilitated by an educator, engaged with the learners involved in this process.

The processes of GrassRoots involvement and the close professional relationships established with the teachers participating afforded a unique opportunity to extract meaning. I realized that my role as consultant/educator served my role as doctoral candidate and scientist. I also realized that I might be able to make a contribution to the research literature by analyzing the courses of these teachers' professional growth. The next chapter will begin with the theoretical and epistemological justification for transforming my professional work into the object of my research as a doctoral candidate. The specific elements of the methodology followed in conducting this research will also be described.

CHAPTER FOUR: RESEARCH METHODOLOGY

This research involved the analysis of the learning journeys taken by teachers participating in an authentic professional development opportunity called GrassRoots. These learning journeys were undertaken willingly by the teachers, who knew it would involve considerable learning for themselves and for their students in the classroom. I oversaw their professional growth in my role as consultant. As the work in GrassRoots proceeded, it became apparent that the processes of learning in which the teachers were engaged could reveal much about effective professional development. There have been calls for just such further knowledge of how teachers grow professionally (Calderhead, 1987; Grimmett & Neufeld, 1994). One question raised by the GrassRoots processes discussed in the last chapter, however, is how such knowledge might be acquired through research. My approach to this question was to use an action research lens to explore the insights to be reached through a close professional relationship between teachers and consultant, between researchers and researched.

The Social Construction of Knowledge Through Action Research

In a discussion of the epistemology of professional development theories, Adey (2004) argued that there is probably too much chaos and unpredictability in educational environments to view this epistemological question from a traditional causal perspective. The classroom, he suggested, takes on its own immediacy and has too many embedded variables to make any definitive cause-and-effect statements. It becomes almost impossible to draw a clear causal connection, for instance, between a specific kind of professional development activity and any resultant growth because there are so many possible explanations to account for growth.

Adey (2004) went on to suggest that, although no predictions can be made with the certainty of physics, experiments in the field of education can be controlled better than the weather. He reasoned that, when looking at the link between specific kinds of professional development and specific outcomes from a causal point of view, the researcher has to know how and why he or she can talk about cause and effect. There has to be some basis upon which to make the assumption of causality. He suggested that, in these circumstances, the task is made simpler and the results more reliable and valid through the triangulation of various research methods and various experimental situations. Sometimes, he argued, it is necessary to ensure a research environment that is rich in different types of data to explore the same phenomenon through several different lenses. Adey describes this as legitimate sense-making and knowledge creation. The methodology literature calls it action research.

Wells (1994) contended that action research, as a methodology, can contribute to the creation of professional learning communities directed towards the enhancement of student and teacher growth and sustained educational change. Calhoun (1993, 2002) agreed that this methodology is a powerful tool for improving the practice and the health of an organization. She suggested that one can use the principles of action research whether one is an educator working alone in one's classroom or involved with a team of people from several different locations within a jurisdiction. Caro-Bruce (2000) took this one step further by suggesting that action research enables one to construct knowledge about education with teachers at the centre. Her argument was that, when teachers use action research to engage in intellectual pursuits, their sense-making reflection contributes to their becoming lifelong learners.

Lewin (1946) was the first researcher in the social sciences to propose that action research was a scientifically valid approach to the search for new knowledge. He suggested that action research is a three-step process of planning a course of action, taking that action, and studying the results of the action. In an educational setting, this involves the educator becoming a researcher by looking empirically at classroom activities and endeavouring to see if specific implemented changes have the desired results. Action research then becomes scientific inquiry in the context of focused efforts to improve the quality of an organization and its performance. It typically is research conducted by practitioners who analyze the data they gather about their own practice in order to improve practice.

Several attributes separate action research from other methodologies. Primary is its focus on turning the people involved into researchers. From an epistemological perspective this translates into making sense from a specific set of empirical conditions (McNiff, 1993). Second, it has a social dimension. It takes place in real-world situations and aims to solve real problems through the active involvement of as many real-world partners as possible (Elliott, 1991). Finally, and most important, the researchers, unlike in other disciplines, make no attempt to remain objective, but openly acknowledge their bias to the other participants (Miller & Pine, 1990).

Calhoun (1993, 2002) saw action research as being the ideal way to study some practical aspects of the school environment and to use the information gained to make improvements. Epistemologically, Calhoun means constructing new knowledge from the sense-making occurring as a result of the research. From a methodological point of view, this invariably follows a set procedure (Calhoun, 1993, 2002; Caro-Bruce, 2000). An

educator, in the role of researcher, identifies an area in need of improvement, whether that is classroom behaviour, program delivery, staff cohesiveness, or some other aspect. The researcher then determines a course of action to be taken to make a desired improvement. Research begins by measuring the environment in some way, usually by collecting baseline data, and then by intervening with the desired changes. After an appropriate time duration, data are collected again to measure against the baseline data to determine whether the changes have been successful or if adjustments have to made to the intervention.

Action Research and Scientific Validity

The epistemology and principles of action research fit well in the circumstances of a consultant working closely with teachers in their classrooms as exemplified in the GrassRoots project. It acknowledges the difficulty of separating from various responsibilities at one's place of work to become the dispassionate researcher (Dooley, 1995; Jones, 1996) and encourages a close collegial relationship between the researcher and any selected group of teachers or administrators. The personal relationship of researcher to participants introduces an element of bias that would be untenable in other experimental designs. Action research principles, however, enable one to listen to the stories of professional colleagues and to extract meaning from them as legitimate and valid sources of research data.

In the Western tradition of scientific inquiry, close involvement of the researcher with the environment and the subjects is believed to introduce an element of bias (Bassey, 1999; Merriam, 1988; Yin, 1994). Such bias can call into question the legitimacy and the validity of the new knowledge gained (Creswell, 1998; Dooley, 1995;

Johnson & Christensen, 2000). In spite of this concern, the methodology associated with action research acknowledges and even encourages a lack of distance between the researcher and subjects (Elliott, 1991; McNiff, 1993; Miller & Pine, 1990). Caro-Bruce (2000), for instance, argued that this lack of distance is precisely what makes for good action research design. It is contextual and it is embedded in the day-to-day work of the researcher and the participant. She also suggested that action research should force self-reflection because it focuses on the actions or practices of the researcher. Miller and Pine (1990) extended the argument by suggesting that when educators actively participate in action research, they use their own experience and expertise to further their knowledge of teaching. This is brought about through the constant reflection on practice embedded in the act of conducting research (Schon, 1986). There is, therefore, a contribution to be made to the knowledge of teaching and learning through the application of action research principles, which advances Guskey's (2000) agenda for educational research to generate new understanding about the process of professional growth. Indeed, Elliott (1991) suggested that the way to profound and sustained educational change is through successfully attempted and completed action research by educators in the classroom. Adey (2004) wholeheartedly concurs in this conclusion. Indeed, he calls for new learning about the practice and process of education through more, not less, action research. The validity and the legitimacy of the new learning thereby gained, he hypothesized, is enhanced through the use of multiple sources of data. This implies looking at the same research environment from a variety of perspectives and collecting data in a number of different ways.

Rigorous examination of any environment is never perfectly unbiased, as pointed out by Berger and Luckmann (1966), Elliott (1991), Hamilton (1996), and Winter (1989). However, within the parameters of action research, it is possible not only to examine the particular in detail but also to make suggestions that go beyond the findings of the particular to the general. This, as Adey (2004) has argued, is why educational research is not as exact a science as physics but is a bit more precise than predicting the weather. The GrassRoots project and process afforded an ideal opportunity to collect data from several sources for the necessary purposes of triangulation and validation.

Recruitment of GrassRoots Participants

GrassRoots had been an ongoing initiative in my board of education since the spring of 2002. In the summer of 2003, I decided that it would be the subject of my doctoral research. In my role as Consultant for Computers in the Classroom, I had the responsibility to organize the participation of teachers in GrassRoots projects. This role gave me the opportunity to witness and support the learning journeys of the GrassRoots participants, which led naturally to the selection of the action research initiative reported on in this dissertation.

In the 2002-2003 academic year, I had worked with 10 teachers on the first set of GrassRoots projects. In September 2003, I invited teachers to participate in a second round of GrassRoots projects. As part of a professional approach to communications in support of a project like this, I kept a log of e-mails, phone calls, memoranda, flyers, and visits to schools from the start of the year. I also kept entries in a digital diary and a digital calendar that itemized visits to schools and appointments with specific teachers, times and places of workshops, meetings attended, and deadlines for various project-

related deliverables. These items documented (a) the initial attempts to encourage and secure participation by teachers and schools and (b) GrassRoots participation throughout the entire project period. By the end of the 2003 fall term, 39 projects had been proposed, but only 37 proposals for projects were accepted and ready to be conducted. Two teachers, despite repeated calls by me to offer help, never completed the first step in the process. In both these instances, the teachers talked about their projects for the rest of the year and made some effort to work on the projects even though the proposals had not been accepted. In the end, the project work was not completed by these two teachers.

Once teachers indicated their intention to participate, they completed and filed the application form (Appendix A). The process of my working through the questions with the classroom teacher often was the first significant point of support for the project. It afforded an opportunity to provide professional development on an individual basis and to make observations about the teacher's capacity to carry the project to completion. The informality of the visit afforded both facilitator and participant a chance to talk about motivation for participating and the procedures needed to guarantee success with students. Teachers sometimes required some support concerning the nature of authentic learning, cross-curricular programming, and/or the integration of technology. Discussions usually began with my making a personal visit to the teacher's school. These visits also provided an opportunity to learn something about the school culture within which that teacher worked. It afforded an opportunity to explore with the teacher what participation in such a project might do to the rest of the school classes or to other students in the same grade but with different teachers who chose not to participate. The visits often included follow-up discussions through e-mail exchanges or telephone

conversations. Occasionally more than one visit was required to expedite the proposal application process. Once the project proposal had been filled out, it was posted to the national site, notification was sent by that office, the proposal was checked for completeness, and the completed proposal was printed out. Thinking they might be useful later, I made brief notes concerning the process of application by each individual teacher on the application form. Eventually, this series of meetings, the diary entries, the printout of the formal proposal, and the accompanying field notes all became part of the collection of artifacts that could serve as research data.

In early January of 2004, I finalized the decision to use action research to investigate professional learning through the GrassRoots process. The project received ethical approval from both my sponsoring university and my employer. Subsequently, letters of invitation were sent to the 80 teachers who had participated in GrassRoots projects from its inception. These letters (Appendix C) invited participation in this formal action research. Teachers were asked to assent to have their materials open to public scrutiny for research purposes. In addition, they were asked to consent to the sharing of all aspects of their involvement in GrassRoots. From those 80 invitations, 26 signed permission forms were received. Of the 26 teachers who agreed to be participants, 16 (62%) were female and 10 (39%) were male. There were 8 secondary teachers (31%) and 14 elementary teachers (54%).

Of the 26 participants, 7 were not involved in project work at the time in which the specific data artifacts were being collected. Despite this limiting factor, I decided to include these teachers as participants because the data they

had provided during the initial school visits and/or phases of GrassRoots were relevant to the research questions guiding the dissertation. Specifically, their journeys and the reasons for not being involved with projects at that particular time shed light on specific aspects of the pathways leading to professional growth, which was the question at the heart of the research. For example, the pressing needs of daily classroom events and the continual demands upon these teachers' class time often made reflection, record-keeping, and communication a difficult task (Calderhead, 1987). The 19 participants who were active GrassRoots teachers frequently affirmed this constraint in personal discussions as I worked with them on their GrassRoots projects.

The learning journeys of the teachers who were the participants in this action research project have commonalities that will be explored through an examination of the research data. Their stories as a group inform the answers to the research questions posed in chapter 1. However, an examination of specific cases is also required to deepen the understanding of these observed generalities and their stories helped to ground the theory formulated in the last chapter. These specific cases will be referred to henceforth as exemplars.

Bassey (1999), Merriam (1988), and Yin (1994) support the conceptualization of a methodology in which the researcher examines a general subject population as well as specific members. While they refer to this approach as a multi-case study, I have chosen to use the concept of an exemplar because no further data was collected from them. This would be necessary for the methodology to be truly mixed. They do, however, contend that the selection of the specific cases from the general subject population must be based

on explicit criteria. My choice of participants for the exemplars originally was based on three variables. Eight teachers were chosen to represent variations in school size, in experiences in GrassRoots up to and including its final year, and in panels of teaching. Therefore there were 4 elementary teachers and 4 secondary teachers, 2 of each who came from relatively small schools (fewer than 300 elementary students or 500 secondary students) and 2 of each who came from relatively large schools (greater than 300 elementary students or 500 secondary students) for this particular jurisdiction. The variable of *degree of experience* yielded 4 teachers with only one GrassRoots experience and 4 who had, previous to the time of the research, completed GrassRoots projects. Two of the 8 case-study participants were not involved at the time of the action research in project work. The insights gained from the examinations of these teachers' individual stories help to particularize and contextualize the observations and insights gleaned from the general participant sample. Coincidentally, these same insights also serve as exemplars of specific elements in the pedagogy informing and the infrastructure underlying the processes of successful professional development.

Phase One: Collection of Baseline Data

The formal GrassRoots project proposal (Appendix A) provided some of the baseline data for the exploration of the journeys of the teacher participants. Questions that were asked in the proposal included the grades they taught, the sizes of their classrooms, their expectations in terms of what they wanted to accomplish with their students, their approach to the completion of the Web pages, and the technology they were planning on using. My discussions with the teachers as they completed their project proposals also became part of the exploration of the beginning of their journeys.

From the beginning, every interaction between consultant and teacher engaged in GrassRoots provided informal opportunities to gather information about that teacher and his or her learning journey. It would have been ideal if I had had an opportunity to make field notes after each interaction but these memos would have had to have been kept from the start of the school year. Prior to having secured approval for the research and the subsequent permission of the participants in the study, however, it would have been unethical to keep notes about which the teachers were unaware. At all times I was cognizant of the conflict between my role as consultant and facilitator of GrassRoots, my professional and sometimes personal relationship with many of the participants, and my role as researcher. To compensate for the lack of field notes, I used other formal sources of data to compile the answers to the five research questions.

Personal and Professional Data

To complement the baseline data provided through the application and interview process, a short formal questionnaire (see Appendix D) was completed by the participants who agreed to be part of the study. The results of this questionnaire provided demographic information about the participants. Age, sex, years of experience, specific teaching responsibilities, size of class and size of school, marital status, and number of students in the teacher's class became a matter of the research record. Of the 26 questionnaires that were distributed, 20 were returned. As with every other aspect of the project, repeated efforts were made through e-mails, phone calls, and memoranda to remind teachers to send in their forms.

Technological Capacity Data

One of the expressed objectives of participation in GrassRoots is for both students and teachers to enhance their competency levels in Information and Communication Technology (ICT) skills. It has been suggested that if teachers are to enhance their use of technology in the classroom, in general, they must first perceive they are gaining in their own skill development in that same technology (Hill, Smith, & Mann, 1987; Mitra, 1998). To measure the participants' self-identified competency level, the International Society for Technology in Education's Recommended Foundational Competencies in Technology for All Teachers (International Society for Technology in Education, 2000) was used as a measurement tool (see Appendix E).

Previous to this research, as part of a pilot study for another project (Slepkov & Kerr, 2004), this tool was found at the International Society for Technology in Education (ISTE). The identified ISTE Foundation Standards were the result of a partnership between ISTE and the National Council for Accreditation of Teacher Education (NCATE; Wiebe & Taylor, 1997). It was created as both groups moved towards a permanent definition of what specific ICT skills new teachers should have as they enter the profession. As part of that earlier pilot project, permission to use the scale was granted. This scale identifies the specifics of ICT skills and it operationalizes for the classroom teacher and the researcher the specific skills under the umbrella of ICT. The competencies are grouped into nine categories:

- Basic Computer / Technology Operations and Concepts

- Personal and Professional Use of Technology

- Application of Technology in Instruction

- Social, Ethical, and Human Issues

- Productivity Tools

- Telecommunications and Information Access

- Research, Problem Solving, and Product Development

- Teaching Methodology

- Hardware, Software Selection, Installation, and Maintenance.

A total of 61 competencies fall within these nine categories. On each of the 61 competencies, all respondents were asked to assess themselves as functioning at one of five levels of use: Entry (1), Adoption (2), Adaptation (3), Appropriation (4), and Invention (5). (The complete definition of each of these levels is provided in Appendix E.) To arrive at a single numerical descriptor to capture self-perception with technology, the scoring of the competencies was done by assigning a numerical value (1 for Entry through 5 for Invention) to each of the possible competencies and adding the value to calculate a sum total.

These self-defined scores of efficacy and ability relative to the use of computer technology were used as evidence of teacher competency and as a source for triangulation of data. Specifically, it could be compared to statements made during the original project proposal process by the same teacher concerning his or her perception of advancement in technology skills and likelihood of continuing to participate in the GrassRoots project as well as to continue to use technology in classroom programming. This was also to be taken as evidence of the teachers' understanding of how the use of technology can contribute to the successful achievement of specific learning outcomes of their students. This is one of the goals from a professional development point of view.

Mitra (1998), Becker and Ravitz (1999), and Christensen (2002) all found in various experimental situations that the need to use technology in project-related environments led to enhanced teacher growth and the likelihood that teachers would not only continue to use technology upon completion of the specific project but also broaden its use in their classrooms.

This questionnaire was sent out to all participants at the same time as the personal and professional information questionnaire. Of the 26 forms distributed, eventually 19 were returned. The same methods as identified above were used to attempt to secure a high response rate.

Phase Two: Experimental Intervention

The intervention phase of the action research design followed the steps involved in the GrassRoots process outlined in chapter 3. Once any teacher began to work on a project, the process was the same whether s/he was a participant in the action research study or not. In terms of this investigation, the experimental intervention period is that period from the initial contact as a prospective participant until the project was completed and published to the Internet. Throughout that process, some teachers were able to function entirely on their own. Others required intervention of one kind or another. This intervention took the form of phone calls, school visits, face-to-face meetings while at other board events, or e-mail exchanges. All of these interactions were documented as calendar entries, telephone log entries, or saved messages. Collaborations not involving the consultant were encouraged but these elements of the journeys by the teachers were not documented at this time, other than to know when or that they occurred. Some teachers sought help from their more computer-literate colleagues

within the same school. Some were able to get considerable help from staff and students at another school. This not only helped to bring other teachers into the project but had an impact on the journey of that particular teacher. The information concerning the fact of collaboration with others is part of the public documents that are filed as the project proposal and the project report. Particulars about the nature of collaboration might have been shared in an e-mail message, a telephone message, or during an informal encounter.

Phase Three: Documenting Growth and Looking for Change

Upon completion of the GrassRoots project, which meant publication of the materials to the Web, every teacher, whether a participant in this study or not, completed a report online at the GrassRoots site. This report (as reproduced in Appendix B) became another piece of data used to explore the learning journey of the research participants. The questions included project details such as numbers of students and teachers eventually involved and the specific ICT skills eventually used. They also included broader questions such as the appearance of the Web site that was created, what the students as well as their teachers learned, and future plans for GrassRoots participation by the teacher. The answers to these questions constitute another source of data for triangulation with the subjective observations gathered during the interaction phase. In addition, teachers' responses to the questions document their new learning and so provide evidence of the success or lack thereof of professional growth from the teachers' point of view. The necessity of filing a report ensured that teachers reflected on their new learning, which Schon (1986) sees as contributing to the likelihood of sustained pedagogical change.

Unfortunately, the actual Web sites, one of the key indicators of a successful journey by all GrassRoots participants, are beyond my use as a researcher because of privacy concerns. The Web site completed by the students under the guidance of their teacher stands out as indicative of the accomplishments of the classroom. To enter these culminating performance tasks as evidence of growth would require permission from each of the students from each of the classes involved in GrassRoots. To cite the Web address in the body of this research and point the reader in the direction of the projects would be to reveal information about the location of this research and the identity of the participants. Although the sites themselves are not entered as artifacts or alluded to in the results, comments about their accomplishments will be referred to in the next chapter.

One final piece of evidence was collected from the participants at the end of the project. Originally, it was intended that these data would be collected through another personal interview with each of the participants. These interviews involved a series of questions concerning the specific journeys of each teacher as they finished their projects in GrassRoots and reflected back on the process. This intended interview was in addition to the numerous points of contact made while the projects were underway. However, due to time constraints and ethical considerations, an e-survey was sent via e-mail to each participant and the answers were entered and returned via e-mail as well. (The e-survey is attached as Appendix F.) This e-survey had a combination of open-ended questions designed to allow participants to express their opinions on significant aspects of their journeys and forced-choice questions (yes/no or multiple choice).

The use of an e-survey for data collection is supported by Clayton (2003) and Anderson and Kanuka (2002). The use of this one method of data collection could be questioned if it were to stand alone as evidence of new knowledge about the learning journeys of the participants in this survey (Anderson & Kanuka, 2002). However, Adey (2004) agues that triangulation of data is extremely important in order to validate the perceptions of the researcher. Multiple data sources allow for insights to be generated reliably. In this research, triangulation was accomplished by collecting data of several types: documentation, interviews, direct observations, project artifacts, and participant observations. The e-survey was only one more data source used to support and validate the findings of the research. The survey was distributed to all 26 participants yet, despite repeated efforts through a variety of communication channels to elicit responses, only 15 e-surveys were returned.

Data Analysis

Over the course of the year, many different types of data were collected from all the teachers participating in the GrassRoots project. In review, there was (a) an electronically maintained calendar (of all appointments, visits, and discussions) reflecting time spent through prearranged visits; (b) digital copies of all flyers, memoranda, and letters; (c) files of all e-mail messages both sent and received; (d) the official project proposals; (e) the final reports; and (f) occasional journal entries and field notes kept electronically by the researcher. After permission was granted by the participants, data from these various sources were included. With agreement to be a participant came permission to include data as well from (g) a personal and professional

data questionnaire; (h) the ISTE Foundational Competencies in Technology; and (i) the e-survey responses.

The problem of record keeping (Calderhead, 1987) extended to the filing of the reports necessary as part of the GrassRoots process. Ensuring that this was done so that the monies offered as "payment" for each completed project could be collected was obligatory. The need for these teachers to also respond to requests for the completion of various data collection tools (Appendices C, D, and F) became an even more time-consuming task. As a result, the response rate for each of those data collection methods was not the same. Six of the 26 participants did not complete the Teacher Demographic Information Data Sheet. Only 19 of the 26 participants returned the ISTE Recommended Foundation Competencies for Technology in Education form. The e-mail log contained only two messages from one of the participants, 21 from another, and 31 from a third. Consequently, there are only 10 teachers for whom there is a complete data set. For the rest, there are various combinations of artifacts.

Given the many different sources of data, the problem became one of making sense of all the data. As Adey (2004) acknowledges, personal observations must be supported by other sources of data in order to verify and validate the subjective assessments made by the researcher. Throughout the process of seeking answers to the questions about the learning journeys of these teachers, the initial source of information was subjective observations garnered over the many months of working so closely with the participants. Subjective observations were then supported by concrete responses from one or more of the data sources. Seldom were there any inconsistencies.

In order to validate and support my subjective observations, I searched each set of data for statements relating to the professional journeys of the participants, and then categorized those responses as to which of the five research questions the data were addressing. I was following a methodology similar to that defined by Corbin and Strauss (1990) as open, axial, and selective coding. Open coding involves the segmentation of the data to form initial categories. In axial coding, the initial categories are compared and sometimes combined into new groupings to better fit the interpretation of the data. In selective coding, the researcher weaves the categories together to present a story which explains and interprets the data set. As supported by Creswell (1998), this data analysis strategy suits some forms of qualitative research because it provides a procedure for developing categories of information, making the connections between those categories, creating a theoretical construct that connects the categories, and then bringing the constructs together in a set of theoretical propositions or a "story" described by the data. Corbin and Strauss refer to this as a process of data saturation and suggest that it occurs towards the end of the research process and it leads to model building. It is for this reason that the process of data analysis is called grounded theory.

In this particular action research project, I began with my raw data and recorded it broadly according to the larger categories, which were derived from the five research questions (i.e. capacity, motivation, facilitation, outcomes, and next steps). I went through each of the separate data sources one at a time, extracting the data as appropriate and recording them digitally in a single file (if this was required), by question first and by participant second. Any and all statements that seemed to be appropriate responses to more than one question were entered in the data set that way. This left with me with one

large digital file divided into five sections and within each of the sections, entries for each of the participants where they had had something to say. In addition, I included the source of the data so I could refer to that source when necessary.

The next step required that each question's group of statements be grouped according to their various subjects. As I began to look at the various data sets in turn, I looked for clusters defined by specific sub variables, e.g. technology ability or lack thereof, extrinsic or intrinsic motivations, support from technicians or consultant, colleagues or students, and so forth. This represented the open coding process also referred to as factor analysis (Harman, 1967). As I began to extract statements referring to any aspect of their journeys of professional growth, I began to give names to the sub categories. These sub-categories were moved around, renamed, refined, or broadened as the coding process proceeded. Statements that could fit in more than one category were so placed, often out of necessity because of the limited number of participants and therefore the limitations of sample size. This was the axial phase of the process.

Once all the data sets were analyzed in this fashion, it became a matter of looking for the commonalities that they revealed. This in turn led to an awareness of two broad categories of variables that defined the process of professional development. This process of selective coding led to a grounded theory that applies the categories of pedagogy and infrastructure to a model for professional development and defined the elements which will be advanced and elucidated in the last chapter.

Ethical Considerations

This action research-based dissertation follows the requirements for research conducted with human participants as specified by both the guidelines

for research as defined by my employer and the Brock University Research Ethics Board. (See Appendix G for Ethics Clearance Documentation.) These requirements specify that each participant will know, in advance, the nature of the research and the commitment expected of him or her, that s/he will be guaranteed anonymity at all times, that the data will not be shared by the researcher with any other research without informed and signed consent, that the results of the research might be shared with a wider audience through conference presentations or published articles, that there is no risk to him/her or his/her person as a result of the research, and that his/her participation is based upon their written informed consent to be a subject.

From the outset of this action research, I was aware of the tension between my role as a consultant working with teachers to accomplish workplace goals and my role as a researcher attempting to fulfill the requirements in completion of the personal goal of a doctorate in Education. Many of the teachers whom I approached or who approached me about GrassRoots from the beginning were close colleagues. I had established an excellent rapport with many of them, and that rapport was part of their decision to become participants. They knew that there would be a great deal of work to do and much important professional learning to acquire. However, they also knew my professional and personal goal was to help them accomplish their professional goals. Over my years as a consultant, I had earned wide spread respect because of this approach to my role. More than a few of them agreed to be participants in this action research because of this rapport and respect. Ethically, it was extremely difficult

for me to impose on them continuously, both during the intervention phase and in the final stage of assessment of the results, beyond what was required for them as classroom teachers. This was crucial to my decision not to attempt to visit each participant yet again to interview him/her. Such interviews were bound to demand even more of their personal time. Therefore, I preferred to compromise the integrity of my research rather than intrude too often into the classrooms and lives of my colleagues. This did not, in the end, detract from the successful analysis of the data.

Finally, there is the ethical issue surrounding the anonymity of my colleagues. I have given pseudonyms to the case studies and tried as best I could to avoid providing the reader with any identifying characteristics that would enable placement of this research in a specific place or with specific people. This need to protect the anonymity of all the teachers who participated in this GrassRoots-based action research meant not being able to direct the reader to specific Web site addresses since the names of the teachers whose classrooms participated and created them are prominently displayed.

This chapter has reviewed the methodology I used to seek answers to the two primary and five secondary research questions that formed the basis of this dissertation. The methodology I adopted involves a combination of action research and multi-case analysis used to collect and analyze the data collected from the participants in GrassRoots. In the next chapter, the results of this process will be presented. The final chapter will discuss the findings of the

research and the implications of those findings in light of the current status of

professional development initiatives for teachers.

CHAPTER FIVE: PRESENTATION OF THE RESULTS

GrassRoots project work required considerable new learning by teachers and through them, their students. This new learning occurred within their various classrooms and therefore can be seen as experiential learning, which for the teachers becomes authentic professional development. Of 80 teachers involved over the span of 24 months, 26 agreed to allow their journeys of professional growth with GrassRoots to be the focus of this action research. The research began with five questions concerning their journeys:

1. What capacities or abilities do learners/teachers bring along with them on their journey?

2. Why do teachers embark on a path of significant professional growth? Why do they take up the learner's challenge?

3. What conditions are in place that facilitate or detract from their journeys?

4. What do teachers see as the outcomes of these journeys for themselves and for their students?

5. What do these teachers see as their next steps?

The answers provided by the participants to these five questions are presented in this chapter. Participants will be identified by number following any information derived from their particular data set. Numbers are assigned alphabetically to the 26 participants. This numbering will enable the reader to hear the individual voices of the participants and follow their particular stories. These stories will be complemented by those of the 8 participants whose journeys are the exemplars. Their voices and the contribution they make to our understanding of the nature of these learning journeys will only enter the

analysis of the data, after their initial introduction, in order to especially emphasize or further explore specific dimensions of the general case.

Learning Capacity and Capability for the Journey

As a group of teachers, who are these participants and what capacities do they bring to their learning journeys? The answers to these two related questions come from a cluster analysis of the statements made in various e-mail messages, field notes made at the conclusion of the project Proposal process, answers to two specific questions on the e-survey, as well as from the teacher demographic information sheet.

The teacher demographic information forms reveal that 10 of the participants were male (39%) and 16 of them were female (61%). Although not an even split, there were enough men to justify being able to suggest that these results are not skewed to one sex predominantly. Eighteen of the participants were from elementary schools (69%) and 8 of them from secondary (31%). This again cannot be seen as skewing the results to one panel or the other.

The teacher demographic information forms indicate that 16 of the participants (62%) came from larger schools and 10 (38%) came from smaller schools within this particular board. This educational jurisdiction is predominantly comprised of smaller schools due to its unique complement of urban versus rural demographics. The largest elementary schools have around 600 students, the smallest fewer than 200. The largest secondary school has around 1,000 students, the smallest fewer than 500.

Of those providing information on their marital status (22) on the teacher demographic information sheet, 16 were married (73%), 4 unmarried (18%), and 2 divorced (9%). Putting these statistics into perspective, in keeping with Bellah et al.'s

(1985) and Hargreaves's (1994) references to the retreat to the private space and the demands on teacher personal time, one might predict that the relative balance between married and unmarried would be the reverse: that being unmarried would result in having more time to devote to professional growth activities. However, this was not indicated by the results.

Information about the age of the participants in this study was available for only 20 of the 26 participants. Of those 20, 5 were between the ages of 25 and 30 (25%), 5 between 30 and 35 (25%), another 5 between 35 and 45 (25%), and the last 5 between 45 and 55 (25%). There is, therefore, no one predominant age group but rather an even number at regular age intervals.

Berliner (1986) drew attention to the passage from novice to expert and the differing speeds with which that might occur. One might predict that years of experience as a classroom teacher would influence participation in GrassRoots. No such pattern was found, however, in examining the responses on the Teacher Demographic Information Sheet. Of the 23 participants who provided information on this question, 7 (30%) were in their first 5 years of teaching, 6 (26%) between 6 and 10 years, 5 (22%) between 11 and 15 years, 3 (13%) between 16 and 20 years, and 2 (9%) between 21 and 25 years of experience in the classroom. These data suggest that it was the younger, less experienced teachers who were more likely to volunteer to undertake a project, rather than the older, more experienced professionals.

No pattern could be detected concerning the relationship between average class size and participation. One could hypothesize that having greater numbers of students in one's classroom would lessen the likelihood of venturing into anything beyond that

which is specifically linked to the curriculum, subject by subject. In actual fact, in this particular sample of teachers, 14 (61%) had classes with more than 25 students and 9 (39%) had classes below 25. More teachers with larger class sizes participated than teachers with smaller classes.

The demographic data are provided to describe the general nature of the group of participants and to situate these individuals as participants in this action research. The second level of descriptive data dealt with statements made about their capacity for the project work at hand. These technical data clustered around the seven capacities: (a) technological capacity, (b) willingness to learn, (c) leadership, (d) background pedagogy, (e) supportive confederates or collaborators, (f) work ethic, and (g) accessible time.

Technological Capacity

This entire project operated under the assumption that teachers and students would need to spend a great deal of time on and with computers. It could be reasonably argued that self-perceptions concerning one's already existing ability with computer technology needed therefore to be positive. In the preparation of the proposals, few if any of the participants expressed grave concerns about their entry level skills. There were more comments written such as "no problems technologically" and "very strong technologically" than "technology challenged" or "knows pedagogy but isn't sure of the technology." Several participants were like this one who "believed himself to be less able than he really is" (field notes, Participant 3) while others allied themselves with partners who they knew would be able to complement them in terms of their technological ability. When asked in the e-survey about their level of technological

comfort prior to beginning their project work, all of the participants responded that they were either very comfortable or comfortable with technology. In fact, 15 of the 26 participants served in their schools as computer site managers and 12 of 20 had previously taken additional qualifications courses to enhance their computer skills. Certainly, many had participated in different in-services that I had facilitated prior to GrassRoots.

Many, however, did not feel that their general computer skills included their ability with Web site creation. When asked specifically about their prior ability with these skills, in the e-survey (Appendix F) of those responding, 8 (53%) admitted to having had prior experiences and 7 (47%) admitted to none. This lack of experience on the part of almost half of the participants only meant that they had a steeper learning curve. Some of these 7 were able to turn to others who had had some ability creating Web sites. Lack of such ability and/or experience did not seem to eliminate the desire to participate. For example, Participant 16 wrote that "I have no Web page design or construction experience, but have a pretty savvy class and a shallow learning curve (I think)" (e-mail). This comment highlights another important capacity shared by many of the participants. What individual participants lacked in any specific capacity, they more than made up for in their willingness to learn, their enthusiasm for the project, and the energy they brought to the process.

Willingness to Learn

As a consultant and as a part-time instructor, I had been involved with many of the participants in GrassRoots over a considerable period of time in learning environments centred on the acquisition of technology skills. I had frequently been the

instructor at workshops many of them had attended. Often they sought out ways to advance their skills. For example, 5 of the secondary participants worked with me on councils that served the needs of system-wide teachers in computer technology so I was familiar with their technical skills prior to any work with them in GrassRoots. Similarly, 14 of the elementary participants came to meetings I facilitated surrounding the use of computers in their schools. As well, they were frequent attendees at workshops for other technology initiatives for which I was responsible. Most of them had taken several or more additional qualifications courses, which also indicated a willingness to further their own professional growth. This growth was repeatedly frustrated by the GrassRoots process, as indicated by this comment in an e-mail message:

> I went online first and tried to complete the form, but as I completed the second page of the form, it asked me to contact an administrator and wouldn't let me continue. I tried to save it and come back later, but again I received (a message to) contact an administrator. Also, the next button at the end to continue did not work. Perhaps you can go on and see if it is working. (Participant 9)

Participant 24 wrote, "Very exciting for all of us here. Sorry about the size. Next year I'll take Computers Part Two and learn to make our Web sites smaller." The same participant wrote, "I have the feeling that our projects are in reality very simple to do. At the moment however, I simply don't know how to do them. I'm counting on you." Finally, for Participant 15 the following was written in field notes: "a novice teacher but quite prepared to go ahead with this project because she has a mentor in another school working on a project too." All these comments or notes speak to the willingness on the

part of the participants to tackle the project at hand. This must be seen as a capacity they brought with them to their project participation.

Supportive Confederates or Collaborators

All of the participants indicated in their project proposals that they planned on collaborating with one or more other teachers in their GrassRoots projects. This meant that they had already made arrangements to share their learning journeys with at least one other colleague. Eight of the participants were planning on working with at least one teacher from another school. Ten of the participants were partnering with colleagues within their own staff. Seven planned on working alone. However, underlying many of the original project proposals were some plans to bring Web sites together across the board to reflect curriculum links in one subject or another after the projects themselves were completed. Even if they did not have colleagues in their school or wider network, they knew in advance that they would be supported by me in my role as consultant. These learners knew that they did not begin their journeys alone.

Leadership

Frequently, participants brought obvious leadership skills to their work in GrassRoots. The Teacher Demographic Information Sheet (Appendix D) indicated almost all of the participants were also their school's computer site manager. In addition, 2 of the participants had taken Principal's Qualifications courses. Participant 23 came to the project on the suggestion of a subject consultant who supported me in my enthusiasm for GrassRoots. In the field notes for her, I wrote that she "came to the project via another consultant and saw the project as fitting in with other initiatives of her school. She took the leadership to find other partners to participate." This was not

atypical of GrassRoots participants. Participant 11 spoke to a colleague in another school and wrote me in an e-mail that "When we have time we are going to chat a little more about it but I will pass him on to you for more details." Unfortunately nothing came of this particular outreach, but the leadership and the effort was noted and appreciated. Several of the participants conducted in-services or workshops, within their own schools or across several schools on technology-related topics or, frequently, in conjunction with the board's literacy initiative. A few of the participants took the initiative to broaden the scope of GrassRoots participation in their schools, Participant 22 enlisting four other teachers, Participant 10 enlisting three. Expressing an interest in GrassRoots and then soliciting the collaboration of a colleague was an expression of vision and leadership. It required the individual participant to be able to see the pedagogical value in becoming involved in project development.

Background Pedagogy

Since much of the emphasis in any project's approach had to be the integration of subject-specific skills and concepts with technology skills, observations were made as to the participants' ability to formulate an integrated approach to the learning of their students (Drake, 2000). All of these participants were quite capable of approaching curriculum instruction in this manner. They understood the importance of linking their students' learning to real-life experiences, in keeping with the brain-compatible curriculum as described by Westwater and Wolfe (2000). Project themes were primarily based on Language Arts or History, Science or Social Studies, but integrated into these projects were skills from Art, Geography, Mathematics, or one of the other basic subject areas. So, projects had components of Language Arts, Art, and Social Studies, or Social

Studies, Art and Language Arts. In a field note I wrote that Participant 17 "easily changed from one project to another to fit into the timelines of the GrassRoots projects. He knew his curriculum inside and out." For 2 teachers who were collaborating, Participants 6 and 16, in the field notes I wrote that they "have a very good idea of what they want to do and how to go about doing it." All the participants could see how this approach to learning would enhance their classroom teaching practice and their students' ability to make sense of the concepts they were being asked to learn. They understood the ways in which a constructivist approach to knowledge creation in their classrooms ought to work. For example, another field note pointed out that Participant 4 "came to one in-service, knew exactly what she wanted to do by the time I visited her in October and had the proposal filled out perfectly." In another comment I wrote that Participant 14 "did the whole proposal with next to no input from me. It was exciting because he posted his project as a collaborative Internet project and as I write this he had informed me that he might have a school in Toronto to collaborate with. He has a great understanding of the pedagogy and how to implement this with his class."

Work Ethic

All the GrassRoots participants were challenged to keep up with the many demands upon their time as classroom teachers. A strong work ethic and capacity to stay on task kept them moving forward. Indicative of some of the participants' approach to their work are the following statements from either field notes I made or e-mail messages I received:

Both teachers in from the very beginning, expressing interest in a project at least 18 months before actually finding the time to embark on one. (Participants 12 and 13)

Very involved in his school and with his family -- attempting to do a lot of things. (Participant 3)

Called me up to come to the school -- no prompting -- took on this project on top of all her many other involvements. (Participant 8)

As usual, things are crazy, with the impending trip to camp and numerous other things on the go and I have just thrown my back out...not to mention I just returned back to school after being off for a week with the chicken pox! (Participant 16)

Looks like we simply ran out of time this year. I'm hoping that we pick up where we left off in the next school year. (Participant 24)

I know that mine won't count (because of the time frame)...but I am almost finished. I will then burn a CD, send it to you and load to the Web site. (Participant 9)

Having the time for all that a GrassRoots project demanded to be completed successfully required an extraordinary commitment on the part of every participant.

Accessible Time

The GrassRoots participants all shared many abilities, not the least of which were: a relatively strong technological background, a pronounced work ethic, an understanding of the pedagogy underlying their work, energy, and enthusiasm. All of the participants anticipated in their project proposals that they would have at least one other

professional educator to collaborate with and share their learning journeys with. However, the one capacity that loomed large in the course of their journeys was having the time to devote to GrassRoots. The word *time* is used loosely in this context because it can mean personal time (number of demands in one's personal life), scheduled time (timetable within a particular school or day in the school), or time with the right group of students (class assignments on or off a rotary schedule).

Even if individual teachers wanted to participate in GrassRoots, each had to have the right class or the right group of students to work with. Participant 26 wrote in an e-mail message that "I would have liked to participate in Grassroots again this year but I don't believe this group of students is ready for that kind of challenge." Another teacher, Participant 21, complained in a message that her principal had taken her technology responsibilities away from her and so her access to the students and the computers were not in synch any more, preventing her from continuing with another GrassRoots project. Participant 12 wrote, "the problem is that I don't have a homeroom as learning resource teacher. Could I do this as enrichment with a group of juniors and intermediates?" Given the right classroom assignment and the right timetable, as well as bringing the individual teacher and his or her class into close proximity of the computer lab or a group of computers, there still were other time constraints to deal with. In e-mail messages, the personal time issues mentioned included include illnesses, major and minor, other school events detracting from time on GrassRoots tasks, marriage or family circumstances, and issues related to personal access to technology to even begin the process of preparing a proposal. For example, Participant 15 wrote "Sorry it took me a while to get it to the both of you. My roommate removed my cable Internet and I had to get a new modem."

To exacerbate the personal time issues, all too frequently time became limited or non-existent for GrassRoots work because of computer issues in the schools. For instance, Participant 7 wrote that "What has happened is that when we used Front Page it seemed to make and name folders on its own and now that we've moved each student's finished product to one location, it can't find the different components of its own page, let alone try and figure out what to link with whatever else. I'll have to fiddle with it, but without having a copy of Front Page at home it will mean trying to fit it into my daily schedule." Participant 9 wrote in an e-mail message the following:

It was completed by the end of January. However, I've been attempting to submit the proposal to GrassRoots. I've encountered a few problems: 1. The project proposal does not work in Netscape, which is what I was trying to use at home. 2. With the work to rule, I haven't been able to get it done at school. 3. Often I cannot reach the GrassRoots site, like right now."

Considering all the obstacles that kept these participants from their desired pedagogical outcomes, it was a wonder that any learning journeys actually were completed. However, as is often the case in the teaching profession, energy, enthusiasm, and a strong work ethic were more than enough to compensate. Student learning did take place, student accomplishments were evident, and professional growth did occur.

The particulars of the exemplars focused on in this data analysis add richness to the general descriptive data from the larger participant group. As pointed out in the previous chapter, each of the exemplars was chosen to reflect variations in three characteristics of these participants: school size, grade/panel, and experience with previous GrassRoots project work. It was indeed fortunate that, despite the problems

with the securing of volunteers, the sample was distributed sufficiently along each of these variables that the exemplars could reflect these variations adequately. The following pages introduce the 8 participants whose stories will be highlighted throughout the conceptual analysis of the data. In addition to descriptors in the categories for school panel, school size and experience in GrassRoots, brief information is provided on the various capacities brought to their participation as well as each specific participant's declared ability with technology.

Elizabeth (Participant 24) who worked in a large (more than 500 students) K-8 elementary school, had little experience with technology before she began working on a GrassRoots project. Her lack of expertise with technology was noted in the field notes and self-declared in e-mail messages from the start of her involvement. However, Elizabeth brought many other abilities to her project involvement. She was 52 at the time of the study, had 17 years of classroom experience, and was eager to learn from whomever was prepared to advance her technical ability. In her first attempt at a project, which was abandoned due to a physical injury, Elizabeth struggled through with the help of a teacher at nearby school who came on her own and with her whole class. In an e-mail message, she wrote that "the head injury set me back this year and I'm still trying to catch up. I don't believe it's really possible to ever catch up. Everyone is so busy." Elizabeth was determined to encourage growth in her technological ability. Her work ethic is revealed in this e-mail message to me: "[I am] technology challenged. I was hoping that you could show me how to set up one student Web site and then I could teach the rest of the class on another day." She did not, however, need to grow pedagogically. She was a leader in the board in her knowledge of literacy development

and quickly saw the link between Web sites by students and their growth as effective communicators. In the e-survey, she wrote, "I wanted to learn how to make aesthetically pleasing Web sites. I wanted to feel more comfortable in the computer lab and to expand my computer skills so that I could participate at a deeper level with my students during class time." In the field notes, I wrote that Elizabeth "had thought this through completely and had a strong pedagogical basis for her thinking and procedures." Despite serious difficulties with technology and many challenges to the time required to complete a GrassRoots project, this teacher's work ethic and enthusiasm helped her to seek help wherever she could. In this way, she could extend her ability to show leadership in the area of literacy development pedagogy.

Wesley (Participant 22) came from a large (450 students) K-8 elementary school as well. At the time of the project, he was a divorced father of one, 43 years old, and had been teaching for 12 years. In his school, aside from his classroom teaching responsibilities, Wesley was the school's computer support person and, as such, was already extremely literate concerning computers. He wrote that he wanted to extend this ability and "learn how to create and design Web pages." In the field notes, referring to the project proposal, I wrote that "it is perfect. He knows his stuff and has no problem with either the pedagogy or the technology." In addition to this technical and pedagogical ability, Wesley brought leadership skills to his project participation. On his own, he enlisted the participation of four other teachers at his school, knowing that he would be challenged to accomplish all that he set out for himself. In an e-mail message he wrote that "it has been a zoo here...singing and dancing...can you do a PowerPoint for this and a PowerPoint for that......ho ho ho! I have given myself Saturday morning...ah

yes, sanctuary…. to complete the components……..really should only take an hour at the most." His enthusiasm for the project is reflected in this e-mail message: "My crew is biting at the bit to start this. This is very cool!" Wesley's enthusiasm, work ethic, and leadership qualities were typical of many of the individuals involved in GrassRoots projects. All of these abilities were required to help him overcome the many time challenges he confronted during his period of participation.

Judith (Participant 1) came from a small (240 students) K-8 elementary school. She was married and she told me about her young children many times as our paths crossed at meetings, in classes at the university, and in professional development opportunities over several years. She was 40 at the time of the project work. Judith had had 16 years of teaching experience by that time and had completed a specialist's course in computers. In her small school, she was considered the computer expert, although she perceived herself to be seriously challenged. Her self-perception reinforced a common sentiment amongst many teachers I have had occasion to work with in that they have frequently told me they feel so inadequate and yet they manage extremely well with technology. Pedagogically, in the field notes I noted that Judith knew exactly what she wanted to do. She wrote in an e-mail that:

> I suppose because all three classes are working on projects using the Four Blocks model, the classes would be able to share ideas and experiences as they work together in building their Web pages. In this case, I can see the younger students being helpful to the Grade 8 class, as the younger students have had more experience and exposure to the Four Block Model.

Judith successfully completed a literacy-based project the previous year, and her work ethic was such that she had partnered with two individual teachers in her school to do separate projects with each. Despite having had some serious time constraints because of a physical injury that required several weeks off work, she came back and found the time to pick up the pieces of both proposals. Judith's only frustration was having a problem accessing the GrassRoots Web site that required me to come and scribe for her to save her some time. She brought a strong work ethic, pedagogical insight, technological ability, enthusiasm, collaboration with two other teachers on her staff, and previous Web site experience to her GrassRoots work.

Brett (Participant 3) was a 30-year-old male from a small (fewer than 300 students) senior grades (7 & 8) elementary school. He had 4 years of teaching experience at the time of the project work reported in this research. In those 4 years he had already taken five additional qualifications courses, which attested to his strong work ethic and desire to grow professionally. Brett was married with a young child at home. He was in two of my university night courses consecutively and had to miss classes sometimes to care for his son. This was only one of the time restraints he dealt with in attempting to complete his projects. He wrote in one e-mail message that "I spent the weekend getting a substantial amount finished on report cards and will be dedicating much of my time in the next week to GrassRoots. There are always a lot of questions and loose ends in the final stages." Brett was extremely computer literate and comfortable with all aspects of the technology. He too was his school's main computer support teacher. Despite this, in my field notes I noted that "he believes himself still a novice with the technology but his skills are much higher than he gives himself credit

for." Pedagogically, Brett was aware of the link between the concept of Web site development and language development. In an e-mail message prior to the completion of the Project Proposal, he wrote that,

> The Grade 7s are doing a hero unit. I know that heroes have been done to death on the Net but I would like to add a twist. If a partner works with me, my class would study scientists and politics that show heroic qualities and the other class would study artists and athletes. We would study their place and time of birth, obstacles, and special qualities. We would combine our classes to share insights on these heroes and find relationships between them. What qualities make a hero? Which do they have in common? What qualities do we have that may lead us to "greatness"?"

Brett brought many abilities to his GrassRoots participation, including his strong work ethic, knowledge of pedagogy and technology, enthusiasm, and ability to manage his time to complete everything that he set out to do.

Rebecca (Participant 4), a 31-year-old female participant, taught English in a large secondary school (900 students). She was, at the start of the project, married but without children. She had only had 1 year of experience in the classroom when she attended a summer workshop on Web page creation. However, Rebecca had already begun to take additional qualifications courses to enhance her teaching skills, which attests to her strong work ethic. Her enthusiasm was evident in three ways: She was the first to sign up for the first GrassRoots workshop of that particular year, she was the first to complete her project proposal, she was the first to complete her project. In my field notes, I noted that "as I write this, she's already almost completely done." This level of

success is notable because, when Rebecca began, she was more than a little bit unsure of her abilities with computers. At that summer workshop, she professed the desire to be able to complete one Web page and had a multi-page Web site completed within the 2 hours, which surprised both of us. Another indication of the skill set Rebecca brought to her project work was that, during the entire duration of her GrassRoots project, I received only 10 e-mail messages from her. I also had to visit her school only twice and each time for only a short period of time, less for any official help that was needed, than as a formal professional courtesy. In one of her e-mail messages to me, Rebecca wrote that "I'm not fully satisfied with what I have, but I think it's the best we can do with the calibre of students we were working with." Rebecca managed to squeeze everything into her busy schedule. "I will try to see you on the 24th, but I'm pretty sure I have a night school supervisor's meeting that afternoon." She came to the GrassRoots project with a strong pedagogical background, which I noted in my field note. In her project proposal, she also indicated her intention to work with a partner in another school on her project.

Zachary (Participant 2) was one of the most able computer support people with whom I had worked in my professional capacity. Despite this, I noted in the field notes that "he didn't really understand the question as to how Web sites would reflect new learning." This was because of his unique background. He had been a computer support person in the private sector prior to becoming an educator. "My background is broad-based technology." He became a teacher of computer engineering in a large secondary school (900 students). Zachary often struggled with the difference between his expectations as a technology teacher and the goals for generalized student learning. This is reflected in the following e-mail message I received in which he wrote that,

Our grassroots project is underway. We started by learning a little HTML, then researched and created tables showing historical facts of the Intel microprocessors. The students were then subdivided into various topics, and started working on their individual pages. The class then used Front Page themes to choose appropriate page headings. We have settled on one design and will now make the headings. We have also standardized the layout of some graphs (created in Quattro Pro) that will appear on many of the pages, and these will be integrated into the pages in the next day or so.

We crossed paths many times over the years that I was a consultant, and got to know each other well. This issue of subject learning versus student learning came up frequently. Zachary had, at the time of the project, 10 years of teaching experience. He had small classes to contend with. He wrote that he became involved because he saw GrassRoots as "an excellent resource that could be shared with others."

Sarah (Participant 4) taught in a small secondary school (540 students) and had no experience with GrassRoots or technology in general. She volunteered to attempt Web page creation with her senior English class as part of their study of Shakespeare. Sarah did not participate in a project during the time covered by this research because she had several personal problems to deal with. In an e-mail message she wrote that "I have been off sick for several weeks and haven't been keeping up to date on the GrassRoots material." Sarah was a 35-year-old single woman who, at the time of her project, had been teaching for 7 years. Her work ethic is indicated by this comment: "Sorry, I didn't open the mail until today. My students have been working overtime on the GrassRoots project. In fact, we will be staying after school on Friday." However, for

Sarah, unfortunately, work ethic did not overcome the obstacle of her compromised work time.

Isaac (Participant 11) was a capable Science teacher in an unusually small secondary school (fewer than 450 students). He was 28 years old and had garnered 5 years of teaching experience by the end of the research period. Although Science was his first teaching subject, Isaac also taught computer programming to a small group of students. He therefore brought well-developed computer technology ability and Web site creation skills to his involvement in GrassRoots. He was a participant in GrassRoots from the beginning, prior to the formal research data collection period, and had demonstrated leadership skills by encouraging a colleague in another school to collaborate with him. Isaac also tried to encourage another Science teacher in still another school to join his planned project. In an e-mail message he wrote that he had suggested to his two colleagues that "At this point in time, I think maybe we should sit down as a group, or maybe just brainstorm by e-mail, a few ideas as to how we can put together the information from all three classes into a nice Web site." Isaac had so much capacity for GrassRoots it came as a disappointment that he did not bring this plan to fruition. However, his learning journey was interrupted for a number of time-related issues, including marriage, career advancement, and other school projects requiring his leadership.

The descriptions of these eight exemplars, along with the more general information provided on the other 18 participants, serve to highlight the fact that teachers cannot all be described using the same broad generalities. As a group of learners, the teachers reflect the same variations that would be seen in any class of

students. They varied by sex, age, experience, marital status, learning ability, and specific situational skills. They were more similar in the approach they took to the classroom and their responsibilities as teachers. They were, as a group, tremendously talented and devoted to the accomplishment of the learning goals they set for their students. All this capacity had an impact on how they responded to the invitation to participate in a specific professional development activity.

Motivation to Participate

Two of the data sources in this action research project have been used to seek insight into the answer to this second question concerning the journeys of teacher professional growth. One indication of motives was found in the correspondence I had with some of the participants. A second source was in the answers to questions in the e-survey. All participants were asked four questions that pertained to their reasons for participating:

1. How did you become involved in the project?

2. Why did you get involved in the project?

3. What were your general expectations as to the project?

4. What did you hope to gain for yourself by being involved in the project?

The data gathered from these sources were clustered to yield three reasons: (a) external motives stemming from various communications to different groups of teachers with whom I came into contact; (b) teacher-centred motives focusing on some aspect of teacher growth; and (c) student-centred motives focusing on some aspect of student learning.

In the e-survey the participants frequently affirmed that student learning outcomes and their own teacher professional growth were actually one and the same. Typical was the response of Participant 17, who wrote: "the same reason I wanted my students to learn it." The "it" to which this participant referred sometimes meant technical skills and sometimes meant pedagogical skills. In GrassRoots these often were seen as one and the same. Generally speaking, the comments made in e-mail messages were in keeping with the responses to the e-survey questions. In addition, the incentive to think about GrassRoots as a learning tool in this way came from an external stimulus.

External Motives

Recruitment emerged as one reason for the participants to begin the GrassRoots journey. They were informed about GrassRoots in a number of different ways, including mass mailings, advertisements, both oral and written in a number of environments, and through personal contacts. These various communications were specifically mentioned as being responsible for the involvement of 8 of the 15 participants who responded to the e-survey.

Heard about it and knew I wanted to participate with several different classes. (Participant 7)

I responded to a mailing to the school. (Participant 8)

I saw the flyer and immediately volunteered. (Participant 21)

Two more of these 15 participants were recruited when they attended a workshop on Web page creation for their own general interest. Three were recruited by colleagues in their schools who wanted to partner with someone else in their project participation. "Through a fellow teacher who wanted help to do hers" is how Participant 14 put it in

the e-survey. The last two became involved because they were able to partially complete the requirements for an Additional Qualification course in Computers in the Classroom by creating a classroom Web site. Participant 26 wrote that "I approached a teacher already involved in GrassRoots in order to learn more for part of my Computer Specialist course work."

None of the participants in this action research mentioned any tangible extrinsic rewards for enlisting in GrassRoots. However, it must be pointed out that there were the token hardware prizes that classes collected for participating. These went to the classroom rather than the teacher. There were also software tools that participants in GrassRoots were provided with to facilitate their project work. Every elementary school where there was a teacher participating in GrassRoots received some additional technical support for the central office staff as was required to ensure that the technology was in place and working properly. Every secondary school received multiple licenses of software tools that students would use to create their Web sites. Not one participant, however, mentioned any of these in any of the data sources.

Teacher-Centred Motives

Personal intrinsic motivation was also evident in the on going discussions with several of the participants over the many weeks they were engaged in their project work. Unfortunately, none of this information was forthcoming in any way in any of the data collected. These participants confided in me that they were hoping to use the profile that GrassRoots promised to advance their careers in one way or another. The participants in this study were not all interested in administrative leadership positions. Five of them were interested in pedagogical leadership, or positions within the system that

empowered them to provide leadership to other teachers as curriculum resources and guides. "I gained a better understanding of the program and this added to the completion of my studies in Computers" only intimates the true intrinsic motivation of Participant 26. They believed that they were showing leadership and that that leadership ability would be noticed. However, indicative of a mix of intrinsic and extrinsic motivation was the response of Participant 24:

> I wanted to learn how to make esthetically pleasing Web sites. I wanted to feel more confident in the computer lab and to extend my computer skills so that I could participate at a deeper level with my students during class time. I also want to develop into a computer site manager. I want to continue to develop and see where it takes me.

Similarly, the comment by Participant 21, already cited above concerning learning the same things as his/her students, indicates this mix of motives.

Student-Centred Motives

For all of these participants, the common thread was their desire to learn more about technology as a tool in classroom instruction. This was reiterated and reinforced in the stated reasons for getting involved in the project revealed by the e-survey. Again, 8 participants, (not necessarily the same 8 identified above) used the word *technology* in their responses. Participant 22 said he "wanted to teach, and his students to learn, new technologies." Participant 3 said she wanted "to develop my own and my student's ICT skills and integrate them into their other learning." Participant 16 said she wanted to "promote new student learning around technology."

While this was one thread, another consensus shared by all 15 participants centred on communication of new learning by students in a novel and different way. "I wanted a refreshing new idea to motivate a group of challenging kids" is how Participant 8 put it. Four participants identified the importance of the enhancement of writing skills since the acquired subject-specific knowledge was to be on virtual public display for any friend or family member to see. Some of these participants realized that they were going to learn along with their students. "For me and them, to learn about technology and software we deal with every day," Participant 21 wrote. "Provide a new medium through which students could express and represent their ideas," Participant 1 wrote.

Mixed Motives

The comments made by the exemplars in this research project profile more clearly the way these three groups of motives were intertwined. The exemplars highlight the strong connection between hopes for personal growth and student learning at one and the same time and the effect of the advocacy of GrassRoots as a way to accomplish this integration. Such advocacy cannot be underestimated in terms of igniting a desire on the part of any individual teacher to embark on this particular kind of a learning journey. What follows is a closer look at only some of the exemplars in terms of this intermingling of motives.

Elizabeth (Participant 24) had been involved in a literacy initiative at her previous school where she began to work with one of the GrassRoots participants. After she moved schools, she decided to do her own project. "Then fate intervened and we ended up at opposite ends of the district," she wrote in the e-survey. Elizabeth volunteered early in the fall after attending a workshop. "I hoped to show students that if

they are willing to take risks with their learning not only would they acquire some skills but that the confidence gained would transfer to other areas of life." Aside from the hopes for her students, for herself, she wanted to acquire greater proficiency with technology. "Well it certainly wasn't because of my computer skills," she wrote in answer to why she was recruited. "This problem-based classroom learning opportunity fit very well into my style of teaching." As cited above, Elizabeth hoped this would enable her to show greater leadership in her school in the area of computer technology and literacy enhancement.

Brett (Participant 3) expressed an interest in GrassRoots "immediately upon receiving a flyer at the school." He was able to receive credit for his work on GrassRoots in a course he was taking for Additional Qualifications. "Originally, I wanted a new experience and a different opportunity for myself and my students to learn." He was motivated by the credit for the course, the desire to do good things with his students, and the hope that such work would secure his tenure at the school where he was currently employed. This information came out in the personal discussions held during our frequent informal meetings at class in the evening and at meetings he attended at my workplace. He noted more than once that his position at his school was tenuous because of declining enrolment and he wanted to present himself in the best possible light to his principal. He was therefore strongly motivated by the desire to be involved with something beyond the school that would enhance his professional and pedagogical skills. "I like the idea of being involved in things that are 'bigger' than the school. Working with other teachers can always lead to new ideas and different perspectives." Brett was one of the few teachers who gave voice to an instrumental motive.

Zachary (Participant 2) had been teaching Web page creation as part of a Computer Studies course at school. Web pages for GrassRoots represented a real-life connection for his curriculum needs. In the e-survey he wrote that "I firmly believe in student-centred, project-based curriculum." He saw the value of sharing teaching resources with his colleagues.

> What do you think about our collaborative Grassroots project being on PICs? I
> was thinking we would do this with our ICE4 classes. As a rough start,
> perhaps the students could start by finding and reviewing Web resources
> and writing tutorials. Later on, any projects they work on could be documented
> and added to the Web site as well. Let me know what you think.

He eventually recruited two other teachers to collaborate with him so that his students could learn the specifics of networking by collaborating with students in other schools whom they never actually got to see.

> A C-level registration requires collaboration with 2 *other* schools (besides
> your own). The registration made me back it off to a level B. I was thinking
> about getting someone else (William Shoemaker, perhaps) involved, but I'm just
> way too busy to drum up the support. If you talk to him and he's interested, I am
> still allowed to change my registration, but I have to do it before it gets reviewed.

He was goal oriented for both himself and his students. I had provided him with a trial version of a particular software tool designed to promote distance collaboration through the Internet. He was always interested in being at the forefront of new technologies but for the purposes of extending this knowledge to his classes. "Macromedia Contribute was a waste of money. It may be better in an environment with better computers and

more bandwidth." Zachary hoped to achieve his curriculum as well as some of his personal professional enhancement goals through GrassRoots. He wrote that "Computer literacy is greatly improved. It allows for networking amongst teachers and students, which is always a benefit." This last statement reflected his interest in the provincial network of Computer Studies teachers and his advocacy of closer links in support of curriculum development. I knew this because Zachary told me quite frequently about his involvement in the provincial organization and shared their electronic newsletter with me, in which he advocated exactly such sharing of resources.

Isaac (Participant 11) first learned about the GrassRoots opportunity at a Computer Studies subject council meeting. He had all the skills in place by virtue of his subject-specific knowledge in Computers and Mathematics (Teacher Demographic Information Form). He liked the idea of engaging his students in a novel way of sharing new learning. He also liked the idea of collaboration with another teacher in another school. He had already begun such collaboration and saw the Web site creation as an obvious advantage to his plans.

> Thanks for your interest in our GrassRoots project. I think it would be a really neat opportunity for your students, as well as those here at [my school] and the [other school] to work together in generating an Ecology site. Just to fill you in on what has gone on thus far, [my colleague] along with his Grade 10 Science class and my Grade 11 Chemistry class, will be putting together a site that incorporates the Ecology expectations at the Grade 10 level, along with laboratory and field test results on water and soil samples, carried out by my Grade 11 Chemistry students. At this point in time, I think maybe we should sit

down as a group, or maybe just brainstorm by e-mail, a few ideas as to how we
can put together the information from all three classes into a nice Web site. I
started a similar project with a previous Grade 10 Science class, and I have
posted the info on the Web, although the page needs to be cleaned up and
improved, as well, I think a few topics are missing some information. I've
included the link for that site below.

Isaac wanted to enrich the learning of his students and create a useful student-centred
resource that others could use. He was a young teacher interested in developing his own
skills but also interested in eventual career advancement. In private personal exchanges,
during the time of the collection of data for this action research, he was not creating new
Web pages with his students. When asked why not, he indicated that he was taking the
principal's certification course and had assumed additional responsibilities at his home
school.

As the stories of the participants who are the exemplars indicate, seldom was
there only one reason for participation. Often, the extrinsic stimuli were mixed with the
personal and the professional motivates and came together finding expression in
involvement in GrassRoots.

Facilitation of the Journeys

Having the tools and/or the ability to be successful on a journey of professional
growth as well as having the desire to embark on such a journey does not necessarily
mean that that journey will take place, or, if it does, that it will end well. The context
within which professional growth occurs can do much to either facilitate or detract from
the success of that journey. All of these participants were supported in their journeys by

various players in and out of their schools. The statements made by the participants in their e-mail communications, the responses made in their project reports in answer to questions concerning the role played by other teachers and their students in the completion of their projects, and the responses to several of questions in the e-survey were grouped according to the various types of individuals that were alluded to as having provided support. These included: (a) fellow teachers inside and outside of the home schools (colleagues), (b) their own students or students from other schools (students), (c) board technicians, and (d) the consultant. In addition, there were 7 participants who, in the e-survey, indicated that they were helped by no one.

Colleagues

Many of the participants relied upon the support and help of their colleagues, both within and outside their home schools. Seven of the 15 respondents to the e-survey indicated that they had received help from fellow teachers. The following extracts from various e-mail messages indicate the variety of ways in which participants helped one another or were helped by other colleagues.

> To tell you the truth, Judy [a student teacher] did a lot of the launching and set up of the site as she was incorporating it with Terry's as part of the Science/Tech curriculum for her teaching block. Terry and I helped input the information, but she was the individual with the know-how. (Participant 10)
>
> I have finished the report. I would like to have Tricia [the school principal] have a look at it before we send it off. We are planning to do this tomorrow after school. (Participant 1)

Sandra [another elementary teacher at a neighbouring school] and her class came over to Simon Street the week before last. We are walking over to Ventura tomorrow morning. (Participant 24)

Sorry I didn't get back to you yesterday. I wanted to talk to Jamal [an elementary teacher in a nearby school (Participant 12)] first and am still trying. We are not completely done as a class but have a few explorers finished. (Participant 13)

I also phoned Bill (a Business and Computer Studies teacher at a nearby secondary school who had agreed to act as a technical resource) and he and I have set out a tentative date for the week of December 8-12 to have the Grade 12 class that is learning Dreamweaver come over and share their knowledge with the intermediate classes. (Participant 8)

When questioned about the interest of their school colleagues in their GrassRoots project work, by far the majority of the participants, at a ratio of two to one, (10:5), found interest to one degree or another. Some of their responses to the e-survey questions dealing with the involvement of others on their staff were: "They were apprehensive when I first introduced the idea. Now that several sites have been created, they are interested in learning more about how the project works. Several are willing to try next year" (Participant 16). "They are amazed at my skills and those of my students" (Participant 14). However, while there was much interest generally in the GrassRoots project work, that interest was not matched by any desire, generally, to get involved or attempt a project. For example, Participant 26 wrote that "A few staff members are interested in collaborating in the future but their time is spread very thin at the present."

Six participants mentioned the amount of work as a deterrent to others becoming involved. Responses varied:

My colleagues were totally unaware (Participant 2)

My colleagues were excited by the nature of the collaboration but intimidated by the work (Participant 7)

My colleagues are very interested and want to get involved next year.

(Participant 22)

When asked whether these were typical responses, 10 participants suggested that this response to anything implying extra work was not unusual. Interestingly, though, when asked directly if they were going to try and recruit others to participate in another project some time in the future, 10 of the 15 participants suggested they were already actively recruiting collaborators.

The personal involvement of one staff person with another seems to be a motivator to participation. This observation was made in quite a few instances in different schools. Typical was what happened in one large K-8 school. Participant 22 began the first year with a single project that he enjoyed completing. The next year, he gathered 4 more teachers around him and helped them as they worked step by step through the project process. When asked about plans for future staff recruitment, his response was that he "already had several new teachers interested in participating on something in the future."

This can be compared to Participant 3 who was in a much smaller school. He completed two projects in two successive years. Each time he enlisted one other teacher to participate with him and collaborate on the finished project. He pointed out, however,

that his colleagues, in general, "were too busy to pay much notice to what I have been doing with my students." "Other teachers expressed a passing interest." If approached by a potential collaborator who is seen as being supportive of the risk-taking venture, then the likelihood of participation was increased. "I was recruited through a fellow teacher who needed help with hers" (Participant 1). This same approach proved successful when used to recruit specific teachers in specific schools. It must not be overlooked that every participant who began the process of GrassRoots with the plan to work with another staff member in that same school completed his or her project work successfully. The several participants whose data cannot be included in this study because they gave no permission also did not have any colleagues working along with them. Those who began GrassRoots completely alone had much more difficulty completing their journeys successfully.

Students

GrassRoots projects were always envisioned as involving a planned partnership between teacher and students. These particular participants fulfilled this part of the objectives of the program well. Ten of the participants indicated that they turned to the students as they worked towards the completion of their GrassRoots projects. In the e-survey, when asked to rate the involvement of their students in various phases of the project, more than 50% of the participants considered their students "Totally Involved" in 6 of the 10 phases. Students generally were not involved in the more obvious teacher-determined activities: choosing topics, evaluating the work of other students, deciding when to work on their projects, and designing the overall Web site. Students were either Involved or Totally Involved in things like choosing their partners, designing their own

Web pages, learning the tools used to create those Web pages, editing their work, creating all the hyperlinks, and deciding on the content of all their own pages. Half of those called upon students from other classrooms to help them and their students as well.

"Many of them have become contributors rather than passengers in technological education" was the way Participant 17 put it in the e-survey.

Participant 22 wrote that "Kids are the teachers as well as the learners."

Participant 2 said that "I was fortunate to have two very capable students who assumed the leadership roles in the class."

"In this case, I can see the younger students being helpful to the Grade 8 class, as the younger students have had more experience and exposure to the Four Block Model" (Participant 24).

Technicians

Seven of the 15 GrassRoots participants identified board personnel as having been supportive of their project work. In all fairness, these responses might have mixed technicians in with consultative staff, which would have included me. However, the following e-mail messages point to the role of the board technicians in helping them achieve their ends.

I have Front Page installed, but it's not working. I'm waiting for the technician to fix the problem. Then I'm ready to go. (Participant 9)

By the way, I will contact the help desk but this project is difficult to do when the computers are consistently freezing. I can re-image but it is happening to so many computers and we were recently re-imaged as a school. (Participant 21)

We had a problem with our burner and have a call in to the help desk to have someone come and have a look at it. (Participant 8)

However, since we are having such a problem with Front Page, I am not interested in doing anything this year. Once everything is working, I would love to continue the project or even start a new one. (Participant 7)

Consultant

It has already been acknowledged that individual participants and schools received hardware and software support in order to facilitate their project work. As consultant, I was able to ensure that this happened. Indeed, part of the terms of reference for involvement with GrassRoots as a board was that the board agreed to provide in-kind financial supports to the program. Part of this term was met by the purchase of software and part of it was through my time commitment. I will return to my role as consultant again in the next chapter in facilitating the journeys of these participants. However, I must include here the statements made in the data as one of their facilitators.

The following statements demonstrate how these participants saw my role as being in support of their work. In some cases, I needed to be the prime mover, the facilitator, or the acknowledger of work well done:

Thanks again for your help. It was the push I needed to get on with this thing! (Participant 8)

Thank you for all of your patience and assistance. We could not have come this far without you. (Participant 24)

Thanks so much for your advice. This will make our GrassRoots work much easier to work on when we can use all of the computers in our lab. (Participant 1)

I would like to have you come in soon. Should I call to arrange a time or when is the best time to reach you? I would like you to come when I have that class but I guess that isn't mandatory. (Participant 3)

In other cases, I was the chief technician or the person who could help mobilize the technical resources available to the participants from the central office.

I wish to access all of their work from one drive or folder. Please send instructions on how to facilitate. I have already spoken to our site manager who directed me to you. (Participant 24)

Anything that you can do to assist us with space, permission, and ability to save in and link our work to Claris would be appreciated. (Participant 1)

Sometimes, all I needed was to answer a question to help get the participants back on their journey alone:

I was already to install Dreamweaver and thought I would do the other at the same time but to no avail. Do you happen to know which executable file is the right one? (Participant 8)

I also had trouble with my QuickTime movies. I couldn't get them to run on the page. If you could look at it and try to get them to work I would really appreciate it. (Participant 14)

As these statements indicate, my role varied from participant to participant, school to school, and situation to situation. However, I was able to use my ability as a consultant to bring to bear whatever resources were necessary to help.

Solitary Work

When asked about their preferences for working alone or with others at their own professional growth, all of the participants indicated that they preferred to be left alone. This expressed opinion did not preclude a desire to seek help when such a need arose. Information regarding whether they asked for help and who gave them that help from was solicited as responses in the e-survey. Participant 17 wrote that "I don't need to know all the answers. Somebody out there knows how to fix, change, or do certain things. All I need to know is where to find the answers." This particular participant was accompanied in his desire to work alone by 4 other participants who also indicated they received help from no one at all while working on their projects. It is reasonable to assume that they did not automatically exclude me as consultant when they responded in that fashion, but it is also fair to say that at least 3 of these 5 participants needed little support from me.

The communications as part of the GrassRoots process afforded opportunities to help teachers in a variety of ways. This help was provided only on demand or on an as-needed basis. When specifically asked in the e-survey if participants felt that they had been left alone to work on their projects according to their own needs, they unanimously responded that they had. The intention was to enable teachers to grow professionally in whatever directions they found necessary. In order to illustrate how this dynamic supported growth and change, the comments made by the 8 participant exemplars in e-mail messages as well as their responses in the e-survey follow.

Elizabeth (Participant 24) became involved with GrassRoots at a previous school placement. At that former school, she worked with a colleague in the same school

involved in using Web pages to extend her literacy program. Her only involvement at that time, however, was in the writing activities the students posted to their Web pages. "GrassRoots gave us an opportunity to look at some of the Big Ideas in writing." Elizabeth was not involved in any way with the technological components. After moving to her present assignment, she volunteered to create her own project, knowing that her computer skills were weak. This time, she found support from a teacher at a nearby elementary school. In an e-mail message she wrote that "Sandra and her class came over to Simon Street the week before last. We are walking over to their school tomorrow morning. Our project is getting really close to the wire." Ultimately, time did run short and she decided to pick up from where she left off in another effort. In the e-survey, she wrote further that "I attended a couple of after-school computer workshops and pestered people at the central office as well." Meetings were held several times to complete the application process, and her knowledge of the pedagogy underpinning what she wanted to do was solid (GrassRoots Project Proposal -- field notes). There were numerous interchanges, some short, some much longer. In order to complete her work, she recruited her family to help, as well as her colleagues, the school technical support staff, and the students. In fact, Elizabeth was the only person to identify a member of her family and actually name him in the e-survey. "Mostly I decided that I would have no shame and just keep asking people to show me what I needed to know. Sometimes it was the students. That was the best." I spent several mornings in her classroom, sometimes alone and sometimes alongside her students. In addition, she told me, but did not include this in her e-survey response, that a colleague with considerable technical ability came

over several times to help her achieve her ultimate goal. Elizabeth's learning journey was long and steep, but her success was phenomenal.

Wesley (Participant 22) first began a year prior to the one under study. That first attempt was completed alone and without much support by his own choice. In the e-survey, his response was "No One" to the question in which participants identified any and all support received as they worked on their projects. "I learned the basics from group sessions with the consultant then self-taught the rest." Wesley decided that, for his second attempt, he wanted to include other teachers, not to learn from them but to offer his leadership to them. He'd attended one of the workshops and was excited about the possibility of involving other classes since he already had access to them as the computer skills teacher. He recruited four other teachers and led them through all the phases of the project. Wesley supported their learning needs in many ways. He needed little support on his own but every so often, he would send an e-mail message or telephone for help in solving a particular problem or meeting a particular need.

> We brainstormed about the design of the project and have already started. Great group of Grade 7s and lots of fun to work with!!! I am hoping to have these workshops at least twice a month. I know you are super busy but maybe you can attend one in the near future.

Sometimes I had to point out administrative details that Wesley needed to attend to. No matter what the request, he followed through to completion immediately. He needed no additional motivation. "Gives the students and I [sic] great sources of information and inspiration. School recognition."

Judith (Participant 1) was the computer site manager of her small school. Her first attempt at a GrassRoots project predated this research. Having enjoyed what she did so much then, she decided to advance her skills even more by enrolling in an Additional Qualification course and then decided to use GrassRoots as one of the required elements for completion. She partnered at her school with two other teachers. "Two teachers got involved this year as a result of seeing what was involved last year," one of whom was a fellow student in the class and another who was not. As a member of the class, Judith was able to get help from her colleagues in the class or from the instructor when she felt it necessary: "A wonderful and helpful teacher when I was taking Computers Part 2." Usually, she solved her problems on her own with little need of support or assistance. She, in turn, helped the participant who was not in the class, but also working on a project. Interestingly, in the e-survey, she identified no one from whom she solicited support. However, as the following e-mail indicates, that was not always the case:

> Thank you again for taking the time to come and visit with us today. I know how busy you are. I think that we all feel good about the direction we are taking and have a clearer picture of where we are headed. It is exciting to see staff and students working together and to be a part of this project.

Rebecca (Participant 3) attended a workshop convened in the late summer of 2003 in order to learn, for self-declared "personal" reasons, how to create a Web page. She merely stated then that she wanted to keep abreast of the things that her students were doing and felt badly that they could do Web pages and she could not. From there, she decided to participate in GrassRoots and attended a workshop early in the fall to acquire more of the basic skills she knew she would need. "I wanted to learn the

technology." At that workshop, Rebecca believed that it would be a struggle for her to get anything accomplished but she went on to far surpass her own modest expectations. I facilitated that initial learning as a consultant, but from that beginning point, Rebecca needed only minor interventions. She did enlist the support and help of students in her school several times. "I went to two of the workshops offered and I relied heavily on the students to teach me, and they did." Whenever she ran into a problem, one of them would help her over her rough spot. In the e-survey, Rebecca identified students and other teachers in her school as well as board personnel who helped her along on her journey.

These few exemplars reflect the variations in the supporting cast of players necessary for successful completion of the GrassRoots projects. Once begun, each of the participants in this study and, indeed, all the participants in GrassRoots needed their learning to be supported in different ways by different individuals, including their own students. In all cases, however, projects were completed and new learning occurred, for both students and their teachers.

Outcomes of the Journeys

In the e-survey, all participants were asked to rate, on a scale of 1 (strongly disagree) to 5 (strongly agree), their perceptions and feelings about 17 statements concerning a variety of different outcomes of their learning journeys in GrassRoots. The numerical value of the responses to each of these 17 statements from the 15 individuals who completed the e-survey was tallied in turn. These statements along with totals of the assigned values are offered in Appendix H. They provide an overview of the perceptions of these participants of their journeys in GrassRoots. In order to make sense of these raw

data, I categorized the statements and put them together with what the participants' responses were to various other questions on the e-survey, in the final project report and obliquely in e-mail communications. When that was done, the clusters of statements were organized according to the following outcomes: (a) achievement of student curriculum outcomes, (b) student technology skill development, (c) enhancement of student learning skills, (d) teacher pedagogical change, (e) teacher growth in technology skills, and (f) strengthening of Learning Community.

Achievement of Student Curriculum Outcomes

In the GrassRoots Project Report that each participant had to submit to bring closure to the process, one of the questions concerned the achievement of curriculum expectations. The report forced participants to reflect on whether or not these expectations were met successfully. Three (20%) referred to growth in literacy skills and the communication of new learning. Other participants reported that "there was nothing that was previously set out that was not met." "I believe that we did achieve all the expectations." "Obviously as indicated above these were all more than achieved." "All the expectations that were built into this project were more than achieved." "We seemed to cover all of the expectations that we set out to achieve. In reality we probably covered more than we proposed. This was an amazing project." Finally, "We are pleased to be able to say that we achieved more than we set out to in the completion of this project." Three participants reported expectations that were not achieved. In each of the three responses, the reason advanced was that "there just was not enough time to accomplish everything that had been set out to accomplish."

Student Technology Skill Development

Participants were asked to comment on the new learning of their students. In reply, the 8 referred to the acquisition of new technology skills. Several referred to software skills, others to the use of the Internet, still others to a general ability with technology. This is a typical comment made by Participant 21:

> My students faced the problem of new software, non traditional project format, and tight timelines with enthusiasm and energy. They finished with pride in the product, excitement from their new learning, and leadership skills as they shared their expertise with others.

All of the comments, in one way or another, pointed to the significant gains made by their students. For example, Participant 14 wrote that "students were amazed at what the end product looked like and how it worked. They were proud of their accomplishments." Although use of the actual Web pages created by students is not permissible I can affirm that anyone would be amazed at the finished products created by the students with whom these participants worked. They document the successful completion of each of the individual GrassRoots projects.

Participants were asked to comment on any problems students might have experienced as they worked through their projects. Nine participants indicated that there were no significant problems. "I can't think of any," is how Participant 16 put it. Four specifically referred to technology-related issues. For example, Participant 17 wrote that her only problem was "extra time when all doesn't link as expected or students don't finish on time." Several participants alluded to the fact that students felt the need to achieve at a higher level, and Participant 17 suggested that students found this

frustrating at times. "Adding a difficult technological component can only exacerbate such deficiencies and cause difficulties for some students." Participant noticed students were jealous when they were not able to use the technology as well as some of their classmates. Participant 14 wrote that "Some students were jealous of how good some students' pages looked compared to theirs."

Enhancement of Student Learning Skills

In the e-survey that participants completed as part of this research project, questions were again asked to determine whether participants believed GrassRoots involvement by their students led to growth in skills and knowledge. These questions, this time not curriculum focused, were posed in several different ways. Some were direct requests about student work, while others queried how well students worked to achieve the outcomes of the project.

In the responses, 5 (33%) commented on their students' enhanced ability to collaborate and work in groups successfully. Five (33%) mentioned the enhanced self-esteem and pride in their work on the part of the students they were working with. Eight (53%) alluded to active learning and the enhanced motivation of their students to succeed. Five (33%) made specific reference to the enhancement of content knowledge acquisition beyond what was expected by the classroom teacher involved. Four referred to problems related to the need for students to work in groups. Participant 17 wrote that "the fear of making mistakes and being an ineffective group participant is still an issue for many kids." Participant 18 concluded that "they knew that their projects were going to be published so they actually worked harder to have a more complete project."

Following are some of the varied responses made in either e-mail messages or the final project reports concerning student learning skill development:

Students felt empowered to take ownership of their projects. They were very proud of their work. (Participant 2)

My students learned how to organize their time and work with others. They learned the importance of compromise and patience. (Participant 3)

I was pleasantly surprised with the group work experiences that the students had and, unlike other classroom group projects, each student seemed to find his/her niche and participated fully. (Participant 16)

While students developed a great deal of respect for the medium, they also learned a lot about themselves. Students learned what strengths they were contributing to a group and how best to utilize those skills. (Participant 17)

Teacher Pedagogical Change

Being involved in GrassRoots required a great deal of new learning on the part of the majority of the participants. Like all students in any classroom, participants varied in their specific learning needs with reference to this particular context. They each brought their own unique prior knowledge and perspective to the task at hand. Skills that they all needed to develop to a greater or lesser extent included:

- how to specifically create Web pages using the technological tools available to them,

- how to integrate the subjects being taught and properly assess for each subject separately,

- how to teach towards a culminating performance task,

- how to manage the students working independently on problem-based, open-ended learning tasks, and

- how to facilitate successfully constructivist knowledge creation.

Each of these required some professional growth on its own. Bundling them together into one project could have proven a difficult task for some, but open-ended tasks focusing on a big question are well-suited to promote growth in skills and new knowledge creation. The participants in these projects did what they had to do and were pleased to be involved. The results with their students were overwhelmingly positive. What follows is a brief listing, in their own words, of some of the responses when asked about their own learning:

That I don't have to have all the answers. Somebody out there knows how to fix, change or do certain things. All I have to know is where to find the answers. (Participant 17)

I learned that I am good at doing these kinds of projects. (Participant 14)

Perhaps that I have to be less of a control freak and let the kids complete something that THEY think looks good, although I do not share their opinion in this. (Participant 8)

Teaching what I believe to be exciting makes me a better teacher. (Participant 21)

GrassRoots projects, despite the heavy involvement of technology, included constructivist knowledge creation, in the form of problem-based learning. When the participants were asked specifically if they would use problem-based learning in their classrooms in the future, all but 2 of the 15 participants said yes. The 2 dissenting

participants had poorer results with their individual classes than the rest of the participants. Participant 26 noted that open-ended learning was probably beyond the abilities of his learning disabled students, and the other believed that his students were too young. The rest saw the profound benefits for students' motivation, attitude, and skill development.

These same participants were also asked about their overall attitude towards problem-based learning. Seven (47%) referred to enhanced learning by students. Seven (47%) referred to improved collaboration and teamwork. Participant 8 raised the issue of assessment and how to correctly assess and report progress on specific expectations using an open-ended task.

Participants were asked if they were satisfied by their participation in GrassRoots, and 13 of 15 participants said that they were either somewhat satisfied or very satisfied. Only 2 participants were not at all satisfied. Participant 14 had attempted a project too difficult for his primary students and realized that it made his project much more difficult and time-consuming to complete. "My students were only in Grade 3 and had never done anything remotely like this so we worked together as a class." Participant 17 gave his students a great deal of independence and became frustrated by the time necessary to bring the project to conclusion.

> There is a danger of students getting lost in the chaos. I think that the students who have the self-motivation and discipline to work independently love this type of learning. However, it is too easy for less motivated students to look busy.

Participants were also asked if there were any costs to them as teachers and as professionals. Participant 20 suggested that he did not enjoy having to fill out so many

forms and found that aspect of participation to be tedious. "I don't like to fill in forms. Just let me do my work." This alludes to the immediacy of the classroom and the demands on a teacher's time. Participant 8 identified specific areas of her regular program that she was not able to cover with students. She wrote,

> Because the project took a considerable amount of time, more than I had bargained for, I feel that some of the other skills that I normally address at the Grade 8 level in computers were taught quickly and perhaps not as thoroughly as I normally would teach them.

Only one participant suggested that there was an excessive time demand. The rest of the participants either left that question completely blank or used the word "no" or "none" as their responses. Responding in the manner noted above by these participants tells much about how positively they viewed their journeys with GrassRoots. However, it also reinforces the limitations many teachers have on their time to get themselves so involved. As Participant 17 wrote concerning the interest of his fellow staff mates in getting involved, "No, they see how much class time it took and could not see the value."

The responses to two further open-ended questions reflect two aspects of teacher learning and how it brings about change. What specific new learning can teachers identify as having been acquired? How might participation in GrassRoots effect change in classroom teaching practices? All but 2 of the participants referred to the integration of technology and/or problem-based learning and/or the use of Web pages as culminating performance tasks in their answers to both questions.

Teacher Growth in Technology Skills

Since one of the aspirations for the participants was that they enhance their skill level with technology overall, the responses by the participants using the ISTE rating scale (see Appendix C) were seen as being key indicators of success. Of the 26 possible responses, 19 forms were returned. A perfect score on that scale is 305. The mean score registered was 203 and the median score 223. Only 3 participants scored below 180, 9 scored themselves between 180 and 240, and 7 scored themselves above 240. Using the categories from the scale (Entry to Invention), 84% of the participants perceived their own abilities to be at the appropriation or invention stages of technology usage. This indicates a strong connection between their participation in GrassRoots and their development as users of technology. This finding is strengthened by the fact that 7 participants (47%) indicated a lack of technological ability prior to their participation.

When asked whether they were more confident with technology following their involvement in GrassRoots, 13 of the 15 participants (87%) said they were more confident. All 15 said they were more likely to use technology in their classroom programming in the future. These results would add validity to the results of the ISTE survey by triangulating these scores with the comments made in face-to-face conversations as well as with the responses to the appropriate questions in the electronic survey.

Strengthening a Learning Community

Work on GrassRoots frequently had an impact on more than just one classroom and its teacher. Schedules for access to resources would sometimes be changed, students would share activities they were involved with, teachers would comment on the work

their students were engaged in, and/or questions would be asked around the staffroom table. As a result two questions in the e-survey attempted to find out specifically what the reaction was on the part of the staff to GrassRoots activity and whether or not interest was sufficient to want to enlist. Tabulating the results, all but two of the responses to the first question were either very positive or somewhat positive. Some of these responses included:

> Very interested and impressed with the students' results. (Participant 1)
>
> Positive. (Participant 20)
>
> A majority of the staff were interested in the project and its development.
>
> (Participant 26)

While there were these unconditionally positive responses, there were also those that suggested hesitancy on the part of the staff.

> Some interest but most feel there is too much initial work. (Participant 7)
>
> Some seemed intimidated by the technological know-how required to complete
>
> the work. (Participant 18)
>
> Initially, I think, they were skeptical because it might interrupt their established
>
> routines, and it did to some extent. When they saw the end result they were very
>
> impressed. (Participant 24)
>
> Other teachers expressed a passing interest. Visibility of technology in use is
>
> always beneficial to our school and may help others to use technology in the
>
> future. (Participant 3)

This last response was prescient of the responses of many of the participants to the question concerning staff recruitment in the future. Nine of the responses indicated

enough interest in the project to lead to possible enlistment and participation the following year.

The general comments identified above are in keeping with those made by the all of the individual exemplars. They all defined their journey with GrassRoots to be either somewhat satisfying or very satisfying. Only 1 of the 8 (Participant 4) suggested that there were any problems to overcome and that one identified a problem with the dependence upon a group environment. Rebecca (Participant 4) wrote in the e-survey that her students "were frustrated when certain group members were not always reliable (attendance, completion of work on time.)" That being said, she wrote that "I have several students who were uncomfortable with computer usage, especially Web page design, who now feel competent enough to use the skill in other classes. Rebecca also wrote that "I now get to use my particular project as an example/exemplar for my other students. I think actually seeing a project online is motivating for students." In the project report, she commented that:

My students learned how to organize their time and work with others. They learned the importance of compromise and patience. I believe that we did achieve all of the expectation, but I feel that we could have fulfilled them more completely if we had had more time. The students often commented on needing to have more time to improve and build on their projects.

Elizabeth (Participant 24) wrote in the project report that "the impact of this project on students' learning was highly motivational. The pride of ownership and the publication of student work on Web sites in cyberspace was the driving force that empowered students to realize their own potential." In the e-survey she wrote that:

> The students' learning involved a star strategy 'thinking like an author' and the Six Traits of Good Writing [pedagogical background to literacy development]. They were highly motivated to not only create clear pieces of writing but to present their work in an authentic way using Web sites as their vehicle to higher learning.

Elizabeth's focus was clearly on the expectations of enhanced literacy and the concept of the technology as the tool to communicate that development. This is a primary example of the goals of GrassRoots at their most elemental. She wrote that she experienced no problems in accomplishing her goals. However, in commenting on her authentic experiences in professional development, Elizabeth wrote that "I was very persistent in asking questions" and "I asked people who knew more than me." As a benefit to her students, she wrote that "my students realized that not only did they learn about how to write and create Web sites, but they gained a confidence about themselves as learners." For herself, Elizabeth concludes: "Thank you for all of your patience and assistance. We could not have come this far without you. What a wonderful learning process."

Elizabeth was most effusive about the accomplishments of her class and her own new learning. She suggested that she had learned how to teach and assess in an authentic way. She felt that there was no better way to prepare her students for their future. She felt that GrassRoots had helped her to gain a great deal of confidence in teaching to the individuality of students. Elizabeth's point of reference always was how what she learned would affect her work with her students and their successes. She wrote:

> I enjoyed learning from the students. I have always empowered my students and it was a pleasure to work side-by-side gleaning bits and pieces of information

and sharing it so that we could all move forward together……….I wouldn't have missed it for the world.

Wesley (Participant 22), in commenting specifically about problem-based learning, suggested that he had a better appreciation for his own work ethic. He knew that "no matter what the time frame, I can get the job done." He enjoyed the problem-based nature of the learning of his students because it leveled the playing field and "students with more experience helped those who had weaker skills." He felt that that particular end justified all the hard work. He was glad of the opportunity to enhance his knowledge of software and other uses of technology in his classroom programming. "It gives the students and me great sources of information and inspiration, and the school recognition." He concluded by suggesting that he hoped to be able to use the concept of GrassRoots in other areas of his program as culminating performance tasks because "the students and I now think of using other GrassRoots projects when finding information for class projects."

Neither Sarah (Participant 5) nor Isaac (Participant 11) completed e-surveys, so there is no real data evidence to support any conclusions about student learning save the Web sites their students created. Sarah noted in face-to-face conversations as well as confirmed in e-mail messages that she enjoyed her participation in GrassRoots completely. She had already planned to do another project complementing the one she had completed prior to the time framed by the research. "Once everything is working, I would love to continue the project or even start a new one." Health and personal issues prevented her from doing so. However, her next project would have required far less support as she had become much more independent in the GrassRoots process. Isaac

adapted to the style of learning and teaching required of GrassRoots easily and quickly. His plan had been to use the same process with at least one of his classes each semester. However, problems with administration in his school thrust him into a greater involvement in school tasks which, of necessity, limited what he could do with his students with GrassRoots, despite his good intentions.

The review of both the full group of participants and the specific participant exemplars tells a story of considerable success with GrassRoots. Every participant indicated professional learning and growth in several areas of his/her teaching practice. While this in itself is a significant finding, it is not possible to ascertain at present whether meaningful observable change had occurred. In order to be able to discover whether these participants have made real changes to their pedagogy and practice, another study would have to be undertaken with these same participants. Such longitudinal research would necessitate tracking teachers over an extended period of time.

Next Learning Steps

The final question posed by this research concerned the impact GrassRoots participation had in effecting change in teacher practice. While it remains to be seen if there were any lasting changes these participants might make to their classroom teaching practices, their answers to questions in the e-survey, comments made in e-mail messages, and the statements in their final project reports give some indication of future intentions. Data clustered around two possible responses for the future: (a) plans to repeat the process which could contribute to future growth, and (b) plans not to repeat the experience of GrassRoots at all. While not all responses were strongly positive, any

suggestion of moving forward along the same path of growth for either participant or his/her students would have to be seen as being an indication of the possibility of future growth.

In the Project Report, two questions specifically provide insight into what the GrassRoots participants saw as their next steps. GrassRoots required that participants speak to the ways in which their Web sites would be used in the future from an advocacy point of view and also to tell how they might do their projects differently in the future. In the e-survey, participants were asked to indicate whether or not they would continue with GrassRoots another time, whether they would use problem-based learning in their classrooms again, why they made that choice, whether they would attempt to involve more teachers in their home schools next time, how GrassRoots had or had not changed their teaching practices.

Plans to Repeat the Process

The e-survey response to the question concerning future plans for Problem-Based Learning was, save for two participants, a resounding "yes" (13 to 2). When asked to explain their choice, some of the statements that were offered included:

the end justifies the means (Participant 22)

students learn more than the basics (Participant 1)

this is the way people work (Participant 20)

class works as a whole towards a common goal (Participant 4)

teachers and students learn together (Participant 21)

each student learns something (Participant 18)

These positive statements with their focus on student learning were supported by the following e-mail messages:

> I'm also very pleased with the product and progress from my students. I am already thinking about next year's site! (Participant 16)

> The student/teacher GrassRoots spirit is enthusiastic to move to the next step. Anything that you can do to assist us with space, permission, and ability to save in and link our work would be appreciated. (Participant 24)

> Sorry, I won't be able to attend Tuesday's GrassRoots meeting. I would still like to be part of the program, and plan to update and get last year's Grade 10 microprocessor projects posted. (Participant 2)

One of the identified courses of action for the future was the advocacy of successful student learning. Seven of the participants, for whom only Project Report data are available, refer to the visits by their parent and student communities to their newly created Web sites. "A newsletter will be sent home to the school and our class to advertise their work shown on the Internet." Not all Web sites stemmed from work in the Language Arts, but those participants who worked on expectations from that curriculum referred to links between their students' Web sites and this particular school board's Literacy initiative. "The Web site will be part of the Literacy portal, featured as such in staff development around the Literacy initiative." All the reports refer to the board-wide celebration that was part of the GrassRoots experience for all participants at a public meeting of the Board of Education.

In answer to the question about the impact of GrassRoots participation on student learning, participants suggested that the next time they work on GrassRoots projects they

will either devote more time to it, especially in the lead-up to the actual work of GrassRoots preparing their students for group work better, or spend more time in advance teaching the computer skills so that they become secondary to the main focus, which was the curricular expectations.

> Next time I would like to be able to spend more time making the students more aware of HTML. I think they need to understand how things work and not just assume that it will. (Participant 13)

> I would have changed the project to have more time allotted for more expert interaction with the kids. (Participant 10)

> I would choose another area of study so as to contrast the approach and learning skills required. (Participant 6)

> When I do the next one next year, I will hopefully have the students do one project in a group and then have them complete one individually. (Participant 8)

This last participant was the only 1 of 6 who referred to a definite plan for next year. All the rest intimated without explicitly saying that they were expecting to repeat the GrassRoots experience next year. Typical of this elusiveness are these statements made by this same participant in two separate communications:

> It has been enjoyable but I know now that I would do a TON of things differently next time.

> Thanks for helping me out with getting our site live. It looks pretty good. There are definitely some changes I would make for next year, though!!

When asked if they would recruit other staff members to participate in GrassRoots with them next year, many indicated that, at the time of the project report

being filed and/or the completion of the e-survey, they had already begun this process. Participant 8 responded that the "next year, I am hoping to partner with the Geography teacher to create a Web site," as opposed to the Science teacher with whom she had partnered during the period of time covered by the action research. Participant 16 had partnered with another colleague in her school (Participant 6) and that same partner was already talking about what project they would do the next year. In fact, "we have offered several ideas to other staff members at staff meetings as to what kinds of projects their students can do." These 2 participants saw GrassRoots as a vehicle for computer integration, with an emphasis on the technology, and also made the connection between GrassRoots and constructivist knowledge creation. One (Participant 16) commented that "I intend on making a GrassRoots project a culminating task each year in a discipline that I teach. It is a different and very motivating way for the students to present their newly acquired knowledge." To continue their similar lines of thinking, they both indicated, as to the changes in their teaching practice, a much better appreciation for the connection between their classroom work and the computer lab: "Allowed me to make better connections between what I do in the classroom and what I can do with the students in the computer lab." Participant 2 wrote in an e-mail that "if there's another project you'd like me involved in (that fits in with Grade 11 or 12 Computer Engineering), let me know." Indicative of the sentiments of the majority of participants are these two comments made in e-mail messages: "I am already thinking about next year's site!" (Participant 16) and "Onward to the next project." (Participant 22)

No Future Plans

Two participants (26 and 14) responded NO to the question about using Problem-Based Learning again in their classrooms. Both of these individual teachers experienced difficulties with time and its relationship to the capacity to undertake a learning journey. These two teachers found themselves with classes that were not, in their opinion, up to the challenge of a GrassRoots project. Participant 26 sent me an e-mail in which he wrote,

> I would have liked to participate in GrassRoots again this year but I don't believe this group of students is ready for that kind of challenge. I'm trying to complete some small projects with them and work on research skills and proper Web surfing.

The other participant (14) wrote in the e-survey that "my students are not old enough to think for themselves or well-behaved enough to learn for themselves." Participant 17 indicated a desire to repeat the GrassRoots process but indicated that he would not recruit anyone else to work along with him because, as he wrote in the e-survey, "the rest of the staff saw how much work it was and couldn't justify the time spent."

The exemplar subjects all reflect the same positions outlined above and there is nothing additional to be gained by looking in detail at what each of them saw as their future plans. Many of their comments have been included in the results reported above. However, some special additional comments indicative of their responses are:

> Often I am in a position to speak publicly to hundreds of other teachers. I will certainly be sharing our GrassRoots experience. This is in conjunction with my

role as a lead teacher in my board's literacy initiative. (Elizabeth – Participant 24)

The students and I now think of using other GrassRoots projects when finding information for class projects. (Wesley – Participant 22)

This is the way it should be; GrassRoots tends to follow an existing mentality of mine. (Brett – Participant 3)

We do have a Grade 12 Media course at our school. I am teaching semester 2 and I have another media class. In a couple of weeks, we will be starting a new unit where my students will be doing basically the same kind of research, but this time they will have the semester 1 Web site to draw their knowledge from. (Rebecca – Participant 4)

However, since we are having such a problem with Front Page, I am not interested in doing anything this year. Once everything is working, I would love to continue the project or even start a new one. (Sarah – Participant 5)

I spoke to the Head of Science about the work we are doing and he is very interested in being a part of the GrassRoots program. When we have time we are going to chat a little more about it but I will pass him on to you for more details. (Isaac – Participant 11)

From Data Presentation to Grounded Theory

I began collecting the data for this action research project at the end of a multi-year process of initiating the involvement in GrassRoots of teachers with whom I worked in various areas of responsibility. These responsibilities included the coordination of many other professional development activities attended by large

numbers of teachers in my school board, the convening on behalf of my employer of meetings of individuals supporting the use of computers in the schools, involvement in various Curriculum Department initiatives that provided me with entry to mix and meet many new colleagues, and the teaching additional qualifications courses at night for in-service teachers over several years' time. These responsibilities provided me with many opportunities to consider the processes of professional development, what seemed to work and not to work, and why some opportunities were more successful over all than others. These impressions were constantly at the back of my mind as I collected and analyzed the data during the research. The theory building, which was the outcome of the data analysis process was similarly affected by this personal history.

Some of the teachers engaged in GrassRoots projects I had previously worked with successfully over several years; some I knew only in passing. Specifically, of the 26 participants in this research, fully 16 of them I had already established an ongoing professional relationship with. The greatest majority of teachers who became involved in project work did so then as a result of my own personal efforts at recruitment. I used a variety of communication avenues to reach these teachers and not all of those who I reached participated with me in GrassRoots. The impact of my efforts at recruitment is validated by the repetition in the data that it was through these efforts that they came to be involved. This finding became the cornerstone of the belief that not just good teaching *pedagogy* lay at the root of transformational professional development but, as well, it was imperative that there be the *infrastructure* necessary to continuously invite teachers to participate in this process and display their successes to others.

Infrastructure

One of the findings of the research is the importance of the role of the educator as facilitator in the learning of those engaged in professional growth. This points to the distinction between that of the organizational facilitator and the pedagogical facilitator. These two are not at all the same thing. All the participants were aware that they were going to be provided with opportunities to learn new things and apply them as they went along. This was an organizational aspect of the program. They knew, in advance, that there would be someone to support their work and guide their learning. This was the pedagogical element in the process. Many of their stories refer to the positive role of the facilitator.

The data also point to the desirability of an infrastructure of support, guidance, and help. The people to whom the participants looked included colleagues in their home school and elsewhere, technicians, other family members, and the students themselves in the GrassRoots classrooms. Participant 24, for example, commented in the e-survey:

Well, I was persistent in asking questions. I asked people who knew more than me. Mostly I decided that I would have no shame and just keep asking people to show me what I needed to know.

In several instances such student help came from other schools nearby and frequently these were secondary students helping their elementary friends. The exact combination of the influences and support provided by these players acting behind the scenes differed from participant to participant, but invariably, the benefit of their support was acknowledged by the majority of the GrassRoots participants. In each case, the balance between organizational needs as facilitator, and pedagogical needs as educator, was

different, highlighting the dual roles of pedagogy and infrastructure in the professional development process. For example, a typical e-mail from Participant 5, who relied entirely on my role as educator to help her achieve her goals, follows:

> My group will be finished by May 27th. Would you like to go over the new material with me? How would you like to receive the updated material? Please advise.

Participants 20, 2, and 14 indicated in their e-survey responses that they required no support. These responses represented two opposing ends of the scale.

A third element of infrastructure emerging from the responses of the participants was the connection between personal and professional goals for themselves and their students and their engagement with GrassRoots. Participants indicated that they were interested in learning new skills, in providing their students with new and different learning opportunities, or in using GrassRoots as a vehicle to enhance student and teacher technology skills. There was then a convergence between the seeking out of new learning by the participants and the opportunity placed before them of a vehicle to accommodate that search. It is difficult to impute a causal relationship between these two events. It is sufficient to say they were closely linked. For example, Participant 3 wrote that

> GrassRoots tends to follow an existing mentality of mine. It gave me an opportunity to give the students a task and take on a stronger role as facilitator. We as teachers need to find opportunities to learn with students and to be a guide.

Similarly, Participant 22 wrote that "GrassRoots gave the students and me great sources of inspiration." Participant 8 concluded,

> Now that I have experienced it firsthand, I feel that I should go back to it and hone my skills and those of my students and challenge myself and my students to create an even better project.

These were the stimuli that engaged the participants in GrassRoots and that initiated them in taking up the journey of the learner. The teachers engaged in GrassRoots projects willingly and eagerly volunteered to participate in a process that would provide them with an opportunity to develop professionally.

GrassRoots teachers came to participate most frequently because, as consultant, I had advocated for GrassRoots as a pedagogical and technological tool to enhance classroom teaching practice. Participant 21 wrote, "I saw the flyer and immediately volunteered." Participant 17 wrote that "I read about it in the Tech newsletter and was interested in learning more." Participant 16 wrote that she was recruited "Through Howard Slepkov who told me about it while teaching me the course at university." These responses indicates how important personal invitations are to professional development opportunities. So often, such invitations are impersonal and institutional in nature, while the research results indicated that personal and professional invitations were important for attracting participants.

The data revealed that the element of time, loosely defined, was crucial to even considering the start of their journeys. The participants had to find themselves with the right group of students, the right subject(s) to teach, and the right access to the technology they would need. Participant 4 would not have been able to accomplish what

she wanted to had this not been the case, as indicated by her comments about not being able to collaborate with her husband in the second semester. She wrote that "currently I am teaching semester 2 and I have another Media class." Participant 26 wrote that "I hoped to create a bond with the regular education students at my school. I often don't get the opportunity to interact with them for curriculum projects." What sets this group of participants apart is that it did not matter to them that they would need to put in extra time. Participant 22 worked tirelessly on accomplishing the goals he set out to achieve with his students regardless of the other time demands he had placed upon himself. "Sorry for the late reply...I told myself not to touch my e-mail over the Easter Break. The Break was hectic...family functions and all." So too did Participant 5, who wrote:

> I have been off sick for several weeks and haven't been keeping up to date on the Grassroots material. However, my group will be continuing the second phase of our Web page using the suggestions that you gave us.

A highly developed work ethic and much enthusiasm for the opportunity to participate in something new or to learn new skills counter-balanced the many extra hours needed to accomplish their identified goals. Once again, this result points to the need to attend to the infrastructure underlying professional development opportunities as well to the pedagogy driving its methodology.

Pedagogy

From the perspective of sound pedagogy, I chose to wait for the student to approach me for some assistance, rather than my setting the directions for them. The fact that the GrassRoots task was open-ended enabled the learners to go off in the directions that were meaningful for them, rather than one set by me as the educator. In the case of

GrassRoots, this pedagogy went together with the infrastructure underlying the overall program.

Not all of participants had all of the skills one would assume would be necessary to complete projects such as were expected with GrassRoots. Some were more versed in the pedagogy as evidenced during the proposal phase of the project and made note of in the field notes taken at that time.

Knows his stuff and has no problem with the pedagogy or the technology. (Participant 22)

Is a strong teacher and is great at this sort of thing. (Participant 3)

She has thought through this thoroughly and has a strong pedagogical basis for her thinking and procedures. (Participant 24)

This is what led these participants to Web pages as culminating performance tasks. They also alluded to this in their e-survey responses:

As an educator, I have long known that I must teach to the needs of individual students. This problem-based classroom learning activity fit very well into my style of teaching. (Participant 24)

Many students who have trouble with paper and pen assignments find GrassRoots liberates them. In return they are able to gain self-esteem and show their true potential to their peers, teachers, and parents. (Participant 22)

GrassRoots tends to follow an existing mentality of mine. (Participant 3)

Some were more adept with technology, or enamored with the technology, and wanted to learn how to apply it to the pedagogy. They acknowledged generally a lack of the

highly specific skill-based knowledge of how to create the Web pages that would display their students' new learning.

> Learned the basics from Howard Slepkov then self-taught the rest. (Participant 22)
>
> Before becoming interested in the GrassRoots program I knew very little about creating Web pages. (Participant 1)
>
> I wanted to sharpen my skills in Web site design. (Participant 8)

They only needed help in conjunction with these specific technological skills. However, they, like the others, possessed a strong pedagogical background for why they should integrate learning and a heightened desire to make this approach work, using technology as a tool to communicate new learning by their students.

The research results point to the significance of applying the knowledge of cognition and learning to the delivery of professional development. One aspect of this is to know, as an educator, when to interact with a learner and when to leave the learner to work through his or her own learning challenges. This reinforces the connection I have found in my data between the pedagogy and the infrastructure underlying successful professional development.

There was wide variance in the individual comfort level with computer technology, and a declared willingness to learn more skills was among the most important capacities the participants brought to their project work. If a teacher was relatively illiterate about the required computer skills, that teacher welcomed the opportunity to enhance his or her expertise. If they were already skilled, they welcomed the opportunity to help their students acquire the same sets of skills. If they were more

skilled or less skilled than a colleague in the same school, they were more than willing to collaborate. The link between computer efficacy and skill set were key components as they agreed to participate and face the challenge of a project and the professional learning to come. The data repeatedly affirm that GrassRoots provided teachers and their students with the opportunity necessary to aim for mastery rather than merely performance in the acquisition of technology skills.

Summary

My research began with a desire to learn more about the journeys of professional growth of a group of educators as they worked through the various stages of an authentic, classroom-based project. It was focused on securing the answers to five questions. However, in analyzing the responses to those five questions, the research moved beyond the particular aspects of a specific group of teachers involved in a single professional development program to a more general understanding of how professional development can become truly transformative. While the data indicate journeys that were well begun and well ended by a group of hard-working and dedicated professionals, they also point to the need to see professional development as the result of the convergence of pedagogical and organizational elements. The next and final chapter will advance a model to address this convergence in the data, relate the findings of this research to the literature from which it was derived, and come to some conclusions about where these findings might lead.

CHAPTER SIX: DISCUSSION AND CONCLUSIONS

Current professional development literature moves research away from the teacher as passive recipient of training to the teacher as active learner engaged in tasks that are meaningful to him or her (Ball & Cohen, 1999; Guskey, 2000; Guskey & Huberman, 1995). This shift is informed by findings in cognitive science that reinforces the need to focus on the teacher as learner (Zemelman, Daniels, & Hyde, 1998). The literature goes on to suggest that such teacher learning directed to meaningful professional growth should be followed by sustained change (Jacobson & Battaglia, 2001). Other research has suggested that, despite substantial amounts of money being directed towards various professional development initiatives, classroom teaching practices do not reflect any meaningful change (Darling-Hammond, 1997). Herein lies the problem confronting the teaching profession. Finding new ways to better encourage professional growth is therefore very much on the research agenda for many educational practitioners (Adey, 2004). This dissertation is situated within this search.

In the spring of 2002, as a consultant with a mid-sized school board in southern Ontario, I began working with teachers on a special project called GrassRoots. Facilitated by SchoolNet Canada, GrassRoots was designed to encourage teachers to have their students create and then publish pages to the Web on curriculum-based themes (Dibbon, 2002; Kitagawa, 2001). Web pages created by students, linked together thematically into Web sites and published to the Internet, become learning resources for other students. Their creation, however, often entails a great deal of professional development for the participating teacher who must learn the skills required to complete this task so that they stay ahead of their students and can accomplish their classroom

objectives. The need to facilitate new teacher learning in a classroom environment or authentic professional development (Harris & Grandgenett, 2002) led me to reconsider teacher growth leading to sustained school change. I began to see these teachers' experiences as a hero's quest (Brown & Moffett, 1999) or a learning journey. As a researcher, however, I needed to transform the metaphor of the hero's journey into a methodology that would allow for new learning to be constructed concerning teacher professional growth.

This research, as a result, began with two broad questions:

1. What can be learned about the process of professional development from teachers themselves as learners actively engaged in that process?

2. How can practitioners in the field use this information to better facilitate professional development for all teachers?

Question 1 was broken down into five empirical questions that were meant to identify and profile elements of the journeys teachers undergo when engaged in professional development. These were:

1. What capacities or abilities do learners/teachers bring along with them on their journey?

2. Why do teachers embark on a path of significant professional growth? Why do they take up the learner's challenge?

3. What conditions are in place that facilitate or detract from their journeys?

4. What do teachers see as the outcomes of these journeys for themselves and for their students?

5. What do these teachers see as their next steps?

I believed that by seeking answers to these questions from a specific group of GrassRoots participants, some general principles might be established that could help guide the form and process of professional development opportunities. The answers to the five empirical questions provide an answer to the first general question. This chapter will discuss what my research has revealed concerning possible answers to these five questions and then return to the implication of the findings as a possible answer to the second question.

Twenty-six GrassRoots participants agreed to be part of this study that followed them as they worked through all of the phases of the project. The results support the argument that teachers should be seen as learners. The variables of motivation, ability, context, and self-satisfaction with the process of learning are just as important to teachers in matters of professional growth as they are to the students these same teachers attempt to reach and teach in their classrooms. Such learning should be supported in the same way educators work to support learning in any classroom. The following discussion of the results explores the connection between teacher cognition and learning and current professional development practice.

Discussion

Guskey and Huberman (1995) made the case that teachers ought to be learning all the time, in and out of the classroom. This strongly suggests that professional development must be seen as a career-long process and that opportunities must be provided to enable teachers to continue to learn (Ball & Cohen, 1999; Sykes, 1999). This belief has led educational jurisdictions at every level of governance to invest significant resources in professional development opportunities for classroom teachers that

frequently require time away from their students. It has been hypothesized, however, that the reason why such professional development was not always successful in the past was that the process followed was not meeting the needs of teachers (Darling-Hammond, 1997). Teachers were seldom reticent about signing up for valuable workshop to enhance their teaching practice. Often these events would be after a long day in the classroom and teachers had voluntarily signed up to participate. This assumed that the ability to participate in such after-school events could be accommodated by their classroom and personal schedules. When no observable change resulted from the actual participation in such professional development opportunities, it was assumed by those who facilitated the event that the exercise was unsuccessful. Nelson and Hammerman (1996), in explanation for this observation, in contrast saw the classroom proper as the place where teachers ought to be constantly reinventing themselves and their ideas about teaching. GrassRoots created such an opportunity for authentic professional development and reinvention.

Atkinson and Claxton (2000) reinforce the theory that new knowledge of teaching is derived through reflection on practice in an authentic learning environment. The requirements of GrassRoots project participation afforded this requisite opportunity to reflect upon classroom teaching practices. Participants were expected to reflect on the nature of learning that occurred and then submit reports. As a result of this reflection, pedagogical change was more likely and participants repeatedly confirmed that this had, in fact, happened. Calderhead (1987) suggested that by providing opportunities to experiment with teaching and learning styles in the classroom and then encouraging

reflection on practice, one encourages growth. The participants' feedback, in this study, supported the validity of that reasoning.

What occurred from the participants' points of view was authentic professional development. The teachers were engaged in their own construct of knowledge. Participating in this project allowed them to gain new procedural knowledge that they then applied to the schema they already had in place about their ongoing practice (Bransford, Brown, & Cocking, 1999; Brooks & Brooks, 1993). In their reflections, the participants, especially several of the exemplars, affirmed that what they accomplished through GrassRoots was a reinforcement of their already existing schema about what classroom learning should look like. GrassRoots also allowed them to significantly enhance their considerable technology skills in an authentic environment where support was readily available to overcome obstacles they encountered. The literature suggests that the successful coupling of this motivation to learn computer skills and develop technological capacity through authentic professional development would lead to positive outcomes (Harris & Grandgenett, 2002). The results validate this supposition.

Teachers are people first, however. There are and always will be teachers who resist calls for anything more than official attendance at any sort of mandated professional development activity. Hargreaves (1994) pointed out that such resistance can be a response of some teachers to a call for change of any kind. They do this, Hargreaves suggested, because professional development activities overlook the emotional component in teaching. Palmer (1998) wrote of the courage to teach and courage is an emotional response to a particular situation. Both Palmer and Hargreaves suggested that teachers will respond to the demands of their classrooms in various ways.

Sylwester (2000) reminded us of the importance of the emotional component in learning. Just as students vary in their emotional needs and responses in the classroom, not all teachers will involve themselves in their profession the same way.

One thing some participants lacked, for example, was a timetable that could be accommodated easily to GrassRoots project work, or a suitable classroom assignment that enabled them to work with a class on a GrassRoots project just because they wanted to, or personal circumstances that provided opportunities for extra time to devote to professional matters. Czikszentmihalyi (1993) and Hargreaves (1998), among others, explore this element of personal time to devote to the evolution of self, and that aspect of it which is professional development. The impact of time on the freedom of any teacher to devote to long-term professional development of this kind is one of the findings of this research that is not explored sufficiently in the literature. Adey (2004), Ball and Cohen (1999), and Guskey (2000) for example, in their various analyses of current professional development practice and theory, do not refer to the question of the time necessary for professional development as it relates to the demands, both physical and emotional, of teaching.

In looking at the motivation of these participants to embark on this journey of professional growth, it could be argued that they replicated the journeys of the heroes of Greek mythology (Brown & Moffett, 1999). They saw a challenge and accepted it. The participants were exposed to advocacy on behalf of GrassRoots and the benefits to be derived from participation in several different environments and through more than one means of communication. Frequently in the e-survey, my advocacy was mentioned as the stimulus that motivated the participants to begin their learning journeys with

GrassRoots. This personal advocacy of a professional development opportunity is not unlike the provision of a culminating performance task focusing on a big question which lies at the heart of the design for understanding approach to teaching (Wiggins & McTighe, 1998). This approach to professional growth and learning by classroom teachers is significantly different from other currently used methods of delivery of such professional development. Rather than predetermining what the expected outcome of any individual professional development opportunity ought to be for every teacher, the topics of professional development opportunities must be sufficiently broad to enable the classroom teacher to construct knowledge and gather skills that are meaningful to him or her at that particular moment in the professional life. Each teacher has his or her own unique approach to the demands of their chosen career. This reinforces the importance of a continuous program of professional development with multiple opportunities or junctures in time for classroom teachers to re-embark on their journeys of professional growth.

The literature on constructivist knowledge creation and the cognition and learning theory that underlies it speaks to the need for learning to be sparked by open-ended challenges (Bransford et al., 1999; Brooks & Brooks, 1993). These sparks provide the learner with a place to begin and a context within which to situate his or her problem solving (Balsom, 1985). Pedagogically, focusing on the big issue in a culminating performance task (Wiggins & McTighe, 1998) was the reason these participants were interested in GrassRoots. Aside from the link to the enhancement of technology skills, the nature of the task itself as a medium to promote student learning was a major reason for beginning the learning journey. The learning by the students under the tutelage of the

classroom teacher ran parallel to the learning by the teachers under my tutelage from the central office. Bereiter and Scardamalia (1989) focused on the role of the teacher in such an intentional learning environment. These authors acknowledge that this requires a refocusing of the cognitive role of the teacher in the classroom. The teacher is no longer the source of all knowledge but rather the guide in the pursuit of knowledge and skill by the learner. The role of the teacher is to then help the student construct his or her own new knowledge, not determine how that knowledge might be constituted, to help with skill development as needed rather than predetermine and teach to the skills students ought to know.

The teachers in the study were learning the whole time they were engaged in their projects. However, not all of them were self-directed, all the time. Some participants needed e-mail messages, phone calls, and even several long school visits in order to accomplish what others accomplished almost entirely without any need of support. Mezirow (1985) suggested that this phenomenon is entirely possible and highly likely in any group of learners. There is a key juncture where the consultant or staff developer as teacher should recognize an opportunity to intervene and facilitate new learning. Each participating teacher's learning needs throughout the project had to be individually met. Grow (1991) hypothesized that there is a need to match learning styles to teaching styles to facilitate growth in independence of learning. Different subjects needed help formulating their project outlines, sometimes integrating their curriculum expectations appropriately, sometimes overcoming technical problems related to the use of technology, sometimes completing all their reports on time. These were the intervals that provided the opportunity for the consultant as teacher to facilitate the needs of those

learners and the needs as dictated by their tasks. If the above processes are in place, constructivist learning is much more likely to occur.

The role of facilitator and project leader as demonstrated in this research becomes analogous to that same role assumed by a classroom teacher. In both cases, the educator is attempting to encourage new learning in the minds of students using a constructivist approach to knowledge creation. What differed was the environment in which these roles were enacted. Rather than having to show students how to use various cognitive skills to deal with content to be mastered, teachers were provided with different tools so that they could accomplish their goals with technology and pedagogy. While classroom teachers have to work at creating a culture in the classroom which would support independent and individual learning by their students, by acting as the guide on the side, I had to accomplish the same thing with the participants in GrassRoots in order for their learning to occur. Rather than moving around in the classroom physically, supporting and encouraging students as they worked at various tasks, various means of communication over wider areas had to be used to accomplish the same thing. Rather than celebrating the successes of students with their classmates and parents through displays or bulletin boards or notes and phone calls home, encouragement and celebrations of success had to be built into the plan for the board as a whole.

The GrassRoots participants brought an awareness of the fact that they would not be traveling alone on their way to the acceptance of this specific learning challenge. While they had confidence in their own abilities to accomplish their goal, requisite to that success was that they found themselves in environments where they knew support was readily available, should they need it. Most of these participants were working with

at least one other colleague in their schools, as well as me, as consultant. This, they reiterated time and time again, made a big difference in their response to GrassRoots and its embedded professional development. While the support derived from colleagues was crucial, like students in the classroom who find partners to work with on special projects, my role as the *guide on the side* can not be underestimated. As the prime mover on their learning journeys, I encouraged them to work with others on their projects where topics were similar or led them towards meaningful collaboration with others when I knew such pairing would be of mutual benefit.

Hargreaves and Dawe (1990) made the distinction between contrived collegiality and true collaboration. They emphasized the implications of that distinction for achieving sustained school change, pointing out that true collaboration is more likely to lead to meaningful change. Fullan (1995) suggested that the value attached to professional growth must permeate the school, linking culture and continuous learning by the staff in the same way as it should be for students. The GrassRoots experience facilitated independent learning by the teachers which meant these teachers as learners reached out for help, sometimes beyond the confines of the school, but also, in many cases, within the school and to their own students. This extends the concept of a professional learning community beyond the physical space defined by a particular school building to include the communal space defined by the professionals with whom one comes into contact on a regular basis. It is the personal involvement with and support from like-minded professionals that apparently made the difference. This observed result might also be in keeping with what we believe to be true of learning by students in the classroom. In some cases internal motivation is enough to overcome

serious obstacles, while in others internal motivation is not enough (Ryan & Deci, 2000).

The literature strongly suggests that meaningful professional development needs to be looked at as a long-range goal and activity for teachers (Borko & Putnam, 1995). Only when opportunities are afforded for teachers to engage in growth over more than one or two periods or sessions, will significant learning occur. As well, reflection upon practice only becomes a useful tool to encourage sustained change if, upon reflection, new opportunities are provided for additional practice of these newly acquired skills. There was overwhelming evidence from most of the participants that further professional growth through more GrassRoots projects was in their plans, had such opportunities been provided.

If one views growth over a longer period of time, there is no need to focus on the one-time-only workshop or the day of seconded professional development. There might still be a place for either or both secondment and in-class work to be part of a program of professional development, but they are seen as being discrete parts of a much longer process (Guskey & Huberman, 1995). This role of the teacher or consultant or coach does not end after one successful event, but needs to continue until mastery can be claimed by a much larger portion of the group being worked with. This then becomes the point at which change is self-sustaining.

There is another reason to build on that which had already been learned or acquired. Olson and Eaton (1987) suggested that teachers adapt only those parts of any innovation that fit into their particular classrooms and school contexts. This response by teachers is no different from students, each taking away something different from the

learning activities in the classroom. This process is what is meant by the construction of knowledge. However, in a classroom, there is a curriculum guiding the continuous growth of students. Learning activities are provided to further develop skills and knowledge. Professional development activities are not guided by any such curriculum and, as has been pointed out, there is little or no emphasis on any continuum of development. However, this research has found evidence that allows me to argue that there ought to be some sort of master plan with multiple opportunities to acquire skills as they become meaningful to the teacher as learner.

What, however, is especially important to note is the process of self-reflection that was promoted. The Project Report forced the teachers to take the time to focus on their accomplishments, on the learning of their students and the positives aspects that were gained by completing the project slightly differently each time. Successful professional development must lead to sustained school change and Schon (1986) has pointed out that self-reflection can contribute to the kind of learning that, in turn, can lead to such change. GrassRoots participants, had there been another round of project work following their reflections from the current round, would have had an opportunity to implement those changes that they saw as necessary.

In the same way, in my role as researcher, I have been able to reflect on my role as consultant and I have come to some conclusions about professional development, professional growth, the role of the consultant and sustained school change. In the section to follow, I will define a model that I believe encapsulates the elemental points profiled by these findings.

A Proposed Model for Successful Professional Development

It is my contention that the role of the professional development facilitator as teacher instructor requires a dramatic shift and redefinition. Professional development facilitators need to become more than administrators of programs, and rather more the facilitators of knowledge creation. There needs to be a way in which professional developers become professional growth facilitators. This becomes especially important when the professional growth requires significant change in classroom teaching practice. Sometimes it is, indeed, only specific easily learned skills that need to be transferred. These require a trained professional who can help others learn such skills. However, if what is to be taught represents more than limited skill and is sufficiently important that it will require continuous support, in and out of the classroom, then an entirely different approach to the organization of professional development activities must be taken.

When preparing teachers for the GrassRoots process, one approach that could have been adopted by other consultants would have been to convene workshops to "train" the teachers in the "skills" required to bring a project to successful completion and payment. Follow-up to the workshops might have been minimal and responsibility would have rested with the teacher to implement or not implement that which was delivered in formal sessions. Success would have rested entirely with the teachers. However, the model that I used was based on active engagement and direct follow-up. Many of the teachers participating knew they would experience a steep learning curve by volunteering. The participants often depended on me to be the ultimate arbiter for success of their projects, to give shape to the direction they took with the project as well as to master the skills involved in curriculum integration and authentic learning. Just as

the classroom teacher is expected to play a role in summative and formative assessment, I was expected to provide these teachers with assessments around matters of pedagogy and process. It is this aspect of the role of a professional development facilitator that lacks sufficient discussion in the literature.

This action research began with two broad questions. The first question dealt with the nature of the professional learning journeys of teachers. These have been explored in detail above. The second dealt with how the knowledge gained through this research can be used to develop policies that might lead to sustained school change. This question can be answered through a model derived from the knowledge gained by this research which points to the policies that ought to be followed.

Research results point to the need to view professional development through two lenses, one pedagogical and the other organizational. The first two research questions, exploring the motivation of teachers to engage in professional development and the capacities they bring to that engagement, deal with issues of pedagogy. The other three research questions explore the organizational details of the journey leading to its successful completion. From a pedagogical point of view, the research leads to thinking about professional development from the same perspective as thinking about learning in any classroom. This means to consider how learning occurs and under what circumstances it is more likely to be successful and sustained (Atkinson & Claxton, 2000; Bereiter & Scardamalia, 1989; Bransford et al., 1999; Brooks & Brooks, 1993; Mezirow, 1985; Ryan & Deci, 2000; Wiggins & McTighe, 1998). In terms of organization, the research points to considerations of place or classroom, curriculum, and structure (Borko & Putnam, 1995; Calderhead, 1987; Guskey & Huberman, 1995;

Harris & Grandgenett, 2002). In current literature, professional development is viewed in terms of either pedagogy or organization but not both. This might be an explanation for why successful professional development is seldom transformational. Clearly, this research points to the importance of both these dimensions being programmed for and hence the following model is advanced. (See Figure 1 for the graphical representation of this model.)

Pedagogy

Professional development opportunities, where the knowledge, skills, or affect warrant, should be delivered through authentic classroom based learning focusing on big questions (Bereiter & Scardamalia, 1989; Wiggins & McTighe, 1998). This is what Wiggins and McTighe refer to as the designing down process. Students would be focusing on one culminating performance task, while their teachers are learning the skills required to ensure success in that very same task. This pedagogical approach to learning capitalizes on what the literature suggests is how we learn (Bransford et al., 1999; Brooks & Brooks, 1993). Not all reasons for new teacher learning require an approach such as this, obviously. Sometimes, the skill development required of the teacher is easily learned. There are certainly times, however, when what is to be learned is hoped to lead to profound classroom change. That would be the time to ensure the learning be linked to classroom program and thereby authentic.

The learning tasks should have as their focus the learning of the students or the way in which the students will use the skills being acquired. The participating teachers must always be able to see the direct connection between what they are learning and

PEDAGOGY ⟷ INFRASTRUCTURE

Authentic classroom tasks
leading up to a big question

Opportunities for classroom
practice so that learning
includes both teacher and
student

Focussed on student success

Teacher self-assessment and
ongoing reflection by the
teacher

Ongoing advocacy for teacher
involvement

Continuity of learning
opportunities

Ongoing facilitation by the
same individual

Continuous classroom
follow-up

Directed by a curriculum or
skills sequence

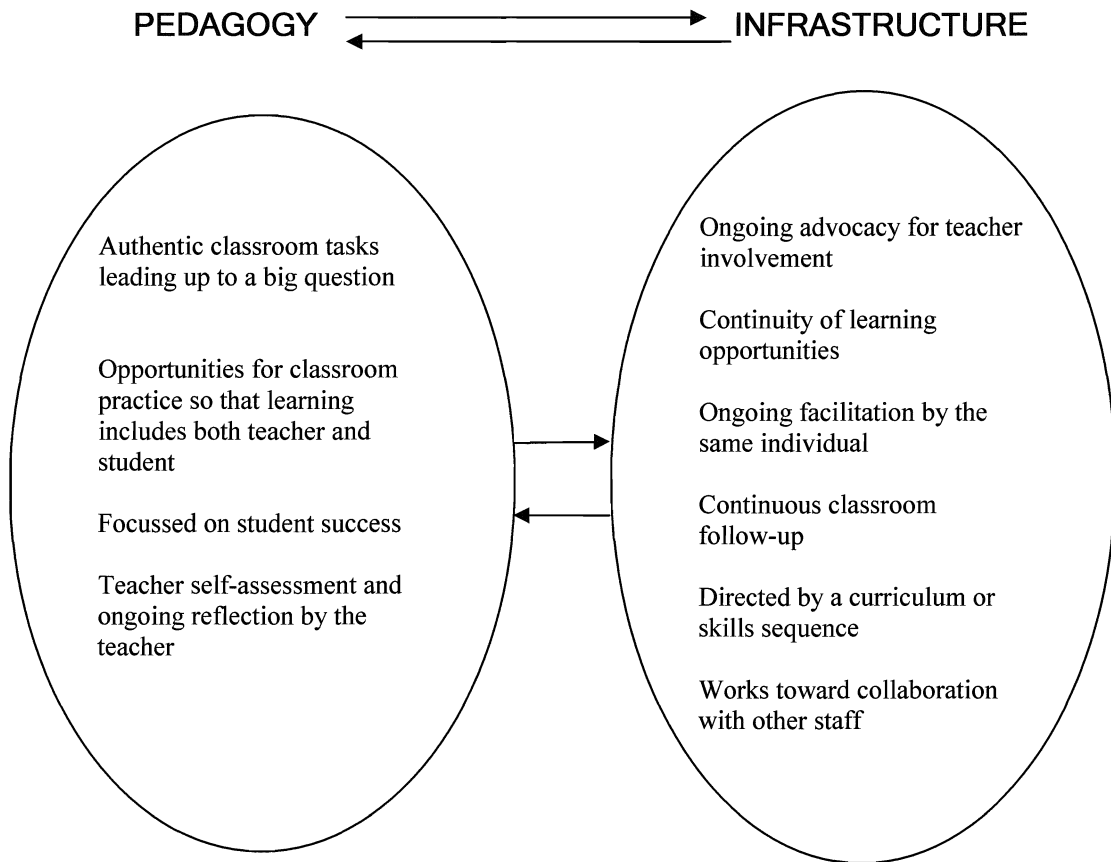Works toward collaboration
with other staff

Figure 1. A model for the structure of professional development leading to
professional growth and systemic change.

practicing and how this will be used and thus impact on the learning of their students. Cuban (1986) found this to be the case in terms of teachers historically adopting technological change in the classroom. Whenever, he suggested, teachers see a benefit to their students' learning in any change, that change will be adopted readily.

In order to promote continuous growth, there needs to be an automatic element of self-assessment. This is what Schon (1986) and Atkinson and Claxton (2000) refer to as reflective practice. This self-assessment is as much a necessary component of student learning as it is of teacher learning. There must be every reasonable opportunity for ongoing reflection by the teacher. This reflection must be part of the outline of the professional development opportunity and a necessary component to participation. The literature cited above strongly argues for this to be an element of any successful efforts at transformational learning.

Infrastructure

Professional development opportunities need to have an individual (a professional development facilitator) to advocate for them and they have to be presented to teachers as opportunities to grow professionally for the benefit of their students. Wiggins and McTighe (1998) suggested the importance of the big question in engaging student interest in learning. The big question is framed in such a way that it catches the imagination of the student and leads to engagement in the learning task. Such a constructivist approach to teacher professional development leading to growth needs to be considered a priority in order to achieve the same outcome. Advocacy has to focus on the twin motives of enhanced student learning as well as desired teacher professional

growth. Someone has to see it as a mandate to capture the imagination of the teacher, in this case, in order to bring the teacher to the point where learning becomes a priority and becomes self-motivating (Ryan & Deci, 2000).

Even the most enthusiastic and dedicated professionals will not always be in a position to take advantage of a specific professional development opportunity. Time, both personal and professional, is a key determining factor in the course of professional growth. As a result, there must be continuous opportunities for all teachers to participate in any one specific professional development activity. This would imply that the same topics would have to be repeated several times over several school terms or years to allow for both new recruitment as well as consolidation by those who have already begun a particular journey. Again, the theory underpinning the designing down process as explicated by Wiggins and McTighe (1998) combined with the idea that students learn only what is meaningful to them at any one particular time (Bereiter & Scardamalia, 1989) indicates that teachers will take up the challenge to learn new skill sets when the time is right for them, not when someone else determines it.

Classroom teachers are the key element in student success. The literature acknowledges the need to involve cognitive learning theory (Guskey & Huberman, 1995). However, it has seldom focused on the question of independent learning on the part of teachers in the classroom. Mezirow (1985) acknowledges that not all teachers are independent learners and yet professional development efforts usually assume the exact opposite to be the case. The results of this research study support the argument that the interpersonal skills of the facilitator(s) in any professional development opportunity are crucial. The purpose(s) and organizational details of that professional development

opportunity are not as important as the person doing the teaching. It is the expertise of the facilitator, the teacher, who is skilled at expediting teacher (student) growth, which is the key component and most important variable in predicting a successful outcome in terms of new teacher learning (Steffe & Gale, 1995). The professional development facilitator must have to have both short- and long-term goals. He or she must be in a position to be able to facilitate the development in the schools of learning communities that offer support focused specifically on targeted skills or pedagogy. There must be continuity of professional support, just as there is continuity of support offered by classroom teachers to their students.

This support means involvement with the classroom teachers engaged in professional development opportunities in their own classrooms. Support must be available in multiple modalities that include oral and written communication where necessary and classroom visitations as required. The literature developing on authentic professional development around the acquisition of technology (Harris & Grandgenett, 2002; Slepkov & Kerr, 2004) strongly suggests this methodology ought to be generalized and extended to other topics considered to be important areas requiring transformational change by teachers. If authentic professional development in technology leads to successful adoption by teachers of new skill sets with reference to the computer, then it ought to be as valid an approach when the goal is enhanced literacy or numeracy, for example.

Professional development opportunities of the sort being described herein must have long term goals. These goals must be derived from a vision of what the impact of these opportunities might have on sustained school change. Consolidation and sustained

school change do not happen spontaneously. They are the result of planned actions implemented by professionals who have that change as their goal. Hord, Rutherford, Huling-Austin, and Hall (1987) argued that change must be engaged actively. Fullan (2001) envisioned much the same. In order to implement change, one needs to know what lies at the end of the journey and move continuously in that direction. Professional development, if it is to be transformational, must also be informed by a vision of the end goal and directed continuously towards that goal, by the same individuals. Classroom teachers take students at the beginning of the year hopeful of moving their charges to the next point along the growth continuum. But there is a curriculum informing their teaching. Transformational professional development must similarly be informed.

The teachers whose journeys were analyzed in this research responded positively, regardless of the organizational variations in their professional development opportunities. That is, length and location of session, time of day, and the specific skills being taught were not critical variables in predicting success. This variance in organizational details reflected the personal learning needs of the teachers involved. These teachers had taken upon themselves the task of growing professionally in some way or other. All they wanted was the autonomy to determine when, how, and why that learning would occur.

Such individuality in professional development opportunities is not easily adapted to plans to be implemented across an educational system. Jurisdiction-wide plans most frequently are structured according to some predetermined schedule. This research has pointed to the need for individualized instruction for teachers in much the same way that the research literature views the concept of individualized instruction for

young students in classrooms. Just as students engaged in constructivist learning tasks benefit from individualized instruction (Steffe & Gale, 1995), teachers need the same constructivist approach to their learning needs (Bailey, Curtis, & Nunan, 2001). It is for this reason that there needs to be a rethinking of how professional development is facilitated. This does not, in any way, undermine the argument that, as much as possible, such efforts have a spin off effect in the rest of the school. Collaboration among and between teachers at the school level or beyond the school level are fundamental to the enhancement of transformational change within an entire school and not just within one teacher's classroom. (Lambert, 2003; Little, 1993)

This research reveals that the people involved in delivering opportunities for professional growth are foundational to success. Therefore, educational jurisdictions ought to examine and possibly redefine the expectations of the professional staff responsible for delivery of these activities. Typically, instructors are experts in their field, called upon to deliver a measure of their expertise to a group of their colleagues. Instructors can be other teachers, consultative staff, or sometimes even non-educators. Frequently, these are short-term appointments. The length of time in which they are expected to instruct is usually short-term as well. There also tends to be variance in the expectation for follow-up to the initial professional development. The findings of this research highlight the need for these professionals to be allowed to continue in their roles and to function in those roles in much the same way as a classroom teacher.

Perhaps, the reason professional development efforts have not been as successful as they could have been is that there has not been sufficient follow-up in the classroom. It was assumed that teachers were automatically self-directed and so would be able to go

back to their classrooms and implement whatever new skills or knowledge that had been the focus of the professional development opportunity. Cranton and King (2003) emphasized that knowledge about teaching can be transformative. One learns something new, one puts into practice that new learning, and then one reflects on the outcome. This transforms the learner in some way. However, if one is not provided with further encouragement and opportunities to experiment with, one does not always reflect, one does not always really learn, and one is seldom transformed. Further, if reinforcement is not present for the need to act on new learning, other things take precedence and the moment to learn is lost.

Deci, Vallerand, Pelletier, and Ryan (1991) applied self-determination theory (Deci & Ryan, 1985) to the realm of education. They spoke to the need of teachers to promote in their students an interest in learning, a valuing of education, and a confidence in their own capacities and attributes. They continued by using research they conducted to show that such promotion will result in high quality learning as well as enhanced personal growth. They add that there are social contextual factors that nurture intrinsic motivation and promote internalization and will contribute to the successful outcomes so much desired in student learning. If teachers are conceptualized as lifelong learners and, when they are engaged in professional development, are viewed as students, there is then a possible explanation for building professional development opportunities in the future. Educators should be trusted as they engage in processes that add their own interest in learning, their individual valuing of professional development, and their personal confidence in their growing capacities and skills. In the classroom, such increased support will serve to enhance the learning of the student.

A Place to Start Anew

My action research began with two research questions which have been answered. The learning journeys of the GrassRoots participants have been analyzed and revealed much about what brings teachers to embark on a course of professional growth; how they, as learners, rely upon others to support their journeys, and how self-assessment and reflection can lead to successful pedagogical change that impacts on classroom practice. In turn, these findings have led to the advancement of a model which can be used widely to guide professional development practices.

As a practitioner of professional development, I have come to realize, and the results of this research affirmed, my perceptions concerning the importance of applying cognitive theory to the structure and practices of any proposed offerings. Before any teachers are seconded or any in-services are planned, the reasons for doing so must be carefully considered and the teaching strategies determined that will yield the desired learning. How best should the new learning be acquired? What will the culminating performance task be to indicate that teachers have indeed learned what is expected of them? What classroom behaviours by their students will be indicators of success? How frequently will the sequence of sessions be offered? Who can best educate the teachers in the skills and classroom behaviours to be acquired? Does that individual have the resources necessary to be successful in the task? Is there a plan in place to ensure that the opportunity for growth is going to be extended to more than one group of individuals? Who will insure that these efforts are part of a wider vision of the change process? These are only a few of the questions that ought to be posed in order to ensure that professional development is organized for success and change.

As a researcher, gaps in the literature have been found that require further explication. Just as constructivist knowledge creation leads to the revelation in gaps of what is known and what is not known, this work has led to new questions which can be used to guide further research. For example, one of the most questionable findings is whether, given replication of the GrassRoots process as described, these participants would have reflected the changes in practice that they declared would have occurred. In tandem to that is the argument advanced earlier that there needs to be continuity in the course of professional development being offered to any specific group of teachers. If the goal of a specific program of in-service is to promote and advance sustained change, new research ought to be conducted using the model advanced in this dissertation and spanning more than 1 or 2 years.

Currently in many jurisdictions in North America and elsewhere, much effort is being expended on developing the skills required by classroom teachers leading to the integration of technology into their classroom programming. Opportunities could be developed using the model advanced above and applied to groups of these teachers to establish whether or not the model of professional development, when replicated, in fact still works. Can any educational jurisdiction organize professional growth opportunities in such a way that sustained change will result? The need to be successful in such efforts is there, as suggested so frequently by the literature cited throughout this dissertation. Can the current state of "no change" be reversed?

Aside from the generative use of the model, there are parts within this framework that suggest gaps in what is known and what is not known. With reference, for instance, to the role of the teacher in professional development, there are a number of directions

that one could take in new research. What are the qualities of a successful educator of teachers? Does gender make a difference? Is there a maximum "class" size? Can teachers be trained in a specific set of skills to help them become successful professional developers? There is also the question of subject matter. What specific knowledge and/or skill expectations require more in-depth opportunities for professional growth?

In Conclusion

Darling-Hammond (1997) found that despite the allocation of considerable resources towards ongoing professional development, little has changed in the quality of classroom teaching. The results of this research perhaps point to a possible explanation, one which the literature does not seem to explore. My research has revealed the importance of considering both the pedagogy underlying and the organizational details facilitating teacher professional development. It is not enough to think about professional development in terms of the manner in which it is delivered, that is in brief, single sessions or seconded all-day events, after the school day, or during the school day. These details are important, but only as part of a larger picture, as indicated by the model I have advanced above.

The success of the GrassRoots project as a medium by which teachers participating gained new skills and knowledge which they then passed on to their students makes a convincing case for including elements of both pedagogy and organization in any long-term professional development initiative. Pedagogically, this means the application of what is known about cognition and learning to the learning of teachers. It reaffirmed the fact that, given any learning opportunity, some learners will do just fine on their own while others will need more encouragement. Teacher capacity

to learn and teacher willingness to learn are only somewhat connected. Other variables do play an important role and no two journeys are completely identical. If the path to sustained school change is through enhanced teacher ability, then a way must be found to connect our knowledge of teaching and learning to professional development.

However, even the most skilled practitioner will make little difference with his or her students if there is no attention paid to other elements in that same teaching and learning environment. The provision of sufficient opportunity to avail oneself of a specific professional development initiative, a curriculum guiding the individual elements offered by any jurisdiction rather than a collection of disparate and discrete topics, and facilitation by a well-trained, experienced, and motivating educator who will be able to work with any group of teachers until they have mastered the skills being transferred are all necessary components. One of the foundations of the vision for education anywhere is the goal of graduating lifelong learners. This same vision must be part of the process in the development of the teaching staff as well.

This then is a model of professional learning to which educators at all levels can turn as a guide in structuring professional development for teachers that might prove to be more successful and more widespread in the future. Such success might enhance the likelihood of true constructivist learning and lead to transformation of the teaching profession. The implications of this for the profession are clear. Successful teacher learning requires both pedagogy and facilitation. Only then will teachers be able to realize their learning goals. This outcome will subsequently enhance their ability to continuously assess and improve their methodology of classroom instruction and their pedagogy of teaching as reflective practitioners (Schon, 1986).

Brown and Moffett (1999) saw change in terms of a hero's journey which could be represented by a continuous cycle of the acceptance of a challenge, the beginning of the journey, receiving help along the way, reaching the goal, and then embarking again. The model advanced by this research can now be used to inform and adapt this view of teacher professional learning. The difference, in my opinion, will be that the educators who embark on their journeys won't have to be heroes any more. Heroic efforts require a special kind of person and teachers are not always heroic. They are people first and foremost. But, using the model advanced as a result of this research, every teacher can be a hero when it comes to learning that which he/she needs to be successful in his or her chosen career. Such an outcome would make every stakeholder in the educational endeavour a winner.

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Appendix A

INDIVIDUAL GRASSROOTS PROJECT PROPOSAL QUESTIONS

1. Project Leader Information:

First Name:
Last Name:
E-mail:
Telephone:
Fax:
Have you participated in GrassRoots Projects before?
If YES, were you the teacher leading the project?

2. School Information:

School Name:
Website:
Province/Territory
Country:
Address:
City:
Postal Code:
Principal's First Name:
Principal's Last Name:

First Nations' School:

3. School Board Information:

School Board Name:
Address:
City:
Postal Code:

4. Project Information:

4.1 Scope:
Project Title:
Please provide a detailed description of the project -- including information on:
- the purpose, theme or focus
- the topic(s) or key aspects to be investigated
- and the main activities incorporated into the project
Project Website URL (if available):
Please indicate the proposed category for the project

Project Start Date
Project End Date

4.2 Curriculum Relevancy:

Please select the main subject area of the project:
Select TWO integrated subject areas of the project:
Integrated Subject 1:
Integrated Subject 2:
Please enter up to 4 keywords or concepts that reflect the topic/theme of the project.
Grade level of the students/class responsible for this project:
Project is intended for student collaboration from Grade __ to Grade__

    (For Category A Projects)
For the preceding main subject area selected, please specify the curriculum outcomes/expectations from the provincial/territorial curriculum documents which will be the foundation of this project.

    (For Category B and C Projects)
For ALL the preceding subject areas selected, please specify the curriculum outcomes/expectations from the provincial/territorial curriculum documents which will be the foundation of this project.

    (For Category B and C Projects)
Please indicate which higher order thinking skills and knowledge economy skills will apply to this project:

    Higher Order Thinking skills
    Analysis
    - Identifying component parts
    - Identifying and explaining interrelationships
    - Recognizing trends and patterns
    - Other
    Synthesis
    - Creating new ideas, concepts, materials, products etc.
    - Integrating knowledge and skills from several areas
    - Making generalizations from trends and patterns
    - Making predictions or conclusions based on data/evidence
    - Other
    Evaluation
    - Judging the relevance of data/information
    - Making informed choices
    - Distinguishing between

          - Selecting the best alternative
- Other

Advanced Knowledge Economy Skills
- think; analyze and solve problems;
- assess situations, evaluate and implement suggestions
- cooperate with others; and work in teams
- locate, gather, analyze and organize information
- adapt to a range of situations;
- take risks, and to formulate and champion a vision.
- learn independently;
- exercise responsibility;
- innovate (generate and use knowledge)

4.3 Design:

Please estimate the total number of students expected to collaborate on your project:
Please estimate the total number of teachers expected to collaborate on your project:
Please estimate the number of classes in your school expected to collaborate on your project:
Please estimate the number of classes in other schools expected to collaborate on your project:

Please identify the opportunities for collaboration on this project (choose all that apply):
- School (Collaboration between classes in one school)
- Provincial/Territorial (Collaboration within province/territory only)
- National (Collaboration with other provinces/territories)
- Global (Collaboration with other countries)

Would you be interested in receiving application information on Exchanges Canada, a reciprocal home-stay exchange program that enables groups to explore another region in Canada?

Please provide a timeline for your project plan outlining the main steps of the project.

Describe how students will be involved in any or all of the following stages of the project:
- Planning
- Design
- Implementation
- Evaluation

Please provide a description of the website which will be created to showcase this project, and its value as an educational resource on the Internet

4.4 Collaboration/Teamwork:

What opportunities for collaboration/teamwork are planned for the purposes of gathering information, developing content, designing plans and creating/evaluating the website?

(For Category C Projects)
Please explain how you will seek collaboration with other classes.

(For Category C Projects)
Please describe how the project website will illustrate the online collaboration that will take place between your students and those of the participating classes outside your school.

4.5 Information and Communications Technologies:

Please indicate the Information and Communications Technologies (ICT) students will use:
- E-mail
- HTML
- HTML Editor
- Audio
- Graphics Design
- Video
- Video Conferencing
- Digital Camera
- Scanner
- Animation
- Word Processing
- Database
- Spreadsheet
- Multimedia Software
- Other:

Please indicate for what purposes Information and Communications Technologies will be used:
- Exploring
- Organizing
- Presenting Information
- Hypothesizing
- Formulating Conclusions
- Communicating

- Researching
- Testing Ideas
- Evaluating
- Predicting
- Collaborating
- Transferring Knowledge
- Finding, Gathering & Collecting Information
- Constructing Personal Knowledge & Meaning
- Synthesizing
- Other:

4.6 Originality:

(For Category B and C Projects)
Please indicate how this project presents an opportunity for information to be collected from a variety of primary and secondary sources, and how the content will be presented in an original way.

5. Partner Questions - ONTARIO PROJECTS

1. Referring to specific expectations in grade appropriate Ontario curriculum documents, list a maximum of six key expectations that students will achieve in this project, and that will be demonstrated on the website.
For example, given the following expectation: demonstrate understanding of the importance of movement principles in performing isolated or combined movement skills (e.g., manipulation, locomotion, and stability) the website might include the following: identification and description of the principles using text and diagrams for both isolated and combined movement skills, a video of students demonstrating the various principles, student reflections regarding what they have learned about movement principles and how they can apply it, etc.

2. Indicate how the GrassRoots' funds will be spent if this project is approved.

Appendix B

INDIVIDUAL GRASSROOTS PROJECT REPORT

Project Information:

Project Leader First Name:

Project Leader Last Name:

Project Title:

Project Website URL:

Project Start Date:

Project End Date:

Main subject area of the projects:

Project is intended for student collaboration from Grade   to Grade

School Information:

School Name:

Address:

Website:

City:

Province/Territory:

Postal Code:

Country:

Principal's Last Name:

First Nations' School:

School Board Information:

Name:

Address:

City:

Postal Code:

Project Summary

Please indicate full collaboration on your project, including those students, classes, schools and teachers that have participated from other provinces/territories and countries.

Number of collaborating students:
Number of collaborating teachers:
Number of collaborating classes in your school:
Number of collaborating classes in other schools:
Number of collaborating classes in other provinces/territories:
Number of collaborating classes in other countries:
Number of collaborating schools:

Questions

Please indicate the most important, useful or unique characteristic of the website created for this project as an educational resource.

Describe the impact of this project on your students' learning. Include comments on the impact of using the Internet and Information and Communication Technologies (ICT).

Describe what curriculum outcomes/expectations were achieved and/or not achieved and why.

In what ways did students work together - both during the project and in creating the website? Please share some of your students' thoughts on this project.

Please indicate the Information and Communications Technologies (ICT) used in this project.

Please indicate for what purposes Information and Communications Technologies were used in this project.

Please describe how you incorporated higher order thinking skills and knowledge economy skills into your project.

Please describe how you promoted (or will promote) the website created by your students. What are the future plans for this website? If applicable, please list recognition, awards, prizes, media coverage, etc. that the project has received. Also please indicate whether you have submitted your project to any national or international competitions.

What aspects of the project would you differently and why?

What recommendations would you give other students and teachers wanting to implement a project similar to this?

Appendix C

LETTER OF PERMISSION

January 5th, 2004.

Dear Colleague:

I am writing you formally to ask you to participate in a research study I am conducting in partial completion of the requirements for my Doctorate in Education. My study is a **case study of the GrassRoots project, why teachers become committed to being involved and how their being involved changes their teaching practice**. It is has been reviewed and received Ethics clearance from the Office of Research Ethics at Brock University and also been approved by the District School Board of Niagara Ethics Committee. My supervisors on staff in the Faculty of Education are Drs. Jim Kerr and Coral Mitchell.

My study will be conducted throughout these next several months and in conjunction with our work together on the GrassRoots project. There are several outcomes I am investigating in conjunction with this project.

I am seeking to ascertain whether or not, as a result of participating in this kind of project you will see enough value in your effort and the outcomes of your students to continue to use this kind of a strategy in your repertoire of teaching skills. I will be interviewing you informally throughout our work together to ascertain how you feel about the use of the technology and how it impacts on your ideas about classroom program in general.

I am also interested in professional learning communities and their contribution to authentic staff development. I will be seeking to find out to what extent your involvement in a centrally driven program such as this leads to involvement by other teachers in your school.

Your involvement in my study will require the following –

Completing a survey instrument to assess your level of technology expertise and providing me with some demographic information such as age, sex, years of experience and so forth.

Two or three extra hours during the period of time while we are working together on your project and while you are filing your report for GrassRoots upon its completion to ask you some specific questions about you and how you felt about being involved in the project, as well as what you think you learned as a result of your participation in a GrassRoots project. We will decide together when this time will be found, whether during some of your preps, over lunch or either before or immediately after school. This might require two separate interviews.

You will be free to refuse to answer any specific question if it makes you at all uncomfortable. Once the study is completed and the dissertation published, there will be no need to keep any of the data we have collected together. Your completed projects, published live to the Internet, will be the only lasting testament to your involvement in a GrassRoots project.

It is my hope that the time we spend together in this examination of authentic professional development and how it impacts on you personally, your colleagues incidentally, and your school as a whole, will be very well spent in making a contribution to what we know about changing teacher pedagogy and practice in the classroom, how we can enhance that and how we can support each other as professionals to facilitate an easier and less-stressful journey down the change path we are on.

It goes without saying that all the information we share with each other will be kept **strictly confidential, however true anonymity is impossible given the kind of materials we will be studying together.** I will be logging and saving all the e-mails, phone calls, visits, and so forth. My written records in the form of a journal will be shared with you throughout and will be available at any time, should you so wish. Also, I will provide each participant with a photocopy of the fourth and fifth chapters of my dissertation where my findings will be analyzed and conclusions discussed. **It is important to point out, however, that at no time will that report refer to any participant by name or school. You are under no obligation to stay in the study, so that, if you so desire, you may withdraw at any time. Withdrawal from the study does not mean withdrawal from GrassRoots however.**

If you have any further questions about the project, its assumptions, its methodology, and so forth, you are welcome to ask me, contact Dr. Kerr (jkerr@ed.brocku.ca), Dr. Mitchell (cmitchel@ed.brocku.ca) or query the Research Ethics Officer at 905-688-5550, Ext. 3035.

Thanks so much for your support and help with this.

Sincerely,

Howard Slepkov,
Consultant, Computers in the Classroom,
District School Board of Niagara,
Allanburg, Ontario, L0S 1A0
howard.slepkov@dsbn.edu.on.ca OR sleppysr@slepkov.ca
905-227-5551 #2207 OR 905-688-1016

Please sign on the line below indicating that you have read the contents of this letter and consent to the terms of the research described in it. Your signature will be testimony of your willingness to participate as a subject in my dissertation study. Thank you so much.

I _____ at _____ hereby give Howard Slepkov permission to use me as a subject in his dissertation – level research into the GrassRoots project process.

Signed_____ Date_____

Appendix D

TEACHER DEMOGRAPHIC INFORMATION DATA SHEET

Please note that the following questions are required to provide some demographic background to the more intensive interviews and the responses that will be collected that way. You have no need to use complete sentences and all of this information will be retained and kept in the strictest confidentiality. Thanks.

NAME _____

AGE _____

SEX _____

MARITAL STATUS _____

HIGHEST DEGREE EARNED IN UNIVERSITY _____

ADDITIONAL QUALIFICATIONS COURSES TAKEN (please be specific and list any and all)

_____

_____

_____

PANEL_____

NUMBER OF YEARS OF TEACHING EXPERIENCE _____

GRADES TAUGHT (over your entire teaching career)

_____

_____

SUBJECTS TAUGHT (over your entire teaching career)

_____

_____

_____

SCHOOL (this year) _____

NUMBER OF STUDENTS IN YOUR CLASSROOM (this year) _____

SCHOOL POPULATION (this year) _____

Appendix E

<u>INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION</u>

Recommended Foundation Competencies in Technology for All Teachers

The ISTE Foundation Standards reflect professional studies in education that provide fundamental concepts and skills for applying information technology in educational settings. The suggestion has been made by them and the National Council for Accreditation of Teacher Education (NCATE), which is an American institution, that all graduating pre-service teachers meet these proficiency standards to ensure technological literacy in the younger members of the teaching profession. While these are only suggestions, they provide a useful guide for us as we try to ensure the same levels of technological literacy in our staff and students.

On this form you will find some suggested competencies for both practicing and pre-service teachers in the area of computer technology. We would ask that you consider carefully the definitions of ENTRY, ADOPTION, ADAPTATION, APPROPRIATION, and INVENTION included and then check off where you see yourself in each of the specific descriptors in the table below.

Stage 1 - <u>Entry</u> - Students Learning to Use Technology

At this stage, teachers are not themselves the technology users. If students are using technology, they are using it in ways determined by someone other than the teacher and without participation from the teacher. For example, they may have a designated computer lab time taught by a computer teacher. Alternatively, they may have classroom computers that are used for educational software games which students independently use during assigned computer time.

Stage 2 - <u>Adoption</u> - Teachers Use Technology to Support Traditional Instruction

Teachers are beginning to use technology usually to enhance their own productivity, mandated either by the school (e.g., electronic report cards) or through their own initiative. Teachers at this stage use technology in a limited way, to do things they already would have done without the technology. They experience an advantage doing traditional tasks with a new tool and begin to see the power of the tool for other applications. For example, a teacher who uses word processing software to prepare a newsletter to parents discovers how much easier it is than using a typewriter. Therefore, the teacher begins to provide opportunities for students to use the computer as a "better typewriter" for completing stories, reports, or other exercises.

Stage 3 - <u>Adaptation</u> -Technology Used to Enrich Curriculum.

Teachers begin to use technology in ways that are connected to the curriculum, and in ways that are already familiar. Teachers are automating existing practices. For example, a teacher who has located web sites with reference material relevant to a particular lesson is using that material to present the subject matter to the class. Perhaps the teacher is having students use CD-ROM encyclopedias and the Internet as an extension of print resources. Teachers at the adaptation stage tend to direct student inquiry (e.g., pre-selecting web sites) rather than allowing student-directed learning experiences.

Stage 4 - <u>Appropriation</u> - Technology is Integrated, Used for its Unique Capabilities.

Teachers at the appropriation stage view technology as a relevant tool for teaching and learning and they design learning experiences and environments to take advantage of its capabilities to meet objectives and desired outcomes. In the classrooms of teachers at this stage, technology begins to reveal its potential to produce improvements in learning, as students master higher-order thinking skills and more complex concepts and skills than they would have encountered without technology. Students will view technology as a tool to meet their objectives. For example, a student assigned a project on a local environmental issue would be empowered to use the Internet and other technology resources, such as e-mail, to direct a personal approach to the project. The teacher might also allow students to determine individual presentation tools, and arrange for a presentation to the appropriate community organization.

Stage 5 - <u>Invention</u> - Discover New Uses for Technology

At this stage, teachers are redefining classroom environments and creating learning experiences that truly leverage the power of technology to involve students in tasks that require higher-order thinking skills as well as mastering basic concepts and skills. For example, a teacher might create a theme or project around which to center most of the activities of the class for a semester. During that time, the teacher and students would create a project or series of projects that weave learning and demonstration ability in each of the required subject areas. For example, a class project to create a web site for a local business might involve opportunities for the students to learn about the business, learn about website creation, hone organizational skills, master content, and apply basic skills. Such a project might look to an outside observer more like a business environment than a conventional classroom, though a wealth of learning would be taking place.

1.1 Basic Computer/Technology Operations and Concepts Candidates will use computer systems-run software; to access, generate, and manipulate data; and to publish results. They will also evaluate performance of hardware and software components of computer systems and apply basic troubleshooting strategies as needed.	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION
1.1.1 operate a multimedia computer system with related peripheral devices to successfully install and use a variety of software package.					
1.1.2 use terminology related to computers and technology appropriately in written and oral communications.					
1.1.3 describe and implement basic troubleshooting techniques for multimedia computer systems with related peripheral devices.					
1.1.4 use imaging devices such as scanners, digital cameras, and/or video cameras with computer systems and software.					
1.1.5 demonstrate knowledge of uses of computers and technology in business, industry, and society.					
1.2 Personal and Professional Use of Technology Candidates will apply tools for enhancing their own professional growth and productivity. They will use technology in communicating, collaborating, conducting research, and solving problems. In addition, they will plan and participate in activities that encourage lifelong learning and will promote equitable, ethical, and legal use of computer/technology resources.	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION
1.2.1 use productivity tools for word processing, database management, and spreadsheet applications.					
1.2.2 apply productivity tools for creating multimedia presentations.					
1.2.3 use computer-based technologies including telecommunications to access information and enhance personal and professional productivity.					
1.2.4 use computers to support problem solving, data collection, information management, communications, presentations, and decision making.					
1.2.5 demonstrate awareness of resources for adaptive assistive devices for students with special needs.					

1.2.6 demonstrate knowledge of equity, ethics, legal, and human issues concerning use of computers and technology.					
1.2.7 identify computer and related technology resources for facilitating lifelong learning and emerging roles of the learner and the educator.					
1.2.8 observe demonstrations or uses of broadcast instruction, audio/video conferencing, and other distant learning applications.					

1.3 Application of Technology in Instruction   Candidates will apply computers and related technologies to support instruction in their grade level and subject areas. They must plan and deliver instructional units that   integrate a variety of software, applications, and learning tools. Lessons developed must reflect effective grouping   and assessment strategies for diverse populations.

	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION
1.3.1 explore, evaluate, and use computer/technology resources including applications, tools, educational software and associated documentation.					
1.3.2 describe current instructional principles, research, and appropriate assessment practices as related to the use of computers and technology resources in the curriculum.					
1.3.3 design, deliver, and assess student learning activities that integrate computers and other technology for a variety of student grouping strategies and for diverse student populations.					
1.3.4 design student learning activities that foster equitable, ethical, and legal use of technology by students.					
1.3.5 practice responsible, ethical and legal use of technology, information, and software resources.					

2.1 Social, Ethical, and Human Issues Candidates will apply concepts and skills in making decisions concerning social, ethical, and human issues related to computing and technology.

	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION

2.1.1 describe the historical development and important trends affecting the evolution of technology and its probable future roles in society.					
2.1.2 describe strategies for facilitating consideration of ethical, legal, and human issues involving school purchasing and policy decisions.					

2.2 Productivity Tools Candidates integrate advanced features of technology-based productivity tools to support instruction.

	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION
2.2.1 use advanced features of word processing, desktop publishing, graphics programs and utilities to develop professional products.					
2.2.2 use spreadsheets for analyzing, organizing and displaying numeric data graphically.					
2.2.3 design and manipulate databases and generate customized reports.					
2.2.4 use teacher utility and classroom management tools to design solutions for a specific purpose.					
2.2.5 identify, select, and integrate video and digital images in varying formats for use in presentations, publications and/or other products.					
2.2.6 apply specific-purpose electronic devices (such as, a graphing calculator, language translator, scientific probe ware, or electronic thesaurus) in appropriate content areas.					
2.2.7 use features of applications that integrate word processing, database, spreadsheet, communication, and other tools.					

2.3 Telecommunications and Information Access   Candidates will use telecommunications and information to access resources to support instruction.

	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION

	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION
2.3.1 access and use telecommunications tools and resources for information sharing, remote information access and retrieval, and multimedia/hypermedia publishing.					
2.3.2 use electronic mail and Web browser applications for communications and for research to support instruction.					
2.3.3 use automated online search tools and intelligent agents to identify and index desired information resources.					

2.4 Research, Problem Solving, and Product Development Candidates will use computers and other technologies in research, problem solving, and product development. Candidates use a variety of media, presentation, and authoring packages; plan and participate in team and collaborative projects that require critical analysis and evaluation; and present products developed.

	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION
2.4.1 identify basic principles of instructional design associated with the development of multimedia and hypermedia learning materials.					
2.4.2 develop simple hypermedia and multimedia products that apply basic instructional design principles.					
2.4.3 select appropriate tools for communicating concepts, conducting research, and solving problems for an intended audience and purpose.					
2.4.4 participate in collaborative projects and team activities.					
2.4.5 identify examples of emerging programming, authoring, or problem solving environments.					
2.4.6 collaborate in online workgroups to build bodies of knowledge around specific topics.					
2.4.7 use a computer projection device to support and deliver oral presentations.					
2.4.8 design and publish simple online documents that present information and include links to critical resources.					

	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION
2.4.9 develop instructional units that involve compiling, organizing, analyzing, and synthesizing of information and use technology to support these processes.					
2.4.10 conduct research and evaluate online sources of information that support and enhance the curriculum.					

3.1 Teaching Methodology   Candidates will effectively plan, deliver, and assess concepts and skills relevant to educational computing and technology literacy across the curriculum.

	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION
3.1.1 design and practice methods and strategies for teaching concepts and skills related to computers and related technologies including keyboarding.					
3.1.2 design and practice methods and strategies for teaching concepts and skills for applying productivity tools.					
3.1.3 design and practice methods / strategies for teaching concepts and skills for applying information access and delivery tools.					
3.1.4 design and practice methods and strategies for teaching problem-solving principles and skills using technology resources.					
3.1.5 observe in a K–12 setting where K–12 computer technology concepts and skills are being taught.					
3.1.6 practice methods and strategies for teaching technology concepts and skills in a lab and classroom setting.					
3.1.7 identify and support implementation and revision of computer or other technology literacy curriculum to reflect ongoing changes in technology.					
3.1.8 design and implement integrated technology classroom activities that involve teaming or small group collaboration.					
3.1.9 identify activities and resources to support regular professional growth related to technology.					

3.1.10 describe student guidance resources, career awareness resources, and student support activities related to computing and technology.					
3.1.11 compare national K–12 computer or other technology standards with benchmarks set by local school districts and critique each.					
3.1.12 identify professional organizations and groups that support the field of educational computing and technology.					
3.1.13 design a set of evaluation strategies and methods that will assess the effectiveness of instructional units that integrate computers/technology.					

3.2 Hardware and Software Selection, Installation, and Maintenance Candidates will demonstrate knowledge of selection, installation, management, and maintenance of the infrastructure in a classroom setting.

	1 ENTRY	2 ADOPTION	3 ADAPTATION	4 APPROPRIATION	5 INVENTION
3.2.1 develop plans to configure computer or other technology systems and related peripherals in laboratory, classroom cluster, and other appropriate instructional arrangements.					
3.2.2 identify and describe strategies to support development of school and laboratory policies, procedures, and practices related to use of computers or other technology.					
3.2.3 research, evaluate, and develop recommendations for purchasing instructional software to support and enhance the school curriculum.					
3.2.4 research, evaluate, and develop recommendations for purchasing technology systems.					
3.2.5 design and recommend procedures for the organization, management, and security of hardware and software.					
3.2.6 identify strategies for troubleshooting and maintaining various hardware and software configurations.					

3.2.7 identify and describe network software packages used to operate a computer network system.					
3.2.8 configure a computer system and one or more software packages.					

Appendix F

GRASSROOTS EFFECTIVENESS SURVEY

Name. What is your name?

Grade. What grade do you teach?

School. What school are you at?

Experience. How many years of experience have you had?

○ fewer than 5 years

○ 5 - 10 years

○ 11 - 15 years

○ 16 - 20 years

○ 21 - 25 years

○ 26 - 30 years

○ Over 30 years

Participation. How many times have you participated in a GrassRoots project with your students?

○ this is my first time

○ this is my second time

○ more than twice

First Time. Have you participated in other centrally-sponsored projects before (e.g. - Windows of Opportunity)?

○ Yes

○ No

Satisfaction. Overall, how would you describe your experience with this project?

○ Very pleasurable

○ Pleasurable

○ Satisfactory

○ Somewhat dissatisfied

○ Very dissatisfied

Technological Comfort. I would say that my comfort level with Information and Communications Technologies (I. C. T.) is

○ Very comfortable

○ Comfortable

○ Somewhat uncomfortable

○ Very uncomfortable

Web Site Ability. When I began working on this project with my students, I knew very little about how to go about creating Web sites.

○ Yes

○ No

Changed Teaching Practice. Please rate your agreement or disagreement with the following statements.

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
1. Working on a GrassRoots project with my class has helped me to use more Information & Communications Technologies (I. C. T.) in my teaching in general.	○	○	○	○	○
2. My enhanced skills with technology have enabled me to be more effective in my integration of I. C. T.	○	○	○	○	○
3. I am more aware of the ways in which I can teach the curriculum AND also use the technology.	○	○	○	○	○
4. I have learned that it is okay if my students are more technologically literate than I am.	○	○	○	○	○
5. I have enjoyed the fact that I was learning the same skills as my students were.	○	○	○	○	○
6. The parents of my students have shown more involvement in what their children were learning and what they produced as a result.	○	○	○	○	○
7. My principal has shown more interest in the accomplishments of my students with this technologically-driven project.	○	○	○	○	○
8. My principal has shared the successes with the GrassRoots project with others in our school community.	○	○	○	○	○
9. Other teachers have shown an interest in what I was doing with my students.	○	○	○	○	○
10. Other teachers have expressed an interest in learning more.	○	○	○	○	○
11. Other teachers would like to collaborate with me in a future GrassRoots project.	○	○	○	○	○
12. I enjoyed my involvement with a GrassRoots Web site project.	○	○	○	○	○
13. I was surprised by what my students accomplished.	○	○	○	○	○
14. I was surprised by how much I accomplished.	○	○	○	○	○
15. I was amazed by how much I learned.	○	○	○	○	○
16. I enjoyed this opportunity to develop my professional abilities while working in my classroom with my students	○	○	○	○	○
17. I would have preferred to be seconded and given time away from my classroom to learn these new skills.	○	○	○	○	○

Changed Practice. Please give a specific example of how participating in GrassRoots has caused you to change your teaching practice.

[text box]

Student Involvement. Please choose appropriately in the spaces provided to indicate how much your students were involved in the following

	Totally uninvolved		Totally Involved		
	1	2	3	4	5
1. Choosing topics	○	○	○	○	○
2. Choosing partners	○	○	○	○	○
3. Designing their pages	○	○	○	○	○
4. Learning the tools you used	○	○	○	○	○
5. Evaluating the work of other students	○	○	○	○	○
6. Editing their work	○	○	○	○	○
7. Creating the links	○	○	○	○	○
8. Deciding when to work on their pages	○	○	○	○	○
9. Deciding content of individual pages	○	○	○	○	○
10.Designing the overall Web site	○	○	○	○	○

Students Learning. Please give a specific example of how participating in GrassRoots has enhanced your students' learning.

[text box]

Problems. Are there any ways in which participating in a GrassRoots project has affected your students in a negative way? Could you please explain?

[text box]

Learning Teachers. Please give a specific example of how participating in GrassRoots has enhanced your own professional development.

[text box]

Authentic PD. How did you go about acquiring the skills you needed in order to help your students complete this project?

[text box]

Cost To Teacher. Have there been any unexpected and unwelcomed outcomes as a result of your involvement in this project?

Benefit to Classroom. How is the GrassRoots program of benefit to your classroom?

Benefit to School. How is the GrassRoots program of benefit to your school?

Recruitment. How were you recruited to participate in a GrassRoots project?

Why Get Involved. What did you hope to accomplish with your students by getting involved?

Personal Reason. What did you hope to accomplish for yourself by getting involved?

Expectations. Did you have high hopes and expectations for yourself and for your students?

C
Yes

C
No

Good Bad Thing. Were you initially sorry you had gotten involved?

C
Yes

C
No

Process. Do you feel that you have been allowed to work away on your own on this project according to your own abilities.

C
Yes

C
No

Outside Help. Have you been assisted in any way by anyone from outside your own classroom? Please check as many choices as apply.

☐ No one helped me

☐ Students in other classrooms

☐ Students in other schools

☐ Teachers in other classrooms

☐ Teachers from other schools

☐ Board office personnel

☐ Parent volunteers

☐ Other

Staff Interest. How would you describe the attitudes of your colleagues on staff towards what you were doing?

Staff Recruitment. Have any of your colleagues on staff indicated a desire to get involved in a GrassRoots project as a result of what they have seen you working away at? Please comment.

Typical or Not. Does your staff always get involved easily and quickly in new learning initiatives or programs?

○ Yes

○ No

Project Participation. Are teachers in your school typically involved in board-based curriculum initiative?

○ Yes

○ No

Confidence. Do you feel the work on this project has helped you to feel more confident about the use of technology personally?

○ Yes

○ No

Self Learning. What have you learned about yourself as a teacher as a result of involvement in this process?

Future Use. Will you be more or less likely to use technology in other ways in your school program as a result of your involvement in the GrassRoots project?

○ more likely

○ less likely

Heading Too Long 1. Working on a GrassRoots project with your students was very much a problem-based classroom learning

activity. Each student would have had to learn something very different about the topic and many times, the skills used by one student were not the same as those used by another in the creation of their Web pages. How do you feel about this type of learning?

Future PBL. In the future, will you be more or less likely to use problem-based learning like this again?

◯
    Yes

◯
    No

Reasons. Why did you make that choice?

Submit Survey

Appendix G

APPROVAL OF ETHICAL RESEARCH

Brock University

Senate Research Ethics Board

Extensions 3943/3035, Room AS 302

DATE: **January 8, 2004**

FROM: Joe Engemann, Chair

               Senate Research Ethics Board (REB)

TO: Dr. Jim Kerr, Education

               Dr. Coral Mitchell, Education

               Howard Slepkov

FILE: **03-196 Slepkov**

TITLE: **Creating a Culture of Sustained Change in Schools**

The Brock University Research Ethics Board has reviewed the above research proposal.

DECISION: Accepted as Clarified

This project has been approved for the period of **January 8, 2004** to **June 30, 2004** subject to full REB ratification at the Research Ethics Board's next scheduled meeting. The approval may be extended upon request. ***The study may now proceed.***

Please note that the Research Ethics Board (REB) requires that you adhere to the protocol as last reviewed and approved by the REB.   The Board must approve any modifications before they can be implemented. If you wish to modify your research project, please refer to www.BrockU.CA/researchservices/forms.html to complete the appropriate form ***REB-03 (2001) Request for Clearance of a Revision or Modification to an Ongoing Application.***

Adverse or unexpected events must be reported to the REB as soon as possible with an indication of how these events affect, in the view of the Principal Investigator, the safety

APPROVAL OF ETHICAL RESEARCH
Brock University

Senate Research Ethics Board **Extensions 3943/3035, Room AS 302**

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Senate Research Ethics Board (REB)

Chair
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Adverse or unexpected events must be reported to the REB as soon as possible with an indication of how these events affect, in the view of the Principal Investigator, the safety of the participants and the continuation of the protocol.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and approvals of those facilities or institutions are obtained and filed with the REB prior to the initiation of any research protocols.

The Tri-Council. Policy Statement requires that ongoing research be monitored.   A Final Report is required for all projects, with the exception of undergraduate projects, upon completion of the project. Researchers with projects lasting more than one year are required to submit a Continuing Review Report annually. The Office of Research Services will contact you when this form *REB-02 (2001) Continuing Review/Final Report* is required.

Please quote your REB file number on all future correspondence.

Appendix H

SUMMATIVE PERCEPTIONS OF GRASSROOTS JOURNEYS (N=15)

The parents of my students have shown more involvement in what their children were learning and what they produced as a result.   38

I would have preferred to be seconded and given time away from my classroom to learn these new skills.   44

My principal has shared the successes with the GrassRoots project with others in our school community.   45

Other teachers would like to collaborate with me in a future GrassRoots project. 46

I was surprised by what my students accomplished.   50

My principal has shown more interest in the accomplishments of my students with this technologically-driven project. 50

Other teachers have expressed an interest in learning more.   53

I was amazed by how much I learned.   55

Other teachers have shown an interest in what I was doing with my students.   56

Working on a GrassRoots project with my class has helped me to use more Information & Communications.   56

I was surprised by how much I accomplished.   60

I have learned that it is okay if my students are more technologically literate than I am.   56

I am more aware of the ways in which I can teach the curriculum AND also use the technology.   64

I have enjoyed the fact that I was learning the same skills as my students were. 64

My enhanced skills with technology have enabled me to be more effective in my integration of Information and Communications Technologies (I. C. T.) in my teaching in general.   65

I enjoyed my involvement with a GrassRoots web site project.   68

I enjoyed this opportunity to develop my professional abilities while working in my classroom with my students.   68