PORTALS, PRACTITIONERS, AND PUBLIC KNOWLEDGE:
A SOCIO-TECHNICAL ANALYSIS OF DIGITAL TEACHER EDUCATION

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Abstract

This study of professional development portals developed by the UBC research consortium, the Public Knowledge Project, analyzes the research, design and implementation of these PD portals from a social as well as technological perspective. The PKP teacher education portals are examined as socio-technical systems: networks of technology, information artifacts, and people and practices interacting with the larger world of teacher education, professional knowledge practices, and educational technologies. For a teacher education portal to be accessible and usable, the users, the knowledge documents, the portal infrastructure, and the social context must be in a continuous process of enrollment and translation, aligning each other into chains of association, moving towards the goal of stabilization or realizing the portal's network.

The thesis asks how we can move towards a socio-technical analysis of professional development portals in order to stave off a techno-determinist evaluation of technological artifacts that result in accounts of either doomsday failure or hypothetical success. I turn instead to an analysis of how two PKP portals made empirical differences in practitioners' professional lives and their knowledge practices, and what studying portals might tell us about information, knowledge, and social processes in teacher education. The chapters, using both empirical and analytical methods, examine the social impact of the PKP portals and the web of social and material relations in which the portals were embedded; two social worlds of teaching - pre-service and in-service - where both groups were grappling with the issues of knowledge and computer practices flooding into teaching via the Internet.
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I want to thank the mentors, the instructors, and all those teachers who tried, tested, and responded to the PKP professional development portals. Their willingness to give their time and energy freely to this project was greatly appreciated. I would like to thank two individuals in particular, both direct participants in the PKP prototypes: Vivian Forssman had the energy and passion to bring her project management talents to this world of teacher education. I thank her for “being there” and her ongoing realistic optimism of what is tenable in educational technologies. And I also want to thank Diane Akey, a practitioner who intuitively understood the powerful knowledge potential of EdX and wanted to share her understandings publicly.

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Dedication


Wise elders who continue to inspire me …

And to Larry Laurens Korteweg (1928-2000)

My father, whose love of education I continue to know, whose path I somehow continue to follow, and whose stories I continue to tell and live by.
CHAPTER 1

Introduction

The purpose of this thesis is to examine the relationships among teacher education, new digital environments for professional development such as portals, and public access to research and knowledge through portal prototypes. A starting point for my research has been a concept of public knowledge (Willinsky, 1999; 2000; 2002) that has the potential to be achieved through digital, technical means, employed to connect users and resources in innovative and dynamic ways, and envisage a transformation or change mission for the roles of research knowledge informing and working within the practice of teaching, potentially contributing to what is now being referred to as evidence-based practice. However, during the course of this research, the notion of a public knowledge portal and its transformational implications – that practitioners would want to access and inform their practice with research-based, public knowledge – became increasingly problematic, given the challenges raised by the participants to the very concept. What began as a clear beneficial purpose for the improved social use of educational technologies by educators, became simultaneously focused and displaced, rewarding and uncomfortable, appropriated and disowned in its implementation. Descriptions of three critical events that took place within the course of this study will help introduce the trajectory of complexity that I experienced during the research period of this thesis.

Event 1: Faculty of Education, University of British Columbia (Spring 1999)

One day in the spring of 1999, in graduate student offices in the Faculty of Education at the University of British Columbia, Dr. John Willinsky met with his research assistants
(myself, being one of these assistants) to discuss a collaborative experiment in-the-making with the *Vancouver Sun* newspaper that Willinsky referred to as the Public Knowledge Project (PKP). The editors of the *Vancouver Sun* believed there was a lack of public discussion taking place on the complex issues pertaining to technology and education in B.C. schools. John Cruickshank, Editor in Chief, was convinced by Willinsky to conduct an experiment in connecting research to journalism, and the newspaper proposed trying out this experiment with a series on technologies in schools. The PKP experiment’s aim was to supplement and provide a richer context or knowledge background for the reader public: we were to create an online portal where newspaper coverage would be combined with online resources filtered from the web, assembled, indexed, and categorized by our Public Knowledge Project. The *Vancouver Sun* portal was designed by PKP to provide relevant web resources drawn from five knowledge domains: research, practices, policies, organizations and issues. The larger mission of PKP was to “participate in scholarly publishing experiments that explore the prospects of greater public access to educational research,” with Willinsky going on to set out five goals of such work:

Such systems will need to offer some form of (1) free and open access through a friendly web-browser interface to a substantial body of research articles, reviews, and surveys, with connections to databases dedicated to educational policies and legislation, media coverage, curriculum materials and projects, organization and courses, etc.; (2) an indexing system that allows topics to be searched across a wide range of parameters, from population studied to research method; (3) a way of readily moving from a given research study to other related materials in other databases, such as media reports and government policies, and back again; (4) open forums for researchers, professional policymakers and public to discuss educational issues, methods, and research agenda; and (5) supporting resources such as indexes, summaries, commentaries, glossaries, reviews, FAQs, and instructional modules. ([Willinsky, 2002, p. 370](#))

From this conceptual beginning, the Public Knowledge Project spun off a variety of experimental prototypes, including the Educators’ Exchange project in May 2000. The
Educators' Exchange (EdX) was designed to develop and test an online knowledge management system for teachers, linking research and practice. The EdX prototype aimed to provide improved access to learning technology research, to assist the formation of online communities of practice, and to demonstrate the use of a web-based knowledge management system as a learning and sharing resource for teacher professional development.

In its original formulation, PKP was a scholarly publishing experiment and its key ingredient was “good” content determined by factors such as provocative theory, solidly researched, and/or evidence-based resources. The research-designers, myself included, believed that build it, and if it is ‘good’ content or knowledge, the public (intended audience) will come and benefit.¹ When PKP started, there were no comparable precedents. The Internet had become increasingly chaotic, endlessly proliferating documents on education, and the Public Knowledge Project’s goal was to bring order to one very narrow channel, scholarly research bearing on educational issues, for the benefit of an increasingly baffled and accountability-demanding public.

Event 2: Salmon Island School District (Autumn 2001)

October 2001. It was another staff meeting to contend with after what seemed an endless crisis-ridden school day, contrasted against a gloriously bright fall afternoon. A staff of thirty-three teachers (including myself, a part-time teacher), two administrators, and a guest senior administrator from the district office of this Vancouver suburb, we sat in a large, relatively unbroken circle of tables in the school library. Our meeting space was located beside the stacks of books with a row of i-Macs sitting against a shared wall with an up-to-

¹ I refer to the team of PKP decision-makers as the research-designers. I want to emphasize how university researchers were making design choices with each prototype decision as well as emphasize the roles of the hired technical designers (software developers, system managers, etc.) who translated or concretized the research ideas into technical application.
date computer lab visible through a large picture window. Only one computer was in use during the meeting: the secretary was taking minutes on the office laptop.

The central topic of this monthly staff meeting was teacher professional development. Each teacher reported which provincial professional development (PD) workshop they were able to attend during the previous week’s provincial PD day. As we went around the circle, teachers spoke of experiences, resources and information that they found important and useful. However, after three teachers’ reports, the names, events, and resources were basically lost to the assembled community of colleagues. The information, coded in the oral, dissipated into thin air. The resources of the school district for teachers’ in-service and professional learning now remained in that individual teacher’s short-term memory. It did not travel or transfer to other teachers during the staff meeting. It wasn’t recorded, converted or translated into a form that would permit it to travel to a public place accessible to everyone, available for further discussion, connections or extensions. The secretary did not take notes of the teachers’ professional development summaries, as they were not official administrative business but rather informal collegial knowledge sharing. We shared our in-service experiences, we shared our verbal knowledge, but it was not made into concrete or retrievable public records. The computers remained unused and the teachers’ new knowledge remained solitary, disconnected, and episodic.

My frustration grew from personal experience and professional observation, as I realized how repeated this loss of professional knowledge and experience is in schools and with teachers. I recognized this instance as a typical case of teachers acting as recipients of knowledge: they have acquired some information from outside organizations, keynote speakers, researchers and workshop leaders, but the institutional culture within which they
work does not actively encourage them to consider this knowledge as an active part of a collective practice, of teacher’s practice as sharing new knowledge with colleagues. There are few institutional mechanisms in place for teachers to view themselves as active foragers, sources, and managers of knowledge for their own development or for the development of teaching. Technologies as inscription devices (Latour, 1987, p. 68; 1988, p. 83) or computer tools as mechanisms for inscribing, extending, and connecting teachers’ knowledge with homogenous professional terms, these technologies are not recognized as active tools for teachers’ knowledge work. Teachers, as knowledge workers, are still understood and institutionally confined to attend to their assigned students, generally isolated in their classroom space, and solitary in their professional growth and acquisition of knowledge.

Event 3: Mainland District (Winter 2001)

January 2001. It is a typical rainy winter day on the West Coast. In an administrative building of a large Vancouver suburban school district (Mainland), nine mentors or teacher-leaders are meeting with their university program instructor and myself, the researcher and implementer of a new PKP prototype. The Mainland District has designated these mentors as established leaders in educational technologies and classroom integration. The district is collaborating with a university extension programs department to organize and offer an educational technologies diploma program to one hundred teachers, both elementary and secondary. NETTL (New Educational Technologies for Teaching and Learning) is a two-year professional diploma program of teacher self-study projects integrating educational

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In the thesis, I use the following stylistic convention regarding names: For the participants, to maintain anonymity, when they do not participate in direct conversation with me or with others, I use designations such as Mentor 1, Mentor 2, etc. For the participants who do participate in direct conversation and to maintain the flavor of conversations (both the online and offline), I use first name pseudonyms. When publications and published scholars are cited, I use their real last names. And when I refer to PKP members, from the University of British Columbia, I use their real names (first and last) with permission.
technologies into their classrooms and, in return, providing enough credits to augment teachers’ pay categories. The NETTL mentors have been targeted as the first line of implementation and in-service for PKP’s professional development portal called the Educators’ Exchange or EdX. EdX is a PD online knowledge management system constructed for a cohort of educators examining educational technologies, studying the technologies’ curriculum integration, and, testing the technologies’ effects in their own classrooms.

At this decisive meeting (January 2001), after nine months of working with EdX, nine mentors discuss the future and fate of the EdX portal for their knowledge work as mentors of teacher-colleagues as well as their own work as classroom teachers. In the below comments, they are addressing me, the author, as the designer and implementer of EdX. The university instructor and mentor coordinator, Chris, was also in the room, leading and contributing to the decisive discussion. The general consensus of the meeting and the conclusion of EdX are summarized by the following selection of mentor comments:

*Mentor 1: All these documents [of EdX] can be found out there on the net and what you've tried to do is make it easier by putting them all in one place. But, unfortunately, there are people like me who are stubborn. So, we're going to go to all of our traditional places [on the Internet] and methods of doing it [finding knowledge] because that's the way we've always done it. Even though there is this one source, this one site, EdX, that has brought it all together, it is still easier for me to do it my way and I'm stubborn.*

*Mentor 2: EdX isn't working for us. Face-to-face discussion and personal interaction is a lot more important to us than resources or research. It's faster and instant and I get what I want from people, from talking to them. The required minimum is what we're doing here [in research for this course]. There's no room for something that does not give us instant gratification. People are not interested in searching for resources or reading research on EdX because they are doing their own grassroots research. ... [Published] Research and papers are irrelevant to my mentees. Once they have done their own field research, it might become relevant to them to look and find out what other people have done or written. They might wonder how might I extend it [their research] or what have other people found out? We're really at
the grass-roots stage here [of professional development] where I don't care what other researchers or educators have done because I am doing my own research and I want to find out the information for myself. I don't care how many papers or resources are out there because it doesn't apply to me, it doesn't apply to my classroom and my situation -- I want to find it out for me by myself.

Mentor 3: My students [NETTL mentees] would rather phone me. It's like we're going into too much of an electronic world where we have to communicate too much by email or discussion forums. Why can't we just pick up the phone?? We're getting too dependent on the electronic world. I'm not going to use EdX if my mentees are not going there.

In these comments, three NETTL mentors state how they perceived the EdX portal as lacking in usability to satisfy their knowledge and communication needs and how they became unwilling to take ownership for the EdX portal. Mentor 1, as representative of the majority of mentors (or “people like me”), describes his own “stubborn” resistances to the driving narrative or expectation of teacher knowledge practices as represented by EdX. He laments how the EdX tool embodies and promotes reform, even efficient commendable reform, to his own stubborn ineffective methods of finding knowledge resources and conducting digital research to inform his teaching practice.

Mentor 2 bemoans the genre of knowledge he finds principally represented on EdX, which he defines as academic. This mentor believes there is little connection, or need for connection, between inside, localized, grass-roots practitioner research, on the one hand, and external, university-located, expert research, on the other. He views EdX as a static technology, reifying the university model of a repository of academic research texts. This mentor holds an epistemic position, which finds few living dynamic connections or human intermediaries existing between two solitary institutions of academic research (theory) and grass-roots classroom teaching (practice).
Finally, Mentor 3 briefly describes his impression of EdX as a dissuasive technology for teacher-to-teacher communication or collegial connections. He characterizes the non-electronic, the non-EdX, as a more comfortable, sociable communication space for his teacher-to-teacher interactions.

*Portals, Practitioners and Public Knowledge*

These three critical events outline the complex unfolding of the study. They might be summarized as (1) the genesis of the Public Knowledge Project (PKP); (2) the collective loss of teachers’ knowledge and learning in the institutional space of teacher professional development; and, (3) the social shaping or rejecting of a technology due to perceived disconnections between theory (university) and practice (school), external (computer communication) and local (face-to-face communication).

These were three events that I experienced in the course of this research, over a period of three years, three locations, and two institutions (university and school districts). While the second event – the staff meeting – presents a mundane, typical reoccurrence in teachers’ professional development, the first event – the PKP-Vancouver Sun collaboration – presents a counter-narrative to typical conventional professional development. The Public Knowledge Project (PKP) presents a unique mission, a means to reform or change the continuing loss or isolation of knowledge in teachers’ professional development. The PKP mission (first event) reveals a significant change of course for the use of digital tools in education: it aims to develop and design technologies which will record, organize/manage and increase the value of knowledge in connection to teacher professional development. PKP supports the teacher’s right to know that what is stated, as “good” content in educational research, will act for the teacher’s professional behalf. The third event, the final EdX portal
meeting, moves beyond the design and consideration of technologies for professional
development or beyond the flexibility of a technology to be socially shaped. In this event, the
majority of mentors, who were PKP’s most important *spokespersons* for potentially
translating the merits of the portal’s capabilities into the interests of the teacher-users, they
declared the EdX portal as an ineffective tool for teachers’ needs (Latour, 1987, p.71). ³ In
this final event of EdX, a critical *theatre of proof*, the mentors were asked to take ownership
of the portal’s management, maintenance, and social shaping (Latour, 1988, pp. 85-87). ⁴ It is
at this review or trial that the mentors declare the portal as generally unusable for teacher-
users, bearing little resemblance to and suitability for teachers’ knowledge work in this
university diploma program.

Here, then, is a chronological and philosophical continuum along which the thesis
travels. My research begins with the needs and gaps in digital teacher education in which the
Public Knowledge Project designed and launched its first knowledge portal, PKP-VanSun, in
April 1999. The PKP portal design development progresses through two implementation
sites (PKP-VanSun, 1999, with a newspaper-reader public, and, PKP-CITE, 1999-2000, with
a pre-service cohort of 36 teacher candidates), culminating in the creation and testing of EdX
with an in-service cohort of 100 classroom teachers. The thesis research concludes with the

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³ *Spokespersons* are those who speak for others who cannot (non-human) or do not (human) speak. In this case,
the mentors, as the designated technological leaders in their school district, could speak for the machine, for
EdX. Simultaneously, they were the representative mouthpieces for those teachers who are not yet “technicist”
or technologically able or comfortable to speak in machine-related terms.

⁴ A *theatre of proof* is a term coined by Latour to refer to “dramatized experiments where spectators can see the
phenomena,” previously described in scientific text (Latour, 1988, p.85). It is usually a spectacular or evident
demonstration rendering the proof indisputable or without doubt.
closing of the EdX portal in February 2001, but only to see it reincarnated into a First Class\textsuperscript{5} database prototype called WebLink Directory, in September 2001.

Complexity of Portals, Practitioners and Public Knowledge

In the empirical context of this chronological and philosophical continuum, the study gathered evidence that spoke to how the design of a PD environment must build upon the participants' clearly perceived needs as well as factor in social elements that are familiar, hence, comfortable to these users. For example, the knowledge work afforded and encouraged by the portal prototype needs to resemble or assist the knowledge work in which teachers participate regularly in either their schools or, at the very least, in their professional coursework. The portal prototype needs to place the local expertise of the user group, of their community of practice (Lave & Wenger, 1991), at the centre of its knowledge repository. And the design of the technical features which function to encourage users to discuss, to access knowledge resources, and to reveal one’s thinking, need to aim for an overall affective response of comfort.

This study’s chronological account of the events that took place around the development of a PD portal is a history of an experimental technology that evolves through three phases in its efforts to increase the educational and professional value of educational research for teacher-practitioners. Professional development portals are to support teachers’ knowledge work as well as extend their educational needs. Portal design for practitioners requires understanding their knowledge work: it requires understanding the ways that it is not only supported, but, potentially changed, even challenged, by educational technologies and professional development portals. What the evidence of the practitioners’ use of the PKP

\textsuperscript{5}First Class is a system that can be described as collaborative groupware for organizations. It is a server system or intranet that provides its users with the ability to communicate and share information via email, conferencing, directories, individual and shared calendars and online chats.
portals demonstrates is that teacher-users can view technologies as systems of external professional control and social shaping as well as simultaneously view them as facilitative media for communication and self-expression. The degree of ownership that the technologies afford or permit teachers is critical to their use of it for purposes such as communicating and sharing knowledge in a PD setting.

When teachers believe they have ownership and primary control or influence upon the tool's design, time period, and purpose, they are more willing to participate and participate regularly. They are more trusting and willing to believe that they are participating in the social shaping of the tool, rather than resent or resist a prototype that they believe has more social influence upon shaping them, their knowledge work, and their professional education. This is the critical tension and complexity of the study: I needed to analyze and understand the relationship between meanings and interpretations of technological artifacts and their sociopolitical milieu as well as trace the social or technological forces exerting shape onto the network. In order to address this complexity, I have sought to balance problems and attention to the technological construction of social, educational worlds with its converse, which is to say, the socio-educational construction of technology.

To trace these influences or forces, I examine the work of the teacher-participants, their knowledge practices (i.e., are primary source research documents important for informing their practice or professional education?); the institutions that support these practices (including the academic field of teacher education); and, the interaction of all these with the portal and the spokespersons-actors representing the portal – software designers, management team, instructors, researchers. Understanding all of this might be too much to aspire to in the complex, nuanced, and variable world that we call education, particularly
teacher education in the digital age. And designing the perfect portal that will address all of these users, needs and factors is certainly too much to aspire for in one prototype at this nascent stage of digital professional development design.

The thesis does not evaluate portals as winners or losers in digital professional development as this type of judgment and examination would simply reinforce a technodeterminist stance. Rather, the thesis is an account of a university research team testing grant-endorsed, sophisticated, research-based portals with practitioner-users. It is not an overly detailed, tell-all text, about these particular PKP portals as that would detract from a focus on teacher education as a field, as an institution, attempting to grapple with the potentials of digital environments and the structures, both social and technical, that either enhance or limit those potentials.

Thesis Statement

Given how few institutional mechanisms are in place for teachers to view themselves as active purveyors, translators, and managers of knowledge for their own professional development or for the knowledge base improvement of teaching, an internet-based PD environment providing public and free tools to access, manage, use, and talk back to educational research would appear opportune with a liberating, reform purpose for the two institutions, schools and universities. Yet, when the time came to transfer ownership of the portal to the key group of teacher-leader-mentors, they refused to participate any longer in this participatory research. Almost contradictorily, these digital PD portals had worked successfully for practitioners’ knowledge needs, while they simultaneously faltered in the co-construction of a stable network with practitioners.
This study locates the paradoxical nature of this event at the intersection of teacher education, Internet-based technologies, and the institutions of university and school, in the ways portals and teacher professional development reciprocally extended, restricted, and otherwise served to disrupt or disconnect from each other. Like other recurring elements of teacher PD and reform, such as outside expertise, university-driven projects with limited funding, involuntary (sic) teacher participation through course assignments and grading, the PKP portals played into multiple viewpoints (user interpretations) concurrently. Not only were the portals perceived as rich knowledge environments and tools of public access for professional learning, but they were simultaneously viewed as models and metaphors perpetuating the gap between teachers and researchers, and, between theoretical and practical knowledge.

As Huberman (1999) has argued, researchers and practitioners’ micro-worlds cannot remain isolated from each other in order for the field of educational research to develop (p. 289). There needs to be greater “sustained interactivity” or shared activity for knowledge to be exchanged, translated, and constructed (p. 291). Digital PD portals can help initiate and sustain interactivity between separated institutions and stakeholders’ micro-worlds by providing greater opportunities and malleable environments for this mutual engagement, yet, this promise was not achieved to any significant scalable effect with the PKP portals for two prominent reasons. Firstly, technological environments that intend to increase teachers’ active engagement in their professional knowledge development need to be consciously designed to recognize and accentuate teachers’ own professional expertise in the form of local knowledge. Secondly, the narrative of use or metaphorical design needs to recognize the contributive element of human intermediation to build bridges between communities of
users, the stored knowledge (repository), and the dynamic knowledge of lived interpretation (discussions). The sense of these two critical components as missing was clearly indicated in the presence of symptoms of displacement and discomfort among participants.

Although much discussion, particularly in information studies and technological design, has focused on user-centred design or usability studies of information systems in general, a theoretical or conceptual base of teachers’ knowledge work to inform prototype design, particularly in digital professional development environments, has been lacking. In this thesis, I investigate the uses of irreductionist social theories of technology (Kaghan & Bowker, 2000) such as science, technology and society (STS) studies, particularly, its branch of actor network theory (ANT), social informatics (SI), and situated learning, as the basis for understanding the emerging knowledge work and professional needs of teachers with educational technologies, and, how the design of teacher professional development portals works in connection with those needs to co-construct a network. As ANT theorists state, there is no (usable) technological object or artifact (such as a portal) unless there is a network of actors (i.e., users) (Latour, 1988; Callon, 1986). And there is no network until the users/actors are willing to take ownership and control of the use of the technological artifact. A portal (a technological artifact) is only as real as its network; therefore, a professional development portal for teachers is only as real as its practitioner-users and their usability of the portal’s functions, contents, or (public) knowledge.

This analysis is rooted in an empirical study of the Public Knowledge Project’s professional development portals for teachers over a 36 month period; however, it is not a specific evaluation or judgment of any one of the portals or the research consortium of PKP

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6 The term irreductionist refers to Bruno Latour’s statement that “nothing is irreducible to anything else, there cannot be tests and weaknesses on the one hand and something else on the other” (1988, p. 214). Irreductionist social theories are those that do not test in order to judge or reduce the web of social and material relations.
in particular. Instead, it addresses concerns raised by its target user group, the teacher-practitioners (both users and non-users), about actual and potential changes in teacher knowledge work and teacher education made possible by portal technologies. I argue that the findings reflect not just issues specific to the PKP portals or to teacher education portals alone, but, rather, to the social, material, and institutional practices of teachers’ knowledge work and the changes brought about by the electronic publication of educational research, by both practitioners and academics, on the Internet. The findings of this PKP empirical work can be encapsulated and analyzed by the following complex question: how did these digital PD portals work successfully for practitioners’ knowledge needs, while they simultaneously faltered in the co-construction of a stable network with practitioners? This thesis will argue that the PKP portals succeeded in having noticeable impacts on certain practitioners’ knowledge practices—making research more accessible and usable in the process—while simultaneously faltering to motivate and persuade a critical sustainable number of users to reliably, generally use and take ownership of these portals as intended by our research project.

As a result of studying the events associated with these PD portals, I first determined that an effective or stable teacher professional development portal is one that has to function at three levels to attain and stabilize a network. First, the portal designer-researchers need to acknowledge the possible narratives of use and the embedded purposes that lie behind changing or transforming users’ or teachers’ knowledge work. Any prototype or digital environment has at its core a vision or narrative of how the prototype is distinct from other portals as well as what it intends to offer in convenient access to useful knowledge that has never been offered previously (Star, 1999). The encoded narrative for a portrayal of teachers’
knowledge work should reflect and actively support changes in practitioners' or users' epistemic communities.

Secondly, the portal design needs to demonstrate an ability to draw forward, draw upon, and draw attention to human intermediaries. This second element is founded on the proposition that a prototype gains and stabilizes a network through its ability to encourage and acknowledge its human intermediaries (Star & Strauss, 1999; Callon, 1986). Intermediaries do the critical fieldwork of translating or bridging human work with the machine or digital environment. These human translators mediate the artifact's narrative or reform mission into terms and actions recognizable by fellow users: they bridge technical difficulties by offering alternatives or shortcuts; they demonstrate the benefits of the system and its contents by modeling themselves as exemplars of use; and, they showcase their own successful connections with the content or functions of the artifact. Their role needs to be patently clear and central in the portal design.

Finally, the portal design needs to enable and influence an affective, social environment that promotes comfort and trust. This third element, the prototype's ability to attend to the affective design of its associated (enabled) social environment (Van House, 2002; Norman, 2004), is a critical function for enrolling practitioners and making alliances with users (Latour, 1987) in the portal's network. The portal's intersections with teachers' knowledge work and its influences on emerging communities of practice, highlights critical issues of comfort and trust in digital professional development portals. Teachers need non-intimidating opportunities to try to articulate new knowledge positions and they need supportive, friendly environments wherein they try to understand new educational research (White, Shimoda, & Frederiksen, 1999).
The PKP digital environments were envisioned and designed as professional knowledge management portals where professionals could access the knowledge they wanted or needed in one convenient library-type e-space. The PKP portals were actively defined and designed as knowledge spaces instead of affective spaces of comfort and trust for teachers to publicly share and try out new ideas. The main knowledge-work paradigm in the design of the PKP portals was *facilitate access*: it sought to provide direct, unmediated access to publicly funded, educational research now made more *public* knowledge in the increased accessibility through the PKP portals. Usability of the portal was understood as giving teachers the means to read knowledge and apply, with no watering-down intermediation by unnecessary translators (Agre, 1999), research-based (or evidence-based) approaches to their own teaching with educational technologies. The focus on teachers’ knowledge work and public access to knowledge was expected to provide conditions for an emerging community of professional practice of its own making, rather than PKP needing to design for conditions and effects of support, comfort, mediation, and trust-making.

*Plan of the Study*

This dissertation is organized into three sections. Part 1 seeks to describe the basic outline of professional development, teacher knowledge, and educational technologies. In chapter 2, I give a brief historical overview of the emergence and growth of educational technologies and professional development for the purpose of providing a setting within which the rest of the study can fit. Chapter 3 explains the theoretical model of ANT and other non-irreductionist socio-technical theories through an examination of conceptual terms that I will use to analyze the digital professional development experiments of the PKP prototypes. Chapter 4 describes the portals in greater detail for the reader to visualize their
infrastructures, tools, and environments, as well as describes the social sites of implementation and the teacher-participants. Chapter 5 explains the evolution of methodologies from a usability focus to participatory action research and finally a socio-technical approach, each corresponding to a particular historical phase of the projects and to a particular implementation context.

Part 2 constitutes the heart of the PKP prototype study, the place where the empirical facts of the PKP project are interpreted and retold through a socio-technical conceptual language. In Chapter 6, I explore the first PKP prototype’s emergence as the historical precedent and encoded master narrative out of which the next two prototypes develop to succeed it (February 1999-February 2000). I consider its impact on a cohort of pre-service teachers composing an electronic essay through WebCT discussions with references to the PKP-VanSun portal’s content. Chapter 7 considers the transformation of the first PKP prototype into EdX and its successful impacts on some of the teacher-users’ knowledge practices through the work of skilled intermediaries. Chapter 8 reviews the trials of EdX officiated by the NETTL mentors, with a range of contributing factors that made EdX an uncomfortable, unconvincing, and unappealing technology to the majority of these actor gatekeepers. Finally, Part 3 or Chapter 9 revisits the thesis in its entirety through three sections or mini-chapters. Section I revisits the questions set forth in Part I concerning professional development and teacher knowledge in digital environments along with revisiting ANT and social informatics as theories and methodologies for following human and machine actors in their interactions. Section II reviews the empirical observations of the actors and the networks by reconsidering the observations as lessons learned to better inform future attempts in designing professional development portals. Finally, in Section III, the
thesis concludes by considering what this study could offer the growing field of educational technologies research.
CHAPTER 2

A Literature Review of Teacher Education and Educational Technologies

Introduction

In the recent past, teacher education has been frequently invoked as the answer to problems in education, including the present dissatisfying state of computer integration into classroom practices (Pea, 1999; Cuban, 2001). A study of the history of teacher education demonstrates that teacher education has been called upon in the past to perform transformative deeds in the field of education (Cuban, 1984, 1993; Goodlad, 1994). And teacher education is a viable part of any change process in education (Fullan & Miles, 1992; Spillane, 1999), particularly when practitioners are actively involved, but teacher education reform cannot work alone. Changes in the technologies available for schooling and for teacher education have an important influence on the way we experience and think of teacher education, but technology is also not all-powerful and cannot work alone. Rather, both technological change and teacher education reform need to intersect with one another and with other critically important social, cultural, political and institutional factors to help impact how digital teacher education could be effectively practiced.

This chapter reviews the research of the fields of educational technologies and teacher education, particularly digital portal environments and teachers' professional development, to locate commonalities or points of intersection between these fields of research. Where the points of intersection occur are the points at which digital tools could be integrated to the greatest institutional effect in teacher education: to use digital portals to establish and
leverage epistemic communities in education with open access to both educational research and a broad range of educational actors.

*Un-usability and Inaccessibility of Educational Research*

Ellen Condliffe Lagemann, a noted education historian, has claimed that educational research is a byproduct of twentieth century values on "scientism"--that is, making education research in the image of the "hard" sciences such as physics (Lagemann, 2000; 2002). As a result, there is a notable shortage of "usable knowledge" coming from educational research endeavors; that is, research knowledge that matters to practitioners and to the way education is done in schools. Lagemann advocates for an effort to convert high-quality academic research into usable knowledge by translating research findings into the kinds of tools and applications that educators and learners can use. She also promotes the stance that “practitioners should be able to take the problems of practice back to research” (2002).

Related to the problems of usable research knowledge for practitioners, is a more pressing problem of the first order: accessing the documents, the knowledge produced by educational researchers, as journal subscription rates soar with digital publication and hardcopy journals, leading to journal cancellations. As Willinsky (2005) has commented, the idea of dissemination or access to educational research by the public (those stakeholders located outside of the university, including teachers) has been seriously questioned. Not only has the scientific quality and contribution of educational research been questioned, but digital open access to educational research has not even been pondered by critically powerful, *public* educational agencies such as the National Academies (US).\(^7\) Willinsky specifically questions the sixth principle of scientific advice, offered in the *Scientific Research in Education* report

\(^7\) Willinsky directly addresses the National Research Council’s publication, the *Scientific Research in Education* report (Shavelson & Towne, 2002) in two publications (2005, 2001).
(Shavelson & Towne, 2002). This principle implies that educational research becomes more legitimate and scientific when its disclosure is given only to professional peers (other academic researchers). The writers, and by implication the National Academies, do not consider or advocate for open access of educational research to the public. “It is as if such research were indeed a professional secret, one which should only be disclosed to those who can be trusted with it. Against such notion, I would argue that the final step in any research project should be about ensuring the circulation and exchange of knowledge in as wide a fashion as is feasible” (Willinsky, 2005, p. 41) and ensuring that “research falls within a democratically informed public sphere” (p. 45).

To fulfill this greater democratic public agenda for educational research, I agree with Willinsky that it could be assisted by Internet-based digital technologies, in the order of “an infrastructure to promote ongoing collaborations among researchers, practitioners, and policymakers” (Shavelson & Towne, 2002, pp. 155-156, as cited in Willinsky, 2005, p. 47). And I want to assist in the realization of this greater democratic role for educational research in teacher education by examining a number of critical elements that I argue must be considered and addressed when providing greater access to research. These elements include the following: teachers as isolated knowledge workers; epistemological models of teacher knowledge in educational research; facilitation and mediation in teacher education; models of communities for practitioner-researcher interactivity; the options of internet technologies for education epistemic communities; and, the complexities of employing technologies to address social problems in the field of education in order to produce change.
Teachers as Isolated Knowledge Practitioners

Few institutional mechanisms are in place for teachers to view themselves as active purveyors, translators, and managers of knowledge for their own professional development (individual consideration) or for the knowledge base improvement of teaching (collective, institutional consideration). One pervasive condition that maintains this impoverished knowledge situation for teachers is teacher isolation from their teaching colleagues, from other schools (or groups of teachers), from other organizational actors within their own school boards (curriculum specialists, administrators, parent advisory councils), from other institutional branches of education (Ministries, universities, policy makers, Faculties of Education) and, other institutional actors (researchers, parents, trustees).

The current situation of professional development is of little help in changing this viewpoint of teachers as knowledge workers. Despite recognition of the importance of regular professional development, the majority of PD available to teachers is grossly inadequate: it is negligibly short-term, fragmented, intellectually vacuous or disengaging, and regularly uninformed by established teacher education research (Ball & Cohen, 1999; Borko & Putnam, 1996; Putnam & Borko, 2000). As the teacher education researcher, Linda Darling-Hammond (1997) has summarized the current situation:

If teachers are to prepare an ever more diverse group of students for much more challenging work – for framing problems; finding, integrating and synthesizing information; creating new solutions; learning on their own; and working cooperatively – they will need substantially more knowledge and radically different skills than most now have and most schools of education now develop. (p. 154)

However, the problem of teacher isolation is not simply the lack of a skill set by the individual practitioner, it also encompasses institutional and cultural elements that cannot be eradicated by a new skill set taught in workshops or schools of education. Shulman (1993),
the educational scholar and president of the Carnegie Foundation, had the opportunity to reminisce on the culture shock and institutional differences, indeed the institutional inversion, between schools and universities. Shulman comments on what he experienced and observed as a new PhD candidate entering and anticipating his membership in the institution of the university, contrasted against his experiences of impoverished and solitary knowledge conditions as a practitioner.

My anticipation contained two visions. One was the vision of the solitary individual labouring quietly, perhaps even obscurely, somewhere in the library stacks, or in a laboratory, or at an archaeological site; someone who pursued his or her scholarship in splendid solitude. My second vision was of this solitary scholar entering the social order --becoming a member of the *community* -- interacting with others, in the classroom and elsewhere, as a teacher.

What I didn't understand as a new PhD was that I had it backwards! We experience isolation not in the stacks but in the classroom. We close the classroom door and experience pedagogical solitude, whereas in our life as scholars, we are members of active *communities*: communities of conversation, communities of evaluation, communities in which we gather with others in our invisible colleges to exchange our findings, our methods, and our excuses. (Shulman, 1993, p.10, *emphases* mine)

The community Shulman is describing in the university, the diligent collaborative community that encourages multiple modes of interaction (activity, conversation, evaluation, exchange) amongst its members, could best be described as a community of practice (Lave & Wenger, 1991). It is a community where members actively, and routinely, seek out interaction with other colleague-actors in their organization (other education academics, researchers in one's particular and related sub-fields) as a means to hone their skills, to continue in the development of their profession, and to advance their thinking on a particular question or problem. The teacher, on the other hand, has a restricted, isolated sense of participation in their profession, in their knowledge contributions to their field, and little

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8 Brown & Duguid (2000) provide a detailed explanation and applied summary of communities of practice through technological environments.
realization that a larger professional community with whom they exchange ideas, methods and observations could improve itself and the effectiveness and engagement of their teaching practices.

Even the building itself, the architecture of the school, promotes isolation in its egg-crate like classroom construction. The infrastructural design of the building neglects conditions for collegial exchange by teachers or an expansive pursuit of ideas for engagement. Teachers' interactions with one another are not a focus in the organizational conditions of the daily timetable; hence, collegial interactions are often fleeting exchanges in hallways, in the staff room over rushed lunches, or tired comments at the end of the day by their doors. In the daily demands of classroom work, teachers do not have ready access or incentives to hone a skill set for establishing networks with one another. This activity of exchange, of developing the practice through professional discussion, is not an inscribed discourse in either their job descriptions, the physical architecture of schools, school district organization, nor in incentives to reward for the time and effort necessary for networking and knowledge sharing.

The results of this isolation and ineffective professional development are most acute when teachers who wish to discuss intriguing problems of practice can only consider graduate school to find like-minded, critically-engaged, professionals. When teachers want to pursue their pressing professional questions, the sad irony is that their main option is to leave the institutional isolation of schools in order to participate in a larger, connected, knowledge-pursuant community such as that of the university.

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9 See Neumann, Pallas & Peterson's (1999) examination of two practitioners, Brenner and Ladson-Billings, and their reasons, motivation and impetus for becoming educational researchers (p. 250).
Teacher education researchers are recommending that teacher isolation can be mediated and overcome when teaching is characterized by collective means and seeks connections with external constituencies. When teachers take collective responsibility for a school-based project, such as student learning, they conceive their work to be a joint enterprise (Little, 1990) and they become committed to discussing regularly the improvement of conditions for student learning, and hence, for their own intellectual engagement in their work. Teachers also develop a higher sense of personal and collective professional effectiveness and assume that learning for the students results mainly from school, rather than non-school factors (Lee & Smith, 1996). And, finally, when teachers engage with parents and other public stakeholders to determine standards of student performance, teachers are demonstrating that they are actively monitoring and developing themselves as a profession (Hargreaves & Fullan, 1998, pp. 104-105).

Models of Teacher Knowledge in Teacher Education

Educational changes of any significant magnitude will require learning and knowledge enhancement on the part of practitioners. This knowledge engagement will be difficult without support and collaboration, particularly from those who are in positions with politically powerful, usable knowledge, in parallel institutions, from researchers in universities who have gathered evidence-based knowledge to policy-makers in government who are forging new curriculum directions. These external-to-schools, yet parallel knowledge seekers in education, can engage in exchanges about what are effective strategies under which conditions or on important questions that impact teachers re-searching and re-considering their practices and professional knowledge.

Conceptions of Teacher Knowledge
In the field of teacher education, academic conceptions of teacher knowledge generally split into two positions that serve two distinct purposes: they can connect or create conditions to place teachers and researchers in “sustained knowledge interactivity” (Huberman, 1999), exchanging, translating, connecting, extending, and constructing knowledge; or they can disconnect or displace teachers and researchers away from each other into separate spheres of scientific/academic and practical/applied, defined into reified positions of formal versus informal knowledge, reinforcing a conceptual dualism between theoretical and embodied, and an enlarging gap between research and practice (Fenstermacher, 1994; Richardson, 1994).

Compounding the problems of usability and accessibility to research knowledge for practitioners and the public is the lens of research often pointed by academics onto practitioners. University-based researchers, whether advocating for teacher research by teachers or arguing the epistemological validity of academic research on teachers, have been the ones to espouse the quest to study teacher knowledge/research as distinguishable and separable from academic knowledge/research. University-based researchers are often studying down from the university into the schools in order to study the topic of where the university encounters and divides away from schools and teachers. It is not often that the university-researcher is attempting to study across, across from one side of the project table to the other, to attempt to collaborate on a project of mutual agenda, roles, purpose, and needs.

There are academics claiming that the culture of school is distinct and different from the university (Hargreaves, 1994; Clandinin & Connelly, 1995; Norris, 2000; Cochran-Smith & Lytle, 1993) in terms of community membership and the impacts of discourse,
organizational norms, and the material conditions of the professional practice. They claim that teachers have a distinct discourse and ways of interacting with one another, which are not to be found in the university. In fact, some researchers have demonstrated that when in discussion, the encounters of researchers and educators can be volatile due to these institutional and socio-cultural differences (Page, Samson, & Crockett, 1998, p. 300). Other academics make epistemological claims about these distinctions between the two institutional worlds. They claim that teachers value practical, personal, particular knowledge useful in their immediate teaching situation while academics value theoretical and generalizable knowledge claims that will be valued and recognized by their academic colleagues (Fenstermacher, 1994; Huberman 1996; Richardson, 1994). There are other researchers who use the classification of teacher’s knowledge as personal-practical for the means to construct practitioners’ stories as narrative research (Clandinin & Connelly, 1995). In these cases, practitioners’ accounts are the primary source, the data, for the researchers’ elaboration and secondary interpretation.

If we enter the discussion of teachers as researchers or generators of original, primary source knowledge, must we inadvertently enter the epistemological debates and seemingly “paradigm wars” (Anderson & Herr, 1999), concerning the validity of practitioner knowledge by battling over the standards, rigour, and criteria of evaluation? If we abstain from discussing teachers as constructors or generators of knowledge and focus instead on teachers as filters¹⁰ (Eco & Coppock, 1995), managers, or connectors to knowledge and

¹⁰ Umberto Eco (1996) recommends that Internet users focus on a skill set of filtering and selecting a manageable set of knowledge in order to avoid being overwhelmed by the sheer volume of research and information in the explosive and “acephalous” era of cascading digital information available through the Internet.
resources, we are still addressing teachers' knowledge but not from the point of defining, judging, or arbitrating it.

Teaching is a complex practice of mediation between different knowledge worlds: the worlds of official formal knowledge (educational research, content knowledge, disciplines, educational policy, resources), the worlds of their students and family constituents (their discourse, communities, viewpoints), and the inherent institutional culture of classrooms (culture of schools, government policies, prescribed curriculum).¹¹ All three of these worlds and how they connect or filter through the teacher are objects of study (sustained, funded, connected) in the university. There must be something missing for teachers' professional knowledge and practice when they have limited or no access to educational research that fundamentally concerns them, their knowledge practices, and the development of the profession. Ironically, this issue of access to pertinent primary source research knowledge has become most pressing during a time of overwhelming overloads of information and new digital technologies. Missing links (Willinsky, 2002) of access, and, consequently, missing organizational mechanisms and technological tools for association, for both teachers and researchers, continue almost imperviously to the quickly establishing medium of the Internet's open access digital connections. Surprisingly, the institutions of school and university remain concretely and unnecessarily divided as the Digital Age gains presence and strength in daily life and work.

Predominant models of innovation in professional development are briefly reviewed here to help challenge the gaps or absences of digital mechanisms, tools, or environments for teachers' access to knowledge. My argument is that if these mechanisms and environments

¹¹ Lagemann (1993) does lament how teachers are not prepared or trained to become public educators or public speakers on the meanings and changes of public education.
were given due attention technologically, socially and institutionally, teachers would begin to view themselves as managers, mediators, and contributors of knowledge for their own practice and for the profession. I contend that it is only when researchers' models of teacher knowledge are flexible and participatory enough, along with technological design and research for knowledge conditions to inform each other, that we will be able to, as Lagemann suggests, create “usable knowledge” (Lagemann, 2002), that is, knowledge that helps us not only as researchers, but as members of the education profession. The members of this profession, practitioners and researchers alike, could stake spaces of commonality through the processes of managing, mediating, and contributing knowledge and this common space could produce new groupings or communities for exchange.

Facilitation and Mediation in Emancipatory Teacher Education

Critical in the project for locating commonalities and building bridges between researchers and practitioners has been progressive, liberatory teacher education movements. Donald Schon’s concept of the reflective practitioner is now generally taken as the seminal academic piece advocating a practice for teachers to refine their knowledge and to examine their practice critically. Schon’s work (1983, 1995), in particular, finds a prominent place in the emancipatory project of getting teacher’s voices, hence their knowledge, back into the debates about improving teacher practice and reforming teacher education, (Grimmett & Erickson, 1988; Liston & Zeichner, 1991; Zeichner & Tabachnick, 1991).

Puzzles of practice for teachers (Munby & Russell, 1990; Grimmet & MacKinnon, 1992) are those teaching events that may occur as puzzles: when what was intended and what actually happen are so unexpectedly dissimilar that no amount of replaying the lesson on the ‘video player of the mind’ will discover what went wrong. Something more is needed,
something such as a facilitated, substantial conversation with an informed or experienced Other. Teacher colleagues could help enlarge and discuss the situation as they themselves may have had previous experience with the same phenomena of practice. But teachers rarely meet for any discussion that is regular or substantial due to institutional constraints of time, money and energy. Teacher researchers have realized that there is research potential in these conversations of mediation as well as a means to help alleviate teacher isolation by offering knowledge engagement opportunities as local inquiry activity (Wells, 1994).

The risk in the practice of mediation in teacher education or reflection-in-action (Schon, 1988) is granting power or authority to usually just one mentor or mediator who is there to point up any collisions between the teacher’s theories-of-action and theories-in-action (Schon, 1988). It becomes the facilitator or the mentor’s role to sort through the implications of puzzling events in the classroom. “Good” reflection is achieved when there is congruence between the teacher’s espoused theory and the teacher’s theory-in-action as negotiated with or decided by the university-based researcher-facilitator. But much can go awry in this encounter with both the event and with the participating facilitator.

It begins with the conceptualization of facilitation by the mediator, usually an external teacher-researcher, who believes they occupy a more authorial position in the mediation. As Kathy Carter advises: “As researchers and teacher educators, we can only serve ... perhaps, by helping teachers to come to know their own stories” (Carter, 1993, p.8). This emphasis on the role of the researcher creates an imbalance that is not easily resolved. Cochran-Smith & Lytle (1993) try to level this imbalance, negate or minimize the hierarchical, authorial position of the facilitator, the researcher, by categorizing them as outside, externally-based interventionists. My position is that mediation should not be
minimized but rather multiplied by many educational actors: practitioners, teacher-researchers, academic researchers, documents by researchers in lieu, facilitators or intermediaries, who are all implied, exchanging, facilitating and gaining (not just providing service or assuming authority) from a discussion centred on common stories and inquiries into the field of teaching.

The setting for the encounters between researcher-facilitator and practitioner has typically not included a knowledge environment or portal system wherein the researcher and the teacher can tap into resources concerned with similar issues and topics to help inform their research and/or facilitation. In a knowledge environment, one’s espoused theory can be more readily connected to developing or established theories and, thus, help enlarge the reflection or facilitation exchange. For example, is the puzzle, problem, or question, located in the teacher’s subject content knowledge, culturally responsive issues or organization of the curriculum as administered in the school? The teacher needs to inform, connect, and extend their knowledge into webs, systems, or communities of other teacher-inquirers, teacher-researchers and research-facilitators in education pondering similar questions. The internal becomes webbed into a larger professional sphere or community of knowledge discussion, where the local is maintained while being extended, and this knowledge movement does not displace the central role of the teacher-contributor and their voice.

A commonality among recent innovative research directions in teacher education that relates directly to the work of PKP and our professional development portals is human mediation. Mediation, usually directed by researchers with teacher-practitioners, was a critical mode of interaction in the portals for helping to move research knowledge into teachers’ knowledge practices. This mediation or facilitation has also gained attention in
projects of innovation in teacher education. Cochran-Smith (2001) refers to it as the teacher-researcher facilitating or encouraging inquiry stances with or alongside practitioners as teacher-researchers. Borko (2004) classifies and describes the knowledge activity of facilitation as one of three critical variables for any successful professional development program (p. 5). And Huberman (1999) proposes human mediation as the engagement activity for both practitioners and researchers which he terms, sustained interactivity, or a more reciprocal activity of knowledge connection, exchange, and construction (p. 291).

The central role of the mediator or facilitator is to engage in knowledge discussion or inquiries with practitioners. Sometimes, the goal of mediation is to challenge and engage in critical examinations of teaching which can result in teacher discomfort or the approach may be to offer affirmation for the practitioners' ideas/thinking (recognition and comfort through validation that their work is meaningful). Cochran-Smith and Lytle (1999) would support a conceptualization of the teacher-researcher as a co-facilitator who works to create conditions for knowledge validation and comfort within teacher circles before engaging in critique, in order to maintain a defensible power balance. As White, Shimoda and Frederiksen (1999) have shown, learners, including teacher-learners, need opportunities to articulate new knowledge positions and they need supportive environments wherein they can understand new educational research or acquire inquiry stances (Cochran-Smith, 2001). I am trying to abstain from characterizing intellectual or knowledge engagement as an outside-teaching activity that can only be re-inserted into teacher networks by the work of researcher-facilitators. I counter that the local knowledge of teachers, gained through practice and classroom contexts, can be transmogrified through interaction with other educational actors.
in a seamless space that is neither inside or outside the school but an overlap between the
two, that of a professional development digital portal.

*Problems of Sustainability and Scalability in Teacher Education*

The tension for these innovative models of in-service teacher education is how much
labour, human-researcher contact labour, in particular, is required for this kind of
collaborative mediation or knowledge facilitation to be initiated and then sustained. The
teacher-researcher interaction works of Page, Samson, & Crockett (1998) and Grossman,
Wineburg, & Woolworth (2001) both discuss the difficult, complex, socio-cultural fault lines
of working and mediating with groups of teachers in longitudinal encounters. Grossman,
Wineburg & Woolworth frame their method of collaboration with teachers as a “community
of learners” but this does not adequately reflect the work they, the researcher-leaders, must
continually do in order to lead, direct and be physically present to sustain these projects.
Thus, any joint, cross-institutional, collaborative grouping between researchers and
practitioners concerns two critical variables: the *sustainability* of researchers’ and teachers’
time, energy and commitment, and the *scalability* of the number of participating teachers and
researchers in order to ensure that the group grows into a *community* (or network) which
continues to garner continuity and strength.

An innovative means for promoting both sustainability and scalability for education
groups has begun to be explored, notably by learning sciences researchers (Pea et. al., 1999;
Barab et al., 2001; Scardamelia, 2004) rather than teacher education researchers (ironically),
through digital, Internet-based tools. This was the impetus for my wanting to be involved in
the PKP portal projects. I began with the dream-position that the PKP portals were to be
designed as “knowledge refinery” tools rather than “knowledge repositories” (Brown, 1997)
where informal, tacit knowledge usually exchanged at the water fountain or coffee pot could be transferred, transmogrified, and re-captured through digital means for practitioner and researcher exchange. This digital space, the portal, would become more of a social refinery because it would involve not simply static, posted texts but live, active members of the education field willing and invested in the exchange of experiences and ideas as well as the explicit education of each other’s point of view. The political contribution of Huberman’s (1999) vision is that he recognized the innate, reciprocally beneficial potential of a sustained interactivity project on both researchers and practitioners. Instead of positioning the researcher as the teacher of teachers, of university facilitators doing practitioners a favour or “service” (Carter, 1993), Huberman (1999) conceived of it as participation by the researcher in not only research of teachers but in their own education as researchers. Sustained interactivity between teachers and researchers can scale up into institutional connections capable of shifting epistemological debates and redefining each actor’s knowledge work.

Unfortunately, as presently constituted, the (analog) institution of school does not lend itself to this kind of supported, sustainable or scalable knowledge work. The mechanisms of peer-to-peer conversations, space and time for research projects, open access resources of articles, projects-in-process notices, meetings and conversations with researchers/academics, publications and conferences of teachers’ knowledge/research, repositories or digital libraries for storing teachers’ knowledge (documents, ratings, comments, learning objects) – and making them all public – alongside other knowledge documents, these mechanisms either do not presently exist or they are rare and not financed by school authorities (i.e., the money and impetus comes from external sources, particularly initiating universities).
My concern here is to establish a sustainable recognition that educational knowledge as a medium or an environment is one in which teachers routinely and actively work. I am approaching educational knowledge as media, as the construction material for knowledge environments or systems, through which teachers can connect with resources, one another, and with other educational actors such as academics and researchers. The conceptualization of this environment or network needs to work the inverse to remain sustainable and scalable: a place where researchers can connect with teachers and other institutional actors to work their knowledge as more accessible and usable in the larger endeavour entitled public education. It is this acknowledgement of knowledge as the common medium for teachers and researchers that should begin to pry open their respective institutional gates to bridge towards epistemic communities in education.

Models of Education Communities

To lessen the conditions of both teacher isolation -reducing teachers' opportunities to learn and share knowledge- and unusable research knowledge -the isolation of research from interaction with and examination by practitioners and the public, there has been a movement in teacher education research to experiment and test different community models in education as well as study different modes of interaction between researchers and practitioners. If the two “micro-worlds” (Huberman, 1999) of teacher and researcher were brought into conversation or collaboration on a project (shared activity), the expectation is that there will be adjustments, shifts, or changes to the shared knowledge work or knowledge situations (environments) in which they collaborate. A general problem is that these projects have not been sufficiently tracked and empirically analyzed as a movement, yet the desire for this ideal of a community continues, with its associated ideal conditions of trust, comfort and
consensus. And an ongoing critically demanding question is how have these projects of communities with practitioners functioned, what have they gained, and why do they regularly falter? The evidence of constant faltering is that there is not, as of yet, an established, accepted view of what model works best to achieve educational communities comprised of practitioners and researchers. Quite the contrary, there seems to have been a proliferation of terms and models to describe, outline, and define optimal communities for educational actors including communities of practice (Lave & Wenger, 1989; Wenger, 1998; in education, Barab & Duffy, 2000), communities of learners (Brown & Campione, 1994; Shulman & Sherin, 2004; Grossman, Wineburg, & Woolworth, 2001), knowledge building communities (Scardamelia & Bereiter, 1993), knowledge management communities (Hargreaves, 1999), and inquiry communities (Cochran-smith & Lytle, 1999; Hollingsworth, 1995; Wells, 1994).

In the literature of professional development, researchers are noting that effective professional communities of teachers with teachers are generally characterized by shared norms and values, a collective focus on a common project (typically focused on learning, be it student- or teacher-centred), collaboration, public (de-privatized) practice and reflective dialogue. But, the researcher-facilitator’s most pressing question remains how to approximate and engender a state of community of teachers with teachers and with researchers through design, mediation, and iterative experimentation.

In its broadest definition, the teacher-research movement is striving towards community models in order to “discover new social relationships to assuage the isolation of teaching for teachers” (Cochran-Smith & Lytle, 1999, p. 22). The idea of community is itself a complex concept with a number of variations in the literature, depending upon the primary focus of that community. In communities of learners (Brown & Campione, 1994; Shulman &
Sherin, 2004), deep understanding is perceived to be accomplished by sharing distributed expertise through teaching one another. A community of practice (Lave & Wenger, 1991; Wenger, 1998), on the other hand, is focused around negotiation of shared activities as new members are inculcated through shared participation from peripheral to central membership. In a community of inquiry (Cochran-Smith & Lytle, 1999; Wells, 1994), the focus consists of posing, not just answering or concluding inquiries, interrogating one’s own and others’ practices for the construction of local knowledge, and emphasizing differences in local classrooms as sites for inquiry.

I examine the former two models in this section to demonstrate how a model functions for teacher education. In the model of communities of learners (Shulman & Sherin, 2004; Shulman & Shulman, 2004), power and authority between actors appear to be negotiated around notions of “expertise.” By implication, the model condones the distinction between inside and outside, local and external of the teacher world, the distinct separation of the institutions of school and university. It does not actively work to permeate those boundaries, to loosen or disengage the distinctions by acknowledging them other than allowing teachers’ expertise that can be used to teach others who need to learn. The model of a community of learners also seems to imply that there is still a need for someone to be the leader-facilitator who helps guide the community and learners. This actor in authority, the leader-facilitator, is often the university-based researcher by deference or default as they are most often the initiators, coordinators, and funders of these projects.

The term, communities of practice (CoP), is very current and popular in a variety of fields including information studies, commerce, and education. CoPs focus on the negotiation and refinement of activities within work-oriented environments and focuses particularly on
the engagement of newcomer-members in practices that move them from peripheral to
central participation in the community. Etienne Wenger (1998) specifically defined the
notion of engagement in these communities: it involves mutual relationships established in
the creation and pursuit of a joint enterprise. A shared repertoire of resources can be
developed for negotiating collective meaning including routines, tools, concepts or anything
that the community has adopted in the course of its development. Taken together, these
elements of mutual relationships, joint enterprise and a shared repertoire/discourse constitute
a community of practice. These elements ring similar to the ones outlined in teacher
education literature for alleviating teacher isolation (Lee & Smith, 1996), yet they do not
implicate mediation or enrollment of actors outside of the immediate context, the classroom
and school community, nor does it apply to cross-institutional spaces. A CoP can become a
space of identity for teachers if it offers members a place to incorporate their histories (past
experiences), local knowledge (present expertise) and also provides an experience that makes
engagement in that community a continuing element in a developing personal future.

*Epistemic Communities in Education*

Yet another approach central to a study such as this one concerning teacher
knowledge, teacher research and the generative need for cross-institutional exchange is the
notion of epistemic communities in education. Epistemic community is a broad generic term
I employ in this study to acknowledge the need for new models of social relationships for
both teachers and researchers, particularly to escape and break down their institutional
isolation. However, I also employ it as a term that acknowledges the need for researchers
(academics) to play active, collaboratory, cross-institutional roles in the establishment of
these epistemic groupings or communities.
The term, epistemic communities, has been accredited to John Ruggie (1998) and has been employed for a number of years in the Social Sciences to study a phenomenon similar to Durkheim's term of "mentalites collectives" or collective mentalities. An epistemic community is not predisposed to the playing out of power relationships between individuals driven by calculations of utility. It is conscious of those "... webs of meaning and signification" (1998, p. 194) that have a profound impact on human interaction. Notice, I am using the term epistemic community in a broad sensibility here in order to avoid pre-designing or pre-defining the desirable social outcomes (e.g., comfort, trust, critical inquiry) that would pre-determine the point at which a group can become a community. The term, epistemic community, leans toward the idea of a group of people engaging in ideas of delimiting their language and assumptions appropriate for this mix of actors and expanding their ideas of an appropriate social reality for educational exchange between teachers and researchers.

The term, epistemic community, is distinct from communities of practice and communities of learners in that it can be used loosely. Epistemic communities are not concerned with teachers becoming more expert in their content knowledge, classroom routines, curriculum development, student assessment, per se, but rather are concerned with spaces (environments) for opening up the institutional knowledge norms and practices to other perspectives (epistemologies), particularly involving those other institutional actors who study and work educational perspectives (education researchers, policy makers, administrators) or those who have a stakeholder interest (parents, trustees). In epistemic

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12 The term epistemic community is credited in this dissertation to Ruggie, principally because he was the first to use the perspective as a central feature of analysis in a theoretically rigorous way. Other social scientists who have employed similar terminology include Knorr-Cetina's (1999) term of epistemic cultures. Knorr-Cetina rigorously describes the epistemic culture of open critical exchange of work amongst physicists and the social conditions and terms for that culture.
communities, a discourse emerges and develops on how to discuss and relate educational research/knowledge to practitioners’ questions, issues, and viewpoints as well as connect with other types of knowledge that these different institutional actors may not have considered for themselves.

When teaching is publicized (taken beyond the immediate local, the school or classroom privacy realm) and when educational research is publicized (taken out of high-subscription cost journals or available to only those with university library access), practitioners and researchers have a new intra-institutional space in which to communicate. Teachers have the opportunity to observe teaching as a third, overlapping space through knowledge exhibits or objects such as stream-lined video cases, to engage with research texts and practitioner accounts, to discuss questions and coach each other, to co-examine, observe and mediate, and to problem solve in a dynamic environment of knowledge objects. This forum could be described as an epistemic community.

The work of educational epistemic communities would be a melding of the private and the public, of autonomy and interdependence, for both researchers and practitioners. Mediation and translation (through cross-institutional dialogue and engagement) would be key leavening or participatory processes in this community or network. By mediation and translation, I am referring to the network-work that develops shared understandings and displaced values for educational discussions: that is the collective movement or ‘mentality’ of the epistemic community may displace the initial assumptions guiding and motivating some participants in the collective. However, the epistemic work can only be successful if the members are enrolled: they will return and participate with both their shifted, displaced values.

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13 I am referring here to specific Actor-Network (ANT) terms of Bruno Latour, which I re-define, elaborate and apply to education in Chapter 3.
assumptions and their new, shared understandings if these understandings bind the new community/network together.

An epistemic community encourages the idea of a collaborative, mutually responsive, contributory group with an acknowledgement of the good of different institutional positions of the members. Members know they will benefit from these different institutional perspectives and encounters. People who want to know more, to gain access, and know well, to go beyond their own local situation, form epistemic communities where they become epistemically interdependent. Such communities become rhetorical spaces (Code, 1995) where knowledge-acquiring, managing, and refining activities are nurtured and shaped into collective activities.

*What Educational Technologies can offer Teacher Professional Development*

The greatest isolation for teachers (practitioners) is the reality that they have little to no visible epistemic community, no one to really know with. No one to actively explore questions about which knowledge claims they have relied upon in practice, how credibility was established for these claims through practice and how they are to be described and exchanged in the collective forum. The promise of digital PD, informed by teacher education research, is that it can work to overcome the chronic problems of time, resources, and context that impede most face-to-face PD programs and education community development. More importantly, digital PD can work to improve the intellectually vacuous or disengaging knowledge conditions of analog PD by giving access to usable research through well-indexed and integrated knowledge repositories.

How can technology help appreciate, accentuate, and support the complexity of engaging in a collaborative study with teachers where the goal is multiple: to honour the
teacher’s voice and knowledge, to extend and connect it to other voices and knowledge sources, to pursue the scope of the knowledge, to embed it inside a larger literature and discussion that is inside educational research (and in which the teacher lives, even tacitly and unaware). My argument is that technologies, malleable technologies, innovative knowledge environments, are capable of allowing and permitting teachers to include their own voices into the creation of the literature and research of teacher knowledge as well as extend their voices into collaborative discussion with researchers, those attempting to produce usable knowledge for teachers.

Educational technology could be argued either as a very new or a very old phenomenon, depending on one’s view of what exactly ‘technology’ comprises. In the largest, anthropological sense, technology is tools, whether it is a physical artifact or a cultural practice that helps people to accomplish what they could not accomplish alone. The contemporary sense today, and the one which implies that educational technology is a new phenomenon, is the notion of technology as information or knowledge technology, particularly through networked information technologies.

Constructivism implies that learning technologies are essentially environmental supports for learners constructing their own knowledge. A constructivist approach to PD portals would focus on practitioner participation through tools to construct and refine new knowledge (Scardamelia, 2004). But this study of teacher education through digital environments is located in socio-cultural theories of learning by practitioners. It examines technologies as socio-cultural instruments for those who want to enter communities: communities of practice, communities of learners, or epistemic communities. I am not examining teachers’ participation in the PKP PD portals as a means to measure and assess
participation in a particular type of community. Instead, I grapple with the theoretical and empirical implications of portal technology designs as socio-cultural instruments designed to encourage volition towards change by both practitioners and researchers. The portals are to foster a desire to enter into public, intra-institutional interactivity concerning knowledge positions in education as defined by the people involved at each site and defined by published and unpublished documents.

PD portal spaces can foster conversations or exchange between different institutional actors. Portals can be designed to invoke discussions where actors, participating from different institutional locations, bridge external-internal divides. Portal design can promote three modes of interaction to take place between people and documents. These include discussion with references and footnotes; adding knowledge documents to make conversations more informed, connected and extended; and, connections between documents and documents through innovative indexing models (Willinsky & Wolfson, 1999). These three media of interaction could evolve into new entities or knowledge spaces that can serve as support systems (for comfort and acceptance through a shared language or vocabulary), sanctuaries (acceptance, shared values, and understanding), libraries (knowledge is filtered and accessible) and learning centers (locations for pursuing deep understandings as well as openings for new evolving epistemic positions) for both practitioners and researchers across institutions in the profession of education.

This was the model of the Public Knowledge Project: to create a wellspring of resources, of knowledge documents defining positions and outlining new models. This model was first conceived of as a type of knowledge management system but the foundation of knowledge management (as defined by commerce and management researchers and journals)
is to create a system to push the organization into a more productive, self-reliant, or think-tank system where workers spend a part of each day consulting and adding to the system's repository (Sveiby & Lloyd, 1987; Nonaka & Takeuchi, 1995). It is a means to collect, store and publish internally the tacit, implicit knowledge of many of its workers. It is a type of digital library and new work practices/training/professional development all combined.

The purpose of the PKP portals was to provide a rhetorical space of access and immersion into educational research where users would find scholars whose work (and presence) could constitute (micro and multiple) epistemic communities in one space. User-practitioners would want to engage in these epistemic communities because they could fruitfully express their knowledge claims in stories of practice, in observations from the field, and in dialogic questions and discussions with writer-researchers they admire.

Complexities of Employing Technologies to Address Social Problems (Informatics)

Presently, across the proliferation of educational technology studies in the last decade, there are problematic patterns. Studies can be either too promotional, involving speculative writing as they have not yet been tested or implemented or they can place too much positive emphasis (techno-enthusiasm) on one specific tool promoted to solve a range of social problems or to instigate substantial reform. Rarely is the studied tool subjected to critical description or empirical analysis. Often, it is based on enthusiastic assumptions and aspirations. The emphasis of many educational technology studies has been on singular components such as technology leaders, cognitive frameworks underpinning the design, potential contributions of the tool or demonstrations of a framework rather than the combination or the entirety of the network. The extent to which any group can even develop certain desirable community-like traits - before they can even be defined as CoPs,
communities of learners, or knowledge-building communities- is a major (large) accomplishment by the designer-researchers and an experience that “many participants find both frustrating and satisfying” (Kling & Courtright, 2003, p. 221).

Social Informatics critics such as Kling and Courtright, complain that the casual use of the term community to characterize groups that are engaged in learning has been over-used and misguided particularly in reference to groups using technologies. I particularly agree that there seems to have been an uncritical overemphasis on the term community, particularly “community of practice” (CoP), to characterize any group that “is engaged in learning or e-forums” (Kling & Courtright, 2003, p. 221). Instead of focusing on the dream of community building for human participants through a technological artifact, a more useful analysis, that seems to have been de-emphasized or neglected, is an examination of the tool’s infrastructural abilities or technical constraints to work in relation with human users.

Digital Epistemic Community Portals

A goal of the PKP portal study was to see the extent to which the engagement of the portal users (the practitioners), their use of the tool, was aligned to any model of community (CoP, Community of learners, an epistemic community). Barab and Duffy (2000) explain the role of community in educational contexts as one where, “the goal of participation in a community is to develop a sense of self in relation to society –a society outside of the classroom” (p. 43). In this study of portals as a set of mechanisms and infrastructure constructing and supporting a rhetorical and resource space for sustained interactivity between researchers and practitioners, I examine the role of and participation in community

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14 Social Informatics is the critical study of the social impact of new technologies (see Kling’s foundational articles, What is Social Informatics? (1999) and Learning about information technologies and social change: The contribution of social informatics (2000). It is a sub-field of Information Studies that is gaining support in a variety of fields including education (see Warschauer, 2003a, 2003b).
to lessen knowledge loss and isolation and improve knowledge exchange and epistemic identity. The goal of participation in a PKP portal community was to assist user-practitioners in developing a sense of self in relation to an epistemic community – a community outside of the classroom yet intimately connected to and invested in teaching and education.

For the PKP portal participants, digital infrastructure and tools were to act as an extension and enlargement of users’ face-to-face communities, allowing them to engage and expand on their educational understandings in ways not supported by the isolation of their school settings and the limitations of their few and far in between face-to-face interactions with each other and with researchers. However, for those who are not able to reframe their teaching or research contexts to engage in this epistemic interactivity or who are less comfortable with the technology, digital supports can be viewed as either unhelpful hindrances, even threatening by becoming evaluative. Further, evidence from studies of participation in contexts which are recreational, social, and voluntary (Schlager & Fusco, 2003) and social informatics studies (Kling, 1996) suggest that online engagement and community building through internet technologies can be very tenuous and complexly influenced by many technical, social, cultural and affective factors.

Collaborative digital environments have been identified as potentially democratizing spaces that allow for multiple “voices” to have opportunity to contribute to and define epistemic communities as well as demand open access to the information they need to further their development (Agre, 1999, 2001; Nardi & O’Day, 1998; Sproull & Kiesler, 1991; Zuboff, 1989). Positions such as these suggest that a community digital environment could provide important support mechanisms for institutional reform (hence, the reform of teaching and teacher knowledge conditions) because the users themselves could define the functions
of the tool's infrastructure, the disposition of the community interactions and the content levels required to meet their knowledge needs. At the same time, these portal environments necessitate a level of openness to collaborative knowledge work that could be overwhelming for some (particularly for teachers unaccustomed to this kind of collaborative knowledge work), and so the extent to which the democratizing knowledge ideal of an epistemic community could be achieved was a factor constantly considered in the PKP portal implementation.

Need for a Socio-technical Approach

It has become increasingly prevalent for most professional development and educational technology interventions with practitioners to be characterized and reported as communities. The term community is really used to depict an ideal of the project, the desired or aspired to state-of-affairs rather than to analyze an existing reality. Instead of assuming that a knowledge space for practitioners on the Internet will result in community (epistemic or otherwise), I turn to an alternative critical methodology, to a socio-technical analysis to counter this aspirational tendency in education literature. The term socio-technical refers to a methodological mix, a practice or even an analysis that integrates social and technical elements in a way that reveals their interactions, interdependencies, and interpenetrations. Socio-technical analysts understand social behaviour and the organization of artifacts (such as websites) in a much more integrative manner.

PD portals are structured socio-technically, in that they are co-configured not only by the constraints and "affordances"\(^{15}\) (Norman, 1988) of the technologies involved, but also by

\(^{15}\) The term affordance was first coined by Donald Norman (1988) to denote and describe technical features that beg the use of the object, just as a shoulder-high flat panel on the side of the door "tells" you that the door opens by pushing.
social, cultural and institutional factors. A socio-technical analysis for PD portals, such as the PKP portals, offers the best method to avoid techno-determinist arguments of either pro-enthusiastic portrayals of technology –the technological artifact is the reason for the formation of close, trusting education communities- or techno-indifferent –the technological artifact is unimportant in offering and leveraging support for group development.
CHAPTER 3
Socio-technical Theories and Tools for Analysis

The historical point at which I am reviewing and assessing the contributions of the PKP portals is one in the field of educational technologies that has led Kozma (2000) and others (Soloway et. al., 2000) to advocate more multi-disciplinary approaches and creative analysis than the field is presently producing or encompassing. In this chapter, I follow a theoretical perspective (with methodological implications) of interactions between technological agents and social groups that differs from those typically followed in most educational research, particularly in educational technologies and teacher education.

In the last decade, a growing literature in the history and sociology of technology has introduced an array of concepts (and terminologies) focused around the idea of “social construction,” which I take to mean that technologies are always developed by groups engaged in building, testing, and using, simultaneously, the technology’s meanings and material form. I primarily draw upon the social construction work of Latour (1988, 1991, 1996) and his theory of interactions between human and non-human actors, or networks, to both describe and demonstrate technology as influential on humans (i.e., as a form, environment and tools of knowledge) as humans on the technologies (i.e., as the innovators, designers, constructors, participants and users of prototypes). I also treat technology in this thesis as integral to teacher professional development in a manner that teacher education scholars generally and currently do not. That is, teachers/practitioners necessarily transform technology just as technology transforms their practices and social relations. And I add to the literature of educational technologies by demonstrating that practitioners, human-actors,
engaged in the use/non-use and implementation/resistance of technologies, transform portal design and development as much as the portal transforms their practices.

In this chapter, I first introduce Latour’s terminology of socio-technical relations or analysis, then illustrate his points and terms with examples from his own work of *Aramis: or the Love of Technology* (1996), and finally lay out how I use his conceptual language in examining the work of the PKP portals by adopting a socio-technical approach similar to Latour’s ANT. In my work with digital PD portals intended as forums for participatory design with teacher-practitioners, I needed a theory (and methodology) of technological change as a social process that would permit an analysis pointing in two directions: 1) the design, tinkering, or *bricolage* of the portals by the users and designer-researchers, and 2) the balance of the portal’s construction with its converse, which is to say the portal’s construction of the users’ social world. At this stage of analysis, I can view the non-linear emphasis of the PKP portal projects where the portal’s construction was influenced by the social players as well as the portal constructing a social “micro-world” (Huberman, 1999), or knowledge environment, where the practitioners and researchers interacted and engaged in knowledge exchange, connections and interpretation (knowledge construction). By employing the language and terms of Latour’s actor-network theory (ANT), I examine the relationships between the meanings of technological artifacts such as digital PD portals and their socio-political implementation by directing the same attention to the material and technical elements as I do to the socio-political elements.
My framework for understanding the PKP PD portal prototypes’ history, concluding
in the portals’ diminished realization\textsuperscript{16}, draws upon multiple related socio-technical
approaches, predominantly located inside science and technology studies (STS), and one of
its central concepts, actor-network theory. I look to this field for its longer history of
examining socio-technical work and socio-technical system design. And I look to scholars in
this field who creatively document and describe technological practices as richly social
practices. These scholars include Bijker (1997), Haraway (1991, 1997), Shapin & Schaffer
in the social construction or social shaping of technology – sociotechnical analysis of bikes,
bakelites, etc. – signals the power of an analysis of technology guided first and foremost by
its role in social groups. He describes how social interpretations of problems (by the target
groups or users) fix the meaning and material, physical form of particular technologies. For
example, the first bicycles were perceived as too athletically daring and physically dangerous
to work for any but the ultra-athletic and adventure-seekers, a very small user group. Hence,
the problems associated with this high bicycle and other groups’ desire for greater bicycle
usage drove the bicycle design development into the shape of a smaller, easier to mount
bicycle.

Bijker’s idea of “technological frames” refers to the combinations of concepts,
theories, goals, and practices used by groups attempting to solve technological problems.
Shapin & Schaffer (1985) define various “technologies,” including the material, the literary,
and the social, that seventeenth-century scientists employed to establish a social space
wherein experiments could count as establishing facts. Their work points to the importance

\textsuperscript{16} Realization is a specific ANT term where Latour describes the actualization and materialization of a
prototype as realized, that is, the drawings and plans have taken material form and exist in use (see Latour,
of performance of the scientific or technological actor for a select, elite group's “seeing” in order to establish and adjudicate fact or scientific truth. This brief sample of socio-technical works present deep and deeply important conceptions of technological change. They help us to understand technological change as a social process, but they do so by focusing on the technology (whether the pump for Schapin & Schaffer or the bicycle for Bijker), and the technology’s stages of development – innovation, design- as an entity of analysis as equally worthy as the social analysis.

These socio-technical approaches are all to some degree non-techno-instrumentalist or socially irreductionist\(^\text{17}\) frameworks (Kaghan & Bowker, 2000). They are concerned with how socio-technical systems – systems or networks of people, technologies, and practices- are created and maintained. And they refer to a similar analytical principle: these systems are not determined by technical mechanisms alone; they are not technologically determined but must be socially examined, worked and theorized in order to become stable accounts. The social order is also not pre-determined or given by the technological artifact: the socio-technical system, or network, is continually re-constructed and re-ordered through the actors’ (both human and non-human) activities and interactions with one another.

Callon (1988), a leading theorist of actor-network theory (ANT), was the originator of the term “network” (1986). ANT emanated from Science and Technology Studies (STS) with ethnographic studies of laboratories and the socio-technical processes by which scientific discoveries gain currency, mobilize resources, and collect allies via the practical social work both inside and outside the laboratory (Latour, 1987; Latour & Woolgar, 1991). ANT sees power and order as effects to be described and, in the process of description/observation,

\(^{17}\) Please see footnote #6 on p. 16, Chapter 1, for a fuller explanation of the term, irreductionist.
analyzed. ANT argues that key elements (and terms) such as actors/actants,\(^{18}\) translation, inscriptions, enrolling and controlling allies, intermediaries, black boxes, and the acquisition of resources, help constitute a challenge to traditional boundaries between technology and society, science and politics, and, by analogy, between portals and educators. These conceptual terms and, by extension, the method of ANT (which I discuss as an ethnography of infrastructure or a socio-technical methodology, following Star's example (1999), in Chapter Five), also help to explain the de-stabilization, de-realization, or failure of socio-technical systems such as Latour's account of Aramis (1996) and the conclusion of PKP's most expensive, well-funded, and sophisticated PD portal, EdX.\(^{19}\)

My purpose in this chapter is to outline a conceptual terminology toolkit, consisting of ANT and Science & Technology Studies, to analyze teacher professional development portals as socio-technical systems, as networks. The contribution of this ANT-informed, socio-technical approach to the PKP prototypes is not simply a reflection of the artifacts themselves but rather a record of development in digital professional development. The method's purpose is not about locating, defining, or evaluating the PKP portals inside taxonomies of educational artifacts, but rather registering the historical design and realization process of PKP into the study of digital professional development. The ANT adopted approach is a toolkit of terms for observing how an electronic professional development artifact, its users, and its designers attempted to make a difference or transform teacher education. The ANT terms do not promote an account of an endlessly reflective mirror on the

\(^{18}\) I will predominantly use the term "actor" throughout the thesis, even though Latour often uses the term "actant" to signal a definition of the term that does not rule out nonhumans as valid (social) actors comparable to humans. I will mainly use the term actor since it is more familiar for the reader. But its association needs to remain of equal weight between human and non-human entities.

\(^{19}\) Aramis is the account of a failed automated personal train system in Paris—how it came into and then lost its existence, resulting in failure or death, surviving only in Latour’s own analysis.
tool's set of technical features or on a cognitive framework scaffolding the design. It works to bridge the great divide in technologies' accounts: the divide between "popularizing technology and denouncing its politics" (Latour, 1996, p. viii).

I am working these theoretical concepts and terms as contingent, practical, hypothetical tools with which to think and communicate about portals in digital teacher professional development. I am testing to see if Latour and others from these socio-technical fields have productive, fruitful theoretical concepts for analyzing my specific work with the PKP PD portals, and for teacher education technologies in general. I am attempting to enrich theoretical development in educational technologies by referring to socio-technical theories in order to simultaneously contend with the PKP portal empirical details and yet broaden the account away from its own particularities.

*The Network*

The primary element and theoretical contribution of ANT is the actor-network which is "any collection of humans, non-humans, and hybrid human-non-human actors who jointly participate in some organized and identifiable collective activity in some fashion for some period of time" (Kaghan & Bowker, 2000, p. 258). ANT is concerned with how these pieces or actors are held together, how they form as amalgams of organizations, social institutions, machines, artifacts, and agents, at least for a time. The most unusual and robust contribution of ANT to the study of socio-technical systems is the inclusion and agency of the non-human. According to ANT, networks are heterogeneous, composed not only of people but also machines, texts, functions, funds/grants and other elements.

The PKP prototypes were networks, in a Latourian sense, as they were composed of heterogeneous actors: pre-service teachers, in-service teachers, university researchers, private
sector project managers, software developers, university program instructors, teacher-mentors, WebCT discussion boards, diploma program website, web-based public e-documents, internet browsers, portal prototypes, servers, firewalls, school computer labs, university computer labs, federal funds, funding pre-requisites, database indexes, tags and classifications. In what follows, I have analyzed how these pieces came together, how some pieces formed for a time, how some didn’t enfold into the network or built weak tentative alliances, and how the network ultimately faltered.

Examples from STS and ANT suggest the extent to which the success of a scientific or technological entity depends upon the manipulation of the world outside the laboratory or the system and the forging of alliances with users and non-users. The network and its claims work not because the portal prototype is true to the intended group’s world, institution, or social context but because the institution or social context is tinkered with (explicitly or tacitly), transformed, or co-constituted by the prototype and this in turn makes the network work. Infrastructural work, such as the development of standards and common platforms, the cooperation of provincial/federal agencies, and complying servers and firewalls, is also required to achieve the claim or the usability of the prototype (as materialized through the system) to work in the wider world in the attempt to effect an institution such as teaching. Socio-technical systems innovation must be consistently applied or co-constituted in order to work and in order to strive towards convergence. Socio-technical systems or networks do not work in just any reality, but only in a particularly (re)worked, designed, and co-constituted context.

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20 See Bowker & Star (2002) and Star, Bowker, & Neumann (2003) for a detailed definition of convergence. Briefly, it is an ideal “fit” of tool/artifact with a group’s needs and social, epistemic functions.
Latour and other ANT scholars view a socio-technical system or actor-network as an entity with a personality or a "machine with a soul" (Kidder, 1981). It is not necessarily an anthropomorphic concept but rather a prototype exerting force in the manner that we view human actors as forces in a network. Latour’s theory is a set of conceptual terms whose purpose is to be deployed as a methodological toolkit to follow these forces. Theoretically, we work to understand who are the actors and how to observe them in order to describe and follow their actions. Latour is careful with the terminology, the descriptors of ANT, because there is the problem of the analyst/reader assuming that they understand the concept “network” from their own use of the Internet and networked computers. Latour prefers to invert the term as a "worknet" where “the work, the movement, the flow, and changes of and between actants should be stressed” (Latour, 2004).

The Actors

ANT is both a theory-method that takes into symmetrical account the technical tools\textsuperscript{21}, or non-human actors, as well as the human spokespersons, or the human social actors. What necessarily arises in tracing the network through its links are not two actors who are essentially different, or dissimilar in nature, but the evidence of co-evolution of two actors. The actors, humans and nonhumans, appear as different when we concern ourselves with evaluating or differentiating their qualities. And, as Latour says, “it is as if we might call technology the moment when social assemblages gain stability by aligning actors and observers” (1991, p. 129). A researcher following Latour’s approach, following Latour’s

\textsuperscript{21} The thesis uses the terms artifact, quasi-object, tool, prototype, and system to all refer to the knowledge portals developed by the Public Knowledge Project. Each term is similar in its reference to an entity that is not firmly established or black-boxed in education. However, each term does have its minor emphasis. Tool brings attention to computer technology as a medium and process rather than an end in itself. Prototype emphasizes the experimental quality of the emerging entity and its openness to revision. Quasi-object is Latour’s preferred term (1996). System emphasizes the techno-social system surrounding, supporting, and holding a tool in a position (Bowker, Star, Turner, & Gasser, 1997).
ways of observing, is alerted to detect particular moments in practice where the actions of the actors are aligned with a certain desire.

The interactions of people and machines are interpreted by human participants (actors or actants) through a form of social negotiation, with actions and meanings negotiated in context by the participants, both human and non-human. The actor-network theory of Latour and Callon directs attention to the ways technologies function as networks of power in which the enrollment of active allies (humans and machines) is a primary mechanism.

The next element of Latour's conceptual method is locating and following these relevant social and technical elements or actors constituting the network. This thesis involves problems in describing technical artifacts in education. The PKP portal experiments were constructed to address the social and technical needs and problems of educational technologies for teacher knowledge management, education epistemic communities, and digital professional development. A central claim in this socio-technical approach is that the “description of relevant social groups (actors) is as important as the detailed description of artifacts in standard technical histories” (Bijker, 1997, p. 47).

The empirical research of the implementation of the PKP portals helps identify the social groups that were relevant for the portal networks. I interviewed human users (and human non-users) of the PKP prototypes in an accumulative fashion in order to get a more complete picture of the sets of actors involved in the controversy. After I followed the actors, I describe these relevant groups in more detail to determine how to delineate them from other relevant groups. Actors simplify and reorder their world by forgetting about obsolete distinctions or by drawing new boundaries (Bijker, 1997, p. 48). They switch to a

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22 Controversy here refers to an unsettled account as well as an undecided verdict on the stability of the network (see Latour, 1987).
different artifact (witness one mentor’s use of ICQ for mentor discussions and a Yahoo chat room for his in-service mentee group) or the user group expands beyond original indication (the research-inclined, teacher-education-centred mentor used EdX in manners unforeseen). These groups or actors are also relevant for the analyst when I set out to explain the development of technical changes with the PKP portals.

The identification, delineation, and description of relevant actor or social groups apply to the characterization and description of artifacts. “If we want to understand the development of technology as a social process, it is crucial to understand the artifacts as they are viewed and transmogrified by the relevant social groups. If we do otherwise, the technology again takes on an autonomous life of its very own” (Bijker, p. 49). Thus in this conceptual model, the meanings attributed to the artifact by the different relevant social groups, or actors, constitute the artifact.

Displacement, Translation, Enrollment, and Obligatory Passage Points

Both human and non-human actors must be “enrolled” into the network through translation, defined by Law & Callon (1988, pp. 288-289) as “a process in which sets of relations between projects, interests, goals, and naturally-occurring entities – objects which might otherwise be quite separate from one another- are proposed and brought into being.” The PKP researchers along with the project or system managers defined a problem, and designed/delineated the actors involved (and to invite) so as to fit the defined problem and proposed solution. Designers of portals want to establish their systems as the “obligatory passage points” through which the actors must work to solve the problem or satisfy the need (Callon, 1986). Designers must also work to keep competitors away from the actors they want to enroll. They cannot enroll all of the actors at once, so they focus on (what they hope
is) a representative sample of the population, adjusting their projects to get the sample to cooperate (Callon, 1986).

We, the research-design team of PKP, wanted teacher-users to turn to our PD portals as their vital link or bridge into educational research. We wanted to construct visions (or narratives) of knowledge management or epistemic portals as the solution, the missing link, to problems in conventional PD programs. We were trying to establish the PKP portals in the manner of what Latour (1987) and Callon (1986) have called “obligatory passage points” in the study of digital teacher education. That is, any study of PD programs or systems would henceforth have to proceed by way of the tools, techniques, and concepts innovated and established by the PKP PD portal precedents. In the PKP goal and shift towards a new narrative of teacher education, in particular, digital professional development, was the dictum that teachers have the right to know, the right to open, free access of educational research commenting on and influencing their profession, practices, and knowledge.

ANT generally emphasizes scientists or engineers’ (designers’) strategies of persuasion in the enrolment of allies. If they are successful, the scientists or system designers become the general representatives of the populations involved and can speak for and about them in a discourse of certainty. The populations have been displaced – moved from their original state into an enrolled state within the scientists’ network or the technological project (Callon, 1986). As an actor or group of actors is displaced, they are moved away from their original position to a convincingly translated new position. This new place is acceptable to the newly enrolled actor because it has been translated to such an extent that the move is

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23 Enrolling a representation of the population (the delegates) is a process of scalability.

24 See the motto of PKP-VanSun’s homepage with the moving banner “You have the right to know.” (www.pkp.ubc.ca)
workable, amenable, and now enrolls or represents their interests as well. However, in the process of translation, the original members or actors of the network, are themselves displaced: they have had to shift their own interests, translate their positions in order to enroll other actors. Thus, the chains of the network are restlessly dynamic, rarely certain, and stability is a question of stable, predictable movement.

Latour (1987) urges the analyst to follow the actors of the network and observe how they translate and transform the knowledge claims under question. This work of transformation (or transmogrification, as described by Bijker) is driven by the activity of actors enrolling and controlling other actors or allies in the network towards the interest of the project and the claim. As one actor attempts to enroll and control other actors, similarly, other actors are attempting to enroll and control it. The result is translations of interests, transformations (and displacements), to some degree, in all directions in the network’s chains.

Resistance

Latour’s (1987) description of a network generally follows that which resists. The network is changed by the resistances, interactions, and translations that it encounters between and with its actors. In each encounter, the effects are mutually given, hence, the chain effects of the network or the socio-technical system.

The method of the thesis is meant to acknowledge and register the resistances of actors as part of the translation and participatory mode of the project. The encountered resistance is not interpreted as “interference” to the design team’s projection or force in developing teacher professional development prototypes. Latour (1986) eschews, while acknowledging the appeal, of such a model of social determinism. “The advantage of such a
model is that everything may be explained either by talking about the initial force or by pointing to the resisting medium: when an order is faithfully executed, one simply says that the masters had a lot of power; when it is not, one merely argues that the masters' power met with a lot of resistance" (p. 267).

A Latourian or ANT goal is to make visible those things that have been lost in the artifact/portal's description (up to this moment) such as resistances; not in order to make the other meanings disappear, but rather to make it impossible for one bottom line, for the final account and record of the PKP teacher professional development portals, to be one single statement. Resistance to an information system by its actors provides important instances for research where the analyst/observer has to follow the resistances (Latour) and distinguish between resistance that is either irrational (disruptions to the system) and opportunistic (sabotage) or resistance that arises from a poorly designed system for the designated users' epistemic needs or world view. Resistance is often a result of actors' readings/perceptions of the system as counter-productive or contrary to their worldview, discourse, or practices. Resistance reveals the inherent dualisms of perception of a socio-technical system (Bijker, 1997; Barab et. al., 2003). An information system (portals) can be viewed simultaneously by actors as a productive solution or affordance—the portal contributes to their worldview and practices, and they are thus enrolled—or the portal can be viewed as an obstacle or significant problem—it is a disruption to their worldview, interference to their practices and thus they are repelled or not enrolled into the system. This was a critically important variable in the complexity of the PKP projects; the actors simultaneously viewed the same portal as representing or embodying oppositional metaphors (i.e., either it was informative, enlightening and enlarging the teacher's desire to participate in educational research or it was
overwhelming, uncomfortable, and reducing the teacher’s desire to participate in educational research).

I am delineating and following Latour’s (1986, 1987) analysis of the development of a network around (or through) a technical innovation or tool as *that which resists*. The (actor-) network may be changed by the resistances, or, to use a more neutral term, by the interactions/translations that it encounters from other actors and networks or the outside of the network. The results are the actor-network’s view becomes effectively distributed (when, for example, an educational technology such as a calculator becomes integrated in a non-obvious, seamless manner into the classroom math curriculum) or the network’s view is marginalized until it is ineffective (hence, no teacher uses an educational technical tool in the delivery of curriculum).

To have an oppositional effect, resistance needs to be recognized as such by the organization. In the PKP cases, recognizable human ‘resistance’ might be characterized by the actions of mentors or teacher-educators, for example, who do not add knowledge resources to the portals’ repositories; or they do not attempt to technically guide their mentees when these teachers are accessing the portal (i.e., when the organizational design of the prototype intended the mediation or technical leadership to be brought into play). Thus, in deciding to deploy an action that might be taken as some form of resistance, the human actors (e.g., mentors) offer an “anti-program.” On the part of non-human actants, an “anti-program” might arise if there is a repetitive technological “fault” or flaw, such as the search engine or search commands of the portal do not produce any related resources to the selected key terms or the portal system does not respond or function in internet browsers other than Microsoft’s Internet Explorer.
Latour is urging us to follow the actors of the network and observe how they transform the knowledge claim under question. This work of transformation is driven by the activity of actors enrolling and controlling other actors or allies in the network towards their interest in the project and the claim. As one actor attempts to enroll and control other actors, similarly, other actors are attempting to enroll and control it. The result is transformations, to some degree, in all directions in the network’s chain.

**Purpose and Method of ANT Terminology**

Latour has not created these terms, these neologisms, in order to adjudicate, judge, or enforce meanings upon the actors. Central to the process of ANT is the semiotic work of description. ANT does not proceed from a policing of terms, but proceeds through description as a means to follow the actors and the translations. What is interesting in the ANT method is how many ways there are to translate, to bring into relation meanings of the artifact, or the entity itself. The central activity of ANT and the dictum of Latour is follow the many actors and heed to what they say. Neither the actors nor the translations of the network are denounced. The ANT method is an uncritical and agnostic process. Latour’s intention is that we observe all actors/actants, human and non-human, as having capacity to transform practices. Latour’s approach is irreductionist in that he does not advocate for any one actor or group of actors, human or non-human, as having greater influence, greater force to determine the network’s outcomes of stability, its realization.

**Black-boxing**

The black-box refers to an image of a box that controls both the input and the output. The inner workings of the box are too complex to investigate or to challenge, therefore, we only see and are concerned with the input and the output (Latour, 1987, pp. 2-3). The box
itself is ‘black’, opaque and impossible to discern. Ideally, an actor, be they a project, process, machine, idea or person, may prefer to attain black-box status as their behaviour is taken for granted and not amenable to reconsideration, thus not open to re-shaping.

In educational technology, we are at a stage where the facts and the machines that create educational technology programs have not been black-boxed. It is a controversial and flexible time for educational technology prototypes, experiments in use, and teacher practice reform. No one knows what the ‘killer app’\(^{25}\) for education or specifically for teacher education is to be or become. No one knows how or even if tools will leverage or change the pedagogical-curricular output of the school. No one is yet convinced that they have a tool that only requires inputs and assures the right output. Many teachers are reluctant to teach with computers, to trust in the notion of a computer’s pedagogical abilities and efficiency (and with some valid reasons).\(^{26}\) The educational technology programs thus far have not been successful in rendering the tools invisible, seamlessly integrated into teachers’ knowledge and teaching practices. In many schools, the tools may be physically invisible because they do not yet run efficiently or they have no defined purpose by the practitioner and are hence “underused” in classrooms (Cuban, 2001).

Once there is an invention/development of a professional portal for teachers which triumphs longevity, credible brand-name status and loyalty of users, this future artifact will lead to closure and stabilization in the discussion of electronic teacher education. This future artifact may become the black-box of digital teacher professional development. But this future moment may not be near. Consequently, when describing the recent history of digital

\(^{25}\) This is a technicist term that literally means the “killer application”. It refers to an application as the one that outdoes any other competitors and becomes the most unquestioned, universally accepted, computer application.

\(^{26}\) For an elaboration of these reasons, see Bryson & de Castell’s (1998a) article, “Imagining teachers as luddites in/deed.”
professional development artifacts, precedents such as PKP-VanSun and EdX need to be described and examined as a series of socio-technical opportunities for creating and stabilizing an educational epistemic community network (that were not fully realized).  

**Intermediaries**

"An intermediary is an actor (of any type [i.e. human or non-human]) that stands at a place in the network between two other actors and serves to translate between the actors in such a way that their interaction can be more effectively coordinated, controlled, or otherwise articulated" (Kaghan & Bowker, 2001, p. 258). Because networks are never completely stabilized, translation is continual and this is the central work of intermediaries. The actor-network theorist, Callon (1991) states "an intermediary is anything passing between actors which defines the relationship between them" (p. 134). But according to Latour (2004), intermediaries are dopes or puppets. Intermediaries are passive –they are not actors, acting in the sense that Latour intended that word. Intermediaries do nothing on their own. Mediators, on the other hand, modify and mediate texts. Mediators transform information. Mediators translate (1996, p. 219).

I prefer the definition of intermediaries as those actors responsible for the invisible work of mediation that often undergirds the support for the social growth and increasing trust in the network (Star & Strauss, 1999). This conceptualization of the term, intermediaries, best captures the effective knowledge work of the enrolled teacher-educators in the PKP portals. Intermediaries are those individuals and organizations that facilitate connections between users (i.e., between teachers, between teachers and teacher-researchers) and between users and the system’s knowledge resources (i.e., documents, research

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27 Latour (1991) uses the word “realize” to emphasize how networks are not simply constructed and intentions materialized but rather the network must be observed and the actors aligned for the entity to exist.
resources, policies, etc.). It is a very active role yet one mostly invisible to observers as it is taken-for-granted. Intermediaries in a community portal can increase access to the system's content or repository: through active suggestion and modeling, they can help teachers want to locate primary sources, return to read documents from the repository, and articulate positions in connection with the content. Intermediaries can be effective human screens for filtering or actively connecting: they point teachers towards knowledge resources that may begin to engage them in dialogue about their specific needs or point them towards researchers (research texts) who are grappling with similar puzzles of practice or questions of teaching.

Inscriptions and Epistemic Communities

Inscriptions are the stabilized messages (texts, graphs, diagrams, maps, etc.) that communicate at a distance in the network. ANT addresses the role of inscriptions in establishing credibility and stability, order and power (Latour, 1986; Law, 1992). Inscriptions play a key role in the creation of knowledge and the processes by which knowledge communities decide what and whom to believe. Inscriptions permit interests to be translated, networks stabilized, and the outside of the lab to be worked and controlled.

Portals enhance the ease with which inscriptions (documents, resources, researcher texts) cross institutional or community boundaries making Latour's "immutable mobiles," mutable mobiles. In digital environments, inscriptions gain mobility but through their mobility and their digital form, they become increasingly mutable or open to transmogrification (e.g., excerpted selections or abstracts of documents representing the whole; additions or revisions to the original document appearing as the primary source document, etc.) (Brown & Duguid, 1996; Levy, 1994). In the PKP portals, we have the
makings of cross-institutional boundary objects\textsuperscript{28} where researchers/academics can have their work posted for and discussed by beginning and established practitioners as well as other documents or research objects for analysis and discussion by both practitioners and researchers. Epistemic communities need to take on the role of determining the inscriptions/boundary objects that will both enter or cross into their knowledge base (what they perceive as valid knowledge worth including) as well as those inscriptions/boundary objects that they need to send out, to distinguish their epistemic community, as stakes of their knowledge claims. Portal and open access technologies (such as the PKP portals) help facilitate the conditions to exert this kind of public knowledge work and epistemic community development.

*Complexity and Socio-technical Analysis*

Socio-technical analysis is important for portal design to make progress or evolve and for observing actors’ decisions or actions as contributive (affordances, D. Norman, 1988) or disruptive (hindrances or resistances) to the prototype’s network life and stability. Ironically, the time and energy to do this conceptual work is rarely available in the empirical crunch to make the system function and maximize its mechanisms and features. The middle ground, somewhere between the maximal technical and the over-simplistic social, is not an easily apparent set of mappings for a teacher education portal in-the-making. Socio-technical concepts bridge the divided conceptual terrain of the technical and the social/institutional and they enable researcher-designers to work simultaneously and more equally these co-evolving sets and chains of actors.

\textsuperscript{28} This term from S. L. Star and J. Greismer (1989) refers to those information objects capable of crossing the social boundaries between communities.
Designing, maintaining, and reviewing a teacher professional development portal involves comprehending social and technical phenomena of increasing complexity. As Latour (1996) contrasts complexity and complicated, we can begin to see how complex networks are and consequently, how complex the work of socio-technical analysis needs to be. “For complication is just the opposite of complexity: a complicated task is one made up of many steps, each one of which is simple: a complex task, as the name indicates, is one that simultaneously embraces a large number of variables none of which can be identified separately” (p. 219).

So what comes to the fore in this chapter is a conceptual toolkit meant to assist in observing and analyzing a “large number of variables” or actor positions, ever shifting and interconnected in a chain with others. The work of this chapter thus far has been to engage in conceptual traffic control, describing the concepts of translation and transformation (or transmogrification), enrolling and controlling allies, obligatory points of passage, resistance and displacement; black-boxes; intermediaries or mediators; and, inscriptions and im/mutable mobiles. No single conceptual term explains everything but, together, the ANT terms of this chapter help assist educational researchers understand how to follow the actors and observe multiple positions, perceptions, and encounters involved in the chains of the network. Together, these concepts help highlight the complexity of relationships inside (in the making and using of the portals) and outside of prototypes (the funding mechanisms, the peer review and audits, the development of other portals, including teacher education portals).

*The Case of Aramis*

To demonstrate how these conceptual terms can work to reveal and describe a network through a case study of technology, I refer briefly to the case study of Aramis, a rail
system, documented in Latour’s (1996) book, Aramis: or the Love of Technology. And, it was this book in particular that inspired me to re-examine and review the project of the PKP portals to determine why they did not become accepted practices and stable objects in teacher education and to give these portals the textual account they deserved. In the book, Aramis, Latour has written something very close to a sociological novel (a “scientifiction,” p. ix) about a public transportation project that nearly "transformed into an object", but which instead, “[i]n the archives, ... turn[ed] back into a text, a technological fiction” (p. 24).

The Aramis transit project, an innovative Rapid Personal Transit (PRT) system intended to service densely-populated urban centres, was to be the obligatory passage point of public transit in the larger metropolitan area of Paris. Latour describes an extraordinarily well-designed, semi-personal robotic rail transit system that moves independently to collect and transport passengers to their stated destination stations. It was a network comprised of many human actors including civil engineers, politicians (municipal and state authorities), corporations, town planners, commuters, journalists, and many non-human actors including robotics, train cars, non-material couplings (such as inter-car linkages orchestrated electronically, optically and acoustically), variable reluctance motors, computerized onboard control units, and new plans of track layouts. All of these actors (and more) were in constant motion or displacement through chains of translation, encountering resistances and translating interests to enroll and control allies.

The network was stable and realizing for a period of time (close to 25 years) and was able to evolve through several prototype stages but it wasn’t stable enough to become a complete object, implemented with commuters in Paris. After millions of francs and years of development, the Aramis project was scrapped and the object became textual inscription. By
the end of the book, the two narrators and key human actors do not attain a complete history
or total resolution of the death of Aramis. Instead, they attain a list of different
understandings of Aramis, summarized from those actors involved in the building of this
train-that-never-was.

Latour’s central question of the book -why did Aramis fail to gain reality?- is
answered by the insight that there were far too few compromises or far too few translations
and transformations achieved in the design, creation, and construction of Aramis by both
human and non-human actors. The list of frequently divergent, even contentious,
understandings and resistances were never manageable enough to be translatable or
agreeable for the many actors involved to become enrolled and controlled.

At the close of the book, as the French government retracts the last set of funding,
Latour concludes that the blame for the failure or death of Aramis is the belief in the
existence of “complete objects.” Latour claims that it is this (modern) belief that prevented
Aramis from aligning the chains of “passions, transported people, money, Communist
ministers and software” (p. 213), because, when Aramis was treated as a complete and
finished object, it could not transform itself “to hold on to its environment, and ... gain in
existence” (p. 212). This belief in complete and completed objects also led to Aramis being
labeled a failure, even though many of its disassembled actors went on to success in networks
elsewhere: an entire public transport system based on a pared-down Aramis (called VAL)
was built in Lille. And the Aramis project’s desire and driving goal for the attainment of a
hybrid transit system combining the independence of an automobile and the transport
efficiency of a regular railway train, continues to this day.
Transformative Technologies for Teacher Education

At this point, the reader may be wondering why should we want to describe educational technologies and digital professional development as human and non-human relations as in Latour’s approach? What in this approach appeals, particularly in teacher education? I draw upon Latour’s analytic strategies, Latour’s method, for an educational technology and digital teacher education purpose. I use this method to follow chains of engagements of “what holds and what does not hold together” (Latour, 1991, p. 110) in digital teacher education portals. And I deploy Latour’s techniques, his conceptual terms, to ascertain how practitioners (teachers) and teacher educators are transformed into practitioners who accommodate particular forms of computer and portal technologies in their customary practices of relating and acting as teachers.

As well, in a manner that augments Kling (1996, 2003) and Warschauer’s (1999, 2003) approach to social informatics, I illustrate how it is that humans, including teachers, inevitably transform non-human actors or digital tools and artifacts. It is my intention to illustrate that power or control to effect change, or, reform, lies not in any individual instructor, professional development program, or technological device/application, but in the translations and mediations of certain social or socio-technical relations for other relations; and, that these transformations in practices arise in particular socio-technical associations.

In the analysis of socio-technical relations in teacher education, I recognize change and reform in teacher education as a displacement of the ways that practices of ‘teaching’ are enacted and experienced by practitioners (human actors). I wish to underline the importance of this theoretical move: in traditional analyses of teacher reform, of teacher

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29 When practitioners align themselves with one teaching practice (pedagogy) or another, they substitute previously held perspectives and practices for others, and the old practices are ‘displaced’ in a move that can appear as power and control by the innovators of the new practices, of the new technologies.
development, it appears that teacher educators, professional development instructors or
teacher-researchers (those from the “outside” of schools) control an agenda, a shaping over
human and nonhuman others. In this way, in any depiction of the social or technical as a
cause of domination (of ultimate force in shaping the network), an argument or sub-text
emerges that blames the practitioners and positions practitioners to suspect or distrust the
institutional role of outside experts. Blaming teachers for lack of reform suggests that while
practitioners have the power to change the way they act in schools and classrooms, they
choose not to exert such influence, particularly over themselves in their own practice (their
reflexivity or their praxis). When such a choice is made, the teachers implicate themselves as
controllers of their own classroom and professional fate. This conceptualization of power
relations in teacher’s work and in PD assumes that individuals are fully autonomous. I seek
to also open and _displace_ (sic) this concept of teacher education for debate.

In this chapter, I suggest that in engaging with statements of social action or social
change involving technology, people cannot help but participate in the enactment of power
relations, in the enrolling and controlling of others. However, I also suggest that technology
is a far more powerful actor in conditioning teachers’ decisions than is traditionally
recognized, and it is becoming a more powerful actor as educational technologies
development increases and increases in its school implementation and presence. If we think
of technology as actively shaping human decision-making processes (Wajcman & McKenzie,
1999), then it becomes possible to see power distributed across a whole range of actors. It
also becomes possible to see that people can act differently than might be expected in any
encounter with technology, and are able to displace, modify, and change an existing chain or
effect of power.
It is important for all teachers to be aware that, according to Latour’s ANT approach to understanding power, force in the shaping or transformation of practices is itself an effect, not a cause of positioning. Power and control in a network can be described in a series of transformative associations made “durable” by technology, and open for the possibility of revision (Latour, 1991). For instance, teachers commonly take administrative directives (i.e., to use a particular computer platform, or to use the district’s intranet and designated internet browser software) as issues of organizational authority and view their practices as ruled by administrators’ power. Once it is described in socio-technical terms, as Latour would describe it, that teachers’ own associations with the computer/Internet or the choice of software effect translations and substitutions in their relations with administrators, then it is possible to reconstruct the whole practice differently (e.g., use the computer/portal in some situations and not in others, or all the time, or not at all).

It would seem that if technology continues to be represented and described in teaching practices (and teacher education) as an add-on, or a tool to enable teachers to accomplish “work,” then teachers will continue to have problems in technological practice and participating in epistemic communities. Problems will be addressed by seeking to refuse the technology (not use the portal), alter it, and/or replace it with another. Recalling the transformative effects of mobilization of non-human actors into practice as shown by Latour, it becomes evident that problems with technology will not be resolved, simply by removing or ignoring the technological artifact. It must also be acknowledged that, just as the addition of innovations may be necessary to strengthen associations with any program, removal of any human or non-human actor will alter the network. Predictability will be gained, or lost, and the network destabilized. Such additions or removals are openings in any chain of human and
non-human relations and offer a possibility for negotiation and realignment of power and domination.

It also becomes evident that when an intention or “desire” is acted on in practice (whether it is a practice of building transit systems or of teaching with technologies), the innovator(s) is positioned to encourage fulfillment of that intention and that computer technology is but one of the innovative means available to tip the balance on a gradient of accommodation. Discretionary decision-making practices dictate innovative (human and non-human) loads that serve to position humans in particular relationships with other human and non-human actors.

Conclusion

The approach of this study is ANT-derived and socio-technical and, as such, reflects a twofold interest. First, I endeavor to answer the empirically oriented question, where did the PKP portals find strength or alignment and why did they falter in enrolling chains of users? In this way, I hope to contribute to a more comprehensive understanding of the challenges involved in digital teacher professional development than has yet appeared in either the teacher education or the educational technologies literatures.

The ANT set of conceptual terms and semiotic practice permits me to investigate the manner in which we (different stakeholder groups or actors) are co-responsible for and co-constituted in these prototypes (digital worlds such as the actor-network world of the PKP portals). I am not attempting to make these observations from a simplistic “I’m for it or against it” standpoint, as some of the EdX mentors (key human actors) were willing to repeatedly state, and, as I positioned them to declare in the heat of project deadlines and the thick of their resistance. I do not intend to tell a simple, determinist, political heroics story
about resistance versus complicity. What the ANT toolkit of terms allow me to demonstrate is that many kinds of agency, both human and non-human, have to be recognized, encouraged, followed, and observed. Both knowledge and agency are not things that are immediately apparent and given, but things the observer/methodologist must describe and trace in the socio-technical network. This work is an empirical account, a thick description of how the portal system and its infrastructure evolved and faltered, and, equally, how the relevant actors, human and non-human, intended and participating, resisted making enough amenable compromise to take full advantage of the PKP portals.
CHAPTER 4
Setting the Study: Locating the Contexts

Although the study under-girding this research was located in the Public Knowledge Project and, particularly, in its professional development portals, as I have stated in the introduction, this dissertation is not a specific or traditional evaluation of its work with teachers.\(^{30}\) Rather, it focuses on following particular forces or actors, human and non-human, embedded within, between, and around the portals, and how those actors influenced one another in the ensuing chains or network of connections and disconnections. Still, an overview of the Public Knowledge Project, the two implemented PKP professional development portals (PKP-VanSun and EdX), and the teacher education programs in which they were tested (the CITE cohort and the NETTL program) needs to be introduced in order to assist readers in following the actors, contextualize the issues, and follow the portals’ effects or chains of enrollment and displacement. In this chapter, I present this overview in a chronological manner in order to help the reader better navigate and situate this study.

\textit{Overview of Public Knowledge Project}

The data for the thesis was gathered over a three-year period (1999 to 2002) by direct participation, as a Graduate Research Assistant, in the Public Knowledge Project (PKP), a research consortium directed by Dr. John Willinsky in the Faculty of Education at the University of British Columbia (www.pkp.ubc.ca). PKP continues to the present day and encompasses many Internet-based projects, mostly focused on digital scholarly communication and academic open-source publishing initiatives. The commonality between

\(^{30}\) Traditional evaluations of information technologies often treat users as objects of the tool and pay little or indirect attention to the social impacts and effects of the prototype’s use. Please see Chapter 5 for a more in-depth discussion.
these more recent projects and the design and implementation of the earlier professional development portals is the commitment to maximizing the public potential of the Internet for both the communication of and accessibility to research knowledge. Or, as Willinsky has succinctly stated (2000), "We [PKP] are exploring ways of using the Internet to make the vast wealth of social science research into a greater public resource" (p. 226).

The genesis of the PKP professional development portals began with the belief that the education stakeholder community needed an integrated web-based forum for collating and sharing publicly available knowledge and insights derived from highly diverse sources on the Internet (researchers, university institutes, non-profit organizations, government groups, newspaper editorials, etc.) pertaining to the topic of education and educational technologies. The PKP consortium or "we"31 wanted to create websites or portals where documents could be found authored by university and think-tank-based researchers, government groups, and non-profit (NGO) groups, side by side with teacher responses; where indexing systems would be integrated and innovative; and, where discussion boards and repositories of documents would be seamlessly connected. We also wanted to capture and publish practitioner knowledge developed through participants' own documented innovations, implementations, and responses to educational technologies in their classrooms.

PKP made the complex needs of teachers our specific focus in a series of website or portal prototypes beginning with PKP-VanSun (March-May 1999)32, the implementation of

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31 I employ the pronoun "we" as I refer to the design period of time and the group of researchers directly involved in PKP's professional development portals. Once the implementation of EdX was officially concluded by my resignation from the EdX project implementation with NETTL, in February 2001, this signals the beginning of the period of time characterized by the pronoun "I", as I grappled with the results and began to analyze formally the dilemmas of usability and teacher participation in the PKP PD prototypes.

32 The date spans listed for each prototype represent a period of time that began with field site consultations, prototype development, implementation or site testing, and a general debriefing by research-designer project members.
the PKP-VanSun portal with a cohort of pre-service teachers (October 1999-February 2000),
the PKPF (a policy forum hosted by the BCTF website, November 1999-January 2000), the
Educators' Exchange or EdX (April 2000-February 2001), and the final conclusion of the
PKP-PD portals which was the transfer of the accumulated built repository to the WebLink
database, housed on a school district’s First Class server. My motivation for involvement
with the PKP project was to test how Internet prototypes could offer possibilities of linking
research and schools to redefine schools as “knowledge refineries” (Brown, 1997):
organizations that actively forage knowledge resources as well as produce their own
knowledge documents and recommendations for action through synergistic reflection.

The two field sites of teacher education chosen for the implementation of these
portals in which I participated directly and one field site in which I helped negotiate the
transfer of the content (of the EdX repository into WebLink in order to extend its knowledge
contribution to more teachers), included the following: one group of pre-service teachers
engaged in collectively composing an electronic essay through discussion33 (PKP-VanSun,
October 1999-February 2000); a cohort of one hundred teachers in a university-directed,
professional diploma program of educational technologies (EdX, April 2000-February 2001);
and, one school district’s attempt to organize and filter Internet resources to facilitate the
district’s and teachers’ practices of curriculum design (WebLink, September 2001-present).

Prototype 1: PKP-VanSun (March-May 1999)

The basic research question we began with as a consortium and wanted to concretely
demonstrate through design, was how can this new technology, the Internet, improve the
quality of public knowledge. We wanted to understand how best to connect and present

33 See Jane Mitchell’s dissertation, Computer Technology in Teacher Education (2001), for another analysis of
this event.
different forms of knowledge in this new medium so that the prototypes would support people's interests in understanding and utilizing the available knowledge on a given topic. Against the fragmentation and proliferation of information on the Internet, we were seeking to create a countervailing force that linked and conceptually connected web-based resources. We were exploring how to design portals that offered research knowledge, in particular, more accessible and public forms. The core idea was to strengthen notions of public knowledge as a vital aspect of democratic education and action. The first Public Knowledge Project prototype, PKP-VanSun, was a working concrete manifestation of the idea of designing “usable knowledge” (Lagemann, 2002) through Internet-based prototypes, first developed in John's book, *Technologies of Knowing: A Proposal for the Human Sciences* (1999).

In the initial PKP experiment, we collaborated with the *Vancouver Sun*, the local newspaper to see how print journalism could be extended by providing interactive forums for readers and newsmakers, as well as web-based links to related research, policies, issues, practices, programs, and organizations, six domains of knowledge that were and still are accessible through the Internet. We chose Technology and Education as the central topic around which we could provide support to the newspaper for two reasons: the Vancouver Sun was compiling articles and material on this topic and wanted to experiment with a new communication medium, and, both the Vancouver Sun and PKP believed it to be the educational topic of greatest pressing interest to the public and educators alike.

*Description of the Prototype*

PKP worked with the Vancouver Sun to cover five prominent technology and education topics that were coordinated to complement a series of articles appearing in the
newspaper, during five days of consecutive special coverage. The PKP portal was designed to work specifically with this Vancouver Sun series, written by two staff reporters, to help parents, teachers, students and members of the public assess the contribution and impacts of new computer technologies in education. With each new article, the PKP portal offered a new collection of web-based links to users to enhance and extend the article’s coverage of the topic. The five sub-topics of education and technologies, chosen by the newspaper, that PKP mined for online resources included 1) the impact of technology on curriculum and education 2) funding issues 3) gender and technology 4) the internet and 5) the future of libraries.

The web-based links or URLs that we selected to back up each of the sub-topics were chosen to represent six domains of knowledge: research (academic literature); policies (examples from both local and provincial government levels); issues (far-ranging editorial opinions on the topic); practices (practical methods for solving problems and creating innovations suitable for integration into an individual’s practice or teaching); projects (projects attempting to reform or problem-solve at a collective level); and, organizations (collectives whose purpose is to lobby and change policy-making related to the topic). PKP, following John’s concept of a knowledge domains schemata, considered the linking of these domains critically important for allowing the public to make connections and to inform themselves more thoroughly on a topic. The idea was that these domains would provide the public with a breadth of information that links theoretical and substantive empirical concerns with practical options and political opinions.

The first function of the PKP-VanSun prototype was to link newspaper articles in electronic form to our portal (Fig. 1). The PKP-VanSun portal was a repository composed of
a matrix of hyperlinks, each annotated with a bibliographic entry including author, source, date, full URL, and a brief summary. We created the matrix based on two axes: one axis was the topic-of-the-day as defined by the corresponding newspaper article. The second axis was the categories of knowledge from which each topic could be probed. These categories included research, policies, practices, programs, organization, and, discussion forums, each represented as a red button on the screen.

Figure 1. Screen shot of PKP-VanSun Web site home page

We were attempting to create strong connections and a seamless integration between the knowledge-heralding medium of the newspaper and the schemata-informed filtering and re-packaging of Internet-published knowledge by our university team. The work for myself and other consortium members became a six-week profound immersion into the Internet for locating the most pertinent, valid, research-based information related to the articles' topics and to reinforce sources, counter-points, or contexts.
Discussion Forums

The Public Knowledge Project considered the expression of public opinion another important domain of public knowledge in conjunction with access to resources. In the PKP-VanSun portal, we first explored how a conference or discussion web-board would play a role for the users’ knowledge-making and knowledge articulation. We offered the users a forum directly connected to each day’s main article and topic that included guest panelists who were the quoted experts in the corresponding Vancouver Sun article. The five forums included Day 1) Technology’s Educational Impact Conference with the then Deputy Minister of Education; Day 2) Funding Equity Conference with the then Minister of Education; Day 3) Gender and Technology Conference with a professor of educational technologies and gender studies; Day 4) Kids and the Internet Conference with an RCMP officer specializing in Internet safety; and, Day 5) Virtual Libraries Conference with the Chief Librarian of a library system experimenting with digital media. Each conference began with a welcome note by myself from PKP and introductory comments by the guest panelist. Unlike a regular radio phone-in show or the editorial page of the newspaper, these forums were designed to permit the user-visitor to choose whom they wished to respond to or to question at any time of the day or night. The forum technology also allowed the user-visitor to compose and edit a message, as many times as they wished in as many words as they desired.

User Results and Site Statistics

The experiment with the discussion forums revealed some important considerations for the next design edition of PKP. While we were surprised at the small number of actual postings by users-visitor, we were also pleased at the number of readings and visitations. In one case, an anonymously posted message describing the problems of a school questioning
the design of a computer lab, was read 90 times over four weeks, even though this did not result in a single posting commenting on the anonymous note. John and I speculated that there may have been too great a number of conferences occurring in this short five-day span (even though the conferences remained online for another two weeks). We also realized that it was difficult in the portal design to know where the expert-guests were available. We hypothesized that testing a variety of formats for the conferences could make a difference for the low rates of participation by users. These formats could include conferences pertaining to personal testimonials and exchanges of personal information (i.e., forums for parents with teenagers who have Internet access in the home or educators attempting to upgrade the computers in their school, etc.). Other conference formats could consist of a group of experts discussing one particular topic or guest panelists answering questions from a general anonymous public.

The statistics we compiled from the tracking logs considered a range of issues and categories of data. The PKP-VanSun site had 453 new visitors over the five days which the project ran with the newspaper’s active coverage, with 749 visits altogether as we left the site actively open to users for a total of four weeks, with an average five minutes spent during each visit to the site. At its busiest, we had twenty new visitors an hour. The site received 1881 hits in total. A quarter of those visits were from outside of Canada. Among the different overviews of Internet resources we provided, the one on “research” concerning teachers (or the educational impact of technologies) was the most popular, followed by the domains of “issues” and “policies”, again both inside the topic of technology’s educational impact on teachers. The discussion forums had approximately fifteen participants a day, with some of the messages being read some 90 times from when they were posted until four weeks later.
when the forums actually closed as an active site. Our final summation as a team was that the average length of the visits was encouraging as was the evidence of reading if not the active engagement within the discussion forums.

*CITE Pre-service Site (October 1999-February 2000)*

CITE is a customized pre-service program within the general Bachelor of Education program at the University of British Columbia. The acronym CITE stands for Community of Inquiry for Teacher Education and the program works to consciously and reflectively create conditions for greater inquiry into the meanings and practices of teacher education by both the pre-service teacher candidates and their surrounding education communities.

PKP, as represented by John and myself, began having conversations with Jane Mitchell, a fellow graduate student working within the CITE program as an educational technologies instructor, as well as support for faculty attempting to integrate new technologies. Jane and I shared similar research interests including how to support and improve the conditions for intellectual engagement by teachers, both new and experienced, through technological means.

As we at PKP were seriously pondering where we could re-contextualize the PKP-VanSun site as a resource repository to inform educational stakeholders or groups, Jane and a CITE instructor were pondering questions regarding the ways in which students justify their ideas and the degree to which published research might inform them. At this time, the CITE instructor was in the process of teaching a course entitled, Education Studies: a course concerned with the study of social relations in educational settings, focused on educational opportunity (or lack of opportunity) in relation to social class, gender, poverty, ethnicity and sexuality. As this type of course regularly examines controversial social issues, the
opportunity for greater access to research and other types of knowledge to inform student
discussion was considered propitious.

The Education Studies (ES) instructor and Jane wanted to consider whether and how
they could use and integrate effectively some of the vast amounts of information and
resources available on the web into a pre-service course. For this reason, we developed an
alliance between our Public Knowledge Project’s need for another human test site and the
CITE instructors’ needs for a working, ready-made knowledge portal to inform student
discussion. Jane and I discussed how the PKP-VanSun prototype could be used and how to
best design an assignment task which would both take advantage of the resources located on
the PKP web site as well as take account of the social issues needing attention in the ES
course.

Jane designed an “ES on-line” task to provide a context for the pre-service students to
consider the ways in which access to and uses of computer technologies in schools intersects
with social issues to generate educational opportunities as well as to perpetuate social
inequities.\textsuperscript{34} Students were given the following task:

As a beginning teacher what do you think are some crucial equity issues pertaining to
technology and education and what action do you think schools and teachers can take
in relation to these issues?

The task was intended for students to develop both a critical perspective and a
practice of informing themselves through research in order to address educational situations.
In this case of collaboration between Education Studies and the PKP-VanSun portal, the task
focused on the topic of educational technologies, a topic that is regularly dominated by a
 techno-determinist characterization. Educational technologies can become the same object of

\textsuperscript{34} This unequal opportunity is often referred to as the “digital divide.” See Social Informatics researchers such
as Mark Warschauer (2003) for convincing critiques of the myth of a technological solution for social problems,
as is often assumed with the problematic term of digital divide.
causality for polarized ends of a techno-determinist argument where one end extols the virtues of ICT and the other end condemns its innate vices. Both PKP and CITE wanted to engage users in the technology itself while they accessed knowledge to help them consider choices of action when encountering educational technologies in their practice in schools.

The method for conducting this collaborative investigation was twofold: it centred on a structured on-line discussion set inside the WebCT discussion tool – a discussion forum enabling participants to engage in a threaded discussion, already a familiar and usable tool to these students – and the task necessitated access and references to the PKP-VanSun portal, an unfamiliar knowledge repository prototype. To broaden the discussion of social issues in educational settings beyond this one group of 36 pre-service candidates -who had been discussing topics with one another for three months in their courses- and beyond this one set of university walls, Jane invited external educators interested in either educational technologies or pre-service teacher education to participate in the experiment. Beneficial to PKP’s purposes, these guests represented a more public audience for our portal as they were from different institutional settings including a Lower Mainland school district, Australian universities, and other departments of the Faculty of Education. Beneficial to the CITE instructors’ purposes, these guests had greater experience and perspectives larger than what these pre-service teachers were familiar with.

Webquest Assignment and Context of the Study

The actual ES assignment was designed by Jane Mitchell as a type of Webquest\(^{35}\) where the task itself was presented in a web-based format, located on WebCT and contained direct links to both the PKP-VanSun portal homepage as well as selections from its.

\(^{35}\) Webquest is a term used to describe a digital lesson or learning object in which students work online conducting research using web-based resources. The intent of our Webquest was to model a working example that students might emulate in their own teaching practice.
repository of resources. Three modes of inquiry – writing for the articulation of one’s knowledge position, consulting established knowledge resources to footnote one’s position, and, doing all of this in a public discussion – were brought to bear upon the question of social (in)equities and educational technologies through a digital medium. The design of the task that appealed most to the PKP research agenda was that in using the portal for a purpose (to accomplish the assignment), the pre-service students would be able to reflexively comment on the usability and usefulness of our PKP-VanSun portal.

Each of the seven discussion threads were “public” to only those with access to the WebCT site, but within WebCT, students could read and contribute to other threads if they so wished. We traded off our PKP mission for public reach in order to seize upon the chance to work in a participatory action setting where students would be continuously consulted with in order to receive their feedback on the assignment, the discussion interactions, and the PKP-VanSun portal’s design and function.

Students were required to make a minimum of three contributions to the discussions. The first two were written over a two-week period in November and December 1999. The final contribution in January 2000 was made after a three-week practicum experience. The guidelines for contributions were that students address a designated topic from the PKP-VanSun selection; draw upon the web-based resources indexed and accessible through the PKP-VanSun repository to support and provide evidence for their ideas; and to build upon and respond to the ideas of others in the discussion forum, including the guest participant’s.

My role in the CITE research project was multiple: I consulted with Jane on the curricular design of integrating the task with our prototype; I was an external guest moderator in one of the seven discussion forums, working with 6 pre-service teachers on the topic of
corporate sponsorship in education and technologies; I taught the PKP-VanSun infrastructure and navigation to the pre-service class in a computer lab; I helped design, administer and analyze the survey; and, I designed the question battery, lead the focus group session, transcribed the tape-recording, and analyzed this data for user response to the portal design and usability.

It is worth emphasizing that time was a constant issue at all the PKP test sites, but it was particularly at a premium in this CITE test site. I had only one computer-lab period in which to introduce the students to the design and navigation of the PKP-VanSun portal. Other complicating factors included the fact that there was still outstanding ES coursework to be finished during class time, which meant the instructor was not able or willing to link online discussion with face-to-face class time. The WebQuest task was implemented at the end of term, hence, it was situated in a compressed time period when students were stressed with numerous other course assignment requirements. Due to constrained time factors and the discontinuity between the WebQuest and their other pressing work, this innovative online assignment became an add-on in the ES course itself. As we began the introductory session, Jane and I overheard and observed negative sentiments such as, ‘Oh, not another assignment’ and ‘Why write when we can just turn and talk to one another?’ Yet, despite this initial (and valid) grumbling, the majority of the group became engaged with the topic, the technological tools, and the participation of external guests. There were students who left their time constraints to the side as they contributed responses that went beyond the required expectations.
Statistics and Results

There were 36 CITE students and 7 external guests who participated in this WebQuest assignment experiment for a total of 43 participants. Each participant was required to make three postings for a minimum total of 43 x 3 or 129 postings. After the task and online discussions were concluded, the total number of web resource references was 68 out of 129 or 53% of the total postings with 43 references or 63% of the referenced postings referring directly to PKP-VanSun’s filtered, indexed Internet resources.\(^{36}\)

More importantly, student response data was collected from two sources: a post-assignment survey of the whole class – which Jane and I conducted inside class time following a short de-briefing discussion – and a two-hour focus group session of five of the participating students, a couple of weeks after the conclusion of the assignment. Responses in both data collection events were categorized according to the following reoccurring themes: the PKP resources and summaries informed or supported ideas; citations were used because it was a requirement of the assignment – a coaxed practice rather than one of spontaneous choice; the PKP articles were interpreted as offering little of merit for citation to support students’ personal opinions; or, the PKP portal was interpreted as an expert filtering tool of the Internet with many advantages and contributions. As can be seen from these conflicting themes, the interpretations were multiple and mixed and there seemed to be no overall consensus as to the merit of the tool when asking students directly for their response after a forced participation event. In the focus group session, the critical barrier for the enrollment of users (to engender sustainable use of the portal) that surfaced repeatedly were navigational

\(^{36}\) The other 37% of referenced postings included URLs, found by students off the web. In the final survey, the same number of CITE students found the self-searched URLs or references as useful and important as the PKP-VanSun URL resources.
design issues for the access to and engagement with the selected PKP resources. These participatory themes and usability issues are further analyzed in Chapter 6 of this thesis.

*NETTL the In-service Program (April 2000 to February 2001)*

At the same time as the conclusion of the CITE implementation and with no indication by the CITE instructors that they would want to repeat this kind of research experiment again, PKP was in the process of completing a concurrent test site, the Public Knowledge Policy Forum (PKPF). PKPF was another teacher-audience prototype developed in cooperation with the provincial teacher union (BCTF) and housed on their BCTF website. Whereas PKP-VanSun-CITE and the later EdX prototype focused on digital supports for specific cohorts of teachers' formal education (course/program enhancement), PKPF was a prototype focused on engaging a 'public' of teachers in ministerial policy formation, revision and implementation. PKPF examined a newly released provincial policy report on educational technologies and was composed of two components, an online repository of educational resources following a knowledge schemata similar to PKP-VanSun's, and, a set of discussion forums moderated by a PKP consortium member. What was striking about the PKPF example and what opened a new problem set to consider for further PKP research was the disconnection between the repository of resources and the online discussion forums, housed in the very same portal. Those users who read more

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37 See Shula Klinger's PhD dissertation (UBC, 2001) that specifically analyzes the PKPF experiment and her role in developing a virtual community of teachers.

38 I refer to the teacher audience of PKPF as a public because the targeted audience concerned all the members of the BCTF union—a group numbering in the thousands. This group is more amorphous, ambiguous and difficult to capture in comparison to the PKP-VanSun-CITE and EdX user audiences.

39 I was fortunate to learn of these results from my participation in the PKP consortium and our regular consortium meetings. I did not directly participate in the PKPF study as my work was focused on different portals and on a different purpose, the integration of research portals into teachers' course and classroom practice.
documents in the repository rarely participated in the discussions and those users who were regular participants in the discussions, rarely read or referenced the resources from the repository. Reader-users weren’t sharing and contributing their knowledge to the discussions and discussant-users weren’t accessing resources or referencing their opinions. Given these participation results, it was as though the usability design of the portal did not connect, integrate, or effectively crossover these two components of the portal, discussions and repository.

We reasoned as a consortium that we had increasingly important prototype knowledge\(^{40}\) and valid, well-selected resources\(^{41}\) to offer to teachers but that we needed a more grounded, specific education community -such as a cohort of teachers- with whom to test and develop the next working prototype.\(^{42}\) At this time, we were also being well funded and endorsed by the Office of Learning Technologies, a federal funding agency that granted us $300,000 over three years for continuing the development of our public knowledge portal infrastructure for the purpose of educating educators.

Our proactive project manager, Vivian Forssman, was keenly working her networks of contacts looking to see who in education might be in search of a knowledge portal. And Vivian found Chris, an experienced, committed teacher educator and instructor of NETTL

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\(^{40}\) We were realizing the complex interactions and regularly divided solitudes between the repository tool of resources and the discussion forum tools.

\(^{41}\) At this point of time (March 2000), we had accumulated approximately 400 indexed and classified web-based documents or resources, all selected by our consortium.

\(^{42}\) Fieldnotes, January 2000. PKP consortium meeting (Wall Centre, UBC).
(New Educational Technologies for Teaching and Learning), a recently established professional development certificate program at a Lower Mainland university.

Who is NETTL and how is it unique?

The NETTL program is situated in a university department that works to implement a model of in-service teacher education that is in the classroom, *in situ*, or situated in the daily work of teachers, both physically by offering university courses in the school district buildings and pedagogically in its approach to teacher reflection, self-study and action research, following the teacher-action-research model of Lawrence Stenhouse (1983, 1985).

The primary text in this approach to teacher education is the teacher's own local practice in their classroom rather than academic articles concerned with practices of a generalized group of unknown teachers. In their daily local practice, teachers are constantly making decisions about ethics and politics in relation to their actions and their effects on students' learning. A cluster of such decisions surround issues of how teachers choose to make their work "public" (Stenhouse, 1983, p. 185), public to their students, to the parent community, to their own teacher-colleagues, and to themselves. Professional development programs such as those offered through this department were popular and successful in "working with partner organizations [school districts] to design innovative in-service programs which engage educators in focused sustained reflective inquiry into classroom practice" (NETTL program guide). These professional development programs did not qualify for graduate accreditation because they were not academic or rigorous enough in their

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43 NETTL is the invented acronym for a two-year university-directed diploma program. The acronym stands for New Educational Technologies for Teaching and Learning and captures the purpose of the existing program.

44 In one of my initial meetings with Chris (prior to the mentor workshops), she and a fellow department colleague emphasized a quote by Lawrence Stenhouse printed on their program pamphlet as representative of their philosophy and mission to teacher education (Fieldnotes, April 2000).
bibliographic texts, resources, and required assignments to be translated into graduate credits. But these programs were constantly tested for user-ship as the department ran on a budget relying upon student fees with no supplemental or subsidiary monies from the university.

NETTL was one of the more recent extension programs developed in this unique professional development department. Not only was NETTL innovative in its teacher educational approach but it was also very popular due to its pressing topic and timely content of educational technologies for teaching. NETTL cohorts were popping up in many school districts and the in-service professional development department needed to hire many of its newly certified teachers to return to mentor in the very program they had just completed. When I began work with Chris in one school district with a cohort of new mentors, the NETTL program had only arrived at its second year anniversary mark and was an obvious success with registered school district partners doubling in number each year.

Specifics of the NETTL Program

NETTL is a program built upon mentor leadership and guidance, and organized through mentor groups. Mentors are teacher-leaders of educational technologies in a school district, hired to supervise and counsel a group of teacher-mentees (usually numbering five to seven in-service teachers) through the NETTL program and new technologies' integration for the classroom. The NETTL program combines two face-to-face summer institutes (each institute is two-weeks long) with other distributed learning events extending over two school years. All learning events and activities are localized in the school district. Teachers are not required to set foot on the grounds of the university, instead the trajectory is inversed with the university instructor traveling to school district locations. This travel is symbolic of the Professional Development department's commitment to collaborative partnerships with
school districts and developing local capacity with district teachers. It is also symbolic of the department’s commitment to participatory teacher education beginning with local empowerment of the teacher’s own classroom-based knowledge.

The summer institutes are organized, scheduled, fleshed out and implemented by the mentors in consultation with the program instructor (in this case, Chris). Each summer institute has a designated number of core pre-designed learning activities that must be completed during the institute. During the school year, teachers choose types of learning activities to focus on their own professional learning or their classroom teaching practice. In NETTL, there are no grades but there are credits. Credits are earned by satisfactorily completing an evolving set of self-designed, mentor-approved learning activities. The teacher-mentee decides, in consultation with their mentor, how many credits they plan to earn in each term, but it is ultimately the mentor who determines and approves for the university if these credits were indeed warranted by the teacher. With this flexible program, centred on the teacher’s participation, choosing their own “learning path”, teachers could design their coursework to accommodate their full-time teaching responsibilities. This was of great appeal to many of the teacher-mentees who were overwhelmingly female in number, of a median age in the late thirties, many with children at home.

The NETTL program could not function as a primarily distance, dispersed form of education if it were not for the mentors. Their role is central in guiding, supporting and translating for their mentees the expectations and ‘standards’ of the NETTL program. NETTL rationalizes that it is a program for educational professionals who are already experienced learners; therefore, learning activities are not graded. To gain a pass, teachers are

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45 This is a noteworthy distinction as most of the NETTL program is built upon an open-ended, grade-less, teacher-defined learning path with next to no compulsory tasks, readings or attendance (other than the Summer Institutes attendance).
required to submit a portfolio to their mentor each semester demonstrating what they have learned and how they determine they have “grown in capacity”. Mentors and the teacher-mentees are instructed that the evaluation criteria for the completion of credits needs to “stress reflection, self evaluation and ongoing learning” (2005, NETTL program guide).

Choice of NETTL as a Site of Implementation

NETTL was a program focused on teachers learning how to integrate new technologies into their teaching and curriculum design as well as engage with new tools for their own technological learning. It was also a program designed as a dispersed, distance method of teacher education relying on mentors to make it personalized, face-to-face, and supportive for teachers who may have never turned on a computer or tried anything more challenging than email as an application. Mentors were also critical implementers of the program as they guided the teacher-mentees to understand the workings of this unique university program that was designed as a self-paced, self-directed, and self-reflective system of learning.

Chris, as representative of NETTL as a program, wanted to locate user-friendly tools for greater support and community building by teachers with other teachers. She was keenly interested in finding a tool that would inspire and facilitate a community of practice for NETTL teachers and mentors and she was hoping that PKP could offer that prototype. Chris was also attracted to the idea of a tool as a demonstration to the university that NETTL could consider a more “academic” research-based approach as an option for teacher-learners and as a future means to validate or qualify the program as a graduate course. But the program and the instructor seemed conflicted over the interplay or accommodation of three demanding strands, each vying for emphasis: how much of an emphasis on technology acquisition for a

46 Fieldnotes, June 2000.
skills-based program (the preference of the majority of these mentors) or how much of an emphasis on teacher's own classroom-situated, personal-practical knowledge of technology integration (Chris's preference) or, finally, how much of an emphasis (if any) on public educational research as a central knowledge resource for teachers (PKP's preference)?

*EdX the Prototype*

PKP's work with NETTL began in January 2000 with meetings between Chris and Vivian Forssman, beginning the collaborative negotiations of partnership. The first stage of partnership was a consideration of PKP evaluating the NETTL website for usability recommendations but this initial purpose quickly evolved into a joint collaboration to co-develop a portal of resources and communication tools to build a virtual community of support for the NETTL students.

With a willing instructor intent on attempting to see this experiment through for her program's teacher education purposes, we now needed a workable, dynamic prototype and software developer. After two prototype development projects, PKP-VanSun and PKPF, we the research-designer team of PKP (particularly myself and Vivian) realized that the work needed to both technically design a portal and coordinate the research project would be difficult to manage given our limited technical capacity in a university setting (no full-time technical staff, server space, or built platforms). We decided to consult with software development companies to determine if we could build upon their technical expertise and established prototype platforms to further our research and implementation goals.

On April 6th 2000, with Chris present, we (the PKP consortium) held a demonstration competition on the UBC campus for two software developers, one from Halifax and the other from Vancouver. After the two show-and-tell demonstrations, it was Chris who was the most
decisive and vocal as to her preference. She quickly determined which portal infrastructure would offer the greatest community building capacity for her NETTL participants. Thus, it was decided that our project would work with John Cousineau of Innovative Information Inc (III), a Vancouver-based, proprietary software development company.

The Educators' Exchange or EdX developed by III was a tool modified and tailored for a specific cohort community, a NETTL cohort of 100 elementary and secondary teachers in a Lower Mainland school district. EdX was built upon an existing platform technology, a knowledge management prototype, called Info Exchange, already tested by Cousineau in corporate settings. In this project collaboration of an in-service professional development program (NETTL), a university research consortium coordinating the participatory design and implementation (PKP), and, a corporate model of knowledge management portals (InfoExchange), we had the makings of a complex network of shifting alliances and competitive stances of enrollment or resistance by these diverse stakeholder actors (and the “masses of actors” they would then influence).47

John has articulated the core vision for the larger PKP infrastructural purpose in books and articles. In his Harvard Educational Review article (2002), “Education and Democracy: The Missing Link May be Ours,” an article that was penned as the EdX project was nearing its close, John describes the technical features and infrastructural characteristics that prototypes need to present to fulfill the PKP vision:

(1)... research sites that provide open access to complete studies with support for less-experienced research readers, those with disabilities, and those without the latest technology; (2) comprehensive, open-access, and automated indexing and archiving systems for online research, which allow readers to locate refereed research, dissertations, and other resources, and conduct fine-grained searches by, for example, research topic, sample characteristics, methodology, and works cited; (3) research

47 The use of the terms network, enrollment, actors and masses of actors all refer to Bruno Latour's work. See Chapter 3 for definitions and uses of these conceptual terms.
support tools that enable readers to readily move from a given research study to its dataset and research instruments, to related studies, reviews, overviews, and glossaries, and to relevant policy, program, and media materials in other databases; (4) open forums for researchers, professionals, policymakers and public to discuss educational issues, methods, and research agendas within the context of this body of research. (2002, p. 370)

The EdX prototype qualified for John’s infrastructural prescription. EdX succeeded in fulfilling John’s mandate because it could be described as a web-based portal or a type of digital library where members could both access and contribute digitized resources collected from a diverse range of sources on the Internet (university research, provincial policies, teacher-created lesson plans, federal programs, international projects) as well as offer their own authored documents. EdX offered a sophisticated site search engine, classification system, rating and review features for documents, and a search archiving mechanism entitled, My Agents. And EdX allowed users to create open forums for discussion with supporting documents retrieved from the portal’s repository. Central to the EdX prototype design were mechanisms for accessing information and connecting for collaboration on almost every page of the system.

The technologies involved in the EdX portal included those to support document creation, retrieval, foraging, transfer, dissemination, manipulation, and management of information. In the screen shot (Figure 2) of the Information channel (or a drop-down menu), readers can observe the categories of information that were modified as the EdX prototype was tested and feedback received from the teacher-users. We began with eight main categories of information (My Interests, Daily News, Articles & Reports, Examples of Innovation, Tips & Tricks, etc.) that were a combination of categories imported from III’s corporate implementation site (e.g., Daily News) and from the last iteration of the PKP repository (e.g., Articles & Reports). The most dramatic modification in this channel was the
expansion of the “My Interests” selection of information into six sub-categories of subjects and school organizations most familiar to teachers.

Figure 2. Screen shot of EdX Web site home page with Information menu.

EdX also did not meet key criterion for an effective public knowledge system as stipulated by John in 2002. First and foremost, EdX was not a public, open-access system. EdX required a registration and password, the means by which the III software developers could monitor and determine the identities of users as members of the selected and funded or paying community (Figure 3) and ensure the protection of their software code and the boundaries of the user group.
Figure 3. EdX Registration or Log-on page

With EdX, PKP exchanged our commitment to public open-access prototype infrastructure for an investment in a privatized community intranet. From Chris' emphasis on this technology as a tool for a NETTL community to the mentors' repeated concerns for privacy, I believed we had to create modes of comfort and define an area of trustworthiness through a closed private system. By giving structure and definition to this digital community, rather than opening it to an ambiguous undefined public user group, we intended to persuade the NETTL practitioner-participants to use this external technology (outside the NETTL program and website as well as outside the teachers' school district's own set of technologies) and trust in its abilities to foster an epistemic community or a community of practice. This was a difficult experimental position for PKP: we knew we had to demonstrate the effectiveness, comfort and trustworthiness of the portal before our stakeholders (the school district or NETTL mentors and teachers) would consider participating, maintaining, or paying for the system, yet we knew we represented both an external institutional actor in
teacher research and education, a university-based research project, as well as the agent of a sophisticated unfamiliar technology that could evoke technological discomfort.

In John’s pivotal *Harvard Education Review* article (2002), he does not state which specific prototype would technically qualify for his purpose (i.e., digital library, portal, MUD, etc.), as there is no one artifact that matches a social purpose but John is clear in his argument for public open-access systems. While EdX was not open-access, it was a portal prototype like the other PKP artifacts. I refer to the PKP artifacts as portals because they were all prototypes concerned with filtering resources from the Internet, of giving a defined gateway into a repository of community-selected information. In a rather technicist or tech-talk fashion, this definition of portal has been offered by the portal software industry:

> Although it may be impossible to settle on one definition of portal from a mission or philosophical perspective, it is pretty clear what a portal is from a technological perspective," said Jenny Rickard, vice president for product management at PeopleSoft Learning Solutions. "With a single log on, portal technology provides the capability to aggregate content from multiple sources, ...integrate workflow from multiple sources, access role-based analytical information and, if desired, facilitate commercial transactions. (Sistek-Chandler, 2000)

The definition of "portal" is still transitory and difficult to pin-down and define in the every-changing continuum of digital innovation but the portals of the Public Knowledge Project can be best described as containing the following elements. There is a collection or database of content that is a structured, indexed aggregation of documents. The PKP portals, therefore, are not the Internet writ large but a distinct filtered selection of Internet resources. The portal’s material includes full-form online resources encompassing a range of knowledge types, media, and intended uses, such as articles, reports, organization statements, discussion archives, email messages, images, and the like. The PKP portal design was concerned with
linking audience, user group or community, with attributes of the repository content in a participatory, needs-oriented manner.

No matter what combination of technologies and content is held to constitute a portal, however, it is important to give full consideration to the human services and social interactions intertwined with the system's design and infrastructure. It is often this complex social element that has been overlooked in a race to develop the ideal technical system. Richard Lucier (1995), the once director of Library Services for the entire University of California system, characterizes these portal tools as evolving social-technical institutions where "information space" complements "information place." The EdX portal was consciously designed to include spaces and places for linking users through the People channel or drop-down menu (Figure 4). Teacher-users could read of other teachers' common interests in the Profiles selection and connect with users through face recognition in the photo gallery with "the EdX Gang" (Figure 4). It was difficult for the NETTL teacher-mentees to make connections to other teachers outside of their small mentor groups, particularly when the Summer Institute had concluded and teachers were working alone in their classrooms. To inform and extend community involvement, teacher-users could be introduced to each other through their document contributions ("My Agents" feature) or through their teacher profiles and project interests ("Key Colleagues"), all recorded, digitized, and indexed on EdX.
Figure 4. Linking Users through the People Menu Functions

In the project channel or drop-down menu (Figure 5), spaces were available where members could set up and participate in web boards for asynchronous discussion among a number of them, and where they could also share and store mutually developed documents such as field study proposals or reviews of work for their term portfolio. These asynchronous discussions (Figure 5) had to be initiated through a user who would be assumed the moderator or coordinator of the discussion. These discussions were open and available through the Projects menu but specific users were personally invited by the moderator to participate by system-generated email.
There were 11 mentors, 89 in-service teachers, one university instructor, one school district technology coordinator, one research assistant (myself) and two external PKP guests (Vivian and John) who participated in this EdX experiment for a total of 105 participants. The only required posting or use of EdX in the NETTL program was in the first Summer Institute: I conducted workshops for every mentor group to ensure that every teacher-participant posted their autobiographical teacher-learner profiles and the school district technology coordinator took a digital photo to accompany the autobiographical profile. This work of profiling and photography was spearheaded and emphasized by Chris in order to set her idea of community-building tools in place. At the culmination of the first Summer Institute’s two weeks, the median number of logins (passing through the password...)

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48 During the morning agenda meetings in the Institute’s (highschool) Theatre, Chris would announce the items of greatest importance as well as list all the workshops and schedule for the day. At this large group meeting, Chris emphasized to the NETTL teacher-mentees the requirement to participate in the EdX workshops for the goal of posting their biography-profiles. (Fieldnotes, Aug. 19)
registration page) by the NETTL teachers was four times and the median number of logins by the 11 mentors at the height of the Institute was 12 times each. At the height and the culmination of the Summer Institute I, the number of logins by the NETTL instructor-leader, Chris, remained zero.

With Chris’ EdX absence and her reluctance to assign any requirements with EdX (other than the first workshop to post bio-profiles and submit photos), it quickly became apparent to me, as the implementer or usability-promoter, that the eleven mentors would be the crucial allies for any usability success with the teacher-mentees. It is important to note that after the first Summer Institute, this enrollment of the mentors became increasingly difficult as the mentors’ logins declined dramatically. In the month following the conclusion of the first Institute (30 day period ending September 23), only five mentors logged onto EdX with the median number of logins for these five individuals reaching five times or approximately once a week. The six other mentors did not even login once to EdX in the 30 day period immediately following the Summer Institute, a critical period for continuity of participation in communication and digital community with the other mentors or for modeling to their own teacher-mentees.

After the eight-month research period of my active involvement in EdX and NETTL, the total number of repository resources (each having to be entered and catalogued by a user) was 634 with the vast majority having been entered by PKP, including 123 resources directly entered by myself during the eight-month period. The repository retained its research base emphasis with 256 resources catalogued under “Articles & Reports” while the “Learning Resources” or classroom practices section grew to a total of 126. In terms of the portal

49 These are websites classified according to their resources being directly classroom applied or curriculum specific such as lesson plans, evaluation rubrics, etc. for math/science education, arts-based curriculum, etc.
becoming a participatory tool with contributions from its users, at the conclusion of the active EdX project, one mentor had contributed six documents to the repository (Information channel) and two other mentors had contributed two documents each.

The greatest number of discussion projects at the height of EdX’s use during the first Summer Institute was a total of five projects with two of the five projects moderated and initiated by two mentors. The remainder of the discussions was initiated by PKP members (John, Vivian and myself each opened a discussion). Not surprisingly, the total number of web resource references by the mentors and teacher-mentees was very low with only four resource references listed to begin one discussion and only myself posting references or footnoting my ideas inside discussion postings. I worked with III to make certain that a hyperlink feature was available and working to easily cite and view resources catalogued from the EdX repository inside the discussion postings. But, the overall problem of both this specific feature and all of the tailored and added features in EdX was the under-utilization of this PKP portal as evidenced by its statistical use results.50

As I attempted to increase the usability of EdX in terms of its available features, its interface design, and functionality and as I attempted to increase EdX’s sociability51 in terms of contacting and working to lobby individual mentors and teacher-mentees to participate in the portal, I was simultaneously attempting to enroll and coordinate the two strongest actor groups, the mentors and the EdX tool.

50 The question of what measure indicates a successful level of participation by users in these portal prototypes is an ongoing question for this project and other digital community portals on the Internet. For example, Selwyn (2000) in an analysis of 24 months of postings by teachers in an electronic discussion (as compared to the 6 months with EdX), he found that 33% of all posted messages came from only 26 of its 900 members or only 2% of the user group.

51 Sociability is a term coined by Preece (2000) to describe the conditions needed to encourage communities and foster human connections digitally.
Part of the analysis of the EdX project is based upon metrics that tracked participation, engagement with knowledge, and indicators of sociability of community building. Measures included frequency of use or logins, levels of participation through contribution of knowledge resources, citation of documents in the discussions, as well as levels of satisfaction or professional learning, captured by a series of email surveys, observations of teachers' practices, teacher-produced documents, and in-depth interviews during the different phases of implementation. Over 1500 email messages have been collected over a period of two years from a total of 27 key participants, representing eight relevant social groups in the network (teacher-mentees, teacher-mentors, course instructors, district technology coordinator, university scholar principle investigator, graduate student researchers, project managers, software developers). These messages have been sorted according to themes of concern for the participants: they include design choices or features, technical stumps, social dilemmas, feedback on the available resources, questions and critiques of the technical system. But these themes of concern were additionally interpreted for the participants' perceptions of the portal as a contributive or disruptive tool inside technical, social, professional and research realms.

The other part of the EdX analysis is based on my participation-observation of the mentors' work and the NETTL program during the summer institutes and social gatherings. My work as the on-site researcher allowed me to perform various roles. I led workshops at the Summer Institute to directly in-service the EdX tool with the 100 teacher-participants (this number includes the mentors). At the last minute, one mentor was unable to assume her institute duties due to a death of a parent. Chris asked me to directly take on this absent mentor’s responsibilities, so I became an acting mentor to six female elementary teachers
during the first two-week summer institute. During the subsequent year, I attended other mentor group meetings that consisted of one mentor in particular, Deborah, and her six mentee-teachers. And I attended various demonstrations of learning by Deborah's teacher-students at different points during the program, including their final demonstrations of learning in the summer of 2002.

In the EdX data collection, I conducted both face-to-face and email interviews for a total of 10 in-depth interviews. I also attended approximately twelve meetings during the key two-year implementation period of EdX within this one school district. These meetings consisted of two main types: the first was the administrative design-research team of the project (software designer, course instructor, research assistant (myself), project manager and principle investigator). The second type consisted of myself, the university instructor, and, the eleven mentors and two mentor groups.

In the collection of data, I have used a variety of sources. These sources include field notes; meeting notes taken by rotating recorders at the mentors' meetings; meeting agenda items; email listserv notices about the planning and logistics of the institutes; debriefing email messages from meetings and the institutes; reference emails where I recommend internet resources that specifically address participants' projects and interests; and, many technical issues messages with the software developers. The collection of all these data has been approved by the human subject ethical review board of the University of British Columbia.

Methodological Approaches in PKP-VanSun and EdX

I conducted the overall PKP study using an interpretive qualitative approach based on in situ observations (teacher-students participating in the course and their mentor group
sessions), interviews, analysis of texts (field studies, postings), mentors in meetings discussing the program and discussing the role of technical features and design in these prototypes. The research sites or participating groups were chosen in a complicated fashion of access through course instructors. These research sites were chosen based on formal meetings and informal discussions/negotiations with the course instructors/administrators as to what our proposed technology (portals) could offer (hypothetically) their teacher-learners and how we could make the research process more inclusive and participatory for the teacher-participants. We chose these two teacher education situations based on their distinct teacher education continuum populations: new teachers familiar with technologies in their personal lives but not in their teaching and experienced teachers familiar with teaching but not with technologies integrated into their personal lives (in most cases) nor into their classroom practice.

I then participated in the two research sites in an intense participatory fashion of modeling and teaching these teachers with the PKP tools. In the CITE course, I participated daily (through WebCT) over a two month period as well as taught the tool’s infrastructure in a computer lab setting and helped review the project formally on two occasions (in the face-to-face class and in the focus group). In the NETTL-EdX site, I participated on approximately a weekly basis over an eight-month period in the year 2000/2001. And I participated daily during Summer Institute I, I observed three full days during Summer Institute II, and I attended the final presentations in Summer Institute III.

During these visits, I interviewed mentor, teacher-mentees, the course instructor, and the district technology coordinator on their thoughts regarding the progress of the course and the integration of technology in education. In the majority of cases, I tape recorded and
transcribed the interviews. In situations where spontaneous discussions arose that were not possible to record, I took notes during or immediately after the discussions. From my discussions with these actors, I sought the names of mentees who were gaining a reputation for outstanding use of information technology in their course work. I would then speak with these teachers about their experience of technology and the challenges/promises of integrating technology into the curriculum and their classrooms. During these observations, I interacted with mentees and spoke to them about their experiences. I sometimes helped teacher-mentees while they were working at computers. I took notes during my observations, or, if I was busy helping the mentees, immediately thereafter. Finally, I was provided course work assignments by the course instructor and the mentees, and I also had access to lessons, units, and World Wide Web sites produced by the mentee-teachers and their classrooms.

*Connections of Purpose Across the PKP Experiments*

In each PKP portal prototype, we located an organization/institution and teacher education context in which the portal collections, services, and social interactions were embedded. We understood the institutional or organizational partnerships as critical in increasing users' comfort, trust, and loyalty in our portals. In a manner similar to a bank's ATM instilling trust in its customers (to put money into a machine), due to its association with the bank's brand name, we at PKP worked to embed our portals into the social infrastructure of two university education programs and a major daily newspaper to validate our purposes in changing teacher education through digital means.

With the PKP portals, we were attempting to demonstrate the value of a certain kind of social movement or reform in teacher education. Through prototype example and model knowledge practices, we wanted to demonstrate to our user organizations (major newspaper,
CITE pre-service teacher program, and the NETTL in-service university diploma) that taking control and managing resources through digital tools would speak more directly to their interests and professional concerns. PKP portals began from the premise that the great democratic promise of the Internet is that knowledge is a public resource and should be made more accessible to education stakeholders through the Internet (Willinsky, 2002). But, concurrently, the great demise of the Internet is that no one can easily find what they really need (Eco, 1996).

The cascades of information or knowledge on the Internet is too much, too overwhelming and too anarchic to access. The promise of a portal is that this supple information place would organize resources in a manner that practitioner-users could locate knowledge to answer needs stemming from practice or interest or institutional affiliation. The vision of the PKP portals was that educators have the right to know what research and resources exist to inform the field of education and that educators have the right to voice and determine what they need to know. Practitioners can select from this research repository what makes the greatest connection to their local classroom situation and what achieves the greatest meaning and usability within the epistemic community that assembles through the portal.
CHAPTER 5
Methodologies for Portals:
Departing from Usability, Problematizing Participatory Action Research, and Reconciling Infrastructure

Introduction
Efforts to understand and make greater sense of portals, as artifacts embedded in complex social systems, can easily lead to the use of multiple methods. This study of teacher professional development portals illustrates the necessity and strengths of methodological pluralism, concerning the work of one research consortium (PKP), across two teacher education research sites (CITE and NETTL). Three methodologies – usability, Participatory Action Research (PAR), and a socio-technical ethnography of infrastructure – were needed to capture the different evolving goals of PKP, the different circumstances of implementation, and the different responses and receptions of the portals by the intended users. Usability (Norman, 2004; Neilsen, 2000; Vicente, 2004) is a methodology focused on humanizing the design of artifacts or human-computer interaction. Participatory action research (Schuler & Namioka, 1993; Schuler, 1996; Reardon, 1998; Bishop et. al., 2003) is a field of action research methodology focused on the direct participation and involvement of the research participants or the technology’s human-user group. And finally a socio-technical methodology (Latour, 1996; Bijker, 1997; Bowker & Star, 2002; Levy, 2003) works to recognize the human and the technical as mutually intertwined and effected with neither one taking precedence or constituting the power or strength of the system/network. These multiple methods emerged as an evolutionary or historical developmental process with each version of the teacher education portal needing to improve upon the last implementation situation. In this chapter, I will address each one in chronological order and portal evolution.
These three qualitative methodologies rely upon naturalistic, interpretive methods—
including interviews, ethnographic fieldwork, and participant observation—useful techniques
for attempting to understand the PKP portals’ complex relationships at the individual,
organizational/institutional and societal levels of analysis. Investigating teacher-practitioners’
understanding of their work, their teacher education needs, their practices with technologies
and educational research, and their interpretations of their circumstances in conjunction with
the use of the portal required flexibility, depth of inquiry and long-term engagement with the
field sites.

For a naturalistic qualitative researcher such as myself in this study, a central focus of
the research concerns the problems of grounding and interpretation. Researcher bias or the
researcher’s stance is a given that must be managed and exposed, not eliminated or
neutralized (not that such a process would be achievable), because each person’s perspective
is understood to underlie the interpretations of events. Interpretation is a problematic issue
given that my observations and interpretations of the events may not match those of the other
actors. And generalization is particularly problematic when attempting to observe and
interpret non-human, technological actors such as portals. In this study, generalization is
grounded by the statistical bottom line or overall conclusion, by the meager rate of use and
lack of commitment to the portal’s continuity by its participatory user groups.

As there were evolving phases of portal development and implementation in this
study so there necessitated phases of methodology. The study can be characterized by three
distinct developmental phases (1. PKP-VanSun and CITE, 2. EdX, and, 3. the closure of the
PD portals), corresponding to these phases are three different methodologies (1. usability; 2.
participatory action research; and, 3. socio-technical method/analysis). The methodologies
were part of an ecological process whereby questions or problems emerged, approaches fit as appropriate as PKP built, tested, implemented, and observed the PD prototypes with different practitioner groups (Nardi & O'Day, 1999). The nature of the issues under investigation, the epistemological complexity and interactions of usable knowledge (teacher knowledge and research knowledge), the multifaceted complexity of networks connected to technological prototypes, the kind of usability, participatory, socio-technical data I hoped to collect, the level and degree of observation and description I hoped to convey, and the understandings and conceptualizations I hoped to construct, all imparted the need to use qualitative or ethnographic methods for analysis rather than quantitative.

In this chapter, I describe the methodologies selected and employed for the phases of portal development that changed to meet the evolving project goals and support the ongoing choices the project and myself wanted to make. And I recognize how my stances as researcher, both connected to the research consortium and as a distinct, separate researcher, affected the development of goals, the choices of methodologies, my actions as site implementer, and my turn in the final phase to a socio-technical analysis. In the process of studying and working with teacher professional development portals, I make the case for departing from a primarily usability focus, problematizing participatory action research (PAR) between university-based researchers and practitioners, and I attempt to reconcile the role of infrastructure in explaining the regularly modest social uptake of technological prototypes in professional development.
Multiple Phases, Multiple Methodologies

In the first phase of project development of this one branch of PKP research\textsuperscript{52}, we began with materializing or building portals concerned with topics of educational technologies and K-12 schools. The principal methodological concern of this one PKP project was to help further the design of the portal for practitioner-users. Dominant matters or themes were the generation of usable knowledge through usability means in the portal design and implementation. The methods for determining the effectiveness of digital usable knowledge was gleaned from use and use was first indicated and observed through access to documents or the number of hits by users (Were users accessing the site? Were they hitting and presumably reading a range of content or any particular domain of documents? Were users responding to the content/knowledge? Were they discussing the collected, filtered resources inside the portal?) As we built PKP-VanSun, I and other graduate students were immersed in the chaos and proliferation of information on the Internet first-hand. I collected participant-observations of the problems of Internet filtering, re-packaging and indexing/cataloguing these available web-based research resources. As I became intrigued by the democratic promise of open-access on the Internet while working on content for the portal, I worked to remain reflexively and critically open to what our project could achieve socially with the users. From the outset, I began a continuous, seesaw cycle of socio-technical evaluation between having the effective technical means and portal features, on the one hand, to impact social change and professional development, on the other.

In the second methodological phase, with a portal already constructed (PKP-VanSun), we began to reconsider and stress the social response and participation of the user-

\textsuperscript{52} Other PKP projects were concerned with enlarging the democratic sphere of participation on the Internet by discussing government policy issues, the impact of electronic publishing on journalism, and the impact of open access publishing of academic journals. (See Willinsky, 2002)
participants after the experience of the large, anonymous newspaper reader public. The CITE research site was an experiment in social implementation of the portal with a specific audience, a specific educational group and with whom we had direct contact and more control. Designing a specific purpose or test for the tool inside pre-service teacher education, user testing through a mandatory task, and focus group interviewing, were methods to ascertain how the social could connect to the built portal. The CITE experiment was the preamble experiment for a greater launch into recognizing and calling attention to the social in the PKP PD portals.

In the Office of Learning Technologies (OLT) grant submission and subsequent research funding applications, the explicit methodology of the consortium, through a written commitment, was one to iterative participatory action research (PAR). PAR was also a methodology, in my opinion, that best suited a PD portal project, given what it needed to impart and purport. Endorsed by the consortium, it was a commitment to PAR that I focused upon in the NETTL site and the EdX portal development. PAR is an ethnographic methodology that emphasizes the researcher’s responsibility to understand the participants and their needs, to understand who the mentors were, what their mentor work entailed, and how we at PKP could work to match their needs (social, technical, mentoring, information, etc.) with the portal prototype. We/I no longer expected the teacher-participants to just use the ready-made prototype. Instead, this phase of implementation and methodological work was to make the fit, the match, the bridge between the social perspective of the key actors and the responsive design of the portal.

In the final phase of the study, after EdX had stopped and the PKP consortium had moved onto other projects, "we" became "I," as I attempted to solve the mystery of how EdX
received little participation and no demonstrable ownership by the mentors. In this next phase of reflexive examination, I needed to analyze why the portal didn’t work to convince these teacher-mentors to participate in the participatory action research of the portal. A socio-technical methodology became critically important and revelatory for “I”/me, as I could only understand the lack of social participation by attempting to reconcile the infrastructural or the technical. In the post-implementation stage of the PKP professional development portals, upon reviewing the unsatisfactory results of use, the Latourian socio-technical toolkit of terms (see Chapter 3) became the means for sorting, re-observing, and re-analyzing the collected data over the different phases of the PKP PD projects.

My Researcher Stances

There were two stances operating simultaneously throughout the study with each alternating for focus or foreground in each portal development: building or constructing portals in order to elicit social change and the constant review of the portal to determine their social impact. In the first phase of PKP-VanSun, I was participating in a group project to build it but I was constantly wondering whether the intended users would come (though I very much wanted them to). While I was participating in the building, I was evaluating and collecting observations on how we/I worked, centred on the construction of this tool.

In the second phase when pursuing participatory action research and design, I was alternating between how I could persuade or entice the social participation of the teachers into the portal: I was transfixed upon what I could do to move the portal’s design forward with the participatory involvement of its teacher-users. However, to encourage this social involvement, I needed to try and understand these teacher-users, the work of the teacher-mentors, and the apprenticeship of the mentors into mentoring and the NETTL approach to
teacher education. In this ethnographic stance, I observed, interviewed, and participated
directly in the work of mentoring, the community of mentors, and the group processes of
negotiating the NETTL philosophy into their own practices as teacher educators.

In this stance as a participant-observer, I played two parts. In the first part as a
participant, I was in the position to experience the direct work of mentoring in-service
teachers in educational technologies and discussing with other mentors what that work
entailed and how it could be best assisted by knowledge portals such as EdX. In this case, I
was an observer from the field focusing on issues of implementation. These issues were
controversial and complex as the mentors themselves struggled to describe and define their
interpretation of their role as teacher-educators, according to the NETTL expectations and
their lived experiences as mentors. In the second part as observer, I reported back to the
design/implementation team in terms of the technical design and the response of the users in
the field. I communicated to the PKP team how we might consider employing principles of
usability for modifications to the user interface to attempt to bring users to the prototype to
actually test its knowledge capabilities. In these historical instances, I was acting for the
common cause of WE, for the active social life of the EdX prototype, for the reform of one
small instance of teacher education.

Every technical change or modification with the portals was an attempt to both
increase the participation of the users by alluring them into a well-modified, tailored, usable
and sociable portal as well as demonstrate its abilities to enhance teacher education practices
(connections to teacher-researchers, university-based researchers, members of their
mentoring groups; access to resources to broaden or focus the discussions and to examine
multiple models of teaching with technologies).
In the final phase, when EdX stopped or concluded with little participation by its intended users, particularly by the mentors, I had to turn my attention back to the portals and their infrastructure. As the majority of mentors were blaming the tool for their lack of participation (for example, the infrastructural requirement that they use Internet Explorer 5, the Microsoft platform, a difficult lengthy URL, the contrast to First Class, etc.), I needed to pursue a Latourian socio-technical analysis. I needed to reconcile the portal infrastructure with the social perceptions and determine how the infrastructure and design had failed the mentor-users or how these users, indeed how all the human actors, had failed the portal. I needed to meld the social and technical back together again, to remerge EdX’s social and technical histories with my stances onto the project and not privilege one over the other(s).

In this chapter, I retrace the historical phases of the PKP teacher education portals project and its methodological turns and choices that the consortium made as we designed and developed these portals and tested them through implementation. I begin with the first PKP portal, PKP-VanSun, to retrace the methodological orientations of usability, PAR, and socio-technical that we were engaged in as we built these portals and tested them with users.

*Phase 1: Designing and Constructing for Usability*

Cognitive psychology studies how the human mind works, but as a field, it doesn’t often consider the mental activity of ordinary people using tools such as cars and appliances (see Hutchins, 1995), nor do the learning sciences or teacher education often consider how computer tools like portals could assist teachers in developing professionally; an understanding of technology, particularly its usability, its degree of user-centred design, is often missing from these fields. Conversely, many in technical disciplines such as web
design or software development have a greater mechanistic, technical focus where social
needs or human capacity is often unnoticed or neglected.

The work to make a technological artifact more user-centred and more intuitive and
simple in its user interface is referred to as usability research. Usability is a well-accepted
approach to information system development that typically includes testing prototypes in use
settings. In usability studies, researchers study the “fits” between design techniques of
artifacts and the psychological characteristics of human users (see Donald Norman 1988,
1993, 1999). They work to implement and materialize those design ideas into working
effective websites with corporate clients (see Jakob Neilsen, 2000). Usability researchers
work to reinsert the psychological or the “human” into engineering and technology at the
design phase. They work to eschew the idea of technology for technology’s sake as a design
principle, instead, usability researchers work to increase the development of usability or
effective, user-friendly, simple, error-less design (see Kim Vicente, 2004).

Working within a research-design team building portals, the first goal was to build the
tool, to materialize the ideas into bits and bytes of what this prototype could look like and
how it would function digitally. Research was to inform design at each site, at each portal
construction, and the design results were to inform the ongoing research, hence my use of the
term research-designers (or design-researchers). The method plans for PKP’s usability
worked well in the sense that our prototypes demonstrated to funding agencies that we had
technical contributions to make in educational technologies and we subsequently gained
more funding based on these working prototypes. The usability methodology also drove the
project forward and materialized knowledge management systems: EdX and PKP-VanSun
both exist and open-access, internet-sourced knowledge can be accessed.
Some of the usability challenges in building PKP-VanSun (that weren’t altogether eradicated) included connecting the foraged web resources to the VanSun article topics; convincing the newspaper website to include a direct hyperlink to our PKP portal URL so that users wouldn’t have to memorize or transcribe our website’s URL; recognizing and reducing the large amount of text on the homepage; making the cross-indexing of topics with knowledge domains obvious and intuitive to users; emphasizing and hyper-linking the access to the discussion boards as well as the indexes on each page of content; and, providing navigational means for the user to return to previous pages and sections without hitting the Back button on their browser.

The usability tension that was in constant interplay in the PKP PD projects was the sense that the project was driven for technical sophistication, to demonstrate how our innovative portal features could make research knowledge more accessible and usable, but we had to also contend with the need for simplicity, to prove to teacher-users that we could create a familiar, comfortable digital space where teachers could accomplish defined tasks easily (such as the course tasks of CITE or the broader assignments for the NETTL field studies). Usability studies recognize that social practices in digital environments and technological design are mutually constituted. Working in this approach, one looks for fruitful ways to bring use or users into the design process and for the design methods to emphasize the users’ experience, hence the term user-centred design. However, usability aims first at technology innovation rather than social change.

In usability research, technological innovations and system features are often materialized first in the belief that they will produce social effects next or later. The political scientist Langdon Winner (1986) and Social Informatics scholar Rob Kling (2000) have both
observed how discussions of values, of social concerns, tend to arise as afterthoughts to deliberations that are focused primarily on making the technological tools “work” or function. This approach to functionality is a primary concern in usability studies: the focus is on the system designers and how they can approach design to enhance ease of use by any abstract, generalized, anonymous user as is often the case in websites for the “public”. Usability researchers do not often focus first on “sociability”, a term to describe issues of trust, community, time, worth, and collaboration inside groups of users (Preece, 2000).

Design problems become harder, messier and more realistic as more networks, interconnections, and chains of association between people, tools and practices are considered and attended to in a prototype’s design. A technological innovation may look good in screen shots by the design team, and yet turn out to be problematic, disconnected, or incomplete in actual settings of implementation with the intended end-users. When research-designers look mainly at technical features to make decisions about how to apply new technologies, or when they engage with participants to only discuss technical features development, they are likely to miss some of the key social and infrastructural interconnections that shape successful practice and permit users to recognize these technologically-enhanced practices as valuable (O’Day & Nardi, 2003).

A nagging validity issue with usability as a design methodology to produce user-centred technologies (and an ongoing consideration with any user-centred research) is the question of how user-centred can the design and prototype actually be when the users aren’t the ones developing or paying for the portal (Lynch, 2003)? For usability researchers, how user-centred can the prototype be when the ownership or power of decision is basically unavailable to the users? Usually, the answer given is in the amount of use of the prototype
by the users. If there were an established number of hits and access measures that merit the label of successful use, then usability will have achieved its purpose. Or, in other words, the issue of achieving a greater user-centred method is negligible in importance if the results are high-use measures.

The strength of a usability methodology is that it pays particular attention to the technical design, the instrumental means to create an effective, human-friendly artifact. Designing this type of an artifact helps persuade or demonstrate to people that they should become "enrolled" users or "allies" (Latour). Designers are primarily the focus of usability research where the emphasis is on how to demonstrate and convince designers to change their design approach to better match and serve human users by matching the technologies with "human factors" (Vicente, 2004) such as intuitive, physical/ergonomic, affective, and efficiency/time factors.

Usability as a methodology helps streamline the energy and efficiency of a research project, to translate the project's intentions into technical, workable features, to make the artifact's content offerings accessible to users through ease of use. Usability allows the researchers (and the research project) to arrive at a technological point at which their research questions can begin to be addressed with user-subjects, to begin to grapple with what the ease of use provides the user, rather than spend the majority of the project's time and funds in making the artifact technically functional.

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33 This is a difficult number to define as there is no uniform standard as to what "success" entails in hits. The success number needs to be determined situationally by the project or group of research-designers. In the PKP prototypes, the PKP consortium -particularly myself, John Willinsky and Vivian Forssman- engaged in debates as to what percentage of use by the designated user group would indicate a proof of value. Would it be 10%, 25% or 50% of the user group who indicated a regular access to the portal? Was regular access measured in terms of logging on once a day, once a week, or once a month?
Phase 2: Participatory Action Research with Portals

Participatory action research appears posed to address the gap and limitations to user participation in many methodologies, including usability research, by attempting to open the possibilities up to participants in its very name and design. After the first PKP-VanSun prototype, the project consortium became concerned with bridging the distance between the prototype and the users so that we could attain loyal regular users and begin to determine the potential value in informing practitioners about educational research through digital means. We needed to succeed at usability (or attaining a loyal user group) in order to understand how teachers begin to frame research knowledge as usable, to understand what ease of access to research means to these practitioners, or to engage them in epistemic communities inside a portal prototype.

The original EdX portal proposal methodology (1999) relied on a participatory design process, describing methods that would require actively involved teacher-users for prototype development and research utilization:

The project will use a participatory design method (Silva & Breuleux, 1994; Schuler & Namioka, 1993). This method establishes a reiterative cycle of proposal, review, and revision in working with the end-users or participants of EdEx [EdX] to design a variety of formats, processes, and methods that will meet the needs and interests of the constituent groups (researchers, educators, administrators, and public). The process will work from paper models, through web mock-up, prototypes, and working models, returning each time for review and revision, while also introducing the designs for assessment to new groups.

The working models will be assessed with the different communities by establishing usage patterns, talk-aloud protocols, and debriefing sessions. Measures would also include, with more complete designs of the site...

- greater frequency and ease of use,
- greater levels of participation,
- greater levels of satisfaction and increased learning than with other models and sites, with all of this captured by a series of email surveys applied over time.
At the outset, the preliminary idea of a PAR methodology for the PKP projects seemed eminently sensible: use iterative participatory design of a knowledge management portal for teacher engagement with research to explore what works, what’s important, and how it relates to scholarly communication and teacher education practices. PAR was the appropriate methodology for PKP because it would allow educational researchers and teacher-users to gain much from each other as the gap between them would be decreased and the legitimate knowledge of both could be recognized and integrated. The PKP portals were to evolve in design, be developed to match participants’ needs by offering, motivating, and assisting the teacher-users to participate in and decide the development of a portal for their own use and ownership.

This methodology works inside action research, as according to Noffke (1997) action research is “fundamentally about emergent meanings of both action and research, as well as the relationships between them” (p. 306). In the case of PAR for portals, action research is fundamentally about emergent meanings of both design/usability actions and prototype research, as well as an evaluation of the relationships between them. Evaluation or review of the use and effectiveness of the portal is a constant concern informing the methodology of the study, the design of the portal, and the participation in the social by the actors.

Participatory action research is an approach to producing knowledge through democratic, interactive relationships. Researchers work with communities to resolve problems identified by the community member-representatives and the process of research is intended to empower the participants (e.g., Schuler, 1996; Schuler & Namioka, 1993; Bishop et. al., 2001). Participants are to be actively involved in the decision-making process as part of the method where the participant-users make decisions rather than function as passive
subjects/objects, waiting to be observed and illuminated back by the researcher’s tales. By attempting to break down historically defined and culturally reinforced power roles between researcher and participants, PAR encourages what some researchers see as “collaborative” research (Sumara & Luce-Kapler, 1993): a form of research that strives for a goal of equal participation in a friendly, comfortable community setting (see Klinger, 2001).

The initial idea of the PKP PD portal projects was that the relationships between theory and practice, between academic knowledge and teacher knowledge could be enhanced and democratized through PAR. Making external-to-the-university stakeholders, such as teachers, an integral part of the knowledge management, knowledge generation and evaluation processes of the portal projects, PKP was motivated to democratize educational research as much as the Internet digital medium would permit. We believed that by inviting teachers to engage in dialogue with the researcher-designers, they would begin to believe that their experiences in educational technologies are important and valid. The intent was that teachers begin to realize that their local knowledge merits a valuable place in the determination or development of teacher-education portals. And these teacher-participants would help the researchers carve out or test digital environments to make technical features workable (usability) for teachers as well as direct researchers to understand how research knowledge through digital means can become more usable, trustworthy, valuable, or aligned to teachers’ knowledge needs.

Problem of Participatory Methodologies with Professional Development Portals

According to Kemmis and McTaggart (2003), “PAR has three attributes employed to distinguish it from conventional research: shared ownership of research projects, community-based analysis of social problems, and an orientation toward community action” (p. 337).
Difficulties ensue when PAR involves teacher-practitioners working with university-based researchers on an educational technology project to consider the reform of both teaching and research.

The first difficulty is that an educational technology project such as the PKP portals cannot be owned by user-participants when there is mandatory participation. In the voluntary mode of participation, ownership is still a contentious and thorny issue. It is difficult for participants to believe in an expensive, experimental environment that has not yet proven itself. The teacher-participants could almost view themselves, their participation as experiments because the life or duration of the portal project continues only as long as funds and research grants continue, ascertained and directed by the university-based researchers. Unlike the commitment and investment of participants in problem-posing, reviewing, revising and reworking a local situation through action research, participants cannot really own or be as invested in a portal initiated by an external source (such as a university research team), even though they were the exclusive users of the system. A portal environment is not a lived or local experience until the user-participant wants it to be. The process of enrollment can be particularly difficult for a voluntary support tool such as the EdX portal. Unlike a course, an authentically PAR digital tool is not mandatory or mark/grade dependent. If they were mandatory and grade dependent, the portals would risk becoming coercive tools, forcing participation and eliciting discomfort.

Enrolling participants to use the tool in order to begin the process of participatory action research/design is an equally tricky and difficult situation. Ensuring that participants will make the effort to learn the navigation and narrative of purpose of the digital tool and in

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54 See the discussion of the Cornell PhD study of a mandatory university physics course that was reviewed and reworked by a committed group of students, intent on improving the learning conditions of what had become an unpopular and low success rate course (in Greenwood & Levin, 2003, pp. 158-159).
the process make a relationship with the portal is more readily and speedily accomplished when employing incentives such as grades, marks, or credits. The PAR method becomes particularly complex when marks are employed (PKP-VanSun with the CITE preservice teachers) because the marking creates a power dynamic that PAR is supposed to challenge and dismantle. When marks are the incentive, the participants have little choice but to participate, little voice to ultimately change this evaluation stance or power imbalance. The participation of students can be interpreted as one of power or oppression coerced by both the tool and the researcher-implementers. And, if the tool is voluntary but not integrated into the course effectively and seamlessly, the tool can become an irrelevant add-on for participants, demanding time for which the participants have not allotted or accounted.

The second difficulty of attaining a community-based analysis of social problems is intricately tied to the first attribute/difficulty but pertains to the recognition of the locus of problems. In a study of teachers encountering new technological tools for the first time, recognizing social problems can be difficult as they are trying to immerse themselves in a technical mind-set (if that is the direction set by the mentors or course instructor). If they believe that technical skills and tools can solve educational problems, then they will find it difficult to recognize and uncover social problems connected with technological or digital tools. Social informatics reminds us that we need to distinguish social problems from technical solutions: the former does not necessarily require the latter, in fact the technical can compound the difficulties of the social (Warschauer, 2003).

The degree of participation by the participants depends on who they believe has authentic or ultimate ownership of the technology. In the case of digital technology, it is never just the human actors who have ultimate control and ownership. There needs to be a
constant consideration of the digital tool as an actor that exerts a certain influence, an enrollment of its own. In the case of an expensive, sophisticated experimental tool (such as EdX), few teacher participants may see the tool as sustainable, financially operational or appropriable by themselves and this in turn makes willing, voluntary, collaborative participation by human participants problematic and tenuous.

Not all theorists of participatory action research place an emphasis on this method as a collaborative process. There are those who argue that PAR is frequently a solitary process of systematic self-reflection by the researcher. Kemmis & McTaggart counter that “one person may change so that others are obliged to react or respond differently to that individual’s changed behaviour, but the willing and committed involvement of those whose interactions constitute the practice is necessary, in the end, to secure the change” (p. 382). Indeed, in teacher education projects, there needs to be early adopters of the new approach, of the idea of change for their professional development. These early adopter colleagues, particularly key stakeholders in the organization, then model for others the rewards and means to participate in this process of change. As some of the mentors change their behaviour, other mentors are obliged to react or respond differently and may even attempt the same process. Similarly, in research projects involving technological or non-human actors such as portals, when that technological actor changes, the other participants, including human users, are obliged to react or respond differently. It was the issue of un/willing and in/voluntary involvement by the intended teacher-users, believing in and becoming committed to a comfortable, trustworthy, community-enhancing technology that became the reoccurring critical issue for the PKP portals.
The difficulties of PAR are many and particularly problematic when the object of the project, of the research involvement, is the development of a portal. By involving teacher education contexts through PAR, there can be a constant tension of the researcher(s) trying “to uncover or unmask hidden forces at work in the situation” (p. 347) and the teachers trying to get the job done quickly and efficiently in a pragmatic sense. Researchers entering a teacher education site need to consider that the teacher-participant viewpoint may pose a substantial challenge to the intended research intervention for social change. Teachers, even those directly involved in teacher education through mentoring, do not necessarily want a critical reflection to determine how historically situated their practice as teacher-mentors is or how it has been socially constructed. Nor, do they necessarily want to consider changes to their practices or engage in making thoughtful, deliberative changes. Teacher education researchers engaging in PAR need to work to reveal and elucidate interconnections and tensions between elements of a teacher education setting in terms that the teacher-participants themselves can then regard as authentic and upon which they can become motivated to participate in activity for change and in the proposed research.

This type of tension, of translating the researcher’s perspective to the teacher-participants or reflexively returning the research project, the research activity back to the participants, is complicated when a portal or digital artifact is involved. The emphasis on the technical or giving the teachers a technological tool to review or participate in has two operative sides: it can help to focus or funnel the research activity into a common project that will demonstrate itself in material or concrete form (the portal itself) or it can become an object of critique whereby the teacher-participants distance themselves from both the tool and the research project. From the first side, the portal construction gives a material anchor to
the research project in such a manner that participants may want to contribute to the research process because it will result in a new concrete usable entity. The portal can draw practitioners into a mode of thinking/researching and collaborating in an epistemic community centred simultaneously on the design of the tool and on the inherent immersive processes of transforming their practices, their understanding of their practices, and the situations in which they practice in conjunction with the Internet-based tool.

From the second side, with the design-construction of a tool, the researcher now has an added dimension of complexity to translate or attempt to make the portal environment familiar to teacher-participants. It is difficult enough to convince teachers to want to engage in social analysis (to make familiar this type of interaction and discourse, on top of their responsibilities and time constraints as practitioners) but to add a technological tool into the project can be distracting, and, may even turn the artifact into a source of critique rather than one of identification and support. If the research goal of the construction or development of a portal is to encourage a community of users (be it an epistemic community or a community of practice), there remains a constant tension of the artifact being delegated to the status of an entity from the outside of the teacher-participants' setting, their work, and their motivation. The portal researcher needs to remain ever alert to participants taking this epistemological turn in relation to the tool. Or, as Latour (1992) would frame it, the researcher-actor needs to remain vigilant in following the actors and observing both their chains of enrollment as well as their chains of resistances.

Phase 3: A Socio-technical Methodology

Collaborative participatory action research, as defined by Kemmis & McTaggart (2003), achieves its purpose when ...
... such a research tradition aims to help people understand themselves both as “objective” forces impinging on others and as subjects who have intentions and commitments they share with others, and both as people who act in ways framed by discourses formed beyond any one of us individually and as people who make meaning for ourselves in communication with the others alongside whom we stand and whose fates—one way or another—we share. (p. 356)

This definition is not in contradiction to a socio-technical approach such as Actor-Network Theory. In ANT, the researcher or analyst achieves their purpose when they observe actors as having intentionality or “force” that affects chains of action and that the network affects and shares the fates of all its actors, human or non-human, social or technological (Latour, 1991). When collaborative PAR involves teachers, researchers, and portals, each is implicated in each other’s actions or fates. When the fate of EdX is its faltering use, the actors of the network, the teacher-participants as well as the researcher-designers are responsible for its little-use demise (Latour, 1996).

The work of PAR researchers in educational technologies needs to become a process of creative delegation of social ownership back to user-participants in connection with the infrastructural. In a technological experiment with each usability item of participant feedback, a researcher tries to materialize the request or the feedback item into a digital form or feature. Users’ needs become dependent upon the researcher bringing these concerns to the software designers and programmers. This translation of users’ needs becomes dependent upon the technical support (software developers can understand the request or social need) or researchers’/participants’ own technical abilities (this is generally limited) or the financial backing of the request (proprietary software designers will work longer to solve a client’s perception of a problem, depending on the financial incentive). The process can involve a long period of time and does not necessarily translate well technologically into the same social request or feedback due to infrastructural limits/demands. It is the infrastructural that
needs to be (re)connected to the social participation of the prototype’s users. A socio-technical methodology (as elaborated through its conceptual terms in Chapter 3) must consider both the material influences and relationships of the social and the technical infrastructure, as well as their interactions and network meanings.

In the period of research and work characterized by “we” (period up to February 2001), my methodological work could be defined as usability driven and responsive to user-participant feedback. I tried to modify the interface and technical features as much as possible to enroll and increase the number of teacher-users. I worked to identify and describe features, account for their expense, review or test the new features, and demonstrate their applicability back to the mentors and teachers. I worked hard, very hard, to entice, gain, and sustain any voluntary participation by the teacher-users and to give the PKP portals a dynamic, social life instead of stultifying them into “showpieces” or “trophy” prototypes for a research CV. But with little voluntary participation or ownership by the participants, there were almost no explicitly defined usability issues (other than ones I believed critical to enticing and enrolling users inside the portal) and a PAR intended system, such as EdX, became too reliant and over-dependent on my efforts to breathe life into it.

After arriving at a point of no return – as I tried harder to make EdX more their tool – the portal was being increasingly perceived by the mentors as someone else’s tool, more removed in its organization and features from their NETTL mentoring practices, local knowledge, and expertise. I realized that I (and EdX) had arrived at a point of no return in its implementation. I now had to determine why and how EdX faltered in generating use and participation by these mentors, these emerging teacher-educators, their course instructor as well as the majority of the teacher-participants.
In Phase 2, PKP was attempting to solicit more social participation through deliberations with the mentors and technical modifications with the portal. But PAR didn’t work to solicit the mentors’ and the instructor’s (both influential key stakeholders) ownership and involvement in the portal. Thus, I needed to review or re-observe what mal-functioned in this social design and methodology by re-considering the social limitations and influences by the portal’s infrastructure.

Socio-technical Methodology for Post-Implementation Analysis

In the post-fieldwork phase of analysis of the PKP portals, I could not locate or describe states of social equilibrium and stability because these prototypes never arrived at these states with their users. Fortunately for the study of digital professional development, the PKP portals become more informative in their states of instability and disequilibrium rather than as technologically-determined, stable, but untested models awaiting human users to wake up to their promise and intended uses.

Up to this chronological point in the study, the data collection techniques of email correspondence, transcribed interviews, surveys, transcribed meetings, presentations and workshops, new features and modifications, and, the pages of field-notes had all been in the service of attempting to concretize and realize portals for effective professional development as well as realize intra-institutional epistemic communities of teachers and researchers. Throughout the study, the goal of the collected data was to be used to inform the implementation situations to improve the usability of the portals and to increase the social participatory actions of the teacher-users in setting the research agenda and designing the portal. A collection of data had occurred for an end-point of setting the conditions of technical use, knowledge access and epistemic community to gauge how research could
become more accessible and usable to teacher-practitioners. But these conditions were not reached, determined or stabilized and the study became focused on a different question: how did the portals simultaneously succeed and falter in influencing teachers’ knowledge practices or creating epistemic community?

In this last phase of analysis, the collected data was analyzed in four stages: a) the assembly and chronological organization of all collected textual data which included hundreds of emails, the audio-taped data of interviews and meetings, the discussion forum postings, and the collected examples of participant coursework (this data filled four 3-inch binders which were indexed chronologically); b) reviewing this textual data in different historical phases—the situated-ness of decisions and actions from the first two research phases (usability and PAR) are replayed in the final phase through a socio-technical analysis resulting in different observation patterns (i.e., following and understanding the mentors’ resistances rather than focusing on competing, collaborating, by-passing, or surmounting them through new portal modifications); and, c) cross-chronological and cross-methodological analysis. In the third phase of the project and the analysis (post-implementations), I needed to re-examine the collected data through a socio-technical lens in order to try to understand the faltering use of the portals and to return the analytical attention to the PKP PD portals as actors in establishing a field of possibilities for digital professional development.

The PKP prototypes are historical precedents and a series of trials in portal development, the recorded lessons-learned from which the next innovative system of professional development can be designed and distinguished. As John Willinsky advised me
after an intensely frustrating and disastrous *theatre de preuve*\(^{55}\), due to the constant crashing of the EdX prototype,

> The best we can do in this research site and with this system ... is to determine an estimation of value of the system rather than a proof of value.\(^{56}\)

The PKP prototypes and their infrastructures were not intended to form a singular, complete answer for the possibilities for digital tools supporting teacher professional development nor is there a singular explanation for their general non-use by the majority of the teacher-users. In order to observe and understand the many actors, both human and non-human, at work in the network of these portals, I needed a methodology that would be agnostic, flexible, open to multiple explanations rather than searching for one proof of the portal’s value.

As I concluded that the EdX portal had received little human user-ship at the end of the intense nine-month implementation period, I realized that I had to attend ethnographically to more mundane infrastructural actors of the portal. For each moment of mentor resistance – for each piece of negative feedback or non-response to new features – I needed to re-view the infrastructural events as actors.\(^{57}\) I worked systematically through these events (see Appendix C: Chronology of EdX’s Infrastructural Events) to determine how they each elicited resistance from the users and how the social transformational promise of the prototype did not overcome or override the technical and social discomfort. For example, I had to re-

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\(^{55}\) This Latourian term translates as a theatre of proof or a critical demonstration of the prototype’s abilities that is meant to enroll key stakeholders in its proof of value.

\(^{56}\) Fieldnotes, May 3, 2000. I had just finished a day-long workshop with the twelve mentors of the NETTL diploma program where I introduced the EdX portal to them as part of the participatory design or user consultation process.

\(^{57}\) Latour considers an actor any influential component of the network, whether human or non-human, that brings a force into the network affecting other actors. An infrastructural event such as the need to use a particular Internet browser (IE5), that was new and generally unknown to the user group, quickly became a critical actor in the developing and intended network.
observe the functions and effects of infrastructural actors such as Internet Explorer 5 and dHTML, system “spam” emails as reminders for use, incompatibilities between Mac (teachers) and PC (software developer) operating systems, the portal’s homepage as the obligatory passage point to condition or set the tone for encounters with the content, the frames hiding the source URL of documents, the star ratings and assessment scales for the documents, and, the inscription devices or public tracking logs of user activity as antithetical to the professional privacy position of many teachers. I needed to study this regularly unobserved materiality, to study the unexciting non-human technicalities, in order to see how their functions were pivotal in supporting or dissuading teachers’ participation in the portals. I began to follow all the actors, both human and non-human, as they effected and negotiated each other’s participation in this portal network (e.g., Latour, 1996; Bijker, 1997).

Infrastructure is the bundle of technical specifications and the hidden, lacklustre mechanisms necessary to make a system function reliably (Monteiro & Hanseth, 1995; Star, 1999). It is infrastructure that carries effects of standardization on the participant-users’ knowledge work, determines the entry to and use of documents, and the means of communication (discussion boards, internal emails, etc.) and how they affect the epistemic community formation. Infrastructural specifications such as browser compatibility, domain names, exchange protocols, user registration, open access, etc., should become topics of intense social debate as they greatly influence any implementation design or participation by users. Infrastructural topics need ethnographic methods to reveal them, to indicate their pivotal roles, rather than allow them to remain a mundane, embedded peculiarity, that of the background, the black-boxed, the seemingly necessary and yet forgotten elements of a system’s functions and a network-in-the-making.
Infrastructure is supposed to facilitate use but use, effective and regular (yet alone, transformational), is rarely achieved or common. Hence, no single measure of use can define the capacity or the “proof of value” of the PKP portals. The portals have much to inform the reader and the education researcher regarding the regular reoccurrence or problem of non-return on the techno-enthusiastic refrain, “build it and they will come.” The PKP problem of a lack of loyal regular users is not an isolated, unusual case in any technological implementation (hence, the refrain in high-tech commercials that implementation feels like “herding cats”).\textsuperscript{58} Paradoxically, and rarely discussed, it is all too often the usual, the general case with most educational technologies, particularly those concerned with teacher education that there is little user-ship (Proof: can we name one or two portals that have received brand-name status?). The problems of attaining and maintaining users is not restricted to the field of teacher education as there is journal and conference evidence in the field of Information and Communication Technologies (ICT) and Library and Information Sciences (LIS) studies that this issue remains dominant and complex as a proliferation of sub-fields of study grapple with this problem such as HCI (Human-Computer Interaction), CSCW (Computer-Supported Cooperative Work), and Usability studies.

\textit{Conspicuous Methodological Challenges}

Issues concerning the design, implementation, and intersection of social and technical, present conspicuous methodological challenges that this study was not able to completely answer or resolve but had to contend with. How can I study the actions by all the many kinds of actors, particularly from a chronological and geographical distance (i.e., the human users are not at the same school and the school district is the largest geographical area

\textsuperscript{58} See the lackluster empirical results from other Internet digital environment projects as accounted for in Selwyn (2000), Barab & Duffy (2000), and Kling & Courtright (2003).
in the province, hence the greatest dispersion factor)? How do I observe the teachers’ and mentors’ interactions with the PKP portal interface and content when I am not in the same physical space (school or room) or inside the same social organization (the 11 mentor groups)? What are the ethics of studying users whose identities they may not want to reveal to me as the (university) observer but which are available through the recording mechanisms of the infrastructure (i.e., activity logs, tracking statistics)? When is a system’s or a portal’s infrastructure complete, refined or convergent with users’ needs and how would I be able to observe it? How do we understand the network of learning or participation of these teachers in this portal as affected by the system’s resources/documents, classifications (or resources) and standardization of practices (i.e., knowledge practices of online discussions, gathering/‘foraging’ and submission of resources, references, footnotes)? And, most importantly, what values and principles of knowledge practices, educational technology design, and teacher education (contested or resolved) did we inscribe onto the interface and into the lower supporting echelons of the constructed learning environment (do they match, compliment or converge)?

*Conspicuous Infrastructure*

The infrastructure of the portal prototypes was not invisible, not taken for granted, not part of the background for most of the key actors in this study (i.e., the mentors and the research-decision-making team). Quite the contrary, the struggles over the social import and use of the system kept the infrastructure in an ambiguous, questioned, unstable state. I kept examining how the interface could be refined and modified in order to make it more appealing, enticing, trustworthy and usable by the teacher cohorts.
Usability of the system, as desired by the regular user (i.e., by most of the targeted teacher group, the mentees) relied on the infrastructure becoming transparent or almost invisible and not needing users’ attention.\textsuperscript{59} But, the portals, particularly EdX, resolutely refused to become invisible, transparent, or black-boxed. The infrastructure of EdX remained highly visible and conspicuous through firewall crashes, incompatibility with Mac platforms, additional unexplained moves or clicks to reveal the source URL of documents/resources, multiple steps to footnote a resource (insert the hyperlink) in the discussions, etc.

A system’s infrastructure can simultaneously present two opposing presentations of the same element or actor. For example, the technical hurdle or system bug can be one actor’s quest or challenge (software developer’s, technicist users) and, yet, another group’s difficult barrier (i.e., an inexperienced portal user who perceives the infrastructural or interface breakdown as somehow attributable to their misuse, their incompetent handling). Social informatics research asserts the theoretical position that technical infrastructure is fundamentally a social, relational, ecological concept that impacts professional practices and organizations (Kling, 1996; Star and Ruhleder, 1996; Orlikowski, 2000). Actor Network Theory reminds us that infrastructure is not a singular, isolated occurrence but a networked actor, exerting influence and changing other actors’ (human and non-human) actions in relation to it (Latour, 1996).

\textit{My Stance of Reluctance in Acknowledging Infrastructure}

At multiple points, I personally (and, at times, painfully) witnessed how the background apparatus, the technical infrastructural actors, presented themselves at the

\textsuperscript{59} See Sandholtz & Reilly’s (2004) study of one Californian school district that attempted to make infrastructure an invisible non-entity for teacher-users by relying on a Thin-Client system rather than networked visible hard-infrastructure computers. Sandholtz & Reilly report that the rate of computer integration into the curriculum by teachers increased in number and effectiveness given this new intranet system whose infrastructure is managed and trouble-shot centrally by a small number of technical staff.
foreground of the action through system crashes and error windows. But, in the midst of the fieldwork of implementation, of bringing the human users together with the knowledge portal, I was as yet unwilling to recognize the material infrastructure of the portal as actors worthy of my observations and analysis. For the most part, I just wanted to make them technically function without crashing, to become usable and transparent to users, and to prove the worth to users of making the effort to enter the portal by evidence of its filtered resource offerings or exceptional content.

In the current state of educational technologies implementation/work, the predominant tendency to focus on the technical as the gateway to reform and to steer away from the messiness of school, staff and school system implementation, made my willingness to recognize and ethnographically engage with infrastructural or non-human actors tenuous at best. I began my work in PKP committed to the idea that the social and the political had been ignored or downplayed in the race for the great technological fix, in the race to not be left stranded and forgotten by the digital divide (Warschauer, 2003). I wondered why many educational technology enthusiasts were pushing a technological solution when there wasn’t even a given defined technological problem (e.g., Kling, 2000). In my role as teacher educator proponent, I relegated the EdX system’s infrastructure as one that was only a prop, a tool, a support to enable our research team’s agenda, as programmed or commanded by the human actors. However, the infrastructure of the portals would not simply stay in the background, and problematic actions, along with my constant attempts at inserting or integrating the PKP portals into the teachers’ knowledge practices, caused myself to be perceived as a loyal champion or as an “annoyance” to some of the NETTL mentors. I
realized that my attempts to influence and change the knowledge practices of teachers were compounded in its problems by the technological means, by the portals' infrastructures.

Methodologies for Teacher Professional Development Portals

Given this definition of digital systems' research as relational, socially interdependent infrastructure, the methodological questions and implications become significant. A methodological approach, amalgamating complementary methods, was needed to examine decisions about encoding knowledge practices, tinkering or modifying features and interface design construction (see, e.g., Gasser, 1986; Trigg & Bødker, 1994), and the observation and analysis of social decisions carried into infrastructural forms (Bowker & Star, 2002). The fieldwork and data collection for these PKP prototypes became a series of methods and methodological pieces: a combination of historical and literary/discourse analysis, interviews and observations, participation and self-reflection, usability criteria, and, socio-technical critique.

My contribution to the PKP PD projects was to contribute rich descriptive accounts from an implementer and insider stance, sitting beside teachers in the computer lab and beside mentors in their daily meetings. And I believed I would be able to speak a common discourse with these participants, understanding almost intuitively their needs and concerns, given that I was an elementary classroom teacher for the past 12 years in the same region. My observations and descriptions were not meant to be overly presumptuous (they needed to resonate with practitioners' experiences) or to advance over-generalizations (they needed to be worded in a theoretically informed manner but cognizant of the local situated-ness of the specific context). My intent was to collaborate in tinkering with prototypes (implementing and refining interfaces), offering accurate descriptions from the field (from the chaotic
impromptu processes of local implementation), tying my discussion and assertions to the
literature and trying to present things in a way that would have experience-distant relevance
but not advanced prescriptive claims.

*Issues of Validity, Reliability, Generalizability*

In Phase 1 (usability) and phase 2 (Participatory action research) of the project’s
methodologies, we constantly checked for success (or evaluated our work, our project’s
evolving goals) by checking our design efforts against the statistics or system metrics to
determine if there had been changes in user activity or if users had described their knowledge
or interaction with resources/research through discussion postings, emails or in
meetings/interviews. Evidence for the effectiveness or impact of the portal was regularly
acknowledged and verified first through usability measures.

I worked to verify the impacts of the portal in other ways than simply electronic
tracings but this was made increasingly difficult by a variety of factors. In the case of the
CITE pre-service students, access to students was gate-kept by the grad student who had
authorized access through an ethical review specifically tailored for her ongoing work with
these particular students. In the case of NETTL, access was more complex for face-to-face
contact due to physical dispersion as well as the social obstacles presented by the instructor
and most of the mentors. Face-to-face contact was difficult to attain as the mentee-teachers
were dispersed in schools across a school district that boasts to being the largest geographical
school district in the province. I would only have the occasion to visit these teachers during
after-school hours and then I would be unable to visit more than one or two per day. The
social obstacles to access with the teacher-participants was due to the mentors’ and the
instructors’ repeated concern that both the portal and the research project would overwhelm
these teachers and thus jeopardize the positive perception of the course, the mentors and the use of educational technologies. I was repeatedly asked not to refer directly to EdX and some of the mentors expressed frustration with the rare and infrequent discussions of EdX taking away from other more important and pressing matters concerning NETTL mentoring.

It is important to note that for our project’s intents of participatory design, it was necessary that the design-implementation work, in addition to theory development, would impact our participants in a positive, educational manner. This service agenda was not simply a result of our desire to test and justify theoretical claims but because of our desire to meaningfully contribute to the reform of teaching and the improvement of teaching conditions (the concrete demonstration of the inter-relatedness of research and practice, the communication of research to support innovative teaching practices, the creation of a community of practice to support discussion and collegial exchange). We began from Willinsky’s premise (2002) that adding more scholarship about education would not alleviate or narrow the communication gap between practice and research but rather exasperate an already overwhelming situation of knowledge proliferation through the Internet. I was inspired by the opportunity to attempt to change teacher education into new modes of digital participation as well as inspired by the participatory-oriented words of Marx (1845/1967, p. 400), “The philosophers have only interpreted the world, in various ways; the point is to change it.”

In my interest to know more about usable research for teacher professional development through digital portal environments, I needed to examine effective usable portals, practitioner involvement in epistemic communities to foster sustained interactivity with researchers, and why professional development portals generally falter in their user-
ship. To assist this examination, I drew upon three methodologies that revealed three large critical themes or lessons-learned in teacher education portals: 1) the underlying meanings of the embedded master narrative of usability in a portal and its effects on the social life of the portal and its users (see Chapter 6); 2) the roles of intermediaries in facilitating PAR or demonstrating the connections and worth of usable knowledge and usable technologies (see Chapter 7); and, 3) the ongoing tensions and difficult relationships between infrastructure and the affective sociability of digital epistemic communities, particularly concerning the issue of comfort (see Chapter 8).
Part II The Empirical Chapters

In these chapters, I examine in empirical detail how teachers' epistemic or knowledge practices were influenced, changed, or reinforced to remain unchanged, by the PKP professional development portals. Having explored the controversies of teacher knowledge and usable research in greater depth (Chapter 2), having introduced Latour's theory of human-nonhuman socio-technical relations (Chapter 3), having deployed multiple methodologies to chart and frame the series of chronological events in the evolution of these portals, I now move to draw upon Latour's ANT or socio-technical strategies for the empirical data. I follow Latour's strategies to observe the actors and follow their chains of enrollment and displacement, to observe "what holds and what does not hold together" (Latour, 1991, p. 110) in PD portals for sustained interactivity among practitioners, research, and researchers. I employ Latour's methods of terminology to describe how teachers are transformed, at certain moments, into practitioners who encounter epistemic engagement as they happen to interconnect with research knowledge inside the portals. In this manner, the non-human technological actor, the portal, transforms both the research content and the teacher-user: the content becomes accessible, usable, meaningful knowledge and the teacher-user and their teacher knowledge becomes connected to a larger educational epistemic community, as they achieve membership. I also illustrate that the human-actors inevitably transform the non-human actors, such as the portals, both during their implementation periods as well as in their conclusions.\(^{60}\) It is also my intention to illustrate that the power to effect change in teaching and teacher education lies not in any one individual, pedagogical/

\(^{60}\) This thesis is an example of the continuing effect or transformation of the portals by my actions, by my writing their stories and conclusions.
organizational program or technological artifact but in the network of socio-technical relations amongst these actors, and that transformations in knowledge practices or in portal design arise in particular socio-technical associations.

My aim is to observe, describe, and trace these socio-technical chains of associations in the PKP professional development portals of PKP-VanSun and EdX, and I do this in association with the three chronological or methodological phases of our PD portal work. Chapter 6, Inverted Hollywood, is an exploration of the narrative of usability or purpose that the PKP research consortium designed in the portal and in the implementation design for the portal. Chapter 7, Invisible Intermediaries, is an examination of participatory action research with practitioner-users in portal fieldwork. It considers how invisible intermediaries become crucial actors in making alignments between the portal’s program of intent and the human actors’ needs. Finally, Chapter 8, The Mentor Trials of EdX, examines a narrative of how a portal was intended to alter the knowledge practices of a key stakeholder group but is resisted on multiple fronts, not the least being a discourse of discomfort by the mentors with not only the technology but with its reform intentions. In the process of these trials, the portal’s infrastructure is re-considered and its actors un-black-boxed or revealed. The portal’s infrastructure trials alter researchers’ intentions, understandings, and communication in relationship with these mentors. Enrollment and alliances are not achieved, the portal is concluded, and the research project in professional development technologies is disbanded.

The symmetrical description and agnostic treatment of both human and nonhuman actors offered in Latour’s network analysis allows me to trace how both technological innovations and its intended users function to influence and transform each other. In my analysis of socio-technical relations through the PKP portals, I recognize Latour’s position
that the role of power or strength in the networks is one where an actor displaces another. I am not following a techno-determinist analysis of power relations, where it is made to appear that either human actors enact domination over the non-human or non-human actors enact domination over the human. In these empirical chapters, I describe how teachers engaging with statements or ideas of social action in education, communicated and propelled by the portal medium, are positioned by the portal to participate in moments of sustained interactivity with research(ers) and allows users the opportunity to engage in power relations in education and their own professional development. In this manner, technology becomes a more powerful actor in conditioning teachers’ knowledge practices and allowing research to become usable, in actively shaping encounters or exchanges between researchers and practitioners.
Artifacts as Narratives

Following Latour and other socio-technical scholars, all human-made things such as technological artifacts have a "social life" (Brown & Duguid, 2000; 1996) or a socio-technical life where the social and the technical are intertwined and co-constituted. Artifacts are bits of either the material or digital world that have been molded and shaped to participate with us, in our social world. Documents and portals of web resources, such as the PKP portals, are "a particular class of artifacts – those capable of speech- and this property makes them even more evidently and intensively social" (Levy, 2003, p. 33), and I would add, political.

Historical inquiry tells us that every artifact – such as each PKP portal – can be made to tell a story (Haraway, 1997; Wajcman & McKenzie, 1999). An artifact is created at a certain historical time and place. It comes out of a certain community and a certain socio-political vision or desire. It exemplifies a certain style and design aesthetic. And it has been subject to modifications and alterations, has broken or crashed and been repaired multiple times, and in the process of repair, revised. Along the way, the artifact has become both the container and the vehicle of stories. To consider an analog example to the digital portal, backpacks have much to tell us about their university student owners, about the objects they contain as evidence of how students act, what they value, how they see themselves, and the kind of image they wish to present to the world. Unlike backpacks, however, the PKP portals

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61 I am referring to both analog and digital artifacts where the literal definition, “made with skill”, serves both forms.
are representational artifacts; they are designed to carry very particular kinds of messages and in very particular ways; hence, their making of and contributing a narrative to both the field of knowledge management portal design and educational research.

The PKP portals *speak* (Latour): they communicate in non-verbal, digital representational schemes from the navigational features to the indexing formats to the inclusion of discussion boards. The PKP portals stand in for the way the PKP researchers (and other educational researchers) would speak to teachers and educational stakeholders as to the purpose of educational research in practice and what usable educational research looks like to how it can speak for itself. The portals tell narratives of teacher education, they represent narratives of teacher knowledge as well as the intersections of practitioner interpretations of research (or speaking *back*) and research’s means of speaking to practitioners. To formulate this chapter on the embedded narratives of portals and the need to pay attention to the design of narratives for digital artifacts and their implications for usability, I discuss the usability narrative of PKP-VanSun as impacting a cohort of pre-service teachers in a manner resembling an “Inverted Hollywood” effect.

*Master Narratives in Technologies*

By drawing on literary theory (particularly Northrop Frye’s work on literary structures or genres), I wish to introduce the concept of master narratives into the analysis of technical systems. A master narrative is a genre of story or message communicated through the form, design, and infrastructure of the system. It can present itself as a single voice that speaks from an alleged authority (e.g., the designer’s god-like position) and doesn’t flexibly permit a multiplicity of interpretations or uses. Latour (1996) discusses the narrative

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62 See my MA thesis (Korteweg, 1996), Mining the Curriculum, an analysis of the Mine Games science museum exhibit centred on the embedded narratives in its multimedia presentations.
inscribed in the failed metro system, Aramis, as one where a presumed nuclear family and its need of a particular size of car was the steering image and master narrative for the subway system's specifications (p. 300).

The encoded\textsuperscript{63} master narrative of the PKP prototypes was a hopeful story, on the part of its developers, concerned with how teachers' knowledge practices could be changed or transformed through open access to \textit{usable or at least relevant} research documents. Let knowledge be free, public, and accessible and teachers will be freed from the delusions of their isolated knowledge and practices, transformed into a shared epistemic community. Let research knowledge be accessible, connected to schools and classrooms, and discussed in an educational epistemic community and teachers may begin a practice of research-connected, evidence-based type teaching. An examination of the encoded master narrative of the PKP prototypes is critical to determining if the knowledge distinctions and knowledge intentions envisioned by the designers-researchers in the university (by us at PKP) began to match the needs or could work with the ways that the participating teachers understood their own professional routines and knowledge practices.

My intention in analyzing the narrative of usability in the PKP-VanSun portal is to demonstrate structurally how Latour's language merges into another analytical strategy (narrative analysis) but maintains the overall characterization of the analysis as socio-technical. In this chapter, I draw less upon Latour's language to structure my analytic descriptions in an effort to show how his methodology can be integrated into more recognizable methodological treatments and integrated into common discourse.

\textsuperscript{63} I am purposefully choosing the word "encoded" here to emphasize how a portal is made up of code and yet has to have a narrative code (or story board) to make usability sense to the user.
How Portal Narratives Can Learn from Movie Pitches

To open this chapter on narratives, I begin with my own story in the form of a confession. While I have learned enormously from research articles and scholarly texts, I have also learned a lot from movies. Like most typical pre-service teachers, when I entered my teacher education program, I had ingested more celluloid inscriptions than academic articles. To frame this chapter, I fuse the theme of increasing the democratic potential of the Internet, through the use of online resources in teacher education, with movie making: I offer a movie pitch for the master narrative of the Public Knowledge Project – The First Installment, PKP-VanSun.

As described and publicized on the PKP website, the driving research question of the project was described as follows:

We are investigating online environments that can be developed to support teachers’ greater engagement with such professional development resources as research, especially as the relevant research is integrated with the other sources of formal and informal knowledge with which teachers work. (Office of Learning Technologies proposal, 1999)

The Public Knowledge Project sought to create a type of digital library of public research (publicly funded and freely available on the Internet), which had been selected, sorted, indexed, connected and repackaged on a website portal, for a stakeholder group who had the means (the portal) to exercise their right to know. The master narrative, the underlying driving pitch of the PKP portals, was that the stakeholder user group, the teachers, would want to know, would care to know, and would take the time, the technical means, and the intellectual energy to exercise their right to know, if only given the opportunity, the access, and the gateway to do so.

I am intentionally choosing a movie pitch script for this chapter to illustrate several points. Not the least of which is that the narrative of a portal, through its infrastructural
design, its organizational implementation, and its methodological choices, is a critically important element worthy of attention and analysis. The narrative of the PKP PD prototypes concern scholarly communication of research in general (through online or any means) and thus inherit its reoccurring problem of *inverted Hollywood*: scholars or academics have wonderfully substantial content to deliver but we often lack the means to motivate users to visit our web sites, to entice them to read our articles, and to persuade them to want to know how research connects to practice in order to become usable knowledge. Hollywood, on the other hand, can motivate high interest amongst the public with fast and furious action but can rarely deliver any substantial long lasting content (Norman, 1993, p. 5). The Hollywood effect in movie pitches has proven itself very effective, highly persuasive, and usable for the ongoing, long lasting profits of the entertainment industry.

In this chapter, I intend to analyze how the Public Knowledge Project’s master narrative, as materialized through its first PKP-VanSun portal construction, could be more “Hollywood” or more enticing for enrolling actors, and, in the process, persuading actors to translate their teaching needs to merge with their right to know educational research. Latour (1987, 1996) tells us that machines prescribe human behaviour, compelling us into certain actions in order to use the machine artifact or portal that we would otherwise not participate in. Madelaine Akrich (1992) maintains that the actuality of the artifact is not in the portal itself, in its designers’ goals, or in its users’ desires/preferences, but in all three at once, particularly as they intersect in the situation or narrative of use. One of the ways in which Latour states that machines prescribe user or human behaviour is through inscriptions of use (such as an owner’s manual), or narratives of use (such as the story line guiding both the design approach, the translation of design into the machine’s infrastructure, and the
enrollment into the story or purpose by the user). Through extension of their use of the portal, by accessing and locating open-access research, by changing their knowledge routines and demonstrating to a larger educational community (academics, teacher-educators, etc.) that they will engage in digital presentations, users participate in the portal’s purpose and narrative. By employing narrative structures that would make the presentation of research more usable, more user-centred, or enticing for enrolling practitioners into this network of knowledge exchange, designers are aligning themselves with the practitioner-users in this knowledge network.

**Movie Pitch Structure**

In this chapter, I employ a mock treatment of a serious research project as a movie pitch narrative and movie production of persuasive story lines in order to bring attention to research’s new challenge in being relevant and usable (Lagemann, 2002) in a digital media age. Movies have made the transition quite successfully from celluloid in the cinema to digital forms on the Internet, though their structure and narrative remain basically unchanged. I want to examine scholarly communication, a narrative of usable research for digital portals against the form of the established (and repeatedly successful) movie pitch narrative in order to understand how usability—a methodology focused on technical solutions for human-centred design—does not necessarily solve this social problem in education of the perceived gap between theory and practice in teacher education. I am aware that other educational technology scholars, particularly Chris Dede (2002), have also written articles employing the metaphor of movies as a counter-narrative or foil to academically strong, research-based policy writing and policy development.⁶⁴ In this chapter, I employ the narrative enticement

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⁶⁴ See Dede’s (2002) keynote address and article, “No Cliché Left Behind: Why education policy is NOT like the movies”, where he critiques the federal administration’s “Star Trek” model of superficial action-hero
device of the movie industry—the movie pitch or preview—to highlight how a usability approach (focus on technical features for human-centred design) does not tap into a social narrative about the purpose of the portal’s use.

To follow this interplay of strategies, of a socio-technical analysis with the metaphor and language of movie pitch narratives, I begin with an outline of the basic building blocks of a movie’s narrative structure. A movie pitch structure usually contains the italicized elements in the following paragraphs—hero, motivation, time, etc. In order to illustrate how this structure applies to movies, I draw upon the example of the popular movie, Chocolat (1999), which concerned the transformation of a repressed village’s practices in culinary and aesthetic pleasures. As the townspeople engaged in the experience of a more informed culinary, gustatory practice, their repression and ignorance was alleviated in their right to know and experience something more. The village’s transformation was as social as it was culinary.

A movie begins with a hero who has a motivation. For example, Vianne, the heroine in the movie Chocolat, is a single mother in the 1950s who wishes to open a chocolate shop in a small conservative French town. She wishes to make this town her home by having a successful business and putting down roots. But, the clock is ticking and the time is beginning to run out for the achievement of the goal. In Chocolat, Vianne is being boycotted by the town's mayor, Comte de Reynaud. To the nobleman-mayor, the chocolaterie's vendor represents desire and lust, grave sins that are to be especially resisted during the pious season of Lent. Vianne's time is running out for her business to take hold and for this town to accept her. Or else - if Vianne does not befriend the mayor, the strongest leader in the community,

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decision making. Dede argues that the technological infrastructure needed to facilitate reform is in place but that there are now sorely missing elements for educational systemic improvement such as genuine responsibility and critical leadership, elements now abdicated by the federal government.
he will continue to dissuade the townsfolk from frequenting her shop or accepting her as a community member. *But luckily*, the heroine befriends other members of the community and they buy her chocolate, participate in these new practices and experience a form of empowerment. *But luckily*, the mayor realises the sensual pleasure of chocolate, the allowance for this transformation of the social, and is willing to accept Vianne into the community. And, *our heroine realized* that she wanted to stay in this community, to take ownership for her part in this community’s social evolution, and make it her permanent home. So, *just in the nick of time*, just as Vianne was ready to declare defeat and move on to another town, the mayor begins to tolerate her and stops his active campaign against her. The heroine and the town have learned to compromise and accept one another and, in the process of acceptance, to change. *The forces of GOOD prevail, change takes place, and then all is returned to harmonious order.*

The Public Knowledge Project (PKP) movie is not as romantic as Chocolat nor is it fictional. PKP portrays an educational quest, a driving narrative, not an epicurean one. However, PKP and Chocolat both strive to convert and reform communities and social practices: PKP wishes to demonstrate the valid, enlightening, *usable* merits of educational research knowledge available online to practitioners, beginning or established in their careers, just as the heroine of Chocolat wishes to demonstrate the liberating pleasures of chocolate to a repressed and fearful community. PKP strives to make research an available and actualized public good that can be engaged in for more informed practice just as Vianne in Chocolat strives to make chocolate a more available, acceptable, and pleasurable public commodity.
PKP Movie Pitch for Pre-Service Teacher Education

The PKP narrative begins with a team of researchers, our so-called "heroes" in the Faculty of Education, University of British Columbia. The motivation of the heroes is the professional development project’s master narrative: we want to make academic research and scholarly literature more accessible to the public, integrating it with other sources of knowledge and information to which people can easily turn at any time. We want to make university-produced knowledge, public consumable/accessible knowledge. We want to contribute more scholarly knowledge for the public’s good. In this particular case, we want to contribute more scholarly knowledge to the education of pre-service teachers. And we want pre-service teachers to know the value of public access to this knowledge to prepare and assist them for their in-service lives. Finally, we want the public and pre-service teachers to know that their tax dollar funding of academic research is going to good, usable, informative use.

But, the clock is ticking and our time/funding is beginning to run out for demonstrating the achievement of our goal. The Public Knowledge Project, our team of researchers, has to learn how best to support the learning needs and interests of educators (e.g., in-service teachers, pre-service teachers, teacher union members, educational researchers), how best to match our master narrative with our users’ knowledge needs, before our research funding runs out.

Or else, the public will continue to see futility, for the most part, when they see academic research. Teachers will view educational research as inapplicable, unusable, or irrelevant to their professional lives. Or else, scholarly texts will be seen as inutile and anachronistic. Or else, the Great Gap will widen between theory and practice, abstractions

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65 Note that I am using the term "heroes" in a literary and, somewhat, ironic sense.
and experiences. Or else, someone else will fulfill the public’s needs for research. Someone, like a private corporation, will fulfill student teachers’ needs for knowledge and the corporation will do so for a price and at a profit. Then the relevance of publicly funded institutions will be further called into question.

But, luckily, PKP had assembled a team of researchers and website designers who were ready to experiment and work at this dilemma. And, our heroic team realized that we should use available technologies to create an online repository of carefully selected and filtered texts. And, our heroic team realized that we should make a tool that permits many different types of users (e.g., teachers, pre-service teachers, administrators, parents, scholars) to access many different types of knowledge texts. And, our heroic team realized that we should demonstrate how to connect different types of knowledge such as research articles and reports, classroom practices and tips, policy documents, organizations working to promote change, and, editorial texts reviewing issues. We realized that these knowledges could inform and introduce public users to a breadth and depth of knowledge on one topic that they probably never imagined existed. And, our heroic team realized that we had a valid master narrative that we should shape, transform, and encode into website prototypes. So, our heroic team, PKP, made the first prototype of the Public Knowledge Project, the PKP-

_Vancouver Sun_ website. 66

_Set-Up: The PKP-Vancouver Sun Prototype_

The first collaborative experiment of the Public Knowledge Project was to electronically complement a series of journalistic articles appearing in the _Vancouver Sun_ newspaper over the course of a week in the spring of 1999. The _Vancouver Sun_ believed it was a critical time for the public to be exposed to the complex issues pertaining to education

66 http://www.pkp.ubc.ca/sun/index.html
and technology in British Columbia schools. On each day of the newspaper's coverage, a different issue was explored. The five main issues covered by the journalists in their series of articles and that were then mined for online resources by the PKP team included 1) the impact of technology on curriculum and teachers 2) funding issues 3) gender and technology 4) the dangers and advantages of the internet and 5) equity of access. In our first repository of web documents, the PKP team wanted to motivate newspaper readers to go deeper into the issues raised by the journalists and to make connections across these issues. We endeavored to organize a web-based architecture of knowledge domains related to each issue that would permit this type of cross-pollination of connections. We created and filled with web resources five knowledge domains entitled Research (academic articles and reports), Practices (classroom practices and tips), Policy (examples of policies from different locations and levels of government), Organizations (non-profit groups working on the topic), and Issues (an editorial approach to the topic).

One of the defining characteristics of a profession is the responsibility of its practitioners to examine the effects of their activities on society and to strive for positive social outcomes. Virtually every profession related to the growth and exchange of knowledge has strong advocates for social responsibility. For example, Jay Rosen (1995) makes a case for public journalism:

Journalists should do what they can to support public life. The press should help citizens participate and take them seriously when they do. It should nourish or create the sort of public talk that might get us somewhere, what some of us would call a deliberative dialogue. The press should change its focus on the public world so that citizens aren't reduced to spectators in a drama dominated by professionals and technicians. (p. 18)
One example where public journalism met public education to encourage deliberative
democracy on issues of educational technologies was the collaborative project, PKP-VanSun,
brainstormed by Willinsky and the then Vancouver Sun’s managing editor, John
Cruickshank. The PKP consortium attempted to encourage and achieve knowledge
connections for users by offering overview pages under each issue and for each of these
knowledge domains. These overview pages summarized each document with a quotation or
chunk that encapsulated its intent, stated the bibliographic information; and, hyperlinked the
title to the actual document.

So, our heroic team now had a working if not yet proven prototype, and we realized
that we were not certain as to what the public had gained from our web site. We realized that
we had something to offer a more specific audience, such as educators, who might be
investigating issues of technology and education. We realized we needed to find a purpose
and a test group for our team to observe more closely how usability of research would work
through a portal. We realized that we needed an empirical example of how this online
experiment in scholarly communication would work in practice with a community that we
could readily study. Or else, how could we establish that educational research should be
made more accessible to those it is meant to inform. Important research findings and probing
questions would remain isolated and unusable for teachers and pre-service teachers. Or else,
as teachers are overwhelmed by a plethora of difficult educational decisions in their
classrooms, research findings lay dormant, unused, and purpose-less.

PKP-VanSun Sequel: The CITE Empirical Example

So, the heroic team of PKP sought a situation where we could test the usability of our
filtered research database portal. We sought a situation where teachers would confront and
discuss issues of educational technology. A sequel to any movie or any web site is always
difficult. We decided to continue with the same PKP-VanSun database but configure it into a
different situation. Basically, PKP was the same but instead of setting it inside a newspaper
context, we set it inside the context of a Faculty of Education class. The PKP research-design
team was convinced that the portal contained documents waiting to signify and create an
alliance or alignment (Latour) between research and practice, to create the conditions that
would signify new meanings and a new narrative of usable research for these emerging
practitioners. The narrative of purpose, the pitch for the usability of this portal, was
fundamentally concerned with formalizing this alliance, for enrolling teacher-users into the
portal’s network (Latour).

And, luckily, we found a rich empirical location, the CITE Teacher Education
program at the University of British Columbia. The acronym CITE stands for Community of
Inquiry for Teacher Education. It is a one-year program of studies for prospective elementary
teachers where the students are actively encouraged to analyze and reflect upon "how
learning is personally constructed, socially mediated, and inherently situated" (UBC, CITE,
2001). The central quality that distinguishes CITE from other teacher education programs is
"a conceptually and experientially coherent program that encourages: full participation by all
CITE community members in all aspects of program design and implementation;
and integration of all curriculum areas within and across two distinct learning contexts
(campus-based instruction and practicum experiences)" (UBC Faculty of Education website,

In my work with the preceding PKP discussion forums and in Jane Mitchell's work
with CITE discussions, we had both witnessed a tendency by users to remain in an exchange
of opinions and anecdotal experiences inside discussions. In this PKP-CITE experiment, we wanted to move academic knowledge (or formal abstractions as well as applied research) into the pre-service teachers' online discussions. We wanted them to cite sources from the PKP repository to inform their positions and incorporate hyperlinks into their statements. In short, we wanted to motivate the pre-service teachers to incorporate academic conventions of discourse into their online discussion to become more involved in an epistemic community, exchanging and building upon each other's knowledge. We wanted to help students achieve a virtual discussion where it was no longer as experience or anecdotally driven as a chat room but not as solitary or static as a term paper. We wanted to arrive in a new in-between place where students would employ academic discourse to exchange and build upon ideas with one another and with other teachers. But we didn't want the students to become overwhelmed by the morass of documents that appears when conducting web searches. We wanted them to have easy access to a range of texts and knowledge documents that they would be unable to find on their own and that they could integrate into their learning and their talking about learning to teaching. We wanted the pre-service teachers to familiarize themselves with a portal research service that had the potential of becoming an obligatory passage point (Latour, 1987, p. 150; Callon, 1986), the means and the only gateway into a unique service or set of usable knowledge in education.

PKP-VanSun was a means to operationalize, to materialize an innovative program of action in teacher education. The intention of the PKP team and the intention of the course instructor/grad researcher was to enable pre-service teachers to access valid research knowledge at any Internet connected computer, any time they would need that information.
Offering these knowledge practices through the portal is how these intentions, how the narrative of purpose was realized, modeled, and engaged in materially and concretely.

From the PKP consortium’s perspective (and reinforced by the participation of the course instructor and grad researcher), the PKP-VanSun portal holds important, relevant, valid, usable knowledge regarding the integration of educational technologies in teaching and the curriculum. We were convinced of this offering as we had filtered, selected, tested these resources against our criteria and we had spent considerable time and money organizing these resources into a usable technological artifact. However, inevitably, the first and most critical problem in this purpose “pitch” that needed to be solved was enrolling the instructor, then the pre-service teachers into this narrative of purpose, into becoming willing users of this portal. In order to ensure the beginning of the enrollment process, and to deal with the little allotted course time, it became evident that the purpose or narrative with the greatest enrollment potential was a narrative of use through an assignment. With the goal for the portal agreed upon as an assignment, the instructor was then willing to set aside the time for this implementation experiment and an alignment between course and portal artifact was speedily recognized. Hence, a machine, such as the portal, that prescribes user behaviour intrinsically through use (Latour, 1987), was given an additional level or narrative of prescribed behaviour, the Educational Studies assignment for course marks. Obtaining the Instructor’s authorization to evaluate the task and the introduction of the assignment to the students both served to launch the PKP-CITE network into being, as a collective of users was brought into contact and use with the PKP portal (Kaghan & Bowker, 2001, p. 258).

Jane Mitchell (CITE grad student) and myself (PKP grad student) designed a task or purpose that required the students to use our PKP prototype for an assignment. We developed
a WebQuest project outline, located on a WebCT bulletin board, where we asked the students to consider how social relations influence the curriculum and implementation of computer technology in schools. In the WebQuest, the students were first given the following question: "As a beginning teacher, what do you think are some crucial equity issues pertaining to technology and education and what action do you think schools and teachers can take in relation to these issues?" Secondly, students were encouraged to find accurate and reliable information on the Internet to support their positions on the above question. Through two hyperlinks on the WebQuest page, they were encouraged to use the PKP-VanSun site and a list of links posted on the Education Library's. Finally, the students were instructed to work in online groups to create a collective text on a WebCT discussion board concerning one equity issue. The students were also instructed to include hyperlinks inside their postings (at least two) to reference or footnote their statements.

The discussion forum was designed in such a manner that each discussion group included a guest external participant whose purpose was to connect the discussion to sources and people outside the CITE program and the university walls. Of the six external participants, five were university-based professors or graduate students. Only one of the six participants was a classroom teacher. Discussion groups and topics for the externals were designated by the CITE technology coordinator. None of the externals had working relationships or professional contact with the CITE pre-service teachers before this Education Studies forum. All the externals had prior contact and relationship with the CITE technology support/grad student as friends or colleagues. The employment of external guests or moderators in the WebCT discussion signaled a new set of actors into the PKP-VanSun network (Latour).

67 See Appendix B for this Webquest assignment in its entirety.
These actors were already allied with the Grad student’s program of research due to their personal and collegial connections to her and her work. They were ready to encourage the student’s discussion in a more intellectually engaged manner and this engagement was defined for them as the students citing relevant, reliable research to footnote their opinions. However, the external guests were not allied with the PKP-VanSun portal as they had not received any formal introduction to the portal or encouraged to use its documents in their interactions with the pre-service teachers. In contrast, the pre-service teachers were told they had to engage and use the portal documents or they would not be fulfilling the evaluation criteria.

This collaborative venture with Jane Mitchell and the Education Studies course was a field study of how pre-service teachers would use a PKP tool. We designed a task or purpose that required the students to employ the PKP-Vancouver Sun tool. We were testing our prototype with real educators to attempt to track how they acted on the website, what connections they were able to draw between texts and between practice and research, and, which PKP documents they found to be of value.

Generally speaking, the pre-service context of most universities is one marked by a culture of fragmentation between program parts; a perceived split between research and practice; and, a lack of communication and articulation between educators located in schools and educators in universities (Goodlad, 1994; Tom, 1997). For the Education Studies instructor and the CITE technology coordinator (Jane), the appeal of integrating PKP into a course assignment was to countervail these fragmenting tendencies. The intent of the assignment was to help student teachers substantially engage with their colleagues, with the available web resources, and with guest participants (including school district personnel)
from outside the BEd program. Our goal was to help the pre-service teachers make intellectual connections between their coursework and their school experiences, between theory and practice, between foundational and curriculum courses.

**Summary of the Actors**

At this point, I can summarize that the primary actors of this implementation site that I am following in this chapter include 1) the CITE pre-service teachers; 2) the research-designer team of course instructor, the grad researchers, the PKP consortium; 3) the external moderators and participants to the discussions; 4) the WebCT technology and the discussion postings; 5) the WebQuest assignment; and, 6) the PKP-VanSun portal. I will highlight particular scenes or scenarios from this implementation site to describe how technologies at work in these scenarios act to modify the intentions, chains of relations by the human actors, and the ensuing re-constructed narrative in this experiment of epistemic engagement. In the first highlighted scenario, the external in the gender discussion introduces a living connection to a machine-posted document that transforms it into usable research for this group of pre-service teachers. In the second scenario, an external (myself) interrupts the developing conceptual associations and assumptions in a discussion thread by providing a direct link, a machine-enabled move, to a source of knowledge that would challenge or displace the students’ building chain of associations. In a Latourian form of analysis that treats events and actors symmetrically and seeks to expose the forces moving epistemic engagements or knowledge practices along a gradient, particular comments from key scenarios or *scenes* become important to hear, observe, trace, and interpret.

**Movie Scenes: Connections in the Gender Discussion**
Online discussions are the equivalent of movie scenes. They are the building blocks of the movie's story. Through connections, questions, and challenges, a good online discussion advances a story, builds or replaces epistemic connections or community, explores an idea thoroughly, and challenges previously held notions. Reviewing some of the key scenes, critical comments, or pivotal turning points in one group's discussion provides some important connections as well as dis-connections for the strength of enrollment and the chains of association into the PKP movie pitch.

The students' discussion that was concerned with gender equity was the most richly connected of all the PKP-CITE group discussions. There were connections made between past experiences and future actions, between conceptual ideas from research and implications for practice. And there were unique connections made between the pre-service teachers and their external participant, an elementary school computer lab teacher working in the same school district as the pre-service teachers' practicum experiences and who had engaged in face-to-face conversations and observations with an educational researcher.

The Gender Equity online discussion began with the following, critically important, opening statement by Claire, a pre-service teacher.

In the GenTech Research Findings Final Report, by Mary Bryson and Suzanne de Castell, they stated "evidence from research on gender and access to, and uses of, new information technologies (NIT's) indicates that in public schools, female staff and students (in comparison to male students) are: (a) disenfranchised with respect to access and kind of usage, (b) less likely to acquire technological competence, and (c) likely to be discouraged from assuming a leadership role in this domain."

It is obvious from the references sited in this article that there is a lot of research out there regarding this statement. I think it would be interesting if we discussed any one of the three areas mentioned. A question that comes to mind is female and male users of technology using technology for the same purposes?
This is a model opening statement on the part of a student, fully meeting the requirements of the ES assignment and fully taking advantage of the indexed and connected research resources on PKP-VanSun. It begins with a citation that is referenced with the hyperlink. The citation comes from a web resource that had been filtered by the PKP repository. Claire then posits a question for her group to participate in. She is actively attempting to make connections with her online colleagues and she refers them to more literature on the issue. As she was the first participant to make a statement, Claire helped model a type of inquiry and intellectual engagement (of citation, question, leading reference) for the rest of her group to follow.

The external participant, Caroline, a teacher working primarily in an elementary computer lab, responds to Claire's statement.

Dr. Mary Bryson worked closely with our school to help us identify goals for technology and then to select appropriate software and hardware to achieve them. Conversations with Dr. Bryson helped me to acknowledge the power imbalance that exists around girls and technology, and I tried to ensure that this imbalance did not prevail in my classroom.

By chance, the external participant, Caroline, has had Mary Bryson in her school and in her lab, the very researcher that Claire's statement quoted and referenced. Not only did Caroline make a connection to Claire's question, she also connected the researcher back to Claire with real classroom, practical, usable encounters.
Claire then asks Caroline to extend the equity discussion into more concrete examples and strategies. She specifically wants to know from Caroline how she would judge and recognize power imbalances in the lab and then what the ensuing strategies for action would be. The pre-service teacher, Claire, is asking a theoretically laden question -- how does one recognize power imbalance -- with an appeal to Caroline for specific instances of practice to address issues of power.

Caroline, I am also interest in hearing about the specific changes you made to your teaching style and the selection of models and mentors you made in your classroom. Also who did you allow access to in the computer lab at lunch and recess? Did you permit those students who showed initiative and productive working habits, or did you allow access to those who did not have computers at home? What were your strategies because as a pre-service teacher, I am not all that confident I would recognize the power imbalance you are talking about.

Caroline goes on to describe to Claire and the pre-service group how Mary Bryson helped her “see” the social interactions of the children differently in the computer laboratory setting from recognizing how students sitting in pairs at one computer appeared to share the responsibilities of the computer more equitably to questioning the teacher’s stance to call upon a male student if there were machine malfunctions. Important to also trace at this moment in the online discussion is how the pre-service user, Claire, is now using the medium, the online discussion, to pursue questions of authentic importance to her teaching. She is not asking these questions to fulfill any requirements of the assignment. At this point, Claire is acting to displace the assignment requirements in the ES network in service of her own teaching knowledge needs, to fulfill her need to know from an experienced classroom-based, research-connected teacher. *Key Scenes: Disconnections in the Gender Discussion*
Every posting in a discussion group sets up the next set of communications like
movie scenes in a dramatic chain of action. The scenes or communication exchanges between
Caroline, the teacher, and the student participants demonstrate some key displacements or
disconnections for the PKP movie pitch. These disconnections are important dilemmas of
scholarly communication and knowledge management projects in a pre-service context.

Caroline did indeed respond to the first student Claire with a continuation of the link
of Mary Bryson. However, Caroline did not make this link explicit to the first student of the
thread, Claire, nor did she make it explicit to the other members of the discussion. Caroline
did not say, "Claire, Dr. Bryson is the researcher who you have referred to in your opening
statement." The connection is not clearly established and, given the lapse of three days and
the addition of three other comments in the thread, it is questionable to presume that the
forum participants have made that connection.

It is also important to note that Caroline, the teacher-participant, did not reveal any
specific ideas of Mary Bryson nor did she list any citations or references to Bryson's work.
She did not directly relate to the citation that Claire had posted by stating her support of this
position or this particular idea's impact on her thinking as a teacher. However, Caroline did
state that Bryson changed her thinking, that in talking to Bryson, not in reading her articles,
Bryson convinced Caroline of the power imbalances that occur in a school lab, through both
the organization of equipment and the use of certain software. Caroline did demonstrate
another facet of how research and researchers serve the schools and how the online resources
can serve as a point of connection.

The fact that Bryson worked in a school with a group of teachers to develop a
technology plan and organize a computer lab for greater gender equity is advantageous
enough. The fact that a computer lab teacher could name a scholar as someone who had changed her practices through conversation is an inspirational model of scholarly impact for new teachers. However, Claire's response to Caroline was a question for specific strategies or tips. It was not a desire for closer examination and discussion of Dr. Bryson's central ideas or theories. Ironically, once the teacher Caroline entered the discussion, the overall rate of citations and references in the forum dropped to almost null. The students became focused on Caroline's own personal experiences, her professional practices and classroom observations, and these became the new reference points for the discussion. Still, here were signs of at least an initial integration of teacher experience and research knowledge working in close proximity. And here were signs that the network's actors were appropriating the forum, the technology, for their own needs rather than those of the assignment and portal designers.

This instance of Caroline's participation, its anecdotal and personal account discourse, was not a unique stance in this online discussion. Unlike the students fulfilling the requirements of the assignment at the outset of the task, most of the other external participants did not use quotations or cite resources from PKP nor did many externals refer students to other web resources outside PKP. For the most part, the external participants tried to push broader thinking for the pre-service teachers by asking the students more questions that sought to expand the examination of the issues. They served the students as another order of knowledge to complement the site's other resources. The externals would respond to the pre-service teachers' statements with more questions rather than experiential examples from classroom observations. The gender discussion was unique in that the questions originated with the pre-service teachers and they were directed almost entirely at the external teacher, Caroline. These questions were focused on the practical implications of what had
been well established in the research literature, helping the participants to focus on and identify the problem in need of strategic interventions.

The external participants fulfilled the role of expanding and enlarging the university classroom walls to include more than just the pre-service teachers and their instructor in this community of inquiry. But, in this experiment, five out of six of the externals were university-based professors or graduate students. The externals did not represent an active perspective from inside a classroom or school. For the most part, the externals represented other institutional spaces of the university rather than this particular course or degree program. The externals were in other university locations, pursuing other disciplines of inquiry in education, or graduate students establishing their academic identities. But, the externals did validate the discussion of this topic and validated the use of an electronic forum. In their positions as professors and graduate students, they were also in the best position to validate the use of citations and references to web documents. The effect was a much richer information environment in which to consider the process of becoming a teacher than what was occurring in the typical teacher education classroom.

In any movie narrative, the heroes usually receive help in their quest. This help often comes from external sources such as a gypsy, a magical wind (such as the one that appeared in Chocolat), an elder of the community or a mentor. The external mediators in the PKP-CITE experiment were "helper" or mentor characters. A helper character is a person who has special knowledge and special skills that can assist the heroes. In the story of PKP-CITE, we knew that the externals had mentor-type qualities that would help the pre-service teachers' in their understanding of the complicated implications of technology's integration into education. However, we didn't fully comprehend the extent to which the externals could
assist us, the PKP team, with our goal of making academic research more accessible, meaningful, and usable to the pre-service teachers through the portal network.

Assistants to the Heroes: The Pivotal Role of the External Mediators

In one topic-group inside the Education Studies discussion, a different dynamic existed between the external mediator and the pre-service teachers than the one that developed in the Gender Equity group. I was the external participant in a group discussing the role of big business and corporate sponsorship for technology in schools through technology initiatives and funding technology's high costs. The group was debating the futility of using corporate funds to buy equipment when there was a greater need to support teachers to become more comfortable with computers.

In my role as external and researcher, I was curious to see how other groups were progressing in their epistemic engagement and use of web resources in the chosen topics. In one of the other Education Studies discussion groups, I observed an exchange between three or four pre-service teachers where they excitedly exchanged information about a new corporate program of environmental education. I felt it was an important example to bring back to my group's attention, as it concerned corporate sponsorship and a delivery of curriculum for teachers and schools, and so I wrote to the group about a program that was much admired:

Subject: re: This may be off topic but...

In speaking about big business involvement with schools, I was struck by an example right here in the CITE forum. I noticed one group excitedly discussing the Grizzlies' Environmental Education curriculum for classrooms. I went to the Grizzlies site to check it out as I wrote my MA thesis on environmental education. Go take a look at it, INCITE people, and tell me what you think. http://www.nba.com/Grizzlies/grizz_ed_index.html

As I gave the free corporate offerings my critical reading, I was struck by a few things...

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68 The Grizzlies were a Vancouver based National Basketball Association team.
I asked my discussion group, the INCITE group, to investigate the situation for themselves by visiting the Grizzlies website address and giving me their opinions. My comments and questions were subsequently intellectually amplified by Brenda Trofanenko, another graduate student and external participant in the Education Studies discussion.

Public sites of knowledge, including the actual sites such as aquariums and museums along with the virtual sites offered on the web, posit themselves as educational. Yes, they certainly are. But you need to ask yourself what is it that they want you to learn and why is it being presented in such a way?

Certainly, each corporation has a mandate for financial viability. My concern is how education is being employed as one way in which to show a profit. While it may be great to have the learning packages each corporation provides, I would advocate you be critical of the package, the intended learning, and the ways in which it has come into your classroom. Whew! Who knew I could get so incensed about a grizzly bear, real or otherwise.

Brenda, on Denman

At this stage in the discussion, the pre-service teachers were placed in a position of response to an example that had incited enthusiasm by their cohort members but had now evolved into a forum of intellectual criticism by two externals. As the external responsible for the corporate sponsorship discussion, I had put my participants in a position of heightened response. I was no longer on the spot to answer their questions or interpret the reality of schools in conjunction with theoretical ideas or academic frameworks. Instead, I had put the students on the spot asking them to visit specific websites and respond to my critical interpretation of an education program. Bravely, four out of the six pre-service participants did respond and they responded in a similar fashion.

In response to the issues that Lisa raises in her comments on the Grizzlies’ environmental ed
program. I was working for the Green team when the B.C. Ministry of Environment was in negotiations to create a Grizzlies environmental ed team and we discussed the pros and cons of working for and with the Grizzlies.... In my mind, corporate sponsorship cannot exist in blatant opposition to an educational system that it funds. What is the point of an environmentally unsustainable company funding an environmental education program? Should we use the word hypocrisy here?

The pre-service students recognized the "hypocrisy" of the Grizzlies program but they found this position of critique "disturbing". A couple of them still believed the Grizzlies' environmental program to be valid and inspirational for students' exposure to and thinking about environmental issues. The pre-service teachers understood their cohort members' enthusiasm for the program, but they were also confronted with academics critically reading this enthusiasm inside an assigned discussion. It must have been a difficult and precarious position where cohort members are looking for affirmation of a curricular idea while academics are simultaneously criticizing it. The position did force my group's members to think, but perhaps it was uncomfortable thinking coerced by my chosen type of participation and intellectual engagement. In this instance, the external was taking control of the discussion's direction and the discussion's agenda. My use of citations and URLs was meant to challenge the pre-service teachers to form an opinion of their own accord on a topic of my choosing.

In the gender equities discussion, the pre-service teachers were more in control of the thread's agenda and direction. Cohesion between participants developed with the introduction of the external, Caroline. All the pre-service students in the gender thread wanted to specifically hear Caroline describe and analyze her classroom observations. Alongside this external, the pre-service teachers wanted to actively participate in the interpretations of classroom observations and strategies to recognize and promote gender equity. The gender
thread's pre-service participants immediately and intuitively recognized Caroline as their bridge between classroom experience and strategic interpretations. They directed Caroline to speak by asking her specific questions. They also directed her to give them practical pedagogical interpretations of gender equity for classroom application. This advice was an extension of the concept of gender with which the students found themselves unfamiliar. They understood the complexity of the issues involved with gender and technology but they did not know where to begin to address it inside a classroom as a teacher. Whenever Caroline answered the pre-service teachers' questions with tips, strategies or practical interpretations, the pre-service teachers were greatly appreciative.

When Brenda and I challenged the pre-service teachers' enthusiasm, we were guided by a similar bridge metaphor. We were searching for ways of making our critique a point of connection for practice in a classroom. Asking students to examine the environmental costs and balance in order to develop ethical criteria for corporate participation in educational programs appeared to be a practical, pedagogical interpretation of corporate sponsorship. However, the pre-service teachers' responses to our critique were cautious, whereas, the responses to Caroline in the Gender online discussion were overwhelmingly positive.

Caroline,
Thank you so much for responding to all my questions. Your ideas and strategies are amazing, and I know I will remember them when I am teaching. I am going to be teaching computers in my practicum starting next week, so I will be conscious of the power struggles that may be going on, and how I can help facilitate a more equitable environment.

Caroline, I want to thank you again for being such an inspiration, and for contributing to our discussion in such a meaningful way. I can't wait to see what else everyone has to say.

Caroline,
WOW! Thank you for all the information. I especially appreciated all your real life experience. It is very obvious that you have serious thought about gender equity and technology. Do girls struggle more in technology or is this just a myth? If girls do struggle more, what do you think contributes to this?
It is apparent from these responses that the users, the pre-service teacher participants, had greater need for Caroline's classroom experiences than for the PKP document hyperlinks. Or, at least, the documents only provided a starting point that Caroline could help extend through its relevance to the classroom. Caroline, the only in-service teacher in the Education Studies discussion, provided a bridge between the students' academic work on the topic of gender inequities and classroom practices. She provided practical interpretations and strategies for making technologies more equitable in the classroom.

After a minimum of five years in the university with myriad essay assignments demanding a certain number of citations, the pre-service teachers seemed saturated with certain academic conventions (e.g., academic sources of refereed journals, citations in a particular style, citations to support an argument). But, the pre-service teachers did not readily transfer these conventions of scholarly discourse into their online discussion. The students' primary criteria for referring to web documents and incorporating hyperlinks were to fulfill the requirements of the assignment as few of them went beyond the required double reference and fewer still cited any web resource after their first two postings. What appeared novel, inspirational, and epistemically engaging for the students was an insider, a classroom teacher, who revealed conventions of classroom practice and identity formation as a teacher. But, more importantly to this study, it demonstrates the value of the PKP portal. Caroline's comments would not have reached any connection to usable research, to any substantive depth of observation and reflection, if it hadn't been for the connection to Mary Bryson, and the connection to Mary Bryson was made by the PKP portal. If Mary Bryson's work did not exist on PKP-VanSun, the student would have never cited it on the WebCT discussion boards.
and Caroline would have not been given the cue or opportunity to add her experience and story of educational technologies teaching, directly connected to Mary Bryson. If the student in the opening quote had not begun to question gender dynamics in teaching educational technologies by citing Bryson; if Caroline had not spent time working with and developing in situ in the computer lab with Bryson those ways of observing gender; and, if Caroline had not been cued by the Bryson quotation from PKP that there were research texts (PKP) supporting a critical perspective of gender in this discussion, it is doubtful that this discussion would have reached the intellectual depth and open embrace that it did. I argue that in this discussion, the portal, the non-human technology, actively transformed the knowledge practices of these pre-service teachers (and the external participant) in a manner that connected them to an education epistemic community larger than their discussion thread, their cohort, and their teacher education program through discussion with Caroline and in connection and reference to research texts such as those by Bryson.

It was only after all the discussions had closed that the collaborative design-research team, PKP-CITE, realized the pivotal and powerful role the externals, such as Caroline, could have in the discussions. In hindsight, I realized how we, the assignment designers, could have helped instruct the externals to model qualities that would have helped us attain our research and narrative goals and motivate the students to integrate PKP as an important knowledge source in their teaching. If the goal of this experiment had been to create an electronic essay or a collaborative writing piece, we needed to communicate to the externals how they might model and direct that type of writing for the discussion participants. If the project’s narrative goal had been to help students internalize into their thinking about teaching, the results of inquiries into education and academic discourse, then we needed to
emphasize to the externals to link references inside their statements (i.e., continually refer to web documents in PKP with full footnotes of the title, author, and publisher). If the PKP research goal had been to link different types of knowledge together to more fully inform the PKP user, then we needed to incorporate criteria into the assignment to make two or more citations, each representing a different type of knowledge. We also needed to ensure that the external mediators stated the types of knowledge they were drawing upon, and they needed to defend how this knowledge worked to answer the student's or the collective's questions.

To summarize, the collaborative research team needed to make its goals, its narrative of purpose, more explicit and transparent to both the external participants and to the pre-service teachers just as a movie's narrative is made transparent in its pitch and preview to its intended viewers. We needed to distinguish what type of discussion, what type of narrative of educational discussion, we envisioned through this assignment, as it moved between machine gateway, documents, and people, and as the integration of themes from these three different sources/actors could have been encouraged and aligned for the strength of the network.

In the online and asynchronous forum, pre-service participants can go beyond simply sharing their experiences and opinions to sharing them reinforced with sources of information and connected to a larger epistemic community of practitioners and researchers (through texts and face-to-face connections) through the PKP-VanSun portal network. Not only can they build upon each other's ideas, applying the ideas of a larger research community, but they can also develop an interpretive framework with the external mediators for future experiences. "For it is not shared stories or shared information so much as shared interpretation that binds people together" (Brown & Duguid, 2000, p.107, emphasis mine). A portal network is the means for a collective of non-human actors (portal), machine-human
actors (documents, resources), and human actors to jointly intersect, to translate the intentions of the group into shared interpretations, a process of displacement of original ideas and intentions between actors and emerging chains of associations (Latour, 1991; Akrich, 1992).

What I am attempting to point out with the example of Caroline and the gender discussion is that technological tools and their particular features can be modified but the social and cultural, or the specific knowledge needs of a particular social group, is much harder to define or change or shift. In the culture of teacher preparation programs, pre-service teachers are highly motivated to learn from practical classroom tips and from established, practicing teachers. In the context of the Education Studies assignment, the pre-service teachers were highly motivated to learn from practical ideas and strategies for the classroom developed in response to scholarly notions. The bridging work between the domains of scholarly research and living local classroom practices was one that we did not actively design the PKP tool to develop or incorporate. We did not realize the potential of this Hollywood factor of enticement or enrollment into the network, of connecting the students' academic experience with a local practitioner actively working to translate the academic into practical strategies for the classroom. The portal in its material form ultimately realizes, or, makes real for the research-design team the complex problem of enrolling practitioners into an educational epistemic network. And the Hollywood movie pitch makes apparent how usability, the issue of persuading the practitioner to use the portal and enter the network, relies on compelling enticing narratives.

For the PKP design team, we believed the user would be able to see the compelling narrative of use for the PKP-VanSun portal, that it would be obvious once they used it. By
designing an assignment purpose for the portal, we believed the students would make
meaning through epistemic connections and bridges for themselves in moving among the
various knowledge domains and resources. However, the act of bridging, connecting, and
translating between types of knowledge was one not successfully facilitated by the PKP site
for various reasons. The site did indeed offer a knowledge typology including research and
practices repositories. But, the irony is that the pre-service teachers never realized the content
of the Practices section. For example, the gender equity discussion had a total of 32 messages
with 11 containing hyperlinks. Six hyperlinks referred to research articles, three referred to
issues (a more editorial approach to reviewing issues), and two referred to organizations
(non-profit groups working on the particular issue). As the researcher, I am the one who has
categorized these texts into these knowledge types because the pre-service teachers
themselves did not refer to the portal typology in their statements. Surprisingly, consistent in
all of the discussion threads, there was a predominant tendency to refer to research
documents located in PKP, not to practices documents.

For example, in reviewing the usability of knowledge category classifications as part
of the document infrastructure in PKP-VanSun, I directed a focus-group interview (de-
briefing) of five pre-service teachers who as a group struggled to define their information
needs in our meetings. I tried to steer the pre-service teachers to view PKP-VanSun as an
obligatory passage point (Latour) in teacher knowledge development. I emphasized how the
tool would assist them as public educators (Lagemann, 1999) to convince parents and
administrators to understand and endorse new approaches to teaching that they would want to
implement for their classrooms.
These students responded by discussing the tension between primary source research and a filtered, distilled media-type approach to professional knowledge (i.e., they explicitly referred to the forms of information provided on other journalistic websites such as the CNN and MSN websites). And they made it clear that they situated their own preferences for knowledge from sources that would be brief, tertiary, a type of Coles-Notes of current burning issues mediated by a reliable trustworthy brand-name source such as a news channel, magazine or newspaper. They worried that primary sources of research would be too much work, too difficult to decipher, too unusable, too inefficient for their teaching purposes and time clock.

In each PKP case, I brought an ethnographic and teacher-research attentiveness to the data collection and analysis: a stance that interprets teacher-users as making meanings based on their circumstances and experiences of teaching and learning, and that these meanings would be inscribed into their judgments, actions, document preferences and usability choices about the PKP portals. When I interviewed this group of five CITE pre-service teachers, representing different discussion groups and topics, I discovered that the students had had no idea that there existed on PKP a whole category of filtered documents that focused on teacher and classroom practices. When I presented them with photocopies of the Gender-Practices Overview (see Appendix D), they were stunned that they had not realized that the site contained this type of practical knowledge. I did not interpret this lack of experience with PKP-VanSun as an indication that these pre-service teachers were uncooperative, ignorant of technology, or unwilling to make an extra effort. I did not interpret this lack of use of PKP-VanSun as attributable to their intentions as users. Quite the contrary, I interpreted these responses as indications of how we, the designers, had faltered in not achieving the level of
usability, user-centred design, we needed to ascertain more information about user’s reception of our knowledge resources and portal design. I also attributed this lack of use to the portal project’s inability to portray and communicate a convincing narrative about the portal’s role, use, goal and purpose in their teaching practice.

Frailty of the PKP Prototype in Comparison to Hollywood Movies

At this point, I can attempt to hypothesize a few factors to explain the tendency on all the pre-service teachers' parts to have predominantly used research citations. The nature of the CITE discussion was one of an assignment where students were required to make two citations. They were also aware that their instructor, the external participants, and their cohort members would be reading the messages. No qualifier was given as to what kind of knowledge would be valid for this assignment. As the normative requirement for most university essay assignments in the social sciences and humanities is refereed journal citations, it is understandable that the pre-service teachers would presume this is the category that would best suit the discussion requirements.

Another hypothesis for understanding the pre-service teachers' reliance on research documents is due to a design feature of the PKP-Vancouver Sun site. Among the set of “knowledge buttons” (Research, Policies, Practices, Organizations, Projects, Forums) located beside the topic title, the Research button appears first in the line. In this case, a design issue could have interfered with the utilization of the knowledge typology. Even though there were buttons that indicated a range of knowledge types and even though the heading on the abstract/summaries page would read Practices, more steps could have been taken to reinforce the knowledge typology. More design features could have been strategically situated to continually reinforce the different knowledge categories available through the PKP site. But,
perhaps, the problem in realizing the potential range of knowledges available in PKP was not a navigational or design frailty of the site. Perhaps the pre-service teachers did not find the Practices section of PKP because they couldn’t make the association of a Practices or classroom based domain inside a university endorsed and research driven website.

The choice/design of the WebCT discussion boards was instrumental in reinforcing the purpose and agenda as one of the university. It is a course management tool that is used almost exclusively in university settings. WebCT and the WebQuest page became obligatory passage points in this implementation site. PKP-VanSun is hyperlinked through the WebQuest page but the pre-service teachers did not have to spend much time in the PKP portal to accomplish their task. In the focus group interview, one student described his time on PKP-VanSun as “get in, find a link, copy it and get out.”

WebCT’s discussion boards have many tasks and steps that need to be understood in order to function in its environment. The task design demanded a greater immersive experience for the pre-service users with the WebCT infrastructure than with PKP-VanSun. WebCT also worked to position PKP-VanSun as just one of many resource choices to add to the discussion task. If the discussion had occurred inside the PKP-VanSun portal boundaries and if the discussion were located on an open-access free site (rather than the paid subscription environment such as WebCT), the boundaries between university and public may have been more porous and the overlap between theory and practice may have been more pronounced. In this way, we can see how non-human actors –WebCT, machine boundaries, PKP-VanSun pages and

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69 Fieldnotes, February 2000, University of British Columbia, Faculty of Education seminar room.
70 These steps include how to log onto the discussions, post, reply, find the appropriate thread, answer in private rather than public, etc.
indexing—also worked to position the human actors, the pre-service teachers in relation to the portal’s content.

In hindsight, it is easy to see that the pre-service teachers were not motivated to peruse all the knowledge categories. We at PKP had taken a website tool that was not user-driven for this group of pre-service teachers, and users did not enroll in our portal as one of their regular sources of web-based information. The PKP-VanSun site was a tool for which we had imagined a group or a public of users. It was not a tool specifically designed for or tested with a group of pre-service teachers and their epistemic needs. We at PKP were looking for buy-in from what Donald Norman refers to as "early adopters" (1998), meaning that, in this case, we had built tool for those, like us, who were regularly reading and interpreting websites and foraging and retrieving knowledge from web based tools. We assumed these pre-service teachers would already be digitally literate and early adopters with Internet technologies. We also had different needs in pursuing technological tools from our position as researchers. We were making tools for public knowledge and we considered them important. Whereas our users, pre-service teachers in the context of a university course, wanted a website that was convenient to use, with technology that had already proven itself. They wanted a good, easy, efficient experience, inside the confines of this course, to serve the particular course requirement needs at a particular time. They did not want a Swiss Army knife experience of too many blades with too many purposes that did not serve the immediate task at hand efficiently and expeditiously.

Final Pitch

71 This was a necessary condition for our first implementation site with the Vancouver Sun newspaper as we were addressing the newspaper reader public.
To conclude, I return to the Public Knowledge Project movie pitch to determine if we, the research team, had reached our narrative, our social goals with the CITE experiment. The PKP team had made a first attempt at electronically delivering substantive knowledge to a group of pre-service teachers. However, we did so without first asking or understanding what these users wanted or what would motivate them to use this type of tool outside the confines of an assignment. We realized that the PKP-Van Sun tool was powerful on providing substantial content, but lacked a critical point of motivation, a compelling narrative of persuasion, for the use of this portal by these students. Our research with CITE culminated in a Hollywood inversion: we had substantial content to support the professional working lives of teachers, but they were not yet persuaded or sufficiently enrolled to thoroughly investigate or use the portal. We failed in convincing these educators to see PKP-VanSun’s full potential, its narrative of active usable application to their teaching.

Generally speaking, there is an overall Hollywood inversion in teacher education: the university has accumulated much solid substantive content to offer teachers – what Lagemann (2002) would refer to as approaching “usable knowledge in education” – yet we have little means or established infrastructure to persuade teacher candidates to engage with the research base of this content and enroll them into the portal network. Hollywood, on the other hand, has a complex sophisticated infrastructure to manufacture the enticement and enrollment of viewers into its network of consumption. It begins with a pitch, an inscribed narrative, based on why anyone would want to see this movie. The movie narrative begins at a point of persuasion – how do we persuade the potential movie viewer to participate in the movie consumption. And it follows up with previews, media coverage, publicity stunts, coupons, and, complimentary marketing: these combined mechanisms promote viewers to
want to buy entrance into movies that have little substantial content to deliver on the promises made by the enticement/enrollment infrastructure. The system or infrastructure that the PKP-VanSun portal was able to enroll was that of funding backers. The narrative pitch did not work to the extent that we envisioned with this group of users, but it certainly worked to align our research consortium work with powerful allies, such as the Office of Learning Technologies, who could fund the next reiteration and improved version of a PKP portal.

Tracing the PKP-VanSun CITE network through the gradients of usability, of tracing enrollment through a movie pitch, of a portal’s inverted Hollywood situation in its first network test, as I have done thus far, portrays one representation of teaching and its relationship to academic research. That is, while the description of the online discussion scenarios or scenes shows a gradient of pre-service teachers’ interests as different from researchers’ interests in the intersection/relationship through the portal, there is no evidence that pre-service teachers intended to avoid academic research. However, there was a cumulative effect of human, non-human and human-machine actors not intersecting long enough, not translating each other’s interests, and not gaining enough strength in association for the portal’s network to gain reality (Latour, 1991; Kaghan & Bowker, 2001).

_Last Pitch of PKP-VanSun_

Just in the nick of time, we the PKP designers have learned important lessons. Our research confirms that teachers are the critical link or bridge for the success of technology's implementation in the classroom, and we are hardly alone in this finding (e.g., Pea, 1998). And we confirmed that teachers need a collaborative community of educators to share, connect and confront ideas on how best to make any innovation or implementation serve students' learning, which has also been established previously (Grant, 1996). PKP remained
committed to the narrative that the Internet and our website prototypes can serve teachers in their professional development by our offering them both a contained library of filtered resources as well as a tool of inquiry and epistemic collaboration to put the research resources to the usability test of a teacher cohort context.

At the conclusion of the PKP-VanSun-CITE prototype implementation, we discovered that the role of the externals (the mentor, experienced professional peer, or academic) is crucial in the creation and cohesion of an online community of inquiry for teachers examining new issues. They are actors who can mediate or translate between different actors: the experienced with the novice, the academic with the practitioner. We learned that the sequels of the Public Knowledge Project portals would need to address this role of the bridge maker or mediator. Like many academic research projects, we were in the process of creating the conditions for sequels. We were committed to iterative design and the participation of our users. We were confident that we would be able to demonstrate to educators our prototypes' contributions, and, along with other contributing scholars, we would win the prize of the Public's continued support and endorsement for research. This was the state of our project's pitch or guiding narrative and social commitment as we concluded the PKP-VanSun-CITE experiment and began preparation for our next prototype and the next network-in-the-making.
EdX, the In-service Teacher Education Portal

The second professional development portal prototype developed by the Public Knowledge Project, known as EdX or the Educators' Exchange, was a second iteration and third implementation of the PKP knowledge management system, this time tailored specifically for a professional diploma program of 100 in-service teachers. The two-year, 30-credit university administered in-service program was designed for teachers to learn how to enhance teaching through the integration of educational information technologies. The program is conducted in schools and teachers gain credits by conducting self-study projects, investigating their own learning and classroom teaching with new technologies. The program combines two face-to-face summer institutes with self-study during the rest of the year. The teachers' learning and progress are monitored and supported by a mentor, a teacher-leader in technology, jointly hired by the district and the university instructor. Every teacher is a member of their mentor's group that is composed of six to seven teachers. In this particular study group, the program cohort numbered one hundred teachers and eleven mentors in a suburban school district of a large metropolitan city.

Unlike most university teacher professional diploma or certificate programs, this program is structured around teachers' designing their own challenges and field study assignments that they implement and conduct in their classrooms. Each assignment revolves around a technological tool or application and its educational value to the teacher and students in its classroom or curriculum use. Each assignment can be an odyssey into making
a tool or application technically work in the classroom or school lab, but the university instructor, Chris, worked to emphasize to the mentors that the educational value of the technological component must be considered.\(^{72}\) The program culminates in a demonstration festival in the third summer institute (July 2002) where teachers display their competencies learned through the various project-assignments or they can expound upon one particular meaningful and valuable project in detail.

The teachers in this specialization program needed to decide what they would take and learn of the technology in order to complement, emphasize or challenge what they were questioning in their classroom practice. The means by which they were to determine their projects, the technical steps, and the reflections on the educational purpose of the technologies, were in consultation with the assigned teacher-leader of technology or their mentor. The means for the mentor to respond supportively and resourcefully to their teacher-mentees was (ideally) to consider their own experiences, to consult the field through literature and resources that would speak to, inform and guide the teacher-mentee questioning technology and its meaningful integration in schools. The resource base for this program and mentor/teacher support, chosen by the instructor along with the PKP consortium, was a portal called the Educators’ Exchange (or EdX).

EdX, the knowledge management portal modified specifically for the technology diploma program and its challenges of distributed delivery, was tailored to give the teachers and the mentors as much epistemic or knowledge support as possible. EdX provided many tools for sharing knowledge and resources, for posting user profiles to build recognition and

\(^{72}\) At each mentor meeting, the instructor Chris reiterated this message. I understood it as a message intended to countervail the technicist emphasis of the majority of the mentors. Indeed, one mentor’s study of his teacher education practice was focused on creating a CD-Rom program that would permit a teacher to re-boot and reload the Operating System of a crashed computer in the school lab rather than call upon a colleague (such as himself) to assist with the trouble-shooting. (Fieldnotes, October, 2000)
a sense of epistemic community, for participating in online discussions, and for searching and locating useful resources recommended and uploaded by any user in the system. It was the most sophisticated and expensive knowledge management system that the Public Knowledge Project had yet produced and it was a project funded by a generous grant from the federal agency, Office of Learning Technologies, Human Resources Development Canada.

Desire for Participatory Action Research

EdX was also the project moment when we at PKP knew the epistemic community value of this professional development portal would be tested and constructed by underscoring a participatory research approach (PAR). We recognized that our portal experiments had not yet received the involvement and participatory response by users that would help further the design process or usability of the system as well as further the sociability conditions for epistemic community formation. We began this project envisioning that the reflexive, critical research work on the design and use of the portal would include the participation, the work and voices of the participants. To start this process materially, the first discussion created on EdX was by John Willinsky inviting the mentors to discuss openly what features this system should have.73 I was not only present as the on-site fieldworker and available EdX trouble-shooter but I also asked at each mentor meeting if there was any feedback or concerns regarding EdX. And to demonstrate to the mentors that PKP’s intent was to align their concerns and needs with the design and modifications of the system as well as accelerate the participatory process, I arranged an evening presentation and discussion.

73Fieldnotes, June 2000.
session face-to-face with the software developer, John Cousineau, at one of the evening mentor meetings.\footnote{Fieldnotes, October 2000.}

In our attempts to ask the mentors, as the key actors, to participate in the portal’s design process, we asked them to assume a level of work that they were not prepared for nor had they requested. Concretely, I asked the mentors in the first set of face-to-face individual interviews in the month of July, to help co-teach the EdX workshop during the Summer Institute (middle two weeks of August). My reasoning was that if these mentors had to teach the portal to their mentees, they would enroll themselves into the portal’s use, maintenance and ownership. Surprisingly at the time, not one mentor agreed to co-teach the required EdX workshop. What I didn’t appreciate at the time of the preparation and anticipation for the first Summer Institute was the amount of work needed to make this portal function, to make it usable, and to make it sociable as a community space.

Work of Professional Development Portals

Information systems, such as these portal prototypes, encode and embed certain types of work in several ways. There is the work of maintaining the system (system managers, repository content managers, software developers). There is the work of making the system usable and useful (online discussion moderators, content providers, user postings, workshop leaders, mentors’ roles in modeling use and application). Finally, there is the kind of tacit work of promoting reform in teachers’ knowledge practices (using documents to inform their teaching; finding, submitting, and sharing documents to the assembled community; assessing information as relevant to their questions or to others in the community, etc.). Many of these kinds of work or processes are invisible, yet examples of all these kinds of work were accomplished in the two prototypes.
Locating, observing, and identifying the invisible work in information systems such as portals requires searching out traces of use and chains of activity left behind by designers, system managers, implementers, and users of the system (Star & Strauss, 1999). Those digital traces not created by the software developers or the explicit technical jobs, are created by almost unnoticeable intermediaries and mediators who are working tacitly to support the system. To locate and understand the role of these intermediaries and mediators in the EdX site, I observed and asked the active teacher-mentees on EdX to tell me who motivated them to participate, who filled in the gaps and spelled out the steps of actually using the portal. In the case of the PKP prototypes, I needed to observe who else was doing the behind-the-scenes work of convincing and demonstrating to users to use EdX, participate in epistemic community, and, consequently enroll allies into the system network. While actively involved in the fieldwork of implementation, I was also consumed in attempting to encourage as many NETTL mentors and teachers to logon and participate in EdX, thus I was not able to accurately observe what was occurring elsewhere in the network. It was after the conclusion of EdX that I began to actively re-trace the connections, the alignments and the links of the chains of the EdX network that were the most successful at realizing teacher participation.

Invisible Work of Intermediaries

With any form of organizational work, there are people whose work is basically invisible (cleaners, centralized technical support of systems—a voice on the other end of the phone) or whose work comprises multiple ‘assumed’ roles that are not necessarily documented (e.g., the social convener or conflict resolution work of administrative assistants). In the case of EdX, the work of the mentors and my work as bridger between organizations/institutions were based on maintaining delicate balances between making
functions and roles visible (through formal description, acknowledgement, and classification) or leaving them tacit (part of the background, part of the social infrastructure). By making the mentor’s work explicit, direct, and visible, there may have been more resistance than I encountered. The school district that hired the mentors would have been uncomfortable with the acknowledgement of this kind of system work since it was not included in the original job postings and it was in “conflict” with their own program of system purchase, First Class. The university instructor would have declined these extra roles added to the position of mentor for it would have tipped the balance of the mentor’s comfort, willingness, and abilities. Yet, to have this work of translating and bridging the technical infrastructure to the content or users remain tacit became not only a disservice to the mediators/intermediaries, it became a challenge for accurately tracing the socio-technical operations of the EdX network.

PAR was meant to elicit and acknowledge the participation or work of the end-users but in this PD portal, most of the key actors, the mentors, refuted or ignored participation in EdX. Yet EdX did function, materialize, and produced successful moments of epistemic engagement by teachers. The socio-technical challenge became one of observing and giving equal treatment to the quiet, background, almost tacit, yet significantly important contributions of invisible intermediary work as well as the technical infrastructure. This chapter works to mainly examine this crucial social intermediary work played by the various actors in the technical portal of EdX.

*Using EdX*

The participation by the mentors and the teacher-mentees on EdX was completely voluntary with no reward of credits or program recognition as a technological application for project work. Every discussion that occurred within the EdX portal and all of the resources
that were contributed by the users were truly intended for lifelong learning and the users’ own intellectual curiosity. The institutional setting or organizational program did not actively support the users spending time on EdX in the manner that might be pursued in corporate settings, where administrators might recognize and reward employees for contributing to or participating in designated knowledge management systems. This lack of an incentive to use EdX was both an obstacle to the utilization of EdX, as well as one of its greatest virtues. EdX was truly an instrument for intellectual pursuits and for potentially building an epistemic community, as part of a teacher’s lifelong learning.

Perhaps, needless to say, without explicit incentives or rewards, very few mentors in the diploma program made the effort to encourage their mentees to participate in discussions, or, made the effort themselves to contribute resources to the shared digital repository inside EdX. The mentors did not use the portal as a means to overcome the distributed nature and distance between themselves and their mentees. Many mentors complained over the course of the two years that they rarely saw or communicated with the teacher-mentees except at demonstration time when assessing credits. However, there was one mentor among the eleven who contributed resources, initiated EdX discussions and, through her modeling and enthusiasm, convinced a core group of her mentees to participate in several EdX discussions. This mentor, Deborah, invited me to work-in-progress sessions of her teacher group at different points in the diploma program, as well as to final demonstrations of her mentees’ competencies earned through their projects, and to participate in some of their online discussions.75

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75 These face-to-face visits and online discussions included the following periods: Fall 2000, Winter Term 2 - 2001, June 2001, August 2001, August 2002.
Deborah was different and distinct from the other eleven mentors in the university certification program due to a variety of factors. Deborah was one of only three female mentors. In the initial, institute/program planning, mentor meetings where we shared our histories and examined the role of mentoring in teacher education, Deborah did not identify her role as teacher or mentor in the same technical or technology-enabled terms as most of her male technicist colleagues. Instead, Deborah spoke of her commitment to and teaching identity in the following terms: she was committed to teaching primary grades; she believed in the increased expression of children's ideas, creativity and imagination through artistic and multimedia representations; she believed in following children's interests and conceptual explorations; and, she was the only mentor who had sought and completed a Master's degree in education. Deborah was certainly intellectually engaged in her teaching and understood the benefits of an epistemic community for professional development before she even began mentoring in NETTL.

There were two other mentors out of the group of eleven who contributed resources to the shared content repository of EdX, but who did not attempt to create any online discussions with their mentee groups or who did not direct their mentees to resources on EdX. Deborah and her group became the case study of participation, usability, and seekers of affordances in this portal, as they actively used and supported EdX. I do not wish to emphasize this case study as an individual anomaly, a rare heroic act of individualism that leaves my question of the purpose of education portals or portals at an individual level of analysis. The case of Deborah's group (being the only one out of a cohort of eleven mentor groups to actively participate in EdX) demonstrates how the social-institutional apparatus of the course, the credits, incentives and rewards, can make a significant difference in the
implementation and use of the tool. The importance of these institutional-infrastructural motivators (such as granting marks for participation) is dramatic when we compare the rate of participation of EdX with the first case study of Ed. Studies on-line (Chapter 6). In the CITE PKP-VanSun study, 100% of the 36 pre-service teachers accessed the PKP portal at least two times during their 2 month project. Of these users, 90% posted a direct hyperlink to a PKP-VanSun resource as well as quoted a section of the document to support their discussion posting. In EdX, after 6 months, only 5 mentors of the total 11 were logging on at least once a month. For the total NETTL cohort, the rate of use after 6 months was a total of 12% of the teachers logged on at least once a month. The numbers are lower for the contribution of resources to the EdX repository (only 3 mentors contributed resources) and the number of posted messages in the discussion boards (only 1 mentor group initiated and used the discussion boards with her mentees for a rate of 6% of the EdX teacher user group).

The low rate of use could be attributed to the question of organizational support of the EdX implementation: the majority of mentors recognized and quickly ascertained this tool and its long-term implementation unsustainable. They understood that new IT applications would quickly disappear if not bought, endorsed, and supported at the school district level. They recognized the rippling effects that a tool of this sophistication would cause and the requirement of hours to themselves, and, in support of their mentees, to learn to navigate it effortlessly and effectively, hence transparently. They intuitively understood that their individual costs of time and effort would not be matched by any organizational commitment by the district. They knew there would be no rewards and they became reluctant to use it, indeed! And their reluctance matched the reluctance of the university instructor to organizationally locate and support the tool through diploma credits. And this reluctance was
matched by the school district administration that were reluctant to endorse or even mention a prototype that was not their product of choice or purchase, and that might one day have a had a price tag associated with it.

Despite these conditions of reluctance and resistance surrounding her, Deborah still saw significant value in the use of EdX for her teacher-mentees’ learning, expansion of ideas, and support for the articulation of their questions and project formulation. The EdX portal matched Deborah’s definition of what intellectual or epistemic support she needed as a mentor and the need for a knowledge network in her work as a teacher-educator.

*Knowledge Work on EdX*

The three discussions that Deborah initiated on EdX and moderated were all similar in form. Deborah would initiate the discussion, set it up in the EdX system, invite her six mentees as well as invite me to participate. She would select the topic based on what she believed would be the most compelling issue/topic that had emerged from their face-to-face meeting and open the conversation with a statement or question pertaining to that topic. And she would reference electronic documents to support and footnote the conversation.

In one discussion, echoing an objective and competency of the diploma program, Deborah wanted the teacher-mentees to engage in ongoing reflection on the educational purpose of technology. She wanted to counterbalance the tendency and tone in this and many educational technology programs of a concentrated focus on technical skills. In this first discussion, Deborah lists eleven prompter questions that she believes will be useful as a template for the teacher-mentees to engage in a depth of reflection on their professional learning rather than mere technical skill acquisition.

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76 The NETTL course requires teacher-students to account for their self-learning, self-study and acquisition of competencies primarily through teacher reflections recorded on templates, through journaling, and other means of collection. This reflection becomes evidence of their learning and the means to acquire program credits.
DISCUSSION: *Creating an overall reflection of your learning this first Term.*
Deborah, October 19, 2000

SUMMARY: Here are some questions to ask yourself when you are beginning to plan how to submit a synthesis of your learning this first term.

REFERENCES [documents for background reading]
- Teachers Connect Online: Professional Development Through Collaborative Networks, n/a, December 21, 1999, Lisa Korteweg

Deborah: Questions to think about.
What competencies have you addressed?
What proof do you have of these competencies?
Summarize what you have learned. i.e. How has the learning gone beyond technology?
How did I learn? The processes.
Why is this learning important to me? This is an educational purpose.
What am I planning to focus on next?
Am I ready to begin a draft of my new Learning Plan?
Is there an educational purpose to my next learning Plan?
How would you evaluate the quality of your learning? What criteria have you set to assess your quality of learning?
What did you learn as a technology user?
Lots to think of. Now is the time to begin drawing your first term's work to a close. don't Panic, though!!! We will talk about all this next Thursday from 4 - 6. We could go later and go out for dinner or have pizza in. I'm looking forward to learning so much myself from all your Journeys. I know we could all benefit from group presentations.

REPLY: Jaye
The first part of this journey has gone so quickly. As I ponder the questions posed, my mind is full of ideas and comments. I think it would be helpful as a group, if we discussed some of these questions at our next meeting. (That is probably your plan) It is helpful to know that our thoughts are shared or supported within our group. I'm looking forward to sharing these ideas and learn more from our group. Jaye

REPLY: Deborah
I have always found ending a project is more like a gateway to a new one! I hope that everyone has enjoyed there first term journey. The Horizon's conference is great! Meeting, talking and sharing with people is always such a wonderful learning experience. See you Thursday!
Deborah
Deborah helped the teacher-mentees realize that reflection is an ongoing process and that it can be optimized in a social, collaborative, epistemic setting. Deborah and her teacher-mentees believed in the give-and-take of ideas in their collaborative face-to-face settings.

This teacher-mentee, Bettee, states the appreciation of this process and locates her own examination on how she best reflects.

**TOPIC: Reflection**

**Bettee**

As always after conferencing with you Deborah, I leave filled with many more possibilities. I'm realizing that reflection time is just as important as engaging in the "task". Tonight I've been sitting with my thoughts and thinking of ways to deliver my group presentation. I forget that the creative process does take time and like art, it usually comes together when I am relaxed and 'playing' with my ideas and having fun. As far as discussion topics? I would still love to look at your KidPix (cdrom) presentation given the server did not cooperate that day. I just love a presentation to get the juices flowin' for others. Group discussion from viewing your work would be beneficial...

In these discussion quotes, we can follow the powerful effects of mentoring mediation by how Bettee loves and is inspired by Deborah’s presentation. EdX became a place, a new mediation space, where ideas and impressions can be shared, and a gateway for individuals to consider offering “their” presentations. Bettee wants to see Deborah’s KidPix presentation and want to continue with other presentations of new ideas for her own learning.

The portal opens the door for exchange of presentations and ideas by permitting presentations to be stored and housed in EdX, easily retrievable, and the submitter’s name highly visible for greater ownership.

In another discussion, other documents were referred to that existed in the EdX content repository. Users had the ability to insert the hyperlink into the discussion messages. Readers could then click on the link for a view of the document while they were participating
in the discussion board. There was no technical need to exit the system or open a new browser window.

Since you are a group interested in multimedia, I thought you might enjoy looking at this article in EdX Multimedia and Multiple Intelligences
Just click on the underlined title (a hyperlink) and it will take you to the article. When you are finished reading it, just close the EdX document window and you will be back in this discussion.
Good luck to everyone. Lisa

REPLY: Deborah, August 22, 2001 08:22 PM
Lisa, Howard Gardner's work on the Multiple Intelligence is important research to consider when designing and implementing new content. Learners learn differently. Options are important. Much like in this diploma program!

REPLY: Jaye, August 23, 2001 02:46 PM
Lisa, Thank you for the time and energy you spent with our group [Deborah’s] in order for us to reach the level of understanding that we have reached. What a fantastic system [portal]. There is so much that it offers! What a treat to be in this system [portal] and have the opportunity to access its information. Thanks again! Jaye

Deborah also used the EdX discussion boards as a means to give a mini-course or just-in-time learning sessions for her teacher-mentees. In this case, the topic was sharing ideas for upcoming field studies, the longer term, in-depth studies of the educational purpose of technology and the social issues arising from the application of tools in classrooms.
Deborah began by inviting the mentees to read and visit Ricki Goldman’s MERLin site for technical tips and skills for capturing images of students and classrooms immersed in the use of educational technology as well as what a digital ethnographer can do with these images.
Deborah was trying to introduce her inservice mentees to the idea of ethnographic research as a means of conducting and framing a field study.
The purpose of sharing collaboratively
SUMMARY
This is a conference where we can discuss our upcoming field studies. We can share and extend ideas. Check out the MERLin site for ideas of how to use digital pics and movies in studies of classrooms.

For details, click here
REFERENCES
• MERLin Articles & Reports - UBC, November 26, 2000 Submitted by Deborah
• Ethnographic Methods in Educational Research Articles & Reports - November 26, 2000 Submitted by Deborah
• Data Analysis in Ethnography Articles & Reports - University of Pennsylvania, November 26, 2000 Submitted by Deborah

Projects@Educators' Exchange
The purpose of sharing collaboratively
TOPIC: 2nd term
Deborah, November 27, 2000 08:03 PM
Here are the university instructor's words about field studies for second term. Please refer to the program resources to check how to write up your field study proposal. Lisa said she would look for some sites that may have some ethnographic examples. Download [sic] your form. Remember [sic] that it must answer an educational question. We are all on the right track, but we need to refine the wording of field study proposals.

REPLY: Guiding Questions
Lisa Korteweg, December 06, 2000 02:03 PM
Guiding questions to help develop an interest into a field study may be helpful at this time. Remember, the distinction of a field study is that it must have an educational focus and purpose. Deborah and I thought a field study could be a type of ethnographic research. The basic point of ethnography is to study and gain insight into the educational worldview of a group of people or students through thick descriptions. Common formats for guiding questions might be:

1. How do a particular group of students perceive of or understand a certain social or cultural phenomenon? (This is often seen through behavior of some kind.)
2. Example: How do active primary students in inner-city "Stanton" (fictional name) conceive of and negotiate the idea of a computer professional?
3. How is a certain social or cultural practice socially constructed among members of a certain group?
4. Example: How do students in a computer club control access to computers for students at lunch hour? And what happens when a new protocol is introduced such as 50% of the
computers must be occupied by girls?
I would be happy to help any of you try and answer these questions inside your own particular interests.

REPLY: Guiding Questions
Deborah, December 06, 2000 08:10 PM
Lisa, Thank-you for modeling some questions for an ethnographic field study. I know they will be helpful.

REPLY: Guiding Questions
Janice, December 06, 2000 11:40 PM
Thanks for the sample questions Lisa. I think this will help me in the wording of my field study question.

These suggestions regarding field study question formulation as well as field study methodology were given through EdX and then discussed by the teachers at their next mentor group face-to-face meeting. Though I was not present at the face-to-face meeting, I heard from Deborah that she was quite pleased with the question design by the majority of the group, in particular with those mentees who participated on EdX. This direction and depth of study by Deborah’s mentee-teachers was in sharp contrast with the other mentor groups. During the November mentors’ meeting, the main issue of the meeting was assessment of credits for the teacher-students first major assignment. One mentor, in particular, was concerned that his mentees were gaining credits for what he perceived as little work because the mentee was working on a software application that would have taken him only fifteen minutes to master. The NETTL instructor, Chris, asked about the educational or implications for classroom use of the application by this teacher to which the mentor replied that his teacher mentees had to first learn the programs. His complaint was that this particular mentee had obviously spent little time working in contrast to another mentee, in the same

77 Email correspondence, December 2000.
78 Fieldnotes from mentors’ first term meeting, October 26, 2000.
group, who had learned every feature and command in a word processing program, from the user manual. The tension of this course became clear through the exchange between this mentor and the instructor: mastering technology for technology's sake or learning a program with an educational purpose or application in mind and articulated in the field study question. It became apparent that Deborah's teachers were already conceptualizing a different kind of assignment or study than a strictly technical one because they were already beginning to probe further into the social and educational meanings of these technologies inside classrooms through the example of ethnography.

*Connecting With a Researcher and Research Methodology*

While these discussions with Deborah's group were interesting and informative, they did not attain the seminar quality of the discussions that were part of the Educational Studies Online case. While Deborah's mentees did some reading, they did not refer directly to articles or resources in their postings. They also did not discuss the readings in any detail rather they used the discussion forums to reinforce ideas of supportive and collaborative epistemic community.

When I attended the diploma program's final Demonstrations Festival (July 2002), I had the opportunity to view three sessions of final presentations by three different mentor groups. In two sets of presentations, I listened to one teacher list approximately 20 technical requirements needed to produce an end of the year slide show for a final school assembly and I listened to another presentation where the teacher-presenter described a litany of technical obstacles to post student work on a class website. In both cases, the teachers described their newly acquired computer trouble-shooting vocabulary and their relationship to technology as

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79 Fieldnotes, July 7, 2002. I viewed one group's presentations before the presentations of Deborah's group and the second set of presentations I viewed after Deborah's group.
one of infinite patience, hyperbolic learning, and near exhaustion. I was left wondering what these teachers had gained other than a weariness and wariness of the technical demands of computers in the classroom.

The presentations by the teacher-mentees in Deborah's group were distinctly different than the other two sets of presentations. First, these teachers did not dwell on the technical hurdles and problems for the majority of content in their presentations. Deborah's teacher-mentees began each presentation with the educational question that they were pursuing in their studies from the effectiveness of digital music composition to the enhancement of abilities of Grade 2 children to participate in critical thinking tasks with KidPix. I was surprised by the quality and depth of thought given to the educational significance of these technologies in use by the majority of teachers in Deborah's group as compared to the other mentor group demonstrations. Each demonstration of Deborah's group focused on a situation of children expressing greater cognitive depth and intellectual engagement than the teacher had encountered in non-technological or non-multimedia curriculum situations. Each demonstration concerned projects that integrated art forms with multimedia (from KidPix slides by Grade Two students demonstrating their creative-critical thinking to planetary poems accompanied by drawings as a virtual exhibit by a Grade 3 class). Deborah's group had coalesced around the theme of how to capture young children's thinking and experiences through multimedia images and then, as a teacher-researcher, how to capture images of young children engaged in that exploration, engagement, and learning.

One presentation by a teacher-mentee, Janice, from Deborah's group presented me with the realization that online resources and discussions can plant epistemic connections between teachers and research texts that are used and implemented in classroom practice.
Janice’s presentation was a detailed in-depth account of how she attempted to research her own teaching and follow her students’ ways of using images to describe their thinking by following a video ethnography framework described by Ricki Goldman in her book (and website), *Points of Viewing* (1998). According to Janice, this framework consists of the following elements:

- Have children capture video footage.
- They speak about their video.
- Speak to their own and others’ video representations.
- Give opinions about how this collective bank of images/representations makes them re-view the topic or question. (Fieldnotes, July 8, 2002)

In interviews with Janice and Deborah subsequent to Janice’s final presentation, we discussed how Janice became interested in the ways in which Goldman’s work could be used in her classroom. Janice’s classroom is 80% ESL with many new immigrant children in a suburban school. As Janice states: "I'm living with this [diverse, conflicting cultural representations and images presented by children] all day long in my teaching." Janice was perplexed and driven by a desire to know "what do these children understand of their lives – some very traditional cultural lives - and at the same time being located in a suburban Canadian school where many different types of cultures and cultural values mix and interact.” Through considerable deliberation, Janice worked out with Deborah that what she really wanted to achieve in her field study was to look through her students’ eyes, to see the world in their way and from their points of view (-ing). Deborah believed Goldman’s work would make an important connection with Janice and could best inform Janice’s thinking.

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80 The longest in-depth face-to-face interview with both Deborah and Janice took place in a Starbuck’s café on a rainy afternoon in February 2003.
about these issues for her field study proposal. Deborah first introduced Goldman’s work by posting Goldman’s website link, MERlin, on the first term EdX discussion board on the consideration of ethnography for formulating a field study question. EdX permitted Deborah the easy means to share Goldman’s Internet resources with the group as well as contextualize Goldman’s approach for the group’s own work inside a discussion as one of the reference sites. Deborah then brought Goldman's book to the second Summer Institute for Janice to borrow and she again referred Janice and the group to Goldman’s web site, catalogued and accessible through EdX.

Janice's first self-directed assignment after the second summer institute was to present images that children took during a field trip. In Janice’s words, the purpose of this field study was "honouring and assessing what children capture as images." Janice wanted to involve her students in meaning-making by imitating the pedagogical promise of Goldman’s Constellations model, without access to these sophisticated tools. Janice wanted her students to achieve the following:

- Create images.
- Speak about their images.
- Speak to their own and others' images in textual form.
- Give opinions about the other images and how this collective bank of images/representations makes them re-view the topic or question. (Fieldnotes, February 11, 2003)

What made the work of Goldman more meaningful for Janice was that she experienced a type of “theatre de preuve” (Latour’s term for a demonstration of proof) in her own classroom work. Janice experienced Goldman’s theories as workable and cognitively
successful when she attempted to film her students, cloistered away in a quiet hallway, to achieve better sound quality for an i-movie presentation. But the context for the filming resulted in her students not elaborating their ideas, not divulging much detail but rather becoming silent, timid, out of context. However, back in the middle of the classroom activity, the students freely articulated their ideas and comments using the digital tools. For Janice, it was a replica of the teaching situation that Goldman had observed and described in her research with her own students. The intense business and verbal atmosphere created an enhanced situation for freer, greater expression by the students in front of a camera and microphone. In the quiet hallway, the students were not immersed into verbal, expressive activities by the energy of the classroom and their classmates. In this cloistered situation of the hallway, the emphasis became the recording devices and the inscription activity rather than the expression of ideas. In the hubbub of the classroom, the recording technologies became part of the furniture and the children were consumed with describing their science fair ideas for future projects through the detail of their poster drawings. Janice was impressed that Goldman’s findings, that multimedia activity is enhanced inside the activity of the classroom, had been replicated in her suburban, multicultural school and she became convinced of Goldman’s multimedia framework’s merit. Janice became convinced that Goldman’s framework and Internet publications, accessed through EdX, referred to more than once or contextualized in EdX, was indeed applicable and usable in her own teaching practice.

What also impressed Janice was the personal-professional connection Deborah had made with Goldman. Deborah had invited Ricki to her classroom and to accompany her and her students on field trip excursions to sensitive ecological areas. Ricki Goldman did indeed
come, and it was apparent to Deborah that they shared a similar vision of primary education, multimedia and artistic representations in the curriculum, and the use of digital tools. The "sustained interactivity" (Huberman, 1999) between Deborah and Goldman had influenced not only Deborah's classroom teaching but also Deborah's teaching of these mentees.

Janice also stated that she appreciated how clear and articulate Deborah was in her interest and focus as a mentor, right from the first day of the first Summer Institute. In an interview, Janice described how the mentor group and Deborah worked well together because they formed an epistemic community (they wanted to express their ideas, connect with and extend each other's ideas) and recognized common interests around the pedagogical purpose of capturing children's representations (whether visual drawing, music composition, or video clips). Deborah's group seemed different from the others because they viewed themselves as a cohesive group or epistemic community through this expressed interest and intentional purpose in a topic that extended beyond the technical realm. Deborah was also very committed to a vision of teaching that used representations, electronic and artistic, as a means of permitting children's ways of seeing the world. She was a strong advocate of this kind of pedagogical exploration and teaching and EdX was able to support her in this advocacy and teacher education. EdX is a flexible knowledge management program, relying upon users to up-loading their own preferences of content. Deborah was able to tailor the content repository to match her teaching philosophy, the needs of her mentees, and the topics emerging from their regular face-to-face meetings.

When an epistemic community or a community of practice (Wenger, 1999), such as the Deborah mentor group, is centred on a pursuit of practice clearly defined, knowledge is defined and received more readily. Members are open to engaging with external research on
the topic and they attempt to connect it to their classroom practice. Deborah’s group took great support from their fellow mentees as they taught in isolation from one another, in different schools with different staff cultures, who may not have valued the same questions or pursuits as the epistemic community in their group. Even though each member’s project, topic, grade level or medium could have been quite different and the subsequent adhering technical problems complicated, the members knew each other’s projects intimately and were willing to support each other in the quest to make it a successful experience. They also knew that there was knowledge, public knowledge on the Internet, supporting their approach to educational technologies because they had access to it through EdX. EdX served to erode the isolation that teachers often experience as they attempt innovation or changes in their practices.

Knowledge traveled and knowledge stuck in this epistemic group, and the EdX portal served as a complimentary space for multiple knowledge sources and as a place where knowledge could be contextualized. Members helped each other with analog/digital conversion problems (the technical) as well as encouraged each other to pursue the goal of letting children create their own digital representations of their work (the conceptual), motivating each other to work through any technical obstacle for the conceptual goal (the socio-technical). Deborah and Janice brought the ideas of Goldman’s approach to multimedia teaching and research to discuss with the group, both in a face-to-face context as well as through the EdX references, and each member felt reassured that they were going somewhere educationally significant and valuable with their course work with children, rather than simply in their acquisition of technological skills.
Once a level of epistemic engagement was acknowledged as important and established in this mentor group, then ideas from the outside of practice (from the outside of these teachers’ own classrooms) could be carried inside to their practice. Accessibility of resource documents through EdX enabled interactivity with research ideas. EdX was a portal resource waiting to extend any mentor group’s conceptual abilities, their epistemic resources, and their depth of engagement beyond what these groups could have achieved on their own in face-to-face meetings. But the critical factor in this chapter is that EdX could not move into this epistemic relationship or conceptual exchange with the mentee-users on its very own technical means. It needed a social, human intermediary –Deborah- to bring these human actors –her mentees- into epistemic relationship with the EdX portal.

Similarities Between the Cases: Findings from the Comparison of Two Portals: PKP-VanSun and EdX

The two cases described in these two empirical chapters, Ed. Studies Online with Caroline (Chapter 6) and EdX with Deborah’s mentee group (Chapter 7), stand out from the rest of the discussions in each portal. While each portal addressed a different cohort of teachers, pre-service and in-service, they had similarities of purpose and intent. Each portal was attempting to provide intellectual or knowledge support to an exploration of issues concerning technology and education. Moreover, both portals shared many of the same documents and resources in their resource databases. Each portal also supported a program of study. In the first case, Ed. Studies Online, it was a social foundations course for the 12-month teacher preparation program. In the second case study, EdX, a two-year program of self-study research projects for teachers to increase their technology skills in the classroom and to gain a specialized diploma.
In the first case study, the pre-service participants seemed intent on understanding what could constitute important professional routines in the classroom or the lab. They were curious about the code of practice that teaching could entail. The pre-service teachers were asking Caroline to elaborate on the routines that she was implementing in the school computer lab in order to shuffle and rearrange the gender practices. They wanted to examine alternative routines to what they had experienced as students or had observed as pre-service teachers. In the PKP-VanSun portal, pre-service teachers were attempting to understand how their previous five years of university study would translate into routines of practice in a living classroom. They were motivated to pursue how their identity and roles would emerge in this new situation of educational technologies practice. And they wanted to test how prepared they were to take on the roles and the socialization of a teacher given the knowledge and preparation they had received in their teacher education program.

In the professional diploma (NETTL) example, in-service teachers were attempting to understand how new technologies could be integrated into their own classroom and curriculum. They were working to construct an identity and role as a teacher working with educational technologies and they were adjusting or shifting their identity in the face of integrating these new tools into their established practices. These teachers were in-service teachers, already routinized and socialized into the professional practice of teaching. But they were entering a risky stage of learning where they would be exposed to problems or new “puzzles of practice” (Munby & Russell, 1990) as they engaged with technological tools in the classroom. Depending on the mentor, these in-service teachers were offered a program designed to engage them in a process of reflection, on what technology would imply for their
teaching practices and their self-directed study of themselves as practitioners teaching with technology.

The in-service teachers in Deborah’s group were merging two critical concerns or complaints related to their ongoing practice. They wanted to give the arts a greater prominence in the expression of the curriculum through their teaching and by their students and they wanted to understand how technology could help them achieve this kind of work. These weren’t puzzles but rather social perceptions of isolation as these teachers felt often misunderstood, unrecognized, and, unsupported in their schools for their efforts to nurture artistic expression by their students as a legitimate way of stating their ideas. Feeling isolated in their schools for the kind of artistic integration in the curriculum that they wanted to achieve, Janice did not want to take on any more “controversial” topics such as gender and technology, as she felt judged enough by her colleagues in her school. She was searching for a question and a focus of study that was meaningful to her goals of culturally sensitive approaches to teaching that would not give her a controversial identity amongst the staff in her new school. EdX was able to give Janice a broader contextualized view that her work, her approach to teaching was not unusual but tapping into a field of work.

Deborah’s mentees were also marginalized (and, consequently, stronger in their convictions about their technological work) as some NETTL mentors and teacher-leaders in this school district believed computers and educational technology did not belong in primary grades. Thus, these in-service teachers had two simultaneous struggles that they were engaged in pursuing through their diploma work: technology in the primary grades (for greater conceptual expression by their students) and the recognition of the arts as an important medium of expression.

81 Interview transcript, February 11, 2003.
All these factors contributed to the emergence of these two discussion groups as important, revelatory cases to investigate and consider in the use of teacher professional portals. What I determined was that there was something different about the level of connection and knowledge probing in the cases of these two teacher-educators and their discussion participants. What I wanted to understand was how these levels of intellectual or epistemic engagement could be the regular, intended consequence of using knowledge portals rather than the exception. I wanted to understand how the PKP portals could regularly serve as the assistance tool or research/resource base in teacher education, in what is still very much a social exchange of people working with people.

The argument can be made that epistemic engagement by busy practitioners is regularly going to be, if not the exception, then not the commonplace. Deborah’s mentor group represented 7% of the total NETTL cohort. This figure can be interpreted as a valid indication of exceptional epistemic engagement. Not all users will be engaged, all the time, but as this figure indicates, EdX did create conditions that fostered this epistemic engagement, though they often worked outside of the system. However, the prevalent theme of this exceptional engagement that emerges in both portal networks is the discussion moderator/mentor who unintentionally and tacitly became the crucial intermediary between the teachers’ questions and needs and the research resources available through the portal’s database. These intermediaries did not intend to act in this manner when they became moderators and the PKP design-researchers, including myself, did not intend for human actors to take these roles that we had designated for the machine. PKP believed the portal design eliminated the need for any intermediary, the need for any translator between the users and the document resources.
Intermediary Work of Deborah (EdX) and Caroline (PKP-VanSun)

In the post-fieldwork stage, I began to recognize and observe Deborah and Caroline as intermediaries in each portal. I am here following the definition of intermediaries as described in ANT and socio-technical studies: "An intermediary is an actor (of any type [i.e. human or non-human]) that stands at a place in the network between two other actors and serves to translate between the actors in such a way that their interaction can be more effectively coordinated, controlled, or otherwise articulated" (Kaghan & Bowker, 2001, p. 258). Because networks are never completely stabilized, translation is continual. This is the work of intermediaries. The actor-network theorist, Michel Callon, states that "an intermediary is anything passing between actors which defines the relationship between them" (1991, p. 134). Deborah and Caroline were in a constant state of translating the resources of their respective portal or knowledge network and how the resources fit the topic of discussion or the requirements of the program curriculum. These intermediaries defined not only their own relationships with the students/mentees but they were also in a process of defining the relationships between the electronic documents and classroom practice, between the portal and the emerging knowledge practices.

In the cases of Deborah and Caroline, I realized that they acted on the network in an unforeseen and unintended manner but that the network or machine system also acted on them and their methods of teacher education. This is the excitement and revolving door of promising work with early teacher professional development portals and knowledge

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82 Latour's use of the term, intermediary, is to refer to entities that are non- translating, non-mediating, non-effecting and is quite distinct from that of Star & Strauss (2001), Bowker & Kaghan (2000) and Callon. Latour defines intermediaries as "dopes ..." Latour's term "mediators" is appropriate for any entity, human or non-human, that acts to co-constitute the network. Star and Strauss appropriate the term intermediary to bring attention to a type of human and social work that is generally unobserved due to its social and organizational invisibility.
technologies. The revolving door promise of any technology is that with each new tool, we have the opportunity to re-define, re-configure, or shape the social. Hence, with the development of a new tool for teacher professional development, we have the opportunity to shape the course of the field, to shape the new opportunities for teacher's knowledge development. This is the promise that I wished to communicate to the mentors to ensure their participation, their active reflexive PAR in the design and ownership of EdX.

In most ICT research, we do not yet understand what form the conventions and genres of portal or knowledge management tool use will ultimately take. The mission of the Public Knowledge Project consortium is that we are hopeful and we are working to design and test how new educational, Internet-based technologies can leverage a democratic difference. To demonstrate what we achieved, I outline how the human-machine or socio-technical interaction of Deborah/Caroline with their respective portals and epistemic communities created 'leverages' that added democratic, participatory value to the various technical and social functions of the portals.

*Epistemic Leverages of the Intermediaries*

Deborah and Caroline worked the tools, demonstrating the portals' potential, in ways that the other mentor/moderators did not. The network, the technical entity, acted on them and allowed them to perform functions such as citing or footnoting that they would not have been able to do outside the boundaries of this network. For example, Deborah initiated 3 different archive-able, hyperlinked discussions inside EdX. 83 Deborah cited electronic

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83 These features demonstrate some of the sophistication and options designed into EdX. Users could initiate discussions with attached resource references, hyperlink to other resources inside their postings (a technical feature not yet attained at this historical moment in WebCT), and finally, the initiators/moderators of the discussion could decide to close (delete) the discussion at any point or convert it into an archive-able file, catalogued and retrievable from the EdX repository. Through this feature, discussions could become more public knowledge.
documents (usually numbering at least 2) in each discussion forum as she used the
discussion’s opening page to list reference web resources in EdX to support and extend the
discussion. Caroline cited her own personal conversations and visits with Mary Bryson
directly involved in her computer lab teaching.

“Dr. Mary Bryson worked closely with our school to help us identify goals for technology and then to select appropriate software and hardware to achieve them. Conversations with Dr. Bryson helped me to acknowledge the power imbalance that exists around girls and technology, and I tried to ensure that this imbalance did not prevail in my classroom.”

And Deborah took advantage of the technical means to invite an external-to-the-group guest, myself, to inform the discussion and offer any knowledge resource that she did not know of.

“Here are the university instructor’s words about field studies for second term. Please refer to the program resources to check how to write up your field study proposal. Lisa said she would look for some sites [to post in this discussion] that may have some ethnographic examples.”

And the mentee’s responded positively to this increased interaction with an external teacher-educator and researcher in the electronic discussion. One teacher-mentee responds directly to my external/internal participation,

“Lisa, Thank you for the time and energy you spent with our group [Deborah’s] in order for us to reach the level of understanding that we have reached.”

Both Deborah and Caroline replied directly to their teacher-participants’ questions and contributed to the idea construction or deliberation in their respective discussions. For example, in Caroline’s moderated discussion thread, a pre-service teacher responds to her intermediary work,

“Caroline, Thank you so much for responding to all my questions. Your ideas and strategies are amazing, and I know I will remember them when I am teaching.”

Deborah and Caroline engaged in intermediary functions as information brokers and knowledge translators. They added value to the system to the machine, that wasn’t automated
in the design's configurations or pre-conceived in its implementations. I want to underline this point: Deborah and Caroline as intermediaries added value to the portal's network by actively demonstrating its worth to other actors rather than passively finding or receiving value in the system by themselves as solitary actors. These teacher-educators were able to connect needs of the end-users with resources of the system in a manner that the technical system could not perform on its own. For example, Deborah begins an EdX discussion with the following opening statement of purpose:

"This is a conference, [The Purpose of Sharing Collaboratively], where we can discuss our upcoming fieldstudies. We can share and extend ideas. Check out the MERLin site for ideas of how to use digital picts and movies in studies of classrooms."

Deborah and Caroline added trust and human "witness" (Shapin & Schaffer, 1985; Haraway, 1997) to the portal's proof of value, in ways that could not be automated. They mirrored the worth of epistemic engagement that the usability/sociability of this portal's design had been intended to effect with the teacher-users. This labour of witnessing by the intermediaries represents a powerful form of "articulation work" (Star, 1989): the human representative labour needed to make the technology understandable and usable in technical steps and meaningful for a narrative of teacher education through the epistemic engagement of educators.

Deborah and Caroline became teacher-educators in ways permitted by the PKP tools that they had not engaged in before. They performed intellectual connections through the resource hyperlinks that were material and accessible on the screen where teacher-users could not only see or access the web resource but the meaning of these resources were applied to their own teaching. For example, Deborah reflects on the meaning of a
researcher's work, on its usability in her teaching and in the context of this teacher education program.

“Howard Gardner's work on the Multiple Intelligence is important research to consider when designing and implementing new content. Learners learn differently. Options are important. Much like [my teaching] in this diploma program!”

And Deborah's example did not go unheeded. Most of her mentees' final demonstrations of study (July 2002) included references to Gardner's ideas of multiple intelligences as a rationale for the integration of the arts and technology.

Deborah and Caroline connected the inside/outside of the classroom and their teaching with accessible, usable research(ers) through the PKP portals. For Caroline, a pre-service teacher directly asks her to respond to how she handled Bryson's questions and outside perspective into her own teaching, observations, and reflection.

“Caroline, I am also interested in hearing about the specific changes you made to your teaching style and the selection of models and mentors you made in your classroom. Also who did you allow access to in the computer lab at lunch and recess? Did you permit those students who showed initiative and productive working habits, or did you allow access to those who did not have computers at home? What were your strategies …

Or in the case of Deborah, a teacher-mentee responds positively to the impact of Deborah sharing and modeling her own experiences with research, ideas and usable application to the classroom.

As always after conferencing with you Deborah, i leave filled with many more possibilities. I'm realizing that reflection time is just as important as engaging in the "task" [the assignment prescribed by the program].”

The two teacher-educator intermediaries became public in their support of teachers' interpretations and ideas, in their own teaching and in the articulation of their reflections. As Deborah stated, "It is helpful to know that our thoughts are shared or supported within our group.” Deborah and Caroline posed, explored and articulated half-formed questions/observations with their discussion participants. For example, Deborah states,

“How did I learn? The processes.
Why is this learning important to me? This is an educational purpose.

What am I planning to focus on next?"

The two mediators solicited peer review or community feedback in the process of these discussions and knowledge exchange. Deborah asks, “How would you answer these questions? Please come prepared to discuss these at our next meeting.” And they referred to and reflected on their own observations and practices. Deborah refers to her own reflections on how she best learns as a teacher.

“I have always found ending a project is more like a gateway to a new one! I hope that everyone has enjoyed there first term journey. The Horizon's conference is great! Meeting, talking and sharing with people is always such a wonderful learning experience.”

To summarize these instances of knowledge intermediary work, the portal permitted and leveraged a type of teacher-educator interaction or knowledge engagement by these two intermediaries that the other moderator/mentors did not demonstrate. The other moderators/mentors hadn’t realized or imagined this type of mediation work from the technical side, from the portal design or the narrative of participation exemplified by the portal’s usability. From a social explanation, the other moderators/mentors may not have had their own prior experiences of direct researcher contact connected to their classroom practice, nor did the NETTL mentors have the graduate education, centred on the importance of building upon external resources and research, that both Deborah and Caroline had achieved. More reasons for the other mentors not taking up the potential value of the portals in their teacher education work will be discussed in greater detail in Chapter 8.

Problematic Costs of Intermediaries and Portals

This chapter yields several important themes, exemplified by the experience of Caroline and Deborah as they negotiated their moves from classroom practitioner to
translator or intermediary in an electronic teacher education setting. Taken together, these central themes are organized to highlight key problematics of portal or digital epistemic engagement that beginning portal moderators or participants may experience as they work to connect or network between the actors of texts (knowledge), the participants (people), and the technology (new tools). These themes or considerations of epistemic connection and engagement in portals are instructive for designers of future portals who will need to consider these social factors to design an intellectual digital space for teachers and researchers in education but who may find it problematic as these human costs have usually been ignored.

As Deborah and Caroline’s work demonstrates, research becomes accessible and meaningful when a skilled intermediary helps the practitioner make connections to the research and readings. Skilled intermediaries in these portals were teacher-educators, not classroom teachers or researchers outside of classrooms. Caroline and Deborah had interacted/engaged with academics in conversations about common interests (common interests, problems, campaigns) outside of course requirements or university instruction. These academic-researchers, Bryson and de Castell, as well as Goldman, had engaged in conversation with these teachers in their sites of practice while the researchers had been involved in fieldwork.

Face-to-face interactions with researchers made the portal research texts meaningful to the intermediaries in a manner that the portal designers did not anticipate. As teacher-educators (in portals), the intermediaries had the technical means of connecting texts to users—uploading the work, direct link to the full-text document—which translates into a commodity view of knowledge as comprised of discrete units. Through the portal and its digital repository, non-human intermediaries, such as the “agents” of ongoing searches in
EdX, could connect the teachers with the unit of knowledge, the article, and state “here it is, now read it.” This technical intermediary would offer a step-one in the access to knowledge. But if the interaction would stop here in the encounter of machine delivery to human user, it would be a zero-sum transaction. Instead, these skilled human intermediaries, Deborah and Caroline, understood how to encourage emotional investment, practical connections, and most importantly, epistemic engagement with these texts. By presenting, explaining, and describing how the texts worked for them personally inside their practices as a teacher, Deborah and Caroline as intermediaries gave “I” witness to the authority/validity of the document and its concepts. It was their vouch, their witness for this research informing their own learning and practices that made the portal participants want to read the documents/ books, engage in discussion, and, use the ideas in their practice. In the portal connected discussions, the teacher-educator intermediaries made visible and explicit the importance of these research texts to their own understandings of themselves as teachers and the work of teaching. Caroline and Deborah gave testimonials: they gave explicit witnessing of the value of these texts or frameworks to their curriculum design, student observations and the reconsideration/reorganization of their practical work as teachers.

Deborah and Caroline, as intermediary participants, and their invisible yet critical knowledge work of connecting teachers with research and researchers has demonstrated that professional development portals may be new technologies but they still reflect and contain old social relationships, particularly in the intersection of research and practice in teacher education. In this study of human intermediation in the PKP portals, I observed much social labour of interpretation, reflection, connection and extension of ideas by the two
intermediaries to establish the value of research knowledge in teacher practices as well as demonstrate how teachers can educate from theoretical models.

Trust in the intermediaries' knowledge connection work had to be first established by Caroline and Deborah telling their own stories of being there (Geertz, 1973): being in conversation with researchers, being in the classroom, being a teacher, being a technology integration specialist, being through the same observations and experiences as the teacher-participants or giving them "eyes" into the anticipated situation. This authenticity convinced the in-service/pre-service teachers to trust the accounts of Deborah and Caroline, to trust their interpretations and connections, and to become participants in the PKP portals and their networks. Deborah and Caroline became the reverse of the anthropological idea of "native informants," as they proved to be guides for the natives' [sic] appreciation of the larger educational research community. They are between and betwixt two epistemic communities: the research/university community of teacher educator and the practice world of teacher in classroom. The intermediaries' accounts are valid and authoritative because they are still practitioners with classroom descriptions and observations.

Conclusions

My experiments with these two portals, PKP-VanSun and EdX, attempted to augment and enrich the university-school (academic-teacher) relationship, the sustained interactivity potential (Huberman, 1999), by expanding direct access to each community's knowledge, and, in the process, observe whether a new community of practice would develop or indicate signs of developing. I follow Julian Orr's idea (1996) that communities of practice or epistemic communities arise spontaneously whenever people have common concerns and have a way to share knowledge and I am following Nancy Van House's (2003) ideas that the
digital library has to work in concert with the epistemic community it is serving. (Note: I am substituting here the term portal for Digital Library.)

... it [the portal] cautions us to be sensitive to the variety of communities' existing practices of knowledge creation and work and indicators of credibility. A successful [portal] has to fit with these practices. In particular, the [portal] has to articulate with participants' hierarchies of credibility and processes of establishing trustability for people to be willing to use and contribute to the [portal]. And these vary across communities of practice.

The world and the work that the [portal] serves are continually changing; so too must the [portal]. Its design needs to be deliberately fluid and dynamic, to accommodate emergent work practices, and on-going enrollment and co-constitution. (p. 272)

Many teachers are unfamiliar with these attempts at professional development, knowledge practices, and epistemic community through portals. They are unaccustomed to stating and articulating half-formed questions and ideas aloud and publicly in front of their peers. Many university researchers are also unfamiliar with publicly engaging in conversations with teachers from a distance and in a semi-public manner. They do not know how to make connections between content, tools and services in a portal in order to create an engaging electronic seminar. They are also unaccustomed with other definitions and conventions (other than a university seminar) of knowledge exchange with teacher practitioners. In their work, they are generally accustomed to the conventions and genres of academic work that they observe in their own workplace institutions, the university but which may not exist in the practitioner's institution of the school.

For the most part, academic knowledge is disembodied when received by practitioners as it is often a secondary or tertiary source communicated by an unknown, distant writer. Caroline and Deborah represent the most local, embodied form of knowledge. They can translate disembodied knowledge and give it authority from their own local
examples. In this sense, they co-constitute its meaning and place for the teacher-participants.

The focus in this chapter is the teacher-educator intermediary as I observed the invisible, unrecognized, and unanticipated labour and service needed to move the ideas from documents, move knowledge from articles in the system's database to discussion in electronic forums, and, finally (in the most successful instance) to classroom use and application.

*Sustainability of Portals and Knowledge Networks*

To build a set of social conventions to accompany a technological tool, such as a digital professional development portal, takes a lot of (often invisible) social labour. The recognition of this social labour raises the complex issue of sustainability for knowledge systems or portals. Often, the argument for increased access to knowledge through digital means often pivots on the promise that this access will minimize social and human labour in the process to maximize the already-publicly-paid-for research (Willinsky, 2002). I am not questioning the urgent social need to minimize publication or delivery costs of these knowledge resources, technologically or institutionally, to make them financially affordable to the (educator) public. However, I am underlining the perennial problem in either digital or analog situations to not recognize or to minimize the importance of the social costs of time and energy to participate in the interpretation and deliberation of knowledge by practitioners. Knowledge can be made more affordable through technical means (e.g., open free access to academic journals and digital libraries) but the social affordances necessary for the uptake or participation in these networks by its intended users is another category of sustainability that cannot be overlooked. In this chapter, I have attempted to recover the invisible but critically constitutive events of the technology. Technological competence (in this instance, the
effective and engaged use of a PD portal) is a social competence. A knowledge portal is the product of the effective distribution and filtering of Internet-based knowledge. But, what can be discovered from the cases of Deborah and Caroline is that technology by itself, technical features designed to make knowledge travel, does not always cause knowledge to move or to displace users into relation with that knowledge. Technology has to be viewed as an actor, a fallible actor of weaknesses and strengths, which may be an insufficient force to move all the valuable knowledge to connect to the intended human users. It is the human intermediaries and their abilities to manufacture social force that also need to be accounted for, symmetrically with the technological, for their impact or force on the usability/sociability success of the portal. In this chapter, I recovered the invisible non-technological forces that would redress the regular asymmetry of the technical favoured over the social that is still surfacing in many educational technology experiments and analyses.

To conclude this chapter, I have examined the question of what the intellectual participation of teachers and teacher-educators in discussion through web tools could look like and how it could democratically affect the processes and reforms of teacher education. At this stage, no one can really determine what shape these portals will ultimately take inside a sustained interactivity project of universities and schools, research knowledge and experiential knowledge. In my analysis of these two case studies of portal participation, I attempted to be attuned to the processes of epistemic engagement by the pivotal social human intermediaries inside these environments. In the next chapter, I identify and describe critical points of resistance\textsuperscript{84} that need to be witnessed, observed, and named. In following Latour's strategies, I have the means to cost increased participation, user-ship and ownership of the

\textsuperscript{84} I would like to add one term to the Latourian toolkit for this study by adding the term “theatres de resistance.”
portals without falling back on a techno-determinist argument that suggests it is an all or nothing test of the portal by its user participation.
CHAPTER 8
The EdX Trials

EdX was the most expensive, sophisticated, researched, well-funded, and extensively supported PKP professional development portal at this particular historical moment (2000-2001) of the PKP projects. It was the most participatory and open to user specifications prototype that we at PKP had had the opportunity to implement: it was the most tailored iteration to flexibly match and work for a specific teacher-user audience in a professional development context. But it was found guilty or consistently wanting in its intents and purposes, in its design and infrastructure, before it ever went public or was given the opportunity to “speak for itself” (Latour, 1996).

EdX was put on trial by its key teacher-user actors, the mentors, multiple times in its introduction, implementation, and throughout its short life. EdX failed to convince the mentors of its merits, its contributions, its openness and flexibility, and its critical need for their participation, hence, it became characterized as stagnant, academic, and guilty of discomfort and irrelevance. The primary reason for these trials was the faltering, weak network with its intended participatory users (not with its institutional endorsement by government and funding agencies) because EdX did not achieve the mentors’ trust, use,

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85 I am referring here to the idea of expert witnessing in scientific experiments (Shapin, 1994; Shapin & Schaffer, 1985; Haraway, 1997) that is required before the scientific claim or discovery is considered a publicly accepted fact or achieved black-box status, now communicable to the public. In the case of EdX, the mentors were the invited, special witnesses. If they gave their “approval” or their expert (technical) witnessing to the EdX event—when EdX would speak for itself in a theatre of proof—then the masses of actors they influence (their teacher-mentees, their favourite resources, websites, other colleagues, etc.) would follow.

86 When I use the generalized term, “the mentors”, I am referring in this chapter to the majority of the mentors. The reader will observe that there were notable exceptions inside this social group, particularly in the case of Deborah and her mentee group who continued to actively use and verbally support the EdX portal up to my resignation from the fieldwork and coordination of EdX.
enrollment, and commitment. The chains of association that normally ensue upon enrollment or successful trial, necessary for the strength of a network, were met by consistent resistance and dissent by the majority of these mentor-actors. The jury of mentors either actively condemned the portal to non-use or they passively avoided engaging themselves in its network. In either case, the mentors repeatedly claimed that EdX was an uncomfortable technology for them, for their mentees, for their professional development, and for their school district. Comfort/discomfort became the defining argument and the reoccurring denial for this PKP prototype seeking its social life in one teacher education context.

_Comfort and the Affective States of Technologies._ Comfort is an affective dimension regularly associated with new ICT technologies, particularly when they are seeking a user group. Norman (2004) claims that the affective dimensions associated with ICT use need to be considered more seriously by designers. In education and educational technologies, the thirst for comfort and trust with new technologies by teacher-users, or inversely, a discomfort with attempting an innovation or attempting change associated with new ICTs, seems particularly acute. Bryson, de Castell & Jensen (2001) perceptively point up how comfort has become the predominant rationale for resisting or refusing technologies in teachers’ practices and the classroom becoming almost a tyranny of comfort.

Like an endlessly rehearsed mantra, we hear that what is essential for the implementation and integration of technology in the classroom is that teachers should become “comfortable” using it.

We might well stop a moment and consider the absurdity of such a demand. We have developed a powerful means for reshaping human knowledge, communications, educational structures and relations, epistemic concepts and practices. We have incalculably increased the amount and kind of information available to ordinary people worldwide. We have a master code capable of utilizing in one platform what have for the entire history of our species thus far been irreducibly different kinds of things - writing and speech, images and sound. Every conceivable form of
information can now be combined with every other kind to create a different form of communication. And what we seek is comfort and familiarity?

What about novelty, unprecedented innovation, intellectual challenge, ideological dissent? Why are these sidelined by familiarity and comfort? How is it even conceivable that the latter can stand in for the former? (Bryson, de Castell & Jensen, 2001—emphasis mine)

With any innovation, the intended audience—colleagues or users—embraces the unprecedented and the unfamiliar once they are ready to change themselves (their patterns, beliefs, understandings, accounts of the phenomena). Changing one’s position can be an unfamiliar practice, hence challenging, particularly in a profession such as teaching where the teacher is assumed to hold the intellectual and ideological authority in the classroom. The potential of the Internet to expand the possibilities of communication and information and to expand the realms of intellectual challenge could create discomfort in teaching, a profession already burdened with discomfort and guilt from its open-ended definition (what is effective teaching?), its intensification of responsibilities, and its increasing time demands (Hargreaves, 1994, p. 156). Yet, innovations are created, accepted, stabilized into use, and socially shaped by their users in the process (Monteiro & Hanseth, 1995). Teaching is not immune to this process of technological adoption or these social effects

Socio-technical Trials

Technological innovations and technological designs begin as fictions seeking familiarity or realism in the same manner that scientists’ new discoveries in the laboratory begin as stories or fairy tales (Latour, 1999, p. 122). According to Latour, the story of an innovation such as a portal giving access to usable knowledge or Pasteur’s microbes causing lactic fermentation, these stories do not gain realism until they pass three trials: the trial of a

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87 See Chapter 6, Inverted Hollywood, for a detailed analysis of PKP-VanSun, the first PKP PD portal, seeking realism for its fiction of knowledge heroism in a pre-service teacher education context.
convincing linguistic story (these almost invisible microbes are described in verbal terms that permit the reader to imagine their heroism in creating lactic fermentation); the trial of the things or nonverbal entities in a situation (the things will act accordingly in a laboratory with glassware, yeasts and Pasteur); and, finally, the trial of convincing one’s professional peers of the competence and independence of the thing(s) to act on its own (the ferment will act independently of Pasteur’s imagination and his plottings to show off its abilities) (1999, pp. 122-123). And these three types of trials need to be aligned, one to the other, in order for the scientific or technological event to gain realism through its chains of association and enrollment with its actors.

In the event of EdX, PKP began with a heroic narrative of EdX giving teachers access to usable research as well as access to an educational epistemic community to support the professional development and change of teachers as they begin to question their practices and classroom technologies. It was an empowering story of connecting and presenting different forms of knowledge in this new digital medium “to support teachers’ interests in understanding and using knowledge” (Willinsky, 2000, p. 223). In order for this story to gain reality, EdX had to go through a series of trials, preferably trials staged by its designers, to demonstrate EdX’s mettle to its users.

Latour (1999) states “there is no other way to define an actor but through its actions, and there is no other way to define an action but by asking what other actors are modified, transformed, perturbed, or created by the character that is the focus of attention” (p. 122). Unlike Pasteur’s microbes, EdX involved the very actors meant to be its third trial, its audience. In defining EdX as the actor of the focus of attention, as the heroic character of the story, EdX would need to modify, transform, even, perturb its participatory users (p. 123). In
order for EdX to concretize its social life, it had to gather the participation, commitment, support and displacement\textsuperscript{88} of its users, particularly its key stakeholder mentors. Unlike the scientist in the laboratory conducting an experiment, we at PKP needed our participatory actors, the mentors, to be both transformed by EdX into spokespersons as well as remain critical testers of EdX's actuality with and for teachers. We needed the mentors to test and determine that there was a real situation of concrete actions constituting and emanating from the portal, that EdX was more than just a showpiece story from the university, and that it would exist and function competently without my work/presence or the work/presence of PKP.

And in the EdX phase of the PKP PD projects, I discovered something relatively unacknowledged in many socio-technical studies. For EdX to work or gain "force" or "strength" as a network (Latour, 1987, 1992) with teachers, it had to provide not just access and usable knowledge in its independent competencies with the mentor participant-testers, but it also had to provide and pass the trials or tests of comfort. EdX needed to provide attainable states of comfort for its user-testers, the mentors: 1) comfort with the assembled group of users or community; 2) comfort with the technology's attention to and value of local user knowledge; and, 3) comfort with the infrastructural demands through technical simplicity or transparency\textsuperscript{89}. These three issues of comfort are the three levels of EdX trials plotted (unconsciously!) by the mentors in order to gauge the overall level of compatibility the portal had with the NETTL program's intentions and teacher education curriculum. The

\textsuperscript{88} The term displacement carries a particular definition in socio-technical studies. The displacement of one actor by another indicates its modification and modification to participate and work in the network. Displacement does not imply the secondary actor's exit or non-action in the network. Callon (1986) describes displacement of an actor as moving from its original, unaffected state into an enrolled state.

\textsuperscript{89} The term transparency refers to transparency as a product of the convergence of social practices and information artifacts (Bowker, Star, & Neumann, 2003).
mentors were testing the comfort level of EdX to determine if the portal would promote and advance the goals of the NETTL program and their own mentoring practices with added value, ease of effort or greater results.

A portal is little but a deserted library, a library without a community and a weak prototype without a network establishing it, modifying it, and holding it in place. In order to be a portal that serves a community, it needs to make users comfortable (Norman, 2004), make teacher-users believe the portal a trustworthy environment for local knowledge (Van House, 2002), and to help users find the portal technically transparent, easy, relatively effortless, and simple to use (Bowker, Star, & Neumann, 2003). In this chapter, I demonstrate how the mentors' resistances to using or promoting EdX can be examined as trials: the mentors wanted proof, demonstrable, usable proof of value that the prototype would shine under the affective lens of comfort, pay credence or affirmation to the users' local knowledge and expertise, as well as demonstrate transparent familiarity in design and technical simplicity through its infrastructure. In the following pages, I explore how the critical trials of comfort—from epistemic communities, local knowledge and simplicity/complexity in design—did not align one to the other and like an accumulating set of evidence, these trials actually prevented EdX from gaining character witnesses and evidentiary reality for its intended practitioner-users.

_Dualisms of User-Tester Perceptions_

Etienne Wenger (1998) posed a predominant dilemma or dualism for those intending to create and design any functioning community of practice or digital community. The challenge of bridging design to community use or achieving “sociability” (Preece, 2000) is complex because “no community can fully design the learning of another … [however] no
The attempt to bring a knowledge network (EdX) to life is, in its own right, a dualism: no group of designer-researchers can determine the comfort-ability for others (practitioners’ tacit social and knowledge needs) and yet, no group or community of professionals (teachers) can fully determine or state its own comfort-ability and knowledge needs. The socio-technical scholar, Wiebe Bijker (1997), looks upon these discernable dualisms of designed technologies as opportunities for interpretative flexibility. Bijker asks the researcher-analyst to account for these dualistic perceptions of technologies as we study and design prototypes in order to consciously examine how a prototype, such as EdX, could be understood simultaneously as comfortable and uncomfortable.

I examine how the mentor spokespersons’ interpretations of the portal as either comfortable/contributive (affordances) or uncomfortable/disruptive (hindrances) both developed and constrained the features, design, and social construction of meaning for the EdX portal prototype. These dualistic perceptions help to explain how EdX both succeeded (e.g., Deborah’s work in Chapter 7) and faltered (the denial of ownership by the mentors). The third section of this chapter, the infrastructural issues, focuses in particular on the portal’s infrastructural actors and their encounters with the mentor actors in “trials of strength” (Latour, 1987). Trials of strength refer to those moments of encounter or showdowns when the actors of the network, both human and non-human, attempt to displace one another in force or persuasion of intention, as they attempt to enroll the other into their purpose/mission by co-constitution (p. 93). This chapter continues a Latourian, socio-technical study describing the co-constitutional ecology or network of the portal with its social, human relations (mentors), and in the process, reveals more than analyses of
technologies or of social relations would accomplish alone or divided (Bowker, Star, Turner, & Gasser, 1997).

Social Context of the EdX Trials

EdX was situated and tested in only one teacher education context: the New Educational Technologies for Teaching and Learning (NETTL) professional certificate program. The NETTL course continues to be popular (gaining strength both in its numbers and chains of association as it is now operating in a dozen districts) and is targeted at in-service teachers who want to both increase their knowledge and abilities to integrate educational technologies into their classrooms as well as qualify through course credits for an increase in salary. The course is designed to compliment teachers’ workloads by focusing on teachers’ own experiences in their classrooms as material or data for their course work. Self-study in NETTL permits teachers to build capacity in the following comfortable ways:

Teachers focus on one area of professional development over the two year period; they design their own learning path to meet their goals; they choose learning activities that best suit their level of readiness and personal style; they track their own growth in capacity as they learn; they demonstrate capacity using relevant examples from their own work; and they access ongoing support from mentors and colleagues. (NETTL website, accessed August 2004)

The NETTL course infrastructure is based on a collegial, comfortable partnership between the university and the school district. The use of school buildings for the summer institutes, teacher personnel as mentors, computers, and planning meeting time are provided by the district. It is a mutually beneficial, hence comfortable, arrangement between the two partners: university and school district. The District is able to train its teachers to become technology leaders and use the district computers more effectively in their program and curriculum delivery. The District can attest that it has fulfilled its mandate to train teachers to handle new technologies in their teaching. The university benefits in that it is the institution
that has trained these teachers and mentors and is creating a market for itself as the institutional choice for in-service teacher education. The program is self-generating as it creates a continuous loop whereby previous mentors can be hired as university instructors for future cohorts and its offerings can multiply.

The university in-service department administering NETTL also uses the same approach of self-directed learning in different program specializations: educational technologies, integration of the arts, early literacy, etc. The market potential is to build comfortable capacity in these teachers as future students, as future mentors, and, as future instructors. It is an adaptable, market- or needs-oriented teacher education program whereby the authority of the instructor is distributed and diffused comfortably amongst the mentors. Any resulting lack of coherence in the approach and any discomfort with the methods of evaluation are equally diffuse: the labour is shared with the mentor group and collaboration emphasized by the instructor, but a superficial, tenuous sense of comfortable cohesion in the course pedagogy results from getting the housekeeping details and course schedules organized (practice makes practice, technical makes technical)\(^9\) rather than agreeing through contentious, uncomfortable discussion on particular theoretical frameworks to set the pedagogical direction and cull real intellectual cohesion.

**Spokesperson Actors of NETTL: The Mentors**

For this NETTL cohort of 89 teacher-mentees, the district and the university instructor hired 13 mentors or teacher-leaders in technology inside this school district. Before the first Summer Institute began, two mentors forfeited their positions due to health reasons, leaving eleven mentors. Of this group of eleven, three mentors were middle-aged women

\(^9\) See Avner Segall’s incisive analysis (2002, Chapter Four) of how this dominant discourse of planning and organizing can quell substantial knowledge and critical reflection in teacher education contexts.
with at least 15 years experience of teaching (two in primary grades and one in upper elementary grades). The other eight mentors were men with three of them being under the age of 40 and most of these male mentors actively involved in computer groups, either formal or informal, in their spare time. At least half of the entire mentor group belonged officially to a Mac user association in the region (not an education group) and two of them were intensely involved in the top administration and organization of this user group of professionals. Two of the mentors also occupied the top administration and organization positions of the largest provincial curriculum specialization group of educators in educational technologies. The majority of the mentor group can be described as actively involved in pursuing professional development for themselves, first as computer users and secondly as teachers of educational technologies.

One of the women mentors, Deborah, had completed a Masters degree in education at the largest university and education graduate department in the region but her degree was not a specialization in educational technologies. Another female mentor, Sherry, was halfway through her Masters program, specializing in educational technologies, at a different university than Deborah, where she was enjoying regular affirmative praise from her advisor for her technological skills and competencies.\textsuperscript{91} The majority of the remaining mentors were not only mentoring in the NETTL course but they were also taking the course for their own professional development and pay category credits as few of them had a post-B.Ed certificate, diploma or degree. Hence, these mentors were simultaneously taking on new roles of teacher educator and university students, mentored and advised by Chris for both positions.

\textsuperscript{91} These comments were reported to me by Sherry herself in a chance encounter at a conference in Whistler, (Fieldnotes, May 2000).
Affective Goal of Comfort in NETTL

The NETTL university instructor, Chris, believed in and acted from a philosophy of establishing comfort in all aspects of the curriculum, and, as much as possible, through the relationships of the course. Her endorsement of the EdX portal over the other competing prototype at the initial demonstration (March 2000) was directly linked to her commitment to teacher community building. She stated that EdX “is the tool my teachers need to get to know one another and talk to each other when they are alone in their own classrooms, away from their mentor groups.”

Chris exuded a belief in comfort as given, as necessary for effective learning by teacher-professionals. In her teacher education work, she sought the establishment of supportive community rather than pursue and study a concept of community that would challenge and push teachers to define and defend their professional values and identity (see Grossman, Wineburg & Woolworth, 2001).

Chris was committed to organizing and concretizing comfort: comfort with the course philosophy of self-directed learning, comfort in the mentee-mentor relationship, comfort with the format of online and distributed/distance learning, and comfort in the use of computer technologies. She demonstrated her commitment to comfort through her regular ‘counseling’ phone calls with different mentors, particularly those in need of extra reassurance that they were approaching the NETTL philosophy correctly. Chris stated that much of her instruction time was facilitation and personal guiding of these mentors on an individual basis.

If discomfort came into the course, into the mentor’s perception of the course, into the

92 Transcribed meeting, March 2000, University of British Columbia campus.

93 I happened to be in Chris’ office one morning when she received phone calls from three mentors in a two-hour period and each mentor was asking for this type of support. Once the last conversation had finished, Chris remarked that these mentors needed affirmation in this critical formation period of their ideas about mentoring. (Fieldnotes, July 2000)
mentee-mentor relationship, and into the use of new technologies, this would result in a risky situation that could lead to an ineffective program, student withdrawal or failure to engage, and the collapse of the course’s positive reputation which was critical in a fee-based, cost-recovery department.\(^{94}\) Chris did not conceive of adult/teacher learning as operational in an atmosphere of risk, frustration, danger, or discomfort with the materials, technologies, or, the advocated learning process of self-study.

An open-ended, democratic approach to the organization of the NETTL summer institutes, a vague cohesion of pedagogical intent, and the issue of the standards of evaluation made the institute or NETTL program planning a contested and risky affair for most of the mentors. Against this wave of apprehension and discomfort, Chris emphasized comfort, talk, negotiations, supportive phrases, democratic decision-making for the institute’s practical details and planning and for this district’s specific NETTL program as a whole. NETTL was a participatory type of teacher education program that centred on the department’s mandated approach of self-study and self-determination. Chris’s immediate recognition of EdX as her tool of choice at the initial prototype demonstration was in its potential to induce familiarity (she particularly appreciated the photo gallery where users could recognize one another or put a face to a disembodied name); promote discussion (discussion boards available at almost every page); reveal individual passion and interests (she valued the user profiles); and, the tool’s impetus for participation by all members of that district’s NETTL cohort. Chris also appreciated that she wouldn’t have to organize or promote EdX as I was the designated field-site implementer and promoter. And, as the mentors were teacher-leaders hired for their technicist expertise as early adopters of technology in their schools, the mentors could

\(^{94}\) This university department was unique compared to the other departments as it received no subsidies or budget from the university but rather is dependent upon student fees for its operations and programs.
productively capitalize upon their technological inclinations in using this tool without need of Chris’ guidance or comfort supports.

First Trial, First Theatre of Proof and First Resistance

Though EdX did succeed at the first critical trial with Chris at the initial prototypes demonstration, ironically, EdX did not reveal Chris’s comfort and strength with educational technologies: it revealed her discomfort with the technical leadership and roles needed to promote teacher education in a digital environment. Chris made it clear from the start of our project’s partnership that she was not a “techie” or technicist in her approach. She deferred technical decisions to her colleagues in the professional development department or to the most vocally technicist mentors. And her rate of use of the EdX portal was one of the lowest rates of the whole NETTL cohort. By acting in such a manner, Chris did not establish an online presence with the mentors in the first phase of the EdX implementation when it was the critical theatre de preuve period or first trial of strength for the portal’s demonstration of worthiness, sociability, and comfort/familiarity.

At the second mentors’ planning meeting (June 2000), with Chris’ verbal support to begin the official enrollment process, we agreed as a collective that we would begin and participate in an EdX discussion as a group. We decided that the discussion would centre on one article that Chris considered the seminal piece for a self-directed philosophy of learning.

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95 Chris made this type of statement on several occasions: at the initial PKP-NETTL negotiation meetings (Fieldnotes, February and March 2000) and at the first mentor meetings (Fieldnotes, May and June 2000).

96 I am referring to some of the mentors as “technicist” to describe their strong affinity to and belief in the technical. Other more pejorative terms to refer to this type of orientation include techies and hackers. I am using technicist as a way to describe people who spend a considerable amount of their non-paid time to learn programming languages, solve technical bugs in their programs, and who prefer to interpret problems as linear issues of logic, etc.

97 Chris and I discussed how EdX’s purpose should go beyond the posting of mentor profiles by proposing a discussion for the mentors to begin their teacher educator learning on EdX. We discussed this first collective use of EdX during breaks at the first mentor meeting (Fieldnotes, May 2000) and in subsequent discussions through email and phone (Fieldnotes, May-June 2000).
that is at the core of the NETTL program. I posted the document, *Walkabout* (Gibbons, 1984), on EdX and invited all the mentors to participate in an online discussion of the document. Surprisingly, Chris rarely logged on and made no response postings to the mentors’ comments and standpoints. One can surmise that Chris believed the document would speak for itself or that the self-directed learning philosophy dissuades direct intervention or interpretation by the instructor, as it could be an intrusion upon the mentors’ learning. Given Chris’ impressive years of experience and popularity as a teacher educator (she was in high demand!), she would also tacitly recognize the risky costs to the program if the instructor, such as herself, went public with written, long-lasting statements against which certain mentors may be uncomfortable and, as a consequence, project their discomfort at the self-directed philosophy and the program itself.

Regardless of the reasons, EdX housed the mentors’ many different-sided standpoints and interpretations of the article with little moderation (except by me) to connect and extend each other’s ideas or relate them to other readings and texts. I felt unsure and uncomfortable as to the purpose of this discussion, the role of the mediator and the instructor, and the pregnant moment of one of the EdX’s first user trial of strength. EdX was not being used in this discussion as it had been designed: it was not employed as a support tool adding intellectual value, depth, and comfort through community formation but rather became a bulletin board that amplified a group of contesting standpoints and diverging personalities amongst the mentor group from Walkabout and child-centred enthusiasts to child-centred skeptics, from those who embrace the teaching potential of technology to those who blame technology’s failures on the Ministry’s lack of professional development and the district’s implementation plans. (See Appendix E for the archive of this discussion)
Mentors and Comfort

The mentors handled and employed the metaphor of comfort in various ways in their mentoring practices and, more importantly, in their discussions of mentoring. Many mentors spoke of the issue of their own personal ‘comfort’ with mentoring, with the NETTL philosophy, and with their personal relationships with their mentees.\(^{98}\) There was one contentious trial in the face-to-face meetings with the instructor and it concerned comfort: it was the discussion of how to organize the forum in which the teacher-students would choose a mentor. This was an issue of great discomfort for many of the mentors with one mentor openly refusing to participate in the proposed process.\(^{99}\) The mentors first discussed how they would present themselves to the large assembled group of unassigned teacher-students. One mentor stated that he was visibly uncomfortable with having to stand up and sell himself as a mentor, as if in a popularity contest or a beauty pageant. The instructor explained that the purpose of the introductions in front of the large group was to give the NETTL teacher-mentees the opportunity to state their three choices of mentors, to democratically participate, and determine with whom they would work.

Comfort issues for the mentors directly attributable to the program’s pedagogical approach or philosophy included the compensation of mentors’ time and effort by the district (there was a perceived broken promise over laptop computers that was vocally pronounced to the District Technology coordinator), the role of the district technology coordinator’s participation in the NETTL program, assessment of teacher’s technological/computer competence, validity of credits earned, negotiation with mentees of what would be

\(^{98}\) This issue came up repeatedly in the individual interviews I conducted with five of the mentors in July 2000.

considered adequate work, and, the extra time demands to support newbie or technologically stressed teacher-mentees. All of these matters of comfort were contested and negotiated in the mentors' planning meeting and the instructor worked hard, very hard, to enroll the mentors into self-directed learning, the instructor's and the department's idea of the most appropriate and effective pedagogical approach to teacher education. This work-net\(^{100}\) of trials of strength involved the instructor and the NETTL program attempting to win over the mentors on issues of pedagogical or mentoring comfort. In the Institute planning and scheduling decisions, the mentor group was actively contesting and negotiating trials of strength for self-study teacher education as EdX was introduced and promoted as the knowledge tool of choice for mentors becoming teacher educators. EdX's narrative of purpose, its emphasis on a certain type of teacher education and mentoring, was quickly suspect to many of the mentors. They tacitly perceived an uncomfortable contradiction between the NETTL program's emphasis of private self-determination and self-examination of teaching/learning (insider knowledge) and the EdX portal's emphasis on foraging outside sources of knowledge, particularly educational research, to inform teachers' practices and make their professional development public through their portal participation and postings.

The mentor who seized the opportunity of EdX as a support tool that best suited her needs and practices as a teacher educator/mentor was Deborah. Interestingly, Deborah chose the theme of "wellness" as her first choice for a discussion on EdX with her group of mentees.\(^{101}\) Deborah was intuitively aware that her mentees needed the establishment of

\(^{100}\) This is a term from Latour (1999) where he has inverted network to emphasize the evolving work of chains of associations and displacement by the actors as they meet/confront and negotiate with one another in a network. Latour consciously changed network into work-net to challenge analysts' assumptions of what network signified (i.e., most people assumed that it referred to a metaphor of network much in the style and operation of a computer network).

\(^{101}\) EdX discussion, September 2000.
comfort to participate on EdX, to facilitate their communication with one another, to regard the course and the technologies as “well” [sic] supported by their immediate accessible portal, EdX.

*EdX, Comfort, and Gender*

In their call for an educational theory of technology, Bryson, De Castell & Jensen (2001) conclude “...such technicist discourse [around computer integration into curriculum] may generate more resistance than teachers are prepared or even care to handle.” In the case of EdX, technicist language worked on two levels. It worked to the advantage of the mainly male technicist mentors who reveled in their ICQ chat rooms to solve server program problems or program HTML together.¹⁰² They enjoyed the power bestowed upon them in schools for their computer trouble-shooting skills, their organization of the computer labs, and their handling of the school server. Technicist discourse or the ability to talk “tech” by these male mentors had been richly rewarded in their schools by staffs and administrators.¹⁰³ School staffs did not want to have to engage in this discourse themselves, and, they did not want to assume responsibility for computer labs, server configurations, or taking computers out of the closets/boxes. Their gratitude to those (male) teachers who would engage in technicist discourse and action was to abdicate themselves of any participation in computer set-up, repairs, and generally, in computer integrated teaching and technology plans.

Consequently, the male technicist teachers were offered regular praise and gratitude, spare

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¹⁰² During one Institute planning meeting, there were many jokes and references made by four mentors about their prior evening’s discussions through an ICQ chat room to solve one mentor’s school server’s bugs. (Fieldnotes, June 2000)

¹⁰³ One mentor told me in detail of how supportive his principal was in giving him extra release time for the computer lab maintenance as well as promoting the use of computers in the school’s accreditation plan and at staff meetings. (Fieldnotes, July 2000) Another mentor described how his school had become the “jewel in the crown” of the district. Whenever there were VIPs (Ministry or foreign education delegates) touring the district, his principal was regularly contacted for a tour of the computer lab for which this mentor took personal credit. (Fieldnotes, November 2000)
periods to attend to technical problems in the computer labs, administrator functions, budget
decisions, and connections to Board administration (computer technical support department,
Information Technology coordinator, board budget information, new hardware, etc.). And the
rewards, praise and status made these teachers feel very comfortable in their technicist stance
and almost made up for the loss of time and the extra energy needed to do this work.

In the case of the NETTL course, technicist language worked to the disadvantage of
the mentee-participants. Many of the NETTL students were elementary female teachers who
were uncomfortable with computer technologies and who were described by one mentor as
complete “newbies.” These mentees seemed to want to begin the conversation with a
technicist vocabulary because they implicitly understood and observed the power structures
associated with technicist positions in their schools. Simultaneously, they were afraid that
they wouldn’t be able to be technicist in their discourse and accomplish any technical tasks
as they had no blueprint or prior experience to assure themselves of these technicist abilities
and skills.

The tensions of technicist discourse were evident in the form of the NETTL course
from the very first day. Prior to beginning the course, students were instructed to have
completed and ranked themselves according to a technical skills rating sheet. On the first
day, students were to come to the summer program with these sheets ready to discuss their
prior technical knowledge with their mentor and cohort members. The assumption and

104 This term was employed as a softer term than technophobe. It was intended to indicate a teacher’s
completely new, raw state, often very anxious or needy, in relation to computers. Newbies are those teachers
who require much comfort, hand-holding, and coaching in basic functions and basic computer
discourse/literacy.

105 One of Deborah’s mentee, Jaye, a middle-age primary teacher who worked fervently to create a final
computer slide-show for the Grade 7 graduation observed first-hand the gender imbalance of recognition for
technological expertise in her school. Her efforts and hard work were ignored or simply invisible to the male
observer as the male school principle publicly congratulated a male Grade five teacher who talked technicist but
hadn’t done any of the slideshow work. (Fieldnotes, July 2001)
steering vision was already in place for the course: technical skills were the objective and the means for greater technicist literacy, abilities, and power in schools.

Ironically, the instructor of the course was very uncomfortable with technicist discourse and technical know-how. From the beginning of the planning sessions, she stated to the mentors that her expertise lay with teacher education and curriculum. She introduced another program instructor of NETTL, Lawrence, as the technical expert of the course website at one of the first Institute planning meetings. At the same meeting (and others), Chris kept repeating that the goal of the NETTL program was not technical skills but the technical in service of the educational purpose of integrating technology into curriculum. However, when it came to making decisions regarding the practicalities of the program (as the mentors designed and organized the workshops, timeline, and curriculum of the summer institutes), the technical regularly ruled. Chris as instructor would not stop any mentor from offering a workshop if they were willing to teach it: she did not filter or regulate the content as these were opportunities for the mentor-leaders to teach and the NETTL cohort to form community. The majority of workshops and sessions concerned technical functioning (know-how) and trouble-shooting rather than integration of technology to achieve teaching & learning goals, self-reflection, curriculum analysis, or critical social issues. When I inquired into this discrepancy, the instructor insisted that these aspects would be introduced in the second summer institute once every student was comfortable with the technology.\(^{106}\) The tyranny of “being comfortable” was really an emphasis on becoming technical or technicist. Being immersed in computer programs and technical details were the primary goal of the

\(^{106}\) These comments concerning the “best” timing of the introduction and discussion of critical social issues of educational technologies were repeatedly relegated to the second summer institute and the second year of the NETTL program by the instructor and then by many of the mentors, couched in a rationale of what would be the best as the most comfortable for the mentees.
course rather than becoming critical and discerning designers/users of curriculum and theoretical frameworks concerning technology and technology integration.

Discomfort with Experimentation, Discomfort with EdX

I began the long road of technological interface, feature tailoring, and change management for users in a face-to-face context in May 2000 at the first planning meeting for the mentors of Lower Mainland District. The question of how I would enter this stakeholder group of mentors and the question of how the tool would be received by these teacher leaders in educational technologies were intimately intertwined from the start and both were conducted in the context of an experiment. The tool was an experiment in its design and in its implementation. But I did not anticipate how these mentors and teachers were to respond affectively to ‘experiment’ as they began a doubly risky event: they were undertaking a university program for the first time, they were beginning to become teacher-educators or mentors, and, in the process, they were beginning to question their computer and teaching practices. And at the same time, the mentors had to contend with an intersecting experimental continuum of the EdX tool.

The PKP portals’ experimental nature was multi-faceted. The content in teacher education was experimental as it was intended to put web-based resources, particularly academic educational research, into an online filtered repository space to make it usable and more accessible for teachers’ use. And the technological entity of the tool itself (its design, features, usability) was experimental and in flux. Finally, there was a constant need to define and communicate the meaningful purpose of this tool, its underlying values, in order to experiment with the social conditions for familiarity and trustworthiness with this teacher community. Two conflicting agendas were convening in the encounter of EdX and the
NETTL program: PKP's need to experiment with many dimensions of EdX (we wanted to push and test parameters, attempt innovation, experiment with users' reception of these features) and the instructor's/mentors' need to construct comfort through the many dimensions of course expectations (establishment of e-communication, technology routines to accomplish course requirements, and, community expectations of what counts as successful, effective mentoring).

EdX was an experimental situation, an experimental tool conceptualized as plastic or malleable and able to evolve with users' participatory input. Our choice of NETTL and the cohort of beginning program participants was not a situation of teacher education stability or actuality. Most of the teachers and mentors were beginning formal studies after a hiatus from the university or any post-secondary institution by ten or more years. The unstable state of the mentors' start in a practice of questioning their teaching and in a start of teaching peers how to teach and learn with new technologies, formulated a situation where the mentors could not easily assume or welcome another position of instability and open-endedness, that of the experimental stage of a professional development portal.

Chris' concern that the teachers were over-whelmed by EdX may have been perceptive or over-sensitive: Chris understood the affective domain of technological encounters and professional development receptivity in the context of developing and teaching programs in a cost-recovery department. Chris represented the position that teacher education is most effective once teachers attain a state of comfort with new ideas and technologies inside their own individual practice (a state of enrollment into the PD department's philosophy) before they are able to reach out, branch outside for greater learning, for critical reflection and a willingness to encounter technologies that bring outside
perspectives inside to practitioners (Cochran-Smith & Lytle, 1999). When I met with Chris in July 2000, one month before the start of the program and the first Summer Institute, we discussed this underlying set of principles and program philosophy. Chris discussed the four Rs of the department’s conceptual framework—responsibility, relevance, relationships, and reflection—and she read directly from Lawrence Stenhouse’s writings, quoted in the Department’s course handbook (1993).

Good teachers are necessarily autonomous in professional judgment. They do not need to be told what to do. This does not mean that they do not welcome access to ideas created by other people at other places or in other times. Nor do they reject advice, consultancy or support. But they do know that ideas and people are not of much real use until they are digested to the point where they are subject to the teacher’s own judgment. (Stenhouse, 1984—as quoted in the department handbook)

As Chris read the Stenhouse quote, I knew the experimental nature and the demonstration of access to usable knowledge on EdX would rely on the social purposes imbued into and constructed through the portal. I realized that the mentors’ embrace of the portal as the location for these social practices, the use and belief in worthy outside ideas and the place to engage and foster local ideas and discussion, would be the defining, critical theatre de preuve for EdX.

The technicist mentors, the most technically able and technically focused, did not have positive reactions, comfort or affection for EdX, a digital tool that should have been their space of greatest ease, interest and technical engagement. But in the encounter with an outside (university-based) experimental technology project, the media and the content did not overcome the technical obstacles (along with the Microsoft platform and other infrastructural issues discussed later in this chapter) and these mentors found little incentive or reason to change their knowledge practices to reform and align to those suggested by the portal in order to enroll themselves into the EdX network. EdX was unable to “displace”
(Latour) these actors and they were resistant to co-constituting their knowledge practices with those of EdX. The majority of mentors were unmoved by the portal because their affective, imaginative faculties were not engaged: they were not inspired to “love” anything they had encountered on EdX, hence, they did not love EdX enough to change or displace themselves into EdX mentor-users.

Technicist mentor: If the electronic world is embraced more, then EdX will find its place. I have my ways of using the electronic world to find the information I need from eLibrary with 550 000 publications or by going directly into library online databases. So I have my preset ways of finding things. If I am going to use EdX, I am going to have to find something I really love about it— that it does a great job for me. I haven’t found that with EdX and I don't think I am going to change and put much more involvement into EdX for those reasons. (emphasis mine) 107

II Local Knowledge, Local Expertise

New EdX users not only needed to learn how to use the new system's functions, but they also needed to figure out how to make the system fuse into their professional life and local knowledge practices. My keen interest as the on-site fieldworker/implementer was to model new knowledge practices to the mentors who would in turn enroll themselves into these knowledge practices by adopting the tool into their local mentoring and professional life.

EdX was designed and intended to play several roles in supporting the construction of a local cohesive community that could become an epistemic community or a community of practice (Lave & Wenger, 1991). First, the portal would become a medium of communication for apprenticeship learning between mentor and mentee, allowing more mentor support and guidance for mentee reflection from a distance. Second, it would be a medium of communication for teacher-mentee to teacher-mentee (or colleague to colleague) communication and social construction of knowledge, thus corresponding to a collaborative

model of apprenticeship learning, with the teacher-mentees providing scaffolding for each other (Bayer, 1990). Third, and most importantly for the PKP mission, it would allow practitioners to learn through direct contact with broader educational communities, thus corresponding to a peripheral participation model of apprenticeship learning into an educational epistemic community involving researchers and practitioners. This third model of a community of practice, discussed in detail by Lave and Wenger (1991), posits that learners in diverse settings, members of diverse communities, learn best by limited but steadily increasing participation on the periphery of communities they seek to enter. The problem with these design and learning intentions for the local NETTL community-in-the-making on EdX, for an epistemic community that could involve outside experts such as research(ers), was that the local community did not seek this outside expertise.

The leadership of the program, the mentors and the instructor, did not seek to enter into dialogue, conversation or membership into an epistemic community that crossed institutional boundaries even by textual and resource means (researchers’ ideas represented through their texts or documents). The local NETTL group did not see the meaning in seeking participation or contact with members of a larger community who were not directly and locally involved in their mentor group, their classroom context, or their particular localized questions. According to these spokespersons, reading others’ accounts of professional practice was tantamount to a betrayal to the core philosophy of NETTL. Luckily, this travesty was openly discussed at the concluding EdX mentors’ meeting (January 2001).

Chris: There’s a theme underlying this discussion that is very prominent in educational thinking at this time. When teachers are engaged in a situation that is meaningful to them, they want to be hands-on, minds-on in the context where they work. If they have to go out
of context and put a lot of energy in making and taking something out of their context and then draw it back in -- that may or may not be meaningful. This is a type of learning that is not natural for teachers - to go out and find out what someone else did. Unless it is close to their context or unless they came across a really deep question and it is too early for them to have found a really deep question. And it is too early for NETTL teachers to have found a really deep question.

In our other NETTL cohorts, we observed that by the end of the program, they wanted to go out to where there was broader thinking on these deeper questions. But we're not into deeper questions yet -- the learning process for teachers begins with their immediate context and what is relevant and where it will have an impact on the work that they do.

Mentor: And they need time!

Chris: Yes, and the time to do it.
So, a tool like this, that asks them to engage at a much higher level of analysis, theoretical analysis, particularly, to ask them to go out and find what is relevant [in the literature] is not their intent.

Lisa: But the majority of articles or documents in EdX at this moment are not theoretical. There are very few. The majority of docs are teacher-produced or district or professional organization-produced. Or written by other educators. The number of high theoretical articles in EdX presently accounts for about one-tenth of the collection. It is actually teachers talking to teachers but not in the same context.

Chris: I'm not talking about theory that way Lisa. I'm defining theory as something that is not connected to your every day experience -that connectedness coming from someone you know is right there. It is bigger than theory. Someone else is right there [locally and face-to-face] that you can talk to about their real experience. It's a theoretical construct when someone else made it up. It's not you making it.

Chris represents the (epitome) position of localism and insider knowledge when faced with a university-based researcher and knowledge tool vying for position and use in a teacher education context. In her view, the outside authority of expertise squashes the practitioner’s local knowledge contribution or quells the epistemic direction that flows from the inside-out of the teacher-learner(s). Chris believes that the external intervention, the introduction of university-based research, risks becoming an object of resistance by the teacher. And in articulating it in this manner, Chris opened a gateway of social resistance by validating and
merging the mentors' multiple resistances (personal, technical, social, epistemic and institutional) for EdX into a trial of strength against NETTL's philosophy.

The EdX portal was not adequately allied with the local interests of the NETTL program, the instructor, the school district, or its technology coordinator. The EdX portal was not the only option of communication or resources for the course (phone communication and photocopied resources out of teachers' file cabinets were still the norm). And EdX was not the only digital tool available locally for the school district as the technology coordinator and district had just purchased First Class as EdX was introduced.

EdX was posed to substitute these local practices if it could have proven itself in trials of strength and consequently, its network could have gained greater force. EdX could have become more dominant if the local organizational actors had added their endorsement or enrollment through local enticements (grades or credits from the NETTL course and workshops, equipment, or release time by the school district). However, in the EdX project, it was made evident by the NETTL course instructor that mandatory participation in EdX (or even enticing rewards or mention for participation) was counter to the locally prevailing and foundational approach of the course, its self-study and self-determination of teacher development. The local interpretation of a self-study philosophy positioned outside sources of knowledge as suspect, even contrary for the program's first year induction and inculcation. If EdX could have been understood as fulfilling the course and school district's program needs and intentions, as being an actor worthy of association, it would have tip the gradient of associations and substitutions in favour of its own continued use and ownership by these local actors.
From an institutional framework of analysis, the university-based researcher or project is not located completely outside the institution of schools as there have been numerous cases of teacher-researchers, teacher educators and ethnographic researchers inside schools engaging with teachers and each other. However, researcher ‘knowledge’ can only function in schools and teacher contexts when it is recognized by the teacher-participants as usable and worthy and it has been incrementally and historically negotiated locally and situationally.

Moments of epistemic community were experienced by the mentor Deborah and her mentees because Deborah was welcoming of that research knowledge interaction, that willingness to engage in discussion with research and researchers. But the epistemic community I was offering the mentors through EdX did not recognize their local contributions and was not comfortable or familiar enough to gain the mentors’ enrollment or the next degree of ownership—an ongoing enrollment with long-term implications and loyalty into the network. Whether the portal continued or not was a secondary issue to the mentors’ primary (indeed “overwhelming”) local issue of establishing and maintaining a comfortable mentor-mentee sustained/sustainable relationship.

Many of the male technicist mentors were resistant to EdX as it appeared to threaten their identities as technical leaders and innovators. It took away from them the control of the programs and the power status attained through their demonstrated technical service in their schools. EdX usurped them of that opportunity to demonstrate their finesse, their talents at

108 In an interview with Deborah (December 2000), she related how she was the one to initiate contact with Ricki Goldman-Segall when she emailed Goldman and invited her to accompany her class on a fieldtrip into an environmentally sensitive and politically controversial nature reserve. Deborah took personal action to have this kind of epistemic engagement with a university-based, outside researcher because she highly valued that interaction.

109 I am purposely using the word “overwhelming” to invert and queer its sense and use by the mentors and the instructor in conjunction with EdX.
the technical in NETTL and EdX did not offer anything in place to accommodate their needs to continue their demonstration of local abilities while their technicist identities were displaced.\textsuperscript{110}

\textit{III Infrastructural Simplicity or Complexity}

This section of the chapter traces the decisions the PKP team made to increase the usability of the EdX interface and the surprising reactions or ‘theatres of resistance’\textsuperscript{111} we received from the mentors. These reactions to the portal’s technical alterations increased the mentors’ overall uncomfortable stance to EdX, even though many of these modifications were made to respond to the mentors’ feedback. With each infrastructural improvement (as perceived by the design-research team), the mentors’ affective response of discomfort to EdX seemed to increase.

Ironically, many of the mentors worked hard to continue and maintain the visibility of EdX’s infrastructure by publicly complaining about it. The most vocally resistant mentors kept repeating technical criticisms of the portal, sustaining technical attention upon the prototype’s features: the nuisance of the reminder-emails issued by the system that they perceived as spam\textsuperscript{112}; their refusal to download and use a Microsoft internet browser (IE5) with which EdX was the most compatible; the lengthy portal URL to cut and paste, and, the lack of memory function in the portal system to remember user’s passwords, as a few of the

\textsuperscript{110} This would help explain how one mentor, Carl, was particularly driven to create and establish his own Yahoo user-group room for his mentees to override EdX and demonstrate his ability to take back his own technological determinism.

\textsuperscript{111} I am purposely playing on the meaning of Latour’s theatres de preuve term to emphasize how important those moments of resistance are for the designer-researchers, particularly in a context of teacher education.

\textsuperscript{112} Ironically, spam refers to un-wanted corporate or commercial email intended to lure customers into purchases. In the case of EdX, the email notifications were to inform and remind users of additions of content by portal participants and the additions of comments or replies in the discussion projects. They were intended to demonstrate the portal’s activity and dynamic state.
technical examples. While these mentors dissented over EdX’s technical features, they also resisted EdX’s educational influence and impeded its application to the course work and transfer of knowledge practices to their teacher-mentees. And they complained that their inability to maintain email communication with their mentees was proof that EdX was too technically sophisticated for the average level of the mentee-user,

One technicist mentor, with nods of agreement from the majority of the mentors at a mentors’ afternoon meeting, asked aloud, “But why do we want EdX, why do we want a Cadillac of a system when we just need a bicycle to get to the corner store?” (August 2000, Summer Institute I)

The EdX infrastructure’s ongoing technical visibility and educational force created discomfort for the stakeholder group of mentors who questioned the necessity of its multiple functions, the menus of resources, and its sophisticated complexity, to satisfy the educational/program requirements of the first year assignments.

Each technical change decision was located in an experimental setting of trials and results. These decisions were made by the design-research team (in consultation with each other and the project’s budget), then technically manifested in the EdX prototype, and, finally socially perceived by the mentors and instructor as either comfortable or uncomfortable.

System designers and implementers can become bewildered by the negative impact on use that the slightest small change or added feature/step can present. An added feature or modification to the system can concurrently be a barrier to the user of an information system. What would appear to the designer or implementer as seemingly minor alterations in the system for adding extra functionality for the benefit of the users, can make the user uncomfortable and sometimes actually stop users from continuing in or with the system.

Modifications (intended to make EdX more responsive and participatory) could include extra
clicks, a combination of keys to reveal options, a separate drop-down menu for the Help page, or the listing of URLs when initiating a discussion.

The size of these “minute” obstacles and the perceived inflexibility of the users’ response presents, at first glance, a problem with the teacher-users. Wouldn’t they want to explore the categories of documents or ask for assistance rather than avoid the system? Why would the mentors, technical-digital enthusiasts in their own right, persist in using less efficient even futile Internet searches or more hard-copy routine knowledge practices instead of gathered, filtered, accessible digital resources which were available? Did the PKP tea, find ourselves in a field site with a cohort of teachers who were so rigid and narrow that they couldn’t adapt or encounter change in using a portal? Had we chosen a highly unusual, unyielding group of professionals? If we had chosen a better teacher group, a group ready and able to access, read and glean knowledge from research documents, would we have avoided these kinds of usability/sociability problems?

I do not believe the choice of user group was the reason for these technical modifications and resource additions being experienced as obstacles. If the EdX had had a different user group in education, another group of teachers, the comfort barriers would have probably been similar. The two teacher groups for the implementation of the two PKP prototypes were distinct but not irrational. The problem here lies in two elements connected with information systems’ use: first, changes become magnified inside established or routine work processes, and secondly, what the design team believed a functionality to be preferable (to add affordances such as to ease work load or enhance epistemic engagement of users)

113 As in the case of one mentor who explained to me her method of meeting her mentees’ information needs by advising them one-on-one in her classroom and referring to hard-copy documents out of her file cabinets. Though she became the President of a large Mac user advocacy group and was technically focused, her idea of research and, particularly, in her own established knowledge practices, did not include electronic sources.
actually became negative hindrances (Bishop, 1995). Changes in routines and knowledge work, provoked by new alterations or features, can lead to greater dis-ease and dis-comfort with the modified system.

What designers may concede as tiny impediments can become magnified inside the flow of the practitioner-user’s work process or routine practice. There is the performance problem of needing to remember extra keystrokes or navigate new pathways to locate desired points or information. But the greater problem is how these extra steps, this increased articulation work\(^\text{114}\) in the system and loss of transparency, complicates the subtle, tacit, comfortable ways of getting the job done (Bowker, Star, & Neuman, 2003). Trivial barriers, those perceived as trivial from the designer’s perspective (i.e., the free download of the “optimal” browser application, Internet Explorer 5), can be magnified by the new or resistant user. The mentors resisted Microsoft products as a corporate intervention into their computer and Internet freedoms as well as were defensive over the fact that they have been chosen to “test” this new technology as they began a new demanding task (with little financial compensation) of teacher education work. Infrastructural barriers, though small from one perspective, can actually result in the end of use or the portal never arriving at any large-scale adoption by the majority of users if they are not adequately recognized or modified/erased.\(^\text{115}\)

The primacy of creating a digital environment for comfort and the attention to providing locally usable content cannot be underestimated. Usable content is that material which can

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\(^{114}\) The term ‘articulation work’ (Star, 1999) refers to the set of steps needed to make seamless the translations and transitions in the system. An example is the work of cataloguers to tag a document with multiple valid keywords in order for the search functions of the system to locate them efficiently, almost intuitively, for the user.

\(^{115}\) See Sandholtz & Reilly’s (2004) study of a school district that adopted a Thin Client system to avoid teachers interacting with hard-drives and being uncomfortable with any complexities of a system.
either acknowledge, leverage, or surpass the local knowledge of the key actor group, the
mentors.

The portal is not an isolated infrastructure and as such, small changes in its infrastructure create magnified effects on the flow of knowledge work and the emotive state of the users and the chains of association between the two. EdX’s demands accumulate and roll into the demands of the NETTL course (e.g., what is a field study and how are credits weighed) and the other new technologies that the mentees are encountering and learning. Tolerance (comfort and usability) or intolerance (uncomfortable and non-use) of add-on features or EdX modifications is intimately connected to the user’s ease of understanding of course expectations (course culture), the mentors’ modeling and advising behaviours, their preferred or standard computer applications (for getting the job done efficiently or transparently), and, organizational/institutional routines (the expectations of the community). Infrastructural ethnography observes and surfaces these hidden tasks of articulation, their impact on the usability of the portal as a whole, and, locates them inside the ecology of the network rather than situate them on the ‘rationality’ of the user (Star, 1999). Infrastructural examples from EdX include the following pivotal technical decisions that resulted in a dualistic interpretative split by the research-design team and the NETTL actors: the research-designers believed the modifications were important for creating a higher functioning, more usable, efficient portal and the majority of the mentors found these technical issues controversial, producing discomfort. These technical, infrastructural issues were critical trials of strength for EdX, the trials that did not convince the mentors of its (trust)worthiness and actuality and resulted in EdX’s faltering, its inability to effect ownership by the mentors.
Proprietary Software Developer

The PKP team decided to hire a proprietary software developer to create a knowledge management portal that could be modified according to users' specifications in the most efficient amount of time possible and in the most effective design. The software developer we hired, III, demonstrated those abilities but it also used a portal platform that they had originally designed for a corporate setting. Remnants or traces of that culture were visible to the mentors from a menu for posting "news articles of the day" to the display of user's performances or activity charts. The user's activity statistics on EdX were the most obvious corporate remnant on EdX that elicited great dissent amongst the mentors. Viewing a record of how many times you had logged on to the portal, which documents you had posted, etc. was tracking information that was available through the system, but the use of it to motivate users into more activity was the corporate sign that caused the greatest controversy for the teachers. From this technical function, some of the mentors viewed EdX as a corporate intervention attempting to socially influence their practices as educators as well as extend the software proprietor's commercial profits. This activity window was removed and made invisible (even though that information was still automatically collected by the system) to the practitioner-users upon request by the mentors. However, the perception of the software developer's corporate leanings did not help to persuade the mentors to enroll in the EdX network.

Controversy of Microsoft

In first encountering EdX, some of the technicist mentors made comments regarding its Microsoft platform that I interpreted as loyalty to their Mac user identities. Increasingly, it became apparent that these mentors were annoyed with EdX's Microsoft platform and its
inability to be locally tinkered with: they had to contact and contend with the private software entrepreneur if they wanted to access code or levels of the portal confined to systems manager status. The PKP team understood that there was a financial, budgetary constraint on each decision-making turn. The software developer was not willing to substantively change the platform or the interface without a price tag that was often untenable given the funding allotted us from the federal agency. The infrastructure continued to be resisted or found suspect by a central group of the technicist mentors as they did not see their technical preferences permissible in a non-Mac, Microsoft platform. From their viewpoint, once the portal was a Microsoft platform, it remained a Microsoft product, unassailable for their importing, coding or modifying for their own purposes and digital constructions as well as a constant presence and threat of surveillance (communicating information back to Microsoft).

I hadn’t fully understood the extent to which some of the technicist mentors were perturbed by the Microsoft platform of the portal until I met with a number of them a few weeks before the first Summer Institute. My plan was to familiarize each to the other, the mentors individually with me as a teacher-educator, to gain some of their trust or at the very least, make myself and the research project more familiar to them. In one case, the technicist mentor was quite reactive when I asked him questions regarding his use or plan of use for EdX with his mentees. His response was one of great frustration that I would be putting the lens, the responsibility, the ownership for using and modeling EdX to his mentees onto him. His discomfort with this positioning, an act exerted upon him by the university project and me, was strong. His reaction included the point that I was making him feel stupid for not embracing a tool that he immediately distrusted as a Microsoft product and a tool of the

\[16 \text{ Fieldnotes, July 12, 2000.}\]
university’s authority. I responded with utter perplexity. I couldn’t understand what deep-seated nerve that I, or EdX, had un-nerved. And it was surprising that a Microsoft platform could be such an obstacle for an early adopter, a technicist leader in educational technologies. I came to realize that the purpose of EdX was counter to this mentor’s technicist knowledge. The technical was held or controlled by the software proprietor in order to free the users to the participatory realm, to the discussion forums, to the uploading of content, to the mentoring reflection, and to the research process realm of this portal project. Where we attempted to free the users of the discomfort of the technical, some of the technicist mentors, such as this computer-leader, saw it as a threat to their new work and identities.\textsuperscript{117}

\textit{Internet Explorer 5}

Another critical infrastructural trial of EdX was the decision by the software developer to maintain a prototype platform optimally operational in Internet Explorer 5 (an application upgrade not yet mainstream or usable by the majority of teacher-participants at this time and, once again, another Microsoft product). What appeared seemingly trivial by the software developer – the need to download a new Internet browser program from Internet for no charge – was assumed to be a monumental obstacle by the mentors and the instructor. While the mentors were technologically capable of downloading their own free software, they resented a variety of factors. They resented the imposition of a Microsoft product onto them (the majority of schools in this district had adopted Netscape as their internet browser), they feared a “buggy” new browser program that had not been adequately tested, and they

\textsuperscript{117} This reaction is in contradiction to the observations and approach documented by Sandholtz & Reilly in San Diego (2004). In the EdX case, the mentors’ identity was built on their proficiency as technicians, not on their proficiency as teacher educators. They wanted to maintain technician roles and distrusted a system that did not reveal enough of the technicalities to them. But at the same time, they distrusted the social costs of the system’s technicalities to their mentees.
feared how much technical support (or hand-holding) would be required to walk their teacher mentees through the download process.

The Internet browser, IE5, was an obligatory passage point that realized the power and authority of the EdX portal. Obligatory passage points are specific spaces or systems through which the actors must work to solve the problem, satisfy the need, or concretize their shared intention (Callon, 1986). In this case, IE5 would optimize all the functions of EdX and realize the intentions that would assist the NETTL program: making resources usable and accessible, educating teachers in educational technologies, and creating a community space on the Internet. Though it was never intended to be a critical trial of strength by the PKP researchers, the question of obliging users to download and familiarize/immerse themselves in a new browser (Netscape was the dominant browser in schools) was a condition that few technicist mentors were pleased to adopt or willing to change. And the software developer was equally unwilling to retrograde his portal prototype to accommodate the mentors' technical preference of Netscape. This first obligatory passage point became the first critical trial of strength between the mentors and the portal and set off a momentum or chains of association characterized by consistent resistance that did not change course or lose force.

**Privacy and Community**

During the first months of EdX’s operation, there were several requests by a couple of the mentors to gain complete privacy and control for their mentor group discussions. As it stood, the function of discussions was located in one channel of the portal that a user would have to make the effort to search for. Some of the mentors believed guaranteed private locked spaces would permit them and their mentees to want to use EdX and want to openly discuss their ideas and work progress. This request for extra private spaces on EdX was
rejected by both me, as representative of a research consortium committed to public access, as well as by the software developer who stated the extra privacy would mean added cost features. I reasoned out loud that the added privacy was unwarranted in a community of practice portal with only 100 registrants who were all students in the same NETTL program. How could we become community members if we could not access one another’s ideas and comments? I also stated that unless the user received a direct automated invitation to participate in a discussion (which was the active feature of the portal), they would not know to go and look for the discussion.

Certain mentors were particularly concerned about verifying the privacy function of EdX as they discovered three unknown names, non-NETTL people, on the People channel that lists all users. These three unknown names were PKP consortium members who had only logged on once or twice to view the prototype, not to examine or participate in the community. But this impression that there was no “private” intact community with strangers lurking (though we removed these PKP people and their access after this discussion) and no locked rooms available for discussion made EdX an untrustworthy, unwelcome digital space for their NETTL work and community building.

In this trial of strength, I resisted being enrolled into the mentors’ idea of and need for privacy through EdX. By this time in the design development process of EdX, it was unclear that adding another feature, in this case a locking feature for the discussion board controlled by the discussion moderator, and adding extra costs to the design budget would result in an increase of use. I had few indications that the mentors were in the process of doing the work of enrolling their mentees into the portal. The hard work of community development — including the recruiting of participants with common interests and the contribution of
resources to support mentees' interests to entice them into EdX—still seemed to be resting upon my shoulders. I wasn’t convinced that the work of bonding and bounding groups in the offline world was happening to any extent that would support the idea of extra privacy to facilitate trust and identity online in EdX. Yet this request/complaint was an important trial of strength encounter wherein I heard the explicit request to dis/replace the discussion function, I resisted back (with what I viewed as reasonable explanation), yet these mentors remained un-enrolled and the network weak. If I had offered the mentors an alternative, even one outside of EdX such as a discussion forum or an email list discussion, perhaps I could have engaged the mentor(s) in a discussion about what kind of a digital discussion space they needed, private or public, in order to bring them back into EdX. But my stance and commitment was focused on regaining a public knowledge stance for the PKP portal as we had compromised our public principle by opting for a private, proprietary, registration-entry system.

*Private Knowledge, Public Knowledge*

EdX did not attain the status of public knowledge that we at PKP had anticipated for it as one of our public knowledge portals. The EdX frames of the pop-up windows for the documents/resources from the database were designed by the software developer to hide the source URL (internet location). Even though documents for EdX were culled from the Internet as publicly available sources, they were then privately appropriated by the software developer through frames and limited the original source view for the one hundred NETTL users on EdX. The developer-actor acted according to his interests: he wanted to protect his portal/system by enrolling users to remain loyal. Loyalty in this instance meant they must access his system, enroll into his proprietary space, if they wanted to find and access these
documents. In each summer institute workshop, I made certain to demonstrate to the EdX users how to hold down the mouse keys to reveal the source URL in a new window. I resisted the attempts by the software developer to make his private system the obligatory passage point for access to this public knowledge.

Another limit to optimizing the public status of knowledge through EdX was the inability through design for the EdX users to email the document URLs and annotations (their description, tags, or classification) outside of this portal system. This inability to extend the knowledge network outside of this portal and cohort meant a restricted view of knowledge and epistemic community in the design. Some EdX users saw this obstacle for sharing resources with school staff colleagues as an impediment to their use of the system and a valid reason to triumph First Class over EdX.118 Portal participants were limited when they couldn’t easily import new usable knowledge into their local settings as they couldn’t email the resource to themselves through another email account.

Multiple steps to reveal the source URL, cut and paste it into an email, and bookmark it onto their own hard-drives, all contributed to a non-transparent system that resembled the awkward difficult steps that makes university knowledge inaccessible (i.e., there are multiple physical steps to access it from driving onto campus, paying for parking or the bus, entering the university library, locating the material and photocopying it for later retrieval). Knowledge that was available on the Internet but impossible to find or difficult to gauge its importance or validity, was finally made accessible through EdX as it became inaccessible outside of the portal. We, the PKP researchers came to view our participation in EdX as one

118 In a school district First Class intranet, all members of the school district have accounts and access. There are functions to “privatize” discussions and exchanges of information through the conference folders.
endorsing both a closed private area for the mentors’ comfort with community building and a
privatized knowledge system which contradicted our project’s initiative.

Final Trial of EdX

My reply to the mentors’ issues of EdX’s technical ineffectiveness or infrastructural un-workability for this local context was to add more technical features to the portal’s functions. However, this increase in technical alterations did little to increase the portal’s effectiveness or local appeal. I acted in a technicist manner to resolve a problem that was a social affective response to the tool and to the research’s aim to alter teacher education. I was decoding the response of resistance and unwillingness to engage with the tool as a problem of the tool’s functionality, of its usability, of its technical determination. However, it was certainly more a problem of the tool’s sociability —its social force and change impetus, and the degree of comfort that could be translated into social practice for the mentors. I did my best to demonstrate all these important features and trust-building strategies to the mentors to start the making of community. In doing and modeling this work alone, it quickly became very labour-intensive, but more importantly, it became counter-productive. I became the most active advocate for EdX and as I became more active, I displaced the roles and enrollment of the mentors: EdX became more my tool, than the mentors’ or the NETTL community’s tool.

I realized that my role as the portal promoter, fieldworker, or implementer was quickly becoming counterproductive for EdX, for the adoption of the prototype by the NETTL users into their professional development practices, and for the mentors who had begun to find my repetitive plea for a consideration of EdX annoying. I decided in consultation with Chris that the time had come for EdX to be transferred to the mentors, to
discuss the ownership of this portal for its continuation. After eight months of daily work on both theorizing and practicing how to make EdX a dynamic, living actuality in teachers' practices, I sat down with eight of the mentors who were taking the NETTL course for credit as students and with the NETTL instructor, Chris.

The mentors began the discussion with how they perceived the portal as a research document intensive repository. They had quickly categorized the portal as a uni-category of external research and almost irrelevant for their practical knowledge needs and those of their mentees. The difficulty for the majority of the mentors seemed located in what they perceived as the portal's over-sophisticated Cadillac formulations for accessing and finding content.

There may be great resources on EdX but they are too hard to find and it is too demanding as an information and communication tool. My students were just becoming used to email this second term. I can't ask them to use EdX.119

The mentors stated that they had no need for EdX as they had their own established patterns of searching on the internet (though they were unable to name or cite one source of educational information). They also rationalized that they weren't going to deal with the portal's infrastructure, its required set of steps, to accomplish what they viewed as a minor task for the NETTL program requirements. NETTL program only required two bibliographic references for the major field study projects and only one field study was required in the first year.

Email is about the maximal level of use our students are at. I could use EdX because I have the skills. But I already have my preferred search engine and places to go when I need information. But my mentees do not respond to email. They didn't go to the two e-rooms that I set up. And I am not going to use EdX if my mentees aren't going there.120

119 Mentors' meeting to deliberate the future of EdX (Meeting transcript, January 2001).
120 Mentors' meeting to deliberate the future of EdX (Meeting transcript, January 2001).
The mentors did not view the search for research, exemplars or evidence-based documents as a worthwhile effort or practice for their mentoring or their own teaching, particularly in the squeeze for time in most teachers' workdays and in this PD program. The infrastructure, both the material mundane actors of platforms, firewalls and internet browser as well as the interface structure of knowledge classifications, discussion boards, hyperlinks, and internal emails, did not work to make the system appear inviting, simple/transparent, relevant, valuable/value-added or efficient.

I compared EdX with First Class, with my mentees. First Class has cute easy icons whereas EdX is boring, long and complicated. First Class is quicker. I don't want to spend time on EdX, especially in the evening during my time. (January 2001)

Most of the mentors had greater technical computer competence than me and could navigate and understand the computer codes used in many different programs. I assumed that this ability would give these practitioners an added advantage and confidence to encounter the social practices of a new technology, but I hadn't realized the many levels of strangeness or social re-alignment of practices that they were thrown into during this first year of the two-year NETTL program. The mentors had to learn how to mentor their professional peers; they had to learn a self-directed form of inquiry and teaching philosophy; they had to plan, organize and teach in the Summer Institutes; and, they had to struggle with the course's open-ended, student-centred approach (there was no defined course outline or set bibliography but there were many steps of self-study templates or documentation that the mentors were required to administer and assess) before having had the "experience" of self-study themselves. Ironically, the computer domain was the one area where they had the most experience, confidence, and skill investment and were thus the least willing to adapt, take on a learning hyperbole and habituate/naturalize their habits of use for someone else's system
and infrastructure. As one mentor plainly stated, he wasn’t being paid to make this kind of investment of his time, of his practices, of his understanding of technologies. And I would add that he along with the other mentors had not been effectively enrolled to change his professional and knowledge practices, adequately enticed to question his teacher and computer-user identities, or compensated to take the time to do so.

No user ownership (no network) resulted from the EdX project. The intended users, the spokesperson mentors, disconnected from the technology and the research project. Disconnection was a result of a discourse of discomfort and a protest of displacement in relation to the portal. EdX displaced the teacher-users’ expertise and their local knowledge. We did not centre the content of the portal on the accumulated (practical) knowledge of our users in terms of their practices of curriculum integration of technologies as well as their technical expertise of LANs, troubleshooting in school labs, server programming, user manual language or technical tips instruction. However, the NETTL instructor did recognize their technical expertise by giving them the local responsibilities for all the technical workshops and computer decisions of the Summer Institutes.

Concluding Thoughts

Comfort, local knowledge and infrastructural familiarity/simplicity were pivotal issues in understanding the un/willingness of actors or stakeholder groups (mentors) to contribute to and use knowledge from EdX, to participate in EdX’s feature modifications, to become enrolled actors in the EdX network and work to take the portal’s ownership. The trials of strength and user resistances highlighted in this chapter reveal the complex issues concerning portals as digital professional development spaces and their relationship to the situated, distributed, and social nature of teacher education and professional reform.
In a manner similar to trends emanating from the street up, the world of digital teacher education is about following the teacher-users where they are going in the portal or digital environment and how these actors encounter each other to reinforce or resist the chains of association of the network (Latour). Greater attention to infrastructural issues along with social practices will need to provide both spaces and mechanisms in which trust, familiarity, and group identity can be forged among digital teacher education participants. But trust, familiarity and group identity also need to be modeled, fostered, emerging, and discussed by the participants in their offline social practices to compliment or reinforce these affective conditions in the online portal.

In the case of reforming teachers’ knowledge practices as an obligatory passage point in teacher education, it was understood by the PKP team that the NETTL program would already be emphasizing this type of teacher education pathway. Unfortunately, the pathways or intentions for reform embedded in the NETTL program were not the same as the EdX portal: NETTL begins with an insider stance, a focus on personal local knowledge first, before considering any external sources of knowledge whereas EdX began from a position that there exists a range and body of knowledge waiting to be tapped into by teacher-practitioners.

Only a technology perceived to normalize and emphasize the NETTL’s philosophy of self-study in locally defined contexts would then be aligned with the organizational program. But a portal that countered or enlarged this idea of teacher education could be interpreted as overwhelming, uncomfortable and suspect. Hence, actions by actors would be directed at restraining, or resisting participation in the portal in order for the NETTL program to run smoothly, comfortably and maintain its dominant and normalized position in the network. If
the mentor-actors had followed another network that discounts or counters the knowledge practices of NETTL, the professional development program’s strength and influence could have been challenged. For instance, if teachers believe footnoting their studies or ideas with external (electronic) sources of knowledge is valid and a value-added practice, then they may turn to EdX. If mentors believe footnoting their ideas and experiences with external sources of knowledge detracts from or impinges upon their own self knowledge and destabilizes their participation in NETTL, then they will resist or refrain from using EdX because it is uncomfortable for their emerging conception of themselves as NETTL mentors.

PKP had ambitious goals for its PD portals, particularly EdX. We expected that these portals would demonstrate to practitioners how to access research, how to understand it as usable, how to apply it to their own practice and how to discuss this application amongst their community of colleagues as well as expand into a boundary crossing epistemic community in education. To fulfill these goals, PKP must be capable of locating and collaborating with practitioner groups that already have a significantly high level of trust building and other social practices that cannot be readily wired or technically resolved in the portal’s design. Portals cannot lead the role in forming close, trusting groups for an epistemic community to emerge. A portal such as EdX could not prove its actuality to teacher-practitioners in trials of strength between NETTL’s philosophy and EdX’s embedded purpose: NETTL needed to emphasize a comfortable, efficient program with an insider focus of local knowledge generation whereas EdX was designed to emphasize an expanding collection of outside sources of knowledge, catalogued or tagged to be accessible, usable, and relevant to support reflective practitioners going beyond a local focus of epistemic engagement.
CHAPTER 9
Conclusions and Socio-technical Lessons Learned

Introduction

New digital tools specifically designed for student learning have received considerable attention in educational technologies research (Roschelle, et. al., 2000; Owston, 1997; Dede, 1998; Scardamalia & Bereiter, 1993; Sandholtz et. al., 1997). But digital teacher education or professional development portals represent a different kind of emerging educational movement for technologies: it can be a movement of professional change for and/or by practitioners. This question of who decides the impetus for professional change through technologies was a critical variable throughout this study. In each site of implementation, a constant question was how to involve teacher-users in such a manner that the democratic potential of public knowledge is demonstrated and co-determined yet the shaping or malleability of the machine-human encounter is understood as evolving, shifting, and experimental.

This study of the PKP portal prototypes makes a strong empirical case for the continuing research and development of digital professional development portals for practitioners as our work signaled an early attempt to begin to explore and test the potential of the Internet for teacher education. Continued development to fully explore and test the Internet is warranted because the medium continues to influence the public’s information seeking and content displaying behaviours and usage continues to increase.\(^{121}\) When I began

\(^{121}\) See the Pew Internet & American Life Project’s report (2003), *The Broadband Difference: How online Americans’ behavior changes with high-speed Internet connections at home*, which documents increasing Internet usage in terms of users becoming creators and managers of online content; users satisfying a wide range of queries for information/knowledge, and; users engaging in multiple Internet activities on a daily basis.
my association with the Public Knowledge Project, I knew that many teachers employed some form of educational technologies with their students but I agreed with John Willinsky that the advent of Internet connections and open-access digital publication, carried an untapped potential for new, public, digital spaces/places for exchange between researchers and practitioners. The two detailed accounts of digital professional development portals that I have examined in this thesis are but small actions and inquiries into the still expanding Internet medium of intellectual and democratic potential. However, these accounts offer important lessons for more effective socio-technical bridges to cross the institutional boundaries of universities and schools and increase the democratic potential of educational epistemic communities.

Three sections or mini-chapters, concerning the three parts of the thesis, comprise the concluding chapter of this dissertation. The first section revisits the literature reviews and re-examines how the responses of the teacher-participants in the face of the PKP experiments answer, reinforce or add to the pivotal concepts or points of these two reviews. The second section is a review of the empirical work of the two field sites of implementation of the PKP professional development portals, PKP-VanSun and EdX. Evaluation of the results of these empirical observations is focused on the question, how do we understand these PKP professional development portals so that we can build better PD portals in the future? This empirical section includes six critical lessons learned for future portal work and professional development design. The third section revisits the dissertation as a whole and provides overall concluding comments regarding EdX's finale and the conclusion of the PKP professional development portals. I draw an overriding conclusion and defend it as an answer given the Pew Internet Project's previous reports (2000), it would appear that Internet usage continues to grow given both demographics and activities connected to professionals such as teachers.
to the question posed in Chapter 1: To what degree, if any, did the PKP portals succeed in having an impact on practitioners' knowledge practices and in making research more accessible and usable in the process, and, why did they falter to motivate, persuade and entice users to generally use and take ownership of them to the extent intended by the designers? The PKP professional development portals succeeded in having a noticeable impact upon the work of the intermediary teacher-educators and in the degree of engagement by their teacher-mentees. These effective teacher education interactions were enhanced and facilitated by the accessibility of research resources on the portals, and in the process, these resources were made contextually usable. And the effected teacher-mentees began to show signs that they were becoming knowledge managers or researchers for their own professional growth. However, these same PKP portals also faltered in motivating and persuading the network's critical allies, the majority of the EdX mentors and the PKP-VanSun external moderators, to believe in the efficiency, usability and productivity of the portals to the extent that their regular use would be confirmed and their willingness to take ownership for these portals ensured. But the thesis' greater contribution has been to raise questions and concerns made visible from these prototypes, implementation sites and socio-technical lenses and to consider these examples in relation to ongoing problems of research directions and epistemological assumptions in the field of educational technologies research.

Section A: The Literature Reviews

Teacher Professional Development

In Part I, the thesis began with a literature review of teacher education, teacher knowledge, educational technologies for professional development, sustained interactivity of researchers and practitioners, and the deep social responsibility of researchers to publicly
communicate usable research. Next, I reviewed the literature of Bruno Latour, his Actor Network theory, and the language toolkit or method of socio-technical analysis. The first reading helped me understand the complexities of the intense social work involved in teacher education, teacher knowledge and teacher research. The second literature reading gave me the means to distinguish between technologies as simplistic technical solutions, doomed to fail, or as complex socio-technical phenomena.

After the literature review of teacher professional development, I confirmed that teacher knowledge is not well understood and highly contested (Munby, Russell, & Martin, 2001) in educational research. There is no unified disciplinary view on the meaning, state of or best means to clearly define, and then engage, extend or connect teachers’ knowledge to researchers’ knowledge. The best example of how a connection between researcher knowledge/views and practitioner knowledge/views could be strived towards is Huberman’s (1999) argument for sustained interactivity. In Huberman’s example, researchers and practitioners were not connected through Internet based tools but rather sustained their interactivity through a research project designed for regular face-to-face collaboration.

In this thesis, I had the opportunity to participate in two projects that promoted sustained interactivity between research and practitioners through teacher professional development portals. PKP-VanSun and EdX gave teachers access to research that was more usable due to its filtered selection by an education university team, sensitive to the needs and work of teachers; due to its categorizations and indexing/retrieving tools for the knowledge to become more situated or contextualized; and, due to its knowledge organization alongside other knowledge resources that would make it more connected and related to teaching. We endeavored to create an Internet-based, digital public space/place (Agre, 2003) of knowledge
exchange for practitioners and researchers. Among the contributions of socio-technical theory has been a clear sense in which a prototype (such as a portal), even when it is digital, is still a place—the place where an epistemic community or a social movement can conduct its collective cognition and community work with a reasonable degree of autonomy, accessibility to the knowledge it needs, and democracy. In the process of the research and design of these professional development portals, we were giving a digital contribution, a material place to Huberman's idea of sustained interactivity and to the professional determination by practitioners and researchers of educational knowledge practices.

My argument for these portals' contributions and impacts for teacher education are that if these technical infrastructures and digital environments were given due attention technologically, socially and institutionally, teachers would begin to view themselves as managers, mediators, and contributors of knowledge for their own practice and for the profession. I contend that it is only when researchers' models of teacher knowledge are flexible and participatory enough, along with technological design and research for knowledge conditions to inform each other, that we will be able to, as Lagemann (2002) suggests, create “usable knowledge”, that is, knowledge that helps us not only as researchers, but as members of the education profession (p.11). Instead of positioning the researcher as the teacher of teachers, of university facilitators doing practitioners a favour or “service” (Carter, 1993), Huberman (1999) conceived of ‘sustained interactivity’ as participation by researchers in their own education. The members of this education profession, practitioners and researchers alike, could stake digital spaces of commonality on the Internet through processes of managing, mediating, and contributing knowledge and this common digital space could foster new groupings or epistemic communities in education.
In this project, we aspired to explore whether sustained interactivity between teachers and researchers through internet-based portals had the potential to scale up into institutional connections capable of shifting epistemological debates and redefining each other’s knowledge work. In my analysis, I have abstained from taking the regular epistemological position in teacher education that characterizes intellectual or knowledge engagement as an outside-teaching activity that can only be re-inserted into teacher education by the work of researcher-facilitators. I counter that the local knowledge of teachers, gained through practice and classroom contexts, can be transmogrified through interaction with other educational actors (practitioners or researchers) in a seamless digital space that is neither inside or outside the school but an overlap between the two on the Internet. My argument is that technologies, malleable technologies, innovative knowledge environments, should be capable of allowing and permitting teachers to include their own voices into the creation of the literature and research of teacher knowledge as well as extend their voices into collaborative discussion with researchers, those attempting to produce usable knowledge for teachers. Teacher education portals should be capable of these results given successful collaborations in science projects between field scientists, lay persons and university-based scientists (e.g., CalFlora\textsuperscript{122}), given community health projects to connect marginalized populations with medical professionals and health researchers (e.g., Afya project\textsuperscript{123}), and given the individual instances of Deborah and Caroline in these PKP portals connecting teachers to research/ers.

Concurrently, my readings in teacher education made me aware that any technology pertaining to or inquiring into teachers’ knowledge needs or teachers’ knowledge practices would be contentious, ambiguous, and controversial. If not well considered, designed, or

\textsuperscript{122} A database project sponsored through the University of California, Berkeley.

\textsuperscript{123} A community health network sponsored through the University of Illinois, Urbana-Champaign.
tested, a technological prototype addressing practitioner and research knowledge for epistemic exchange seemed ill-fated. In these cases of the PKP portals, I knew first hand that they were well researched, well considered, and well funded prototypes with the potential to present a sophisticated portal design and an ongoing commitment by the consortium to test it with real teacher-users. My first (naïve) stance was that if PKP built this type of portal, it would be evident to the teacher-users that it could provide rich usable professional development resources, almost impossible to find on one’s own by searching the Internet, and they would easily become loyal users.

*Readings of Latour and the Socio-technical Literature*

The second literature review began with the question of how we (analysts, educational researchers) can come to understand the role of technology for social change or the relationship between the social and the technological in teacher education. At issue were a variety of opinions and positions as to the influence of social practices on technologies and the influence of technologies on social practices. Within those positions, technology is often treated as either a bell-and-whistle add-on to practice or as a panacea for practice’s social problems. In the second literature reading, I took up a theoretical perspective that enabled me to study technology from another vantage point, to escape the confining boundaries and limited imagination of a techno-determinist stance: I followed the socio-technical perspective, as primarily described by Bruno Latour, which enabled me to study technology as an active participant, an actant, in the social world of teacher education.

Using Latour’s socio-technical or Actor Network theoretical construction, I sought to analyze the PKP portals in three terms or phases: firstly, as it contributed to and materialized a narrative of knowledge exchange, a narrative of sustained interactivity between researchers
and practitioners in teacher education; secondly, as it played an oft-overlooked yet critically important role of human intermediaries both to demonstrate the value-added contribution of the technological prototype and the link for exchange between the worlds of the practitioner and usable research/ers; and finally, as it served the connection between the user community’s affective response to infrastructure and their social response to the changes or reform to their knowledge practices from the portal.

In the first phase, the PKP portals added an innovative technical story to teacher education by demonstrating how technical tools facilitate sustained interactivity, a story or direction that did not exist in Huberman’s example or in other notable accounts concerned with teacher-research/er communication (cf. Grossman, Wineburg, & Woolworth, 2001). The portals materially demonstrated that knowledge exchange between practitioners and researchers can occur through the Internet and contribute to the improvement of teacher education by providing usable accessible research.

Secondly, the PKP portals confirmed the crucial role of the technologically neglected or forgotten human intermediary actors. In the quest to prove the automation of knowledge functions through portal design, in order to prove knowledge portals as being complete without human mediation, we the PKP designers forgot to factor in the significant contribution of teacher educators or mentors such as Deborah and Caroline. Luckily, the portal environments were flexible enough in both their technical features and in their implementation design to permit Deborah and Caroline to act independently as intermediaries. While not attending to these intermediaries in the technical design, we were nonetheless able to observe how these teacher-educators added value, added living, breathing accounts of how the research documents and researchers contributed to their own daily
practices as teachers and to their ongoing reflections of what it means to be a teacher of/with educational technologies. It was through the modeling of real-life links, of confirming the contribution of research to practice, that these intermediaries, Caroline and Deborah, were able to bring greater impact for the network and greater potential for change to the portal’s participants.

In the final phase of the study, the portal’s infrastructure was discerned as a significant actor and understood as shaping the mentors’ affective responses to EdX. I recognized how the Microsoft infrastructural platform could not enroll the mentor-users due to their distrust in this proprietary, privatized approach to computers and the Internet. I also analyzed how the infrastructure was not transparent, easy and simple enough to make these practitioners trust and believe that they could shape or control the social encounter with this technology. They may have perceived the infrastructure and the inherent reform agenda of the portal would shape (or displace) them both technologically as well as socially, or socio-technically.

The term socio-technical refers to a methodological mix, a practice or even an analysis that integrates social and technical elements in a way that reveals their interactions, interdependencies, and interpenetrations. Socio-technical analysts understand social behaviour and the organization of artifacts (such as websites) in a much more integrative manner. Professional development portals are structured socio-technically, in that they are co-configured not only by the technical constraints and “affordances” (Norman, 1988) of the technologies involved, but also by social, cultural and institutional factors. A socio-technical analysis for PD portals, such as the PKP portals, offers the best method to avoid technodeterminist arguments of either pro-enthusiastic portrayals of technology—the technological
artifact is the reason for the formation of close, trusting education communities—or techno-indifferent—the technological artifact is unimportant in offering or leveraging support for group development. Latour (1986) eschews, while acknowledging the appeal, of such a model of techno- or social-determinism. "The advantage of such a model is that everything may be explained either by talking about the initial force or by pointing to the resisting medium: when an order is faithfully executed, one simply says that the masters had a lot of power; when it is not, one merely argues that the masters' power met with a lot of resistance" (p. 267).

By following the lead of socio-technical theorists such as Latour, I added to the literature of educational technologies by demonstrating that practitioners, human-actors, engaged in the use/non-use and implementation/resistance of technologies, transform portal design and development as much as the portal transforms their practices. In my work with digital PD portals intended as forums for participatory design with teacher-practitioners, I needed a theory (and methodology) of technological change as a social process that would permit an analysis pointing in two directions: 1) the design, tinkering, or bricolage of the portals by the users and designer-researchers, and 2) the balance of the portal's construction with its converse, which is to say the portal's construction of the users' social world.

A socio-technical purpose is not about locating, defining, or evaluating the PKP portals inside taxonomies of educational artifacts, but rather registering the historical design and realization process of PKP into the study of digital professional development. The ANT adopted approach became a toolkit of terms for observing how an electronic professional development artifact, its users, and its designers attempted to make a difference or transform teacher education. The ANT terms did not promote an account of an endlessly reflective
mirror on the tool’s set of technical features or on a cognitive framework scaffolding the design. Instead, they worked to bridge the great divide in technologies’ accounts: the divide between “popularizing technology and denouncing its politics” (Latour, 1996, p. viii).

Throughout the study, I wanted to examine if these socio-technical theoretical concepts such as enrollments, trials, translations, chains of association, alignments and displacements, might improve the understanding of portals in digital teacher professional development than what currently seems the dominant approach in educational technologies research. The term enrollment was particularly helpful for describing how we, the portal designer-researchers, attempted to demonstrate the value of the portals or how we attempted to entice the users and instructors to ensure that they would return to the portal or that they would communicate its appeal. With EdX, most of my efforts were aimed at enrolling the mentors into the EdX network, by aligning their mentor interests with the technical features of the portal. If the mentors believed that they could communicate more regularly and easily with their mentees through EdX, they would have changed their current analog or non-EdX practices. My hope was to move the mentors, to displace their behaviours of telephoning their mentees and photocopying documents, in order to translate these social mentoring practices into digital portal practices. I worked to demonstrate through theatres of proof or trials that creating discussion forums, distributing system emails to mentees referencing catalogued documents, and footnoting one’s positions with hyperlinked research documents from the portal’s repository would result in improved, enhanced, value-added through research-added, digital teacher education.

This enrollment work or chains of association became the displacement of one type of master narrative of educational technologies—the technicist story of technologies solving
practical problems — by a different master narrative — the PKP story that educational research communicated through Internet tools can inform the practitioner to enhance their knowledge practices. The PKP portals worked or held together as a network for those users who believed in the same narrative: it worked to enroll Caroline, Deborah and their teacher-mentees as trusting, content, loyal users of the PKP portals. But the PKP portals did not work and did not hold together as a network for those (mentor) users who believed in a different narrative, in a technicist narrative: the portals elicited their resistances, their ensuing critical trials of each feature, and their final rejection of ownership of an expensive, technologically sophisticated, research-informed tool.

In this thesis, I applied and demonstrated that Latour and others from socio-technical studies have creative, dynamic theoretical concepts for analyzing digital professional development. These socio-technical theories helped the examination of the empirical details of EdX and PKP-VanSun, and concurrently broadened the account away from their own technical particularities. I worked the analysis to not get stuck on a technical treadmill describing different features or hypothesizing better mechanisms for index tags, retrieving resources, or converting Word documents into share files. Rather, I worked to drill down into the socio-technical successes and affordances as well as the obstacles and resistances that surfaced when implementing portals in teacher education.

The examination of the two site implementations adhered to a socio-technical analysis, leading up to the conclusion that there are no technical fixes to deep institutional divisions or misunderstandings between researchers and practitioners, between universities and schools. The best that technical tools such as portals can do is to enhance or support institutional re-configurations that have already begun, that already have a network in the
making. My intent was to follow chains of engagement of “what holds and what does not hold together” (Latour, 1991, p. 110) in digital teacher education portals. And I deployed Latour’s techniques, his conceptual terms, to ascertain how practitioners (teachers) and teacher educators were transformed into practitioners who accommodated particular forms of computer and portal technologies in their customary practices of relating and acting as teachers.

It was a socio-technical analysis that helped me identify practitioners such as Deborah and Caroline who transformed into crucial intermediaries through the opportunities presented by the portal, and, in the process, who translated the merits of the portal networks into pedagogical, professional claims for their mentees to follow. The fact that these intermediaries had found reasons to convey their personal/professional connections with researchers was directly attributable to the portal’s tools (the research texts were readily accessible and easy to insert) and the portal’s purpose (to communicate with other educators their understandings and uses of technologies). And it was a socio-technical analysis that permitted me to recognize the significant response of resistance that the majority of mentors were communicating. The portal did not enhance their technicist approach to education as it did not isolate in its recognition or reward the individual’s technical expertise to solve server problems or re-boot crashed computers in school labs. The portal was not a bulletin board of technical problems encountered and technical problems solved. On the contrary, the portal network was designed to displace these localized actions, by extending, connecting and locating them into a larger investigation of what educational technology means, what it can contribute to teachers, students, and classrooms, and what has already been investigated and learned by researchers.
I also followed Kling’s (1999, 2000) and Warschauer’s (1999, 2003) approach to social informatics (a sub-set of socio-technical studies), to illustrate how it is that humans, including teachers, inevitably transform non-human actors or digital tools and artifacts. It was my intention to illustrate that empowerment for practitioners or the means to effect change, or, reform, lies not in any individual instructor, professional development program, or technological device/application, but in the translations and mediations of certain social or socio-technical relations for other relations; and, that these transformations in practices arise in particular socio-technical associations. I was not able to predict how the transformations would occur and I could not attribute these changes to particular features, a particular technology, while coordinating and implementing the portals in the fieldwork. What I could determine was that each actor had the potential to cause some transformation in the portal networks by translating their needs into actions and these actions then displacing themselves and the others they affected. For example, I did not anticipate how the practitioner-users would transform the portals’ knowledge organization. In the case of EdX, the original intention was to organize the resources by six domains or knowledge types that would demonstrate the breadth of knowledge related to one topic. But the ongoing demands or feedback from the teachers was for resources directly related to the categories they used to identify themselves as practitioners, by their subject and/or grade specializations. Hence, EdX became transformed into a resource repository defined by subjects first rather than knowledge categories: Language Arts or Math & Sciences took precedence over research articles or think-tank reports. In the case of PKP-VanSun, the use of the portal was transformed into a one-stop purpose of fulfilling the assignment requirements of the WebQuest task. PKP-VanSun became a quick stop for de-contextualized quotes rather than a
digital space/place to inquire and connect into a breadth of primary re/sources on specific educational topics. In both cases, the teacher-actors transformed the knowledge schemata to align to their specific interests, and in doing so; they transformed the organizational shape of the digital space.

Section B: The Empirical Chapters

Reframing Evaluation of Digital Professional Development Portals

With a focus on the empirical, I began to contend with the nagging question of how does one evaluate the results from these experiments, from these complex, nuanced undetermined, unstable networks. An examination of these portals is in some sense an evaluation without one definitive answer, a means to understand how they succeeded and why they failed simultaneously. The evaluation of digital (ICT) technologies in education is too often characterized by a techno-determinist position composed of the following features: it relies on outside standards of expertise, treats teacher-users as subjects or objects of the evaluation, and pays only indirect attention to the range of social impacts associated with use, often striving to take a neutral and objective view, and giving undue ‘causality’ to the technology itself.

In the PKP projects, this type of techno-determinist evaluation would be inconsistent with the type of project we were trying to offer the teacher-participants. We were attempting to establish a far-reaching exchange between teachers and research/ers, to establish an epistemic community between university-based and school-based participants. Our prototypes’ goal was to build capacity for creating, sharing, and demonstrating usable, accessible educational research across the institutional divides that separate teachers and
educational researchers for social professional change in both teacher education and educational research.

To support these goals, PKP needed to achieve the following methodological criteria of participatory action research: “shared ownership of research projects, community-based analysis of social problems, and an orientation toward community action” (Kemmis & McTaggart, 2003, p. 337). In other words, we needed to incorporate local knowledge held by the teacher-participants; gain the participation of the teachers early in the design and development process; and, build capacity and ownership for this epistemic community in order to achieve constructive social (and epistemological) outcomes. I wanted to incorporate participatory action research practices to engage teachers more fully in their own social change practices, to eschew a techno-determinist approach to project design and, consequently, to give digital/information technology evaluation back to the intended user-participants.

The thesis was not centred on evaluating the portals as either successes or failures but rather attempted to cost through the factors of the trials, enrollments, translations, and displacements (transformations) of the network. I was not examining teachers’ participation in the PKP PD portals as a means to measure and assess participation in a particular type of community. Instead, I grappled with the theoretical and empirical implications of portal technology designs as socio-cultural instruments designed to encourage and foster a volition, a desire by both practitioners and researchers to enter into public, intra-institutional, sustained interactivity concerning knowledge positions in education as defined by the people involved at each site and defined by published and unpublished documents.
For the PKP portal participants, digital infrastructure and knowledge documents were to act as an extension and enlargement of users' face-to-face communities, allowing them to engage and expand on their educational understandings in ways not supported by the isolation of their school settings and the limitations of their few and far in between face-to-face interactions with each other and, perhaps, with researchers. However, one reading of the mentors' behaviour is that those who were not able to reframe their teaching or research contexts to engage in this epistemic interactivity or who were less comfortable with the technology, digital supports were viewed as unhelpful hindrances, even threatening practitioners by their believing that their use of the technology was being critically evaluated. One explanation is that the majority of the mentors could not reframe their ideas of teaching with technologies as sources of open-ended questions or in need of different conceptual considerations or perspectives. Consistent with a logical, linear approach reinforced by the pragmatics of technological tools for solving problems, these mentors may have steered away from invoking social or political complexities. Some mentors openly resented any portrayal of their use of EdX as evaluative or reflective of their identities as users of technologies. Yet, they themselves were able to quickly evaluate the portal's effects. These mentors criticized the portal's infrastructure as being too demanding and complicated for their newbie-mentees. These mentors assessed the features of EdX as over-complicated, diminishing the precious little time for their mentoring encounters with their mentees and jeopardizing their mentoring accomplishments by technically overwhelming their newbie-mentees.\footnote{Another way of reading the mentors' behaviour and response to the portal is that they did not want to reframe their ideas, rather than a reflection of their ability to reframe.}
Socio-technical theory recognizes the interconnections between research and design/development. Socio-technical research acknowledges that prototype evaluation is a socially grounded activity focused on working with the technical in order to achieve socio-technical consequences. It is a "technically informed social analysis" (Bowker, Star, Turner, & Gasser, 1997, p. xiii). Digital tools of professional development cannot speak or do their work without the collaboration – the willingness for alignment and displacement – of a vast network of actors: of people, institutions, documents, and other artifacts/tools. This is the effort of digital professional development and the re/fashioning of teacher education, accessible educational research, and portals, which are all essential parts of this socio-technical work. As Van House (2003) states for digital libraries, "The [portal] is not simply a new technology or organizational form but a change in the social and material bases of knowledge work and the relations among people who use and produce information artifacts and knowledge [through this portal system] (p. 272)."

This study of the PKP portals has outlined a change in teacher education – not at a level that PKP expected- but there was nonetheless a significant, unexpected, demonstrable set of changes by Deborah and Caroline in their mentoring practices as well as the breadth and depth of knowledge engagement as demonstrated by their teacher-mentees. Deborah and Caroline were able to create discussion that went beyond mere opinions and anecdotes but became anchored in research, adding classroom usability to the research documents and presenting them as immediately accessible through the PKP repositories or hyperlinked directly into postings or system emails. The teacher-participants or mentees were able to engage in a guided, referenced manner that gave them directions or avenues to pursue, ideas
that they could reflect upon or materials they could return to in their teaching, in their assignments, in collegial meetings, or in demonstrations of professional learning. To summarize, these teacher-participants were on the way to becoming knowledge managers of the information resources concerning education on the Internet and reflective teacher-researchers of their own practices.

This thesis has outlined some of the institutional, socio-political and technical infrastructural problems with which the future development of portals must contend. It has also made clear that portal coordinators, researcher-designers, teacher educators and intermediaries are far from being automated into non-existence by new technologies and retain a considerable role in ensuring that professional development, in its digital form, continue to encourage these values (cf. Nardi & O'Day, 1996, for libraries and librarians). This role is centrally one of design, not the command-and-control positivist style of design from which computers first emerged but a participatory style of social design in which the well-being of communities and their participants cannot be separated from the construction of technical systems.

This new style of design as attempted in the PKP PD portal implementations demanded involved coordination and leadership skills of a high order. It meant the consultation and coordination of a range of stakeholder actors from teacher-educators, course instructors, school district administrators, teacher participants, university researchers and software developers, to name but a few. And it meant that the project manager or management team had to attempt to understand each actor's intentions and needs within the portal network as well as provide continuous opportunities for these actors to explicitly participate and voice their concerns, all during the intense start-up time of making the portals
technically function. Participatory social design in these portals needed constant analysis or research where social theory could have played a more significant role in the practical work of designing portals that were intended to become **useful** and **usable** in this socio-politically complex profession called education. Instead of forging ahead to materialize these portals into digital places, greater time, energy and funds needed to be spent on the constant analysis and negotiations of what should these portals become and how would the concerned actors participate in the co-constitution and ownership of these portals.

Designing a professional development portal involves comprehending social phenomena of great complexity. No single research discipline will provide all of the necessary concepts, hence, my turn towards Library and Information Studies (LIS) and communities of practice (CoP) or situated learning studies as well as teacher education, educational technologies and socio-technical theory. For example, after arriving at a point of no return with this portal development – as I tried harder to make EdX more the participants’ tool – the portal was being increasingly perceived by the mentors as someone else’s tool, more removed in its organization and features from their NETTL mentoring practices, local knowledge, and expertise. I realized that I (and EdX) had arrived at a point of no return in its design and implementation. I now had to research why and how EdX faltered in generating robust, regular use and participation by these mentors, these emerging teacher-educators, their course instructor as well as the majority of the teacher-participants.

*Socio-technical Lessons Learned (and remaining questions)*

In researching a socio-technical analysis of the PKP professional development portals, I can delineate six significant lessons learned from this study or “traps” (Agre, 2003) that “may afflict the unwary designer” or researcher of future portals (p. 221). I list these
lessons here for convenience but they will be subsequently treated in detail and in relation to the study. They include the following:

1) The lesson of the inscribed, embedded narrative of teacher professional development needing to match the portal participants’ purposes and the collaborative partners’ visions.

2) The lesson of presupposing or assuming compatibility, both technical and social, between actors.

3) The lesson of time: assuming (rapid) change technically and socially by the actors.

4) The lesson of attempting to automate access to public knowledge or seeking disintermediation.

5) The lesson of underestimating the affective conditions of comfort, pleasure, and ease, through the transparency of infrastructure in project and portal design.

6) The lesson of attempting to automate epistemic community functions in order to cause epistemic communities.

To further substantiate these lessons learned or conclusions I discuss each one separately, including recommendations for future portals and technological prototypes in teacher education.

*The inscribed, embedded narrative of teacher professional development and the portal design*

Sustained interactivity and usable research were goals of an important story or narrative for professional development that will not recede or dissipate in the literature of teacher education. But a professional development technology, a PD portal, cannot write this story, this techno-fiction, and manifest its reality by itself, quite unlike the movie pitch. The movie industry knows how to make any apparent narrative explicit in its movie pitch, fast and furious in its advertisements and with no hesitation, question, or explanation about its
intentions or its purposes. It is a black-boxed affair in movie-making where the genre and formula has been repeatedly tested, witnessed, and found successful/profitable enough to fuel more reiterations. Portal development in teacher education needs to strive for this type of acceptance, this type of agreed upon narrative or purpose for digital professional development.

We at PKP were making prototypes for public knowledge and we considered them critically important for promoting and demonstrating social and professional changes for teachers. Our collaborators and participant-users, on the other hand, wanted a repository of valid sources or a website that was convenient to use, with technology that had already proven itself. They wanted an easy, efficient experience, inside the confines of their courses, to serve their particular course requirements at particular times. They did not want a Swiss Army knife experience of too many blades with too many purposes that did not serve the immediate task at hand.

The collaborative research team of PKP and its teacher education partners (CITE and NETTL) needed to make their goals, the narrative of purpose, more complimentary, synonymous, explicit and transparent to each other. In the case of CITE and PKP-VanSun, we needed to distinguish what type of discussion we envisioned through the assignment, as it moved between documents and people, and as the integration of themes from the portal’s different knowledge sources could have been encouraged. In this collaborative forum, the teacher-participants could go beyond simply sharing their experiences to sharing them reinforced with sources of information and connected to a larger epistemic community of practitioners and researchers (through texts and face-to-face connections). Not only did the PKP-VanSun portal help permit students to build upon each other's ideas, applying the ideas
of a larger research community, but the portal also helped develop an interpretive framework with the external mediator for future experiences. "For it is not shared stories or shared information so much as shared interpretation that binds people together" (Brown & Duguid, 2000, p.107, emphasis mine).

In the event of EdX, PKP began with a heroic narrative of EdX giving teachers access to usable research as well as access to an educational epistemic community to support the professional development and change of teachers as they began to question their practices and classroom technologies. It was an empowering story of connecting and presenting different forms of knowledge in this new digital medium “to support teachers’ interests in understanding and using knowledge” (Willinsky, 2000, p. 223). In order for this story to gain reality, to become a shared story and a shared interpretation, EdX had to go through a series of trials. For the most part, these trials were negative trials by the resisting mentors where the portal was assumed guilty until proven innocent, teacher-friendly, efficient, or usable. If EdX’s trials had been more in the control of the designers (through a greater degree of trust by the mentor-users), where the portal was consistently staged as usable and contributive with the mentors, where the portal was permitted to demonstrate freely its effective mettle to its teacher-users, this might have made a positive, significant difference in both EdX’s rate and quality of impact on the NETTL users.

Presupposing or assuming compatibility, both technical and social, between actors

Presupposing compatibility before the prototype experiment is a difficult position to maintain given the co-constitutional, shifting patterns of interaction in a socio-technical network. We assumed complimentarity and transparency between the research project and its collaborative partners –between an educational knowledge portal and courses for teacher
learning. Portal researcher-designers entering a teacher education site need to consider that
the instructor-partners and the teacher-participants’ viewpoint may pose a substantial
challenge to the intended technological intervention for social change. The PKP teacher-
participants were cautious in relation to how the portal would impact the structure of their
work in the courses, their work in the proposed portal projects, and the locus or power of
control for this new (additional) work.

Teacher education researchers engaging in participatory action research (PAR) need
to work to reveal and elucidate interconnections and tensions between elements of a teacher
education setting in terms that the teacher-participants themselves can then regard as
authentic, efficient, and usable, and upon which they can become motivated to participate in
activity for reform and in the proposed research. This type of tension, of translating the
researcher’s perspective to the teacher-participants or reflexively returning the research
project, the research change activity back to the participants, is complicated when a portal or
digital artifact is involved. As was the case with the PKP PD portals, the emphasis on the
technical or giving the teachers a technological tool to review or participate in had two
operative sides. From the first side, the portals did help to focus or funnel the PKP research
activity into a common project that demonstrated itself in material or concrete form (the
portal itself): the portal participants were able to see clearly and concretely how we, the
university designers, wanted to make knowledge resources publicly accessible and how we
wanted to include practitioners as participants or testers of the system. From the second side,
as was shown earlier in the EdX case, the portal became an object of critique whereby the
teacher-participants, the mentors, distanced themselves from both the tool and the research
project: they abstained from participating in the research project for the improvement of the portal as they did not consider it aligned to the purposes of the NETTL program.

From the first side, the PKP portal construction gave a material anchor to the research project in such a manner that participants such as Deborah and Caroline wanted to contribute to the research process because they intuitively understood it as a new concrete usable entity that they could return to or that they could capitalize upon in future teacher-educator situations. As happened on a limited scale with these two intermediaries, the PKP PD portals drew these practitioners into a mode of thinking or researching and collaborating in an epistemic community centred simultaneously on the design of the tool and on the inherent immersive processes of transforming their practices, their understanding of their practices, and the situations in which they practice in conjunction with an Internet-based tool.

From the second side, with the design-construction of a tool, myself in particular, as the field site implementer, now had an added dimension of complexity to translate or attempt to make the portal environment familiar to some resistant and firmly entrenched teacher-users. It was difficult enough to convince teacher-users to want to engage in social analysis (to make familiar this type of interaction and discourse, on top of their responsibilities and time constraints as practitioners) but to add a technological tool into this teacher-education project became distracting for those mentors exerting most of their energies into their new mentor identities. This added toll or pressure turned the EdX portal into a source of critique for a good number of the mentors rather than a tool of identification and support. For future designers, if the research goal of the construction or development of the portal is to encourage a community of users (be it an epistemic community or a community of practice), there will remain a constant tension or danger of the artifact being delegated to the status of
an entity from the *outside* of the teacher-participants' setting, their work, and their motivation. The portal researcher needs to remain ever alert to participants taking this epistemological turn in relation to the tool. Or, as Latour (1992) would frame it, the researcher-actor needs to remain vigilant in following the actors and observing both their chains of enrollment as well as their chains of resistances. Any source of critique or articulated resistance by the users can be turned into an educational focus and event in itself, creating value out of a situation that is precariously leaning towards failure. And that required the highly skilled mediation work and leadership of the research team and project coordinator.

As indicated in this study, the work of PAR researchers in educational technologies needs to become a process of creative delegation of social ownership back to user-participants in connection with the infrastructural. In a technological experiment similar to the PKP PD portals, with each usability item of participant feedback, a researcher must try to materialize the request or the feedback item into a digital form or feature. As was shown in my fieldwork with EdX, user needs or feedback became dependent upon me, the researcher, adequately articulating these concerns to the software designers and programmers. This translation of users' needs then became dependent upon the technical support (whether software developers could understand the request or social need) or researchers'/participants' own technical abilities (this was generally limited) or the financial backing of the request (the EdX proprietary software designers would work longer to solve a client's perception of a problem, depending on the financial incentive). The process of multiple layers of translation can involve a long period of time and does not necessarily translate well technologically into the same social request or feedback due to infrastructural limits/demands. It is the
infrastructural that needs to be (re)connected to the social participation of the prototype's users. A socio-technical methodology (as elaborated through its conceptual terms in Chapter 3) must consider both the material influences and relationships of the social and the technical infrastructure, as well as their interactions and network meanings.

In the case of reforming teachers' knowledge practices through the obligatory passage points of teacher education portals, it was understood by the PKP team that our partner instructors and PD programs would already be emphasizing this type of teacher education pathway. Unfortunately, the pathways or intentions for reform embedded in the NETTL program were not the same as the EdX portal: NETTL began with an insider stance, a focus on personal local knowledge first, before considering any external sources of knowledge whereas EdX began from a position that there exists a range and body of knowledge waiting to be tapped into by teacher-practitioners. Only a technology perceived to normalize and emphasize the NETTL's philosophy of self-study in locally defined contexts could then be aligned with the organizational program. In hindsight, I can speculate that a portal which would connect the NETTL self-study templates to practice, which would connect teachers' stories of technological travail and triumph with advice posted from other NETTL colleagues, would have helped to reinforce the course's framework on local teachers' setting the agenda and the focus of study. But a professional development portal, such as EdX, that countered or enlarged the program's conceptual framework of teacher education, that worked to connect public and published research ideas to teachers, was interpreted as overwhelming, uncomfortable and suspect.

*The Lesson of time: assuming uptake, participation, and rapid change, technically and socially by the actors*
This joint, cross-institutional, collaborative grouping between researchers and practitioners demonstrated the salience of two critical variables: the sustainability of researchers' and teachers' time, energy and commitment, and the scalability of the number of participating teachers and researchers in order to ensure that the group grows into a community (or network) which continues to garner continuity and strengthen (regardless of the end of the study or funding — it gains a life of its own).

The first difficulty of sustaining participatory action in an educational technology project such as the PKP portals is the difficulty of promoting and demonstrating ownership of the portals to the users when the users are not visiting or using the tool. To combat this obstacle, research-designers are tempted to employ mandatory participation through course assignments (as was done in CITE). In the voluntary mode of participation, ownership is still a contentious and problematic issue of time and energy. For example, it was difficult for the teacher participants to believe in an expensive, experimental environment that had not yet proven itself. The teacher-participants, particularly the NETTL mentors who understood the phases of technological implementation, viewed themselves and their participation as becoming experiments for the university research project. They understood themselves as expendable or anonymous because the life or duration of the portal project would continue only as long as the funds and research grants continued, ascertained and directed by the university-based researchers. It was clear that key EdX actors, a critical number of the mentor-participants, allowed this limited time factor, this ‘shelf life’ tag on the portal, to stop them from authentically participating in or using the portal. One mentor asked why he should take the time, the time required to familiarize himself with EdX, when there was no guarantee that the portal would be there in one or two years. He portrayed his personal cache
of time as only capable of investigating a new technology for professional development that was already committed to by the school district and guaranteed longevity.\textsuperscript{125}

The other double-edged problem with portals and participant uptake is the assumption that actors will change their local orientation for a new epistemic orientation once they take the time to incorporate the portal into their practice. In the PKP PD sites, we experimented with compelling participant engagement in the portal through institutional power incentives of marks or credits, for the sake of efficiently counting on participation and speeding up the process of testing the teachers’ uptake of the portal. But, as seen in the case of PKP-VanSun with CITE, this strategy did not translate into many pre-service teachers returning to PKP-VanSun outside the confines of marks or assignment requirements. The pre-service teachers who did return were primarily seeking more interaction with their external mediator, Caroline.

\textit{Automating Access to Knowledge or Seeking Disintermediation}

A convincing rationale for professional development knowledge portals is the proposal that these artifact gain disintermediation. Disintermediation is the direct access and contact between user-viewer and document/resource with supposedly no translation or mediation between these two points. Yet, as observed closely in the empirical work of these portals, human intermediaries are the actors most capable of extending the work of the network into close, trusting, social processes of community. They are the actors capable of translating the portal documents into usable resources for their teaching and knowledge practices. Hence, disintermediation through machines is a costly means to zero sum interaction whereas the state of intermediation, where portals and humans facilitate more

\textsuperscript{125} Mentors’ meeting, post Summer Institute 1, September 22, 2000.
effective and meaningful connections and translations for the targeted participants, becomes
the means to enhanced, community, epistemic interaction.

For example, the external guest-mediators in the PKP-VanSun-CITE discussions
were actors ready to encourage the CITE students’ postings to become more intellectually
engaged and more connected to one another’s ideas and postings. However, the external
guests were not allied with the PKP-VanSun portal as they were not given any formal
introduction to the portal or encouraged to use its documents in their interactions with the
pre-service teachers. These externals had not been recognized or encouraged to become key
intermediaries for the effective use and integration of PKP’s portal into the electronic
discussion.

The critical factor in the EdX site implementation was that the artifact could not move
into an epistemic relationship or conceptual exchange with the mentee-users on its very own
technical means. It needed a social, human intermediary, such as Deborah, to bring these
human actors, namely her mentees, into epistemic relationship with the EdX portal. Deborah
was able to demonstrate and model a level of epistemic engagement, how ideas from the
outside of practice (from the outside of her own classroom), from the university and research
communities in education, could be carried inside to their practice. There was something
exceptional about the level of connection and knowledge probing in the cases of the two
teacher-educator intermediaries, Deborah (EdX) and Caroline (PKP-VanSun), and their
discussion participants. Deborah and Caroline engaged in intermediary functions as
information brokers and knowledge translators. They added value to the system to the
machine, that wasn’t automated in the design’s configurations or pre-conceived in its
implementations. I want to underline this point: Deborah and Caroline as intermediaries
added value to the portal’s network by actively demonstrating its worth to other actors rather than passively finding or receiving value in the system for just themselves as solitary actors. These teacher-educators were able to connect needs of the end-users with resources of the system in a manner that the portal system could not perform through its own technical functions.

The prevalent reason for the exceptional engagement of these two groups that emerged in both portal networks was the discussion moderator/mentor who intentionally and intuitively became the crucial intermediary between the teachers’ questions and needs and the research resources available through the portal’s database. These intermediaries did not set out to act in this manner, to connect research and practice, when they became moderators and the PKP design-researchers, including myself, did not intend for human actors to take these roles that we had delegated to the machine. PKP believed the portal design eliminated the need for any intermediary, the need for any translator between the users and the document resources. Yet, Deborah and Caroline were committed teacher-educators and effective teachers who would seize upon any resource that would help them teach in the situation.

Socio-technical theory describes how technology has to be viewed as an actor, a fallible actor of weaknesses and strengths, which may be an insufficient force to move all the valuable knowledge to connect to the intended human users. It is the human intermediaries, it is Caroline and Deborah, and their abilities to manufacture social force that also need to be accounted for, symmetrically with the technological, for their impact or force on the usability/sociability success of the portal.
A portal environment is not a lived or local experience until the user-participant wants it to be. And the user determines this want is relation to their affective response to the technical infrastructure. The degree of participation by the participants depends on who they believe has authentic or ultimate ownership of the infrastructure. In the case of digital technology, it is never just the human actors who have ultimate control and ownership. There needs to be a constant consideration of the digital tool as an actor that exerts a certain influence, an enrollment of its own. In the case of an expensive, sophisticated experimental tool (such as EdX), few teacher participants saw the tool as sustainable, financially operational or appropriable by themselves and this in turn made willing, voluntary, collaborative, easy, enjoyable participation by these human participants problematic and tenuous. In research projects involving technological or non-human actors such as portals, when that technological actor or the infrastructure changes, the other participants, including human users, are obliged to react or respond differently. It was the issue of some actors’ willing and voluntary responses, on the one hand, and other actors’ unwilling and resistant responses, on the other hand, that became the reoccurring divisive and faltering point for the PKP portals. The portal network’s chains of association were often being pulled in different directions and creating a tug-of-war that emphasized weak alliances and a weak network.

In the EdX phase of the PKP PD projects, I discovered something relatively unacknowledged in many socio-technical studies. For EdX to work or gain “force” or “strength” (Latour, 1987, 1992) as a network with teachers, it had to provide not just accessible and usable knowledge in its independent competencies with the mentor participant-testers, but it also had to provide and pass the trials or affective tests of ease and
comfort. EdX needed to demonstrate attainable states of comfort for its user-testers, the mentors: 1) comfort with the assembled group of users or community; 2) comfort with the technology’s attention to and value of local user knowledge; and, 3) comfort with the infrastructural demands through technical simplicity or transparency. These three issues of comfort were the three levels of EdX trials plotted (unconsciously!) by the mentors in order to gauge the overall level of compatibility the portal had with the NETTL program’s intentions and teacher education curriculum.

The EdX tool was an experiment in its design and in its implementation. But I did not anticipate how these mentors and teachers were to respond affectively to ‘experiment’ as they began a doubly risky event: they were undertaking a professional university program, they were beginning to become teacher-educators or mentors, and, in the process, they were beginning to question their own computer and teaching practices. And, at the same time, the mentors had to contend with an intersecting experimental continuum of the EdX tool.

The mentors tested the affective and comfort level of EdX to determine if the portal would promote and advance the goals of the NETTL program and their own mentoring practices with added value, ease of effort or greater results. The mentors wanted proof, demonstrable, usable proof of value that the prototype would shine under the affective lens of comfort, pay credence or affirmation to the users’ local knowledge and expertise, as well as demonstrate transparent familiarity in design and technical simplicity through its infrastructure.

The majority of workshops and sessions in the first NETTL Summer Institute concerned technical functioning (know-how) and trouble-shooting rather than integration of

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126 The term transparency refers to the ease of the convergence of social practices and information artifacts (Bowker, Star, & Neumann, 2003) where little effort has to be made by the user to (re)learn the technical functions/features to satisfy their needs.
technology to achieve teaching & learning goals, self-reflection, curriculum analysis, or critical social issues. When I inquired into this discrepancy, the instructor insisted that these aspects would be introduced in the second summer institute once every student was comfortable with the technology.\textsuperscript{127} The tyranny of "being comfortable" was really an emphasis on becoming technical or technicist and being pleased with that status. Being immersed in computer programs and technical details were the primary goal of the course rather than becoming critical and discerning designers/users of curriculum and technology integration. The EdX infrastructure’s ongoing technical visibility and educational force created discomfort for the stakeholder group of mentors who questioned the necessity of its multiple functions, the menus of resources, and its sophisticated complexity, to satisfy the technologically basic program requirements of the first year assignments.

\textit{Automating Epistemic Community}

Portals do not cause community (CoPs, or epistemic communities) but they can be crucial for supporting communities and enhancing epistemic engagement. Social Informatics critics such as Kling & Courtright (2003), complain that the casual use of the term \textit{community} to characterize groups that are engaged in learning on the Internet has been overused and misguided. I particularly agree that there seems to have been an uncritical overemphasis on the term community, particularly “community of practice” (CoP), to characterize any group that “is engaged in learning or e-forums” (p. 221). Instead of focusing on the dream of community building for human participants through a technological artifact, a more useful analysis, that seems to have been de-emphasized or neglected by many in

\textsuperscript{127} These comments concerning the “best” timing of the introduction and discussion of critical social issues of educational technologies were repeatedly relegated to the second summer institute and the second year of the NETTL program by the instructor and then by many of the mentors, couched in a rationale of what would be the best as the most comfortable for the mentees.
educational technologies research, is attention to an examination of the tool’s infrastructural abilities or technical constraints to work in relation with human users for epistemic effects.

The epistemic community I was offering the mentors through EdX did not recognize their local contributions and was not comfortable or familiar enough to gain the mentors’ enrollment or the next degree of ownership—an ongoing enrollment with long-term implications and loyalty into the network. Whether the portal continued or not was a secondary issue to the mentors’ primary (indeed “overwhelming”128) local issue of establishing and maintaining a comfortable mentor-mentee sustainable relationship.

My reply to the mentors’ issues of EdX’s technical ineffectiveness or infrastructural un-workability for their local context was to add more technical features to the portal’s functions. However, this increase in automation did little to increase the portal’s effectiveness or community appeal. I acted in a technicist manner to resolve a problem that was a social affective response to the tool and to the research project’s aim to alter teacher education. I was decoding the response of resistance and unwillingness to engage with the tool as a problem of the tool’s functionality, of its usability, of its technical automation. However, it was certainly more a problem of the tool’s sociability—its social force and change impetus, and the degree of comfort that could be translated into social practice for the mentors.

The teacher-user in digital teacher education has become the determinant of their professional development spaces. Greater attention to infrastructural issues intertwined with social practices, will need to provide both spaces and mechanisms in which trust, familiarity, and group identity can be forged among digital teacher education participants. But trust,

128 I am purposely using the word “overwhelming” to invert and queer its sense and use by the mentors and the instructor in conjunction with EdX.
familiarity and group identity also need to be modeled, fostered, emerging, and discussed by
the participants in their offline, social practices to compliment or reinforce these affective
conditions in the online environment.

*Portal Design Openings for the Future*

Latour (1999) states “there is no other way to define an actor but through its actions,
and there is no other way to define an action but by asking what other actors are modified,
transformed, perturbed, or created by the character that is the focus of attention” (p. 122).
Unlike Pasteur’s microbes, EdX involved the very actors meant to be its third trial, its
audience. In defining EdX as the actor of the focus of attention, as the heroic character of the
story, EdX would need to modify, transform, even, perturb its participatory users (p. 123). In
order for EdX to concretize its social life, it had to gather the participation, commitment,
support and displacement of its users, particularly its key stakeholder mentors. Unlike the
scientist in the laboratory conducting an experiment, we at PKP needed our participatory
actors, the mentors, to be both transformed by EdX into spokespersons as well as remain
critical testers of EdX’s actuality with and for teachers. We needed the mentors to test and
determine that there was a real situation of concrete actions constituting and emanating from
the portal, that EdX was more than just a showpiece story from the university, and that it
would exist and function competently without my work/presence or the work/presence of
PKP.

In looking back upon this situation for desired exchange, designers-researchers of
future PD portals can learn that they need to locate the optimal value(s) of exchange for their

129 The term displacement carries a particular definition in socio-technical studies. The displacement of one
actor by another indicates its modification and modification to participate and work in the network.
Displacement does not imply the secondary actor’s exit or non-action in the network. Callon (1986) describes
displacement of an actor as moving from its original, unaffected state into an enrolled state.
particular practitioner group. In both the CITE and NETTL cases, the exchange needed to begin with PKP demonstrating an authentic need for teachers' local expertise. In exchange for practitioners' expert knowledge on how valuable and usable existing educational research web resources are to them, PKP would need to give these practitioners expertise knowledge or skills related to computers, mentoring, or teaching in schools. We would need to give them concrete benefits such as lifelong memberships into an intranet or digital library, or computer equipment, teaching supplies, or software program. In both cases, the practitioner-users and the project designer-researchers would need to be changed by the other in order to develop the new prototype and develop the strength of the network.

Another lesson learned is gaining the intermediary participation of the majority of the key stakeholders who could influence critical masses. For future PD portal research, there needs to be a concerted effort to identify the key human stakeholder group of critical allies, to understand their affective response to the prototype as well as their resistances, and to work strategically (to design) to involve them as intermediaries. In the case of the technicist EdX mentors, we could have attempted to involve them more directly in the construction, modification, and evaluation of EdX. We could have attempted to convince both the NETTL instructor as well as the III software developer to permit us to employ these mentors as evaluators of EdX in order to gain their local technical expertise (school-based knowledge of implementation with practitioners), to identify appropriate criteria and guidelines for the portal, to participate in the ownership of the portal through immersion, and to extend Huberman's "sustained interactivity" through purposeful participation in the research side of the EdX project. I needed to start the sustained interactivity of researchers and practitioners with our own EdX project by enrolling these mentors from the very start by recognizing their
expertise as school-based practitioners of educational technologies and teacher liaison actors through their computer lab coordination and collegial work. By employing the mentors as evaluators of EdX, they would have built their technical capacity as critical, technical users of the portal and digital educational research so that their future capacity as teacher educators and their future Curriculum Vitae are enlarged. The next challenge would be enroll these mentors as social evaluators as much as technical, usability experts. Social practices of teaching with educational technologies need to remain the focus of the design-research process. The boundaries of the portal we created encompassed social values and political relationships and these factors need to be attended to as well as improved.

The need to enroll the NETTL mentors or the CITE discussion moderators as PKP intermediaries is the need to follow PAR processes that transfer/develop the social driving force of the portal project as one determined by the user-participants’ desire to understand and change their own practices. To acknowledge and encourage the involvement of critical intermediaries who are willing to model and make their own actions the subject of (teacher) research, of critical self-reflection and experimentation, permits the project to develop in line with Schon’s new epistemology (1995) where reflection in the portal bridges knowledge and action, bridges research and practice.

Section C: Overall Conclusions

This chapter concludes the thesis by refocusing professional development portal evaluation/design around action, design, empowerment, and social change. For knowledge/epistemic community digital tools in teacher education, evaluation, design, and research needs to be reframed to follow a socio-technical approach and to attempt to learn lessons for future projects. The lessons learned from these PKP portals include the social
responsibilities of educational researchers and portal designers; a need for a new epistemology to be materialized through portals by legitimizing "local" knowledge in teacher education and then connecting/extendng it for interactivity with usable educational research; the need for key teacher-educator agents or intermediaries to be recognized and supported for their role in the PD network to work and promote mediation; the affective response of users needs to be attended to in order to understand their resistances and leverage their participation into the network; and, a need for socio-technical analysis/evaluation of teacher education portals to reveal these issues/lessons.

A particularly telling quote on the state and direction of future research into educational technologies appeared recently in the *Society for Information Technology and Teacher Education*. It indicates a continuing reliance on technologies to solve social problems in education:

... technologies are the only choice to support certain learning activities because they: (a) address past problems, (b) have unique symbol systems and processing capabilities to solve the problems, and (c) are a better logistical choice than trying to implement the solution in another way. It is on this foundation of need, unique capabilities, and more feasible conditions that we must base future research. A new paradigm such as this is the starting point for generating a revised research agenda: a new set of research questions and the methods to study them. (Roblyer, 2004, p. 30)

When I first read Roblyer's comments, it struck a responsive chord. The field of educational technology is indeed in need of a new paradigm shift for its future research studies. And the future learning activities of digital teacher education need to be informed and supported by technologies and educational technology research. I found the statement compelling and yet insufficient as it does not mention the complex issues I discovered through this study such as the socio-technical actors of technologies and society. Portals are socio-technical systems or much more than technology, contents, and purpose. They do not
address anything on their own, without the participation of their human actors, the institutions that surround and the other technical actors realizing the network’s actuality. I understood that applying Roblyer’s comments to the study would be a bit too facile yet I realized that many comments such as these are still at the forefront of discussion on the future of educational technologies research. In analyzing the implementation of PKP professional development portals, it was crucial to follow a socio-technical analysis in order to bring a closer examination of the complex, nuanced worlds of prototype development, technology integration into teacher education, and participation in online epistemic communities than assuming that technologies are the tools to solve educational problems.

I follow Haraway (1997, p. 126) who notes that technology does not exist, is not constituted, until it is in relation with its world or network of actors: “The computer is a trope, a part-for-whole figure, for a world of actors and actants, and not a Thing-Acting-Alone. ‘Computer’ causes nothing, but the human and non-human hybrids troped by the figure of the information machine remake the world.” So, too, the professional development portal, the technology, causes nothing –but stands for a network of practitioners (human users), knowledge practices, research documents, technical artifacts, and technology that stand to remake at least parts of the educational world.

The link between teacher education through sustained interactivity or epistemic communities with research/ers seemed particularly plausible through digital environments such as portals. From a socio-technical perspective, the issue was not a perfectly designed tool, or the optimal social group—as these factors do not exist—the continuing issue is the ensuing network, the trials of strength, the willingness and ability to displace each other into alignment and co-constitute chains of association. The decisive issue for the case of EdX, the
point that brought the PKP professional development portals to their conclusions, was the inability of the mentors, the inability of all the human actors, to love EdX or the PKP portals enough to change their knowledge practices, their computer routines, and their understanding of knowledge technologies. As one mentor clearly stated,

If the electronic world is embraced more, then EdX will find its place. I have my ways of using [the Internet] to find the information I need ... So I have my preset ways of finding things [to fulfill information needs]. If I am going to use EdX, I am going to have to find something I really love about it-- that it does a great job for me. I haven’t found that with EdX and I don’t think I am going to change and put much more involvement into EdX for those reasons.¹³⁰ (emphasis mine)

And as Latour notes with the fast-rail prototype, Aramis (1996), “Aramis died because it was not loved enough” (p. 296).

The PKP PD portals’ conclusion had been inevitable, on the one hand, and yet, on the other hand, they have not vanished. The story, the need, the dream of epistemic community where teachers engage in conversation with researchers and research texts, of returning theory and practice to its merged DNA strand status with one twisted into the other seamlessly, and having the arena of educational knowledge democratized and participatory, is a story that does not falter or dissipate in educational research or teaching. But in PKP’s attempts to materialize and concretize those social goals into digital existence, into knowledge portals, none of it had come out the way we at PKP imagined it would. And in writing this dissertation, I imagine another attempt at a portal project in teacher education could very well repeat this ill-fated love story.

Bibliography


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Appendix A

Screenshots of the PKP Portals

PKP-VanSun Screenshots

Overview Page: Teachers and Technology

Janet Steffenhagen, Vancouver Sun, 24 April 1999.

**Teachers take on technology**

Now educators across North America are taking a hard look at past purchases and future needs as they grapple with a crucial question: Have expensive new technologies actually improved student learning? "The jury is still out," says long-time educator Charles Ungerleider...

**Technology's Educational Impact**

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<th>PK² Overviews</th>
<th>Research</th>
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The Overviews include links to...

- Research on computer's impact on education.
- B.C.'s report and action plan for technology.
- Scholars debate implementing technology in schools.
- Canada's technology showcase Schoolnet.
- Changing role of the computer in the classroom.
- An Open Forum with Charles Ungerleider, B.C. Deputy Minister of Education. [Forums]

(PKP) is run by a team of researchers in the Faculty of Education at the University of British Columbia, led by John Willinsky. We are exploring ways of using the Internet to make the vast wealth of social science research into a greater public resource. [Cont'd]

**Ethical Guidelines for PKP Research?**

In our efforts to learn more about how to build websites that bridge the gap between research and public knowledge, we will be studying your responses to this site. [Cont'd]

As an experiment in public knowledge, we need your response to a simple question or two: Does this version of PKP help to make more sense of the issue of technology and education? How can it do its job better? Just click on "How's This Working?" and TELL US.
Girls Aren't Computer Geeks

"Girls are underrepresented when it comes to technology and education, as they once were with math and science and it's an impediment that could cost them dearly when it comes to earning their way in an increasingly technological world..."

Gender and Technology

The Overviews include links to...

- What students say about the school's computer lab. [Research]
- The B.C. Ministry of Education's goals on gender equity. [Policies]
- How software companies are targeting girls. [Research]
- A course syllabus on gender and technology. [Practices]
- The Society for Canadian Women in Science and Technology. [Organizations]
- GenTech's research on girls, tools, and schools. [GenTech]
- An open forum with Mary Bryson, Suzanne de Castell, & Jennifer Jensen, GenTech, SFU/UBC [Forums]
Research Overview

Jackie Bradshaw, Sue Clegg and Deborah Trayhurn. Summary of "An Investigation into Gender Bias in Educational Software Used in English Primary Schools," Gender & Education (June 1995).

"A study of children's perceptions of gender in software which uses purposely 'androgy nous' humanoid figures found that children overwhelmingly identified these figures as male. Evidence shows that "gender conditioning begins at a very young age and is reinforced through the toys purchased and the nature of play.""


This study in a Grade 7/8 classroom in Kingston, Ontario girls had a tendency to opt out of computer use during classroom "free time." Classroom dynamics, computer software and teacher intervention affected the ways in which girls interacted with computers. Suggestions are made for teachers to ensure that girls have more equitable access to computer technology.

Hi Everyone,
I wanted to mention that when you are creating your questions keep in mind that your field study may not help you in definitively answering the question. Larger educational questions (especially ethnographic ones) are not easily reduced to simple answers. In your field education: Marian Anderson: A Life in Song.
EdX People Profile Example

Person Profile

Lisa Korteweg, EdX Manager & UBC Researcher

I am a teacher with the Richmond School district on educational leave. During the past 10 years I have taught Grade 6 and 7 Latte French Immersion with two years as a part-time hospital/homebound teacher. I am currently a doctoral student at UBC where I am studying how educational research can be made more public and more accessible through electronic means. I have been a member of the Public Knowledge project since its inception.

I love surfing the web. In my opinion, the internet is the greatest invention as it gives me access to the world's library (and libraries).
EdX Information Resources/Documents: My Contributions

Teacher Research
Example - Graduate School of Education, George Mason University, February 14, 2001
Lea Korteweg

Teachers Without Borders
Example - Teachers Without Borders, February 14, 2001
Lea Korteweg

The Children's Literature Web Guide
Learning Resource - University of Calgary, January 30, 2001
Lea Korteweg

Looking Collaboratively at Student Work: An Essential Toolkit

Background: The issues associated with technology in education are many. However in what ways do they connect with the issues covered in Education Studies? In Education Studies thus far we have considered educational opportunity in relation to, for example, social class, poverty, gender, ethnicity, sexuality and geographic location. It is perhaps no coincidence that access to technology and the skill and knowledge that can be gained through the use of technology is not universally distributed and can serve to reinforce inequities associated with class, gender, ethnicity and so on.

Have a look at the following excerpts and see how the problems associated with access to and use of technology can be framed:

1. From a research project funded by the United Nations Research Institute for Social Development:

   The correlation between wealth and telephone lines is exemplified by the average number of telephone lines per 100 inhabitants being a mere 1.5 in the world’s poorest countries, as opposed to 52 in the richest ones (ITU, 1995). In addition to lack of telephone lines, many developing countries also lack sufficient electricity supplies, especially in rural and remote areas. Unless these problems of basic infrastructure can be imaginatively solved, and in a sustainable way, there is little point in maintaining any illusion about the widespread application of the Internet in developing countries (Uimonen, 1997).

2. An excerpt from the Vancouver Sun (April, 1999):

   While some youngsters enjoy access to sophisticated software and hardware that enables them to churn out impressive school assignments, many less fortunate kids can barely scrape together paper and colouring pens.

3. From a research paper about the access to and use of information technologies in schools written by Bryson and de Castell (1999) who work at UBC and SFU.

   ...empirical evidence suggests that female staff and students (in comparison with males) are: (a) disenfranchised with respect to access and kinds of usage, (b) less likely to acquire technological competence and confidence, and (c) likely to be actively discouraged from assuming a leadership role in this domain (Learning to Make a Difference: Girls, Tools and Schools).

   However, some knowledge and skill with communications technology is now considered a necessary part of school education because it will enable students to participate more equitably in the activities that will constitute the global economy in the 21st century. In the
same way that we automatically expect that students will learn to use a pen and read a book at school, there seems to be an increasing expectation that students will also learn to write using a computer and read information stored on the internet.

This poses a problem for teachers and schools - how to implement and use technology while considering questions of equity.

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The task:

As a beginning teacher what do you think are some crucial equity issues pertaining to technology and what action do you think schools and teachers can take in relation to these issues?

The next question concerns the means by which this problem can be investigated. Our intention is to consider whether the communications technology that we have available to us in the CITE program actually helps us to conduct this investigation, and to think about whether this electronic task can be adapted for use in classrooms.

There are two parts to this task:

1. Consider research resources on the Internet.

Here are two sites which act as filters for web based information:

The Public Knowledge Project. (PKP)

http://www.educ.ubc.ca/faculty/ctg/pkp/

The PKP is an innovative web site designed by a research team in the Faculty of Education at UBC. Lisa Korteweg is member of the PKP team and she will be explaining its key features on Monday 8 November.

Ed. Studies Library links

(look for links in a 'schools, equity and technology' listing)

You might also want to conduct your own search. Searching the net can be time consuming and frustrating. Here are two guides that offer some tips on how to search the net.

UBC Library web search guide

Media Awareness Network - tips for searching
Making judgements about the content of web sites can also be problematic - it is sometimes hard to find out who wrote the material and to know whether it is accurate. Yahooligans is a search and information tool designed for children and teachers. It presents a useful set of criteria for judging web sites. There is also information on the Yahooligans site that is useful if you want to reference an idea found on the web. The Media Awareness Network, a Canadian organisation also has some very good information for teachers in relation to using the Internet as an educational resource.

The key is can you find accurate and reliable information to support your ideas? Secondly, how can you integrate the different sources of knowledge to make judgements about the problem?

2. Compose and discuss on-line.

Conduct the discussion using the WebCT Bulletin Board. Please note, a discussion assumes that there are many different ways of thinking about a topic, therefore the purpose of entering into a discussion is to take account of these ideas in order to develop a point of view on the topic. You will be in your Inquiry Groups for the discussion. Each Inquiry group will have its own forum. You might want to read and/or respond to another forum, but start by focusing on your own group discussion.

The purpose of conducting the discussion on-line is three-fold:
• You can create a collective text that addresses this issue and that shows the progress of a discussion.
• You can directly link to and reference the work of others.
• Other people from outside the program can participate.

Guidelines and suggestions for initial contribution and subsequent posting:
• Be succinct and directly address the topic.
• Frame a question or raise an issue you still wonder about.
• Draw on internet material, if appropriate, to support and provide evidence for ideas.
• Ensure that you acknowledge and reference others' work.
• Respond in ways that build on or thread from each other's ideas.
• Respectfully acknowledge the entry you are commenting on or building from.

Requirements: A minimum of three responses is required.
2 contributions over the two week period from 8 - 19 November.

There will be lab time over two Fridays to provide class time for this. The third contribution will be in Term II so that you can draw on practicum experience. Your participation in the on-line discussion will count as the remaining 20% of your Ed. Studies mark.

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Link to the Bulletin Board Forums
Appendix C
Chronology of EdX Technical/Infrastructural Events

Key infrastructural actors of the EdX portal pertain to the following chronology:

1. (May-June) First crash of the EdX server occurred at the start of the first mentor workshop slot of time dedicated to a demonstration (theatre de prevue) of EdX. The system was overloaded by the number of users accessing it at once (first explanation). Later, the bug was attributed to an incompatibility issues between EdX's PC platform and the i-Mac labs of this school district.

2. (July) First online discussion on the portal is performed by the mentor group discussing an article the instructor, Chris, recommended for mentor learning (an article promoting self-directed learning by Maurice ...). Ten of the fourteen mentors actively participate but they do not refer to one other document in the three hundred plus database of EdX. Only two mentors directly refer to the assigned article.

3. (July) It becomes apparent by some of the mentor complaints that the EdX portal is not functioning well in Netscape 3. The software developer admits that he chose to take advantage of the new dHTML features of Internet Explorer 5 and that it shouldn't be a problem for any user as it is a free download. Many of the mentors refuse to download the new browser as some believe it is 'buggy' until the software has proven itself bug-free after a trial year of use. Others want nothing to do with another Microsoft product.

4. (July) Many mentors express annoyance with receiving EdX email notifications, emitted by the system, to alert them to new discussion postings or new resources added to the repository. I have this feature terminated by the software developer.

5. (July) Again, the mentors give feedback on a feature that they find particularly unnerving, almost antithetical to their professional standing. They find the "system scorecard" that was inherited with the KM platform, a type of surveillance that they want no part of. The system scorecard reveals the tracking statistics that the system collects. It notifies the user as to how many times they have logged on, how many resources they have contributed to the system, how many discussions they have initiated, etc. The mentors felt this corporate inheritance was an unsettling mechanism displaying a rating of their performance and making them more uncomfortable with the EdX system. It was an acute example of how the portal did not match the NETTL course or the practices of teachers: NETTL is structured on a non-grading approach and teaching as a profession is generally non-hierarchical and non-competitive (i.e., the teacher union motto, "a teacher is a teacher is a teacher").

6. (August -Summer Institute I) Every NETTL teacher must attend a mandatory 'scavenger hunt' or exercise workshop on the NETTL website. This proof of attendance makes up part of the diploma credits granted in the first Summer Institute.

7. (Summer Institute I) After personally inviting each mentor to co-teach a workshop for their mentee groups on EdX, I am stalled out by the mentors' planning until the second week of the Institute and then I am solely responsible to lead the workshops with no credits to offer the teacher-participants. The instructor Chris makes it clear
that she wants each NETTL student to register on EdX and post a profile (which
would be followed by a digital photo captured by the school district coordinator).

8. (Summer Institute I) I teach workshops continuously for each day of the last week of
the Institute. During the first two days of workshops (attended by almost forty percent
of the mentor groups), the school firewalls prevent but one user/terminal being able to
upload data into the field boxes. The introduction to the portal is fraught with
infrastructural actions/problems. The school-based firewalls cannot be easily re-coded
by the one on-site technical support because the firewall was programmed by a
teacher now on vacation and unavailable. Meanwhile, the EdX server crashes again
and again in response to the firewall problems.

9. (Summer Institute I) Presentation to the whole NETTL cohort happens on the last day
of the Institute after much negotiation to be permitted to take that time away from the
mentors and the schedule. There is no live Internet connection in the large theatre
space so the software developer creates a ‘server-in-a-box’ that recreates the EdX
portal and allows a simulated live presentation of the portal and its features.

10. (September) The school district technology coordinator decides that the posting of
teacher photos on the EdX portal is in violation of the users’ privacy rights. He sends
an email stating his ethical concerns to the mentors and decides to withhold the digital
photos. The NETTL instructor, Chris, contacts higher administration to resolve the
issue. The photos are sent onto the software developer of EdX, six weeks after they
were taken.

11. (October) After reviewing the statistical logs of activity on the portal, I decide that the
homepage is both the obligatory passage point into the portal as well as its critical
gateway. This is the point at which users decide to enter or venture further into the
system. I design a homepage interface that resembles a newsletter of headlines or
“Top Picks” listing of links with annotations to tempt the user to click into further
content.

12. (November) A URL hyperlink feature is added into the discussions. Any participant
can write a response or question and add a system URL. The other discussion
participants can then click into the document and have the two windows open
simultaneously. The purpose of this feature was to encourage referencing or
footnoting one’s questions or ideas directly connected to the source.
Appendix D
Gender-Practices Overview Page in PKP-VanSun Portal

Practices Overview

Gender, Technology, and Computer Culture
(Course Syllabus), Massachusetts Institute of Technology, Spring Semester 1998, Professor Sherry Turkle, Program in Science, Technology and Society.


"What Girl Tech Does for Girls, and What the Industry and Media Can Do to Improve Their Products for Girls" and "What Educators, Parents, and Mentors Can Do For Girls." Girl Tech is devoted to encouraging girls in technology use. The research of Janese Swanson, Ed D, founder of Girl Tech, has shown that peer group, family, education, industry, and media all affect girls' self-perceptions.

Math, Science, and Technology Programs For Girls, American Association of University Women. "Individuals, American Association of University Women branch and state organisations, schools, and community groups are designing and implementing creative projects to improve girls' achievement in math, science, and technology, and help narrow this gap. Below are a few of these innovative programs..."

As an experiment in public knowledge, we need your response to a simple question or two: Does this version of PKP help to make more sense of the issue of technology and education? How can it do its job better? Just click on "How's This Working?" and TELL US.

©1999, PKP, A Public Knowledge Project.
This site was designed by Henry Kang, while PKP research is sponsored by Canada's Underwritingowment of Centres of Excellence.
Chris: Teaching is a lot different when each student is setting goals and following an individual path. Can we really trust our students to find their own ways without our direct instruction? How else do we help them learn?

Mentor 1: I don’t know if trust is the issue for student’s learning. The question is can we reconcile where their learning takes them with where WE (ministry, teacher, parents) want them to be.

Mentor 2: My role as a teacher is a continuum of learning. I have had to learn to pause, and to wait for my students to engage. I have to give each child the opportunity to explore, to investigate, to respond and to then present their knowledge in many different ways. As a teacher I have had to learn how to use technology to extend learning in the child-centred classroom. From my position in the classroom, it is exciting to see how children integrate technology as an extension of their presenting of their knowledge.

Mentor 3: Wouldn’t it be nice!! Education for the sake of learning, growing, experiencing. But then there are those letter grades and the CURRICULUM!! Teachers need to be given permission and training to teach concept instead of content. One rarely goes “what a good idea and starts teaching like that.” Training is necessary. Although we encourage our students to be risk takers it’s not something that’s easy to do on one’s own. The other issue to address in training is a clear idea of who and when. Teachers thought and were probably correct in their assumption, here is the new curriculum, it’s new, unknown and guess who’s responsible –me! and who will support me?- “Not I” said the government, “Not I” said the school district, “Not I” said the school, “cause we don’t know either!” so how can we bring about change??

Mentor 4: My experiments with learning, which were based solely on the learner’s interests, failed miserably. Like many teachers, I’d like to blame my own weaknesses, but I believe the reality is that many young learners can’t manage the emotions that come with freedom. I know that the system already includes more options and opportunities than I had as a student and some “tweaking” is all that is needed in the public school system.

Mentor 5: Has the substance of education been credibly enhanced by technology and computers? I’m not sure. I’m not saying that technology can’t be one of the greatest tools we can use as educators, but a more thorough analysis of it is surely warranted.
Mentor 6: I think we went about the technology thing all wrong in this school district and in other districts and I am not sure we can turn things around at this point. We focused on getting the technology in to students hands by developing labs and pods and by bringing in fancy software. The problem was we didn’t convince teachers it was good educationally and teachers didn’t see how it made a positive impact on learning, so they did not embrace the idea and thus I firmly believe technology in schools has been a failure. In my classroom, students can choose projects which fit their learning styles. Passion also plays a role.

Mentor 1: We need to find a balance in the school system to allow for all passions. As an infotech teacher, many of the students that I teach have computer/information technology as their passion.

Mentor 3: We needed to get the technology tools in this district. Now the emphasis has switched in the district and now it’s on professional development. Unfortunately, like all things it seems you need an enthusiastic member on your staff who has a bent in that direction. But then isn’t that true of many aspects of our schools and teachers.

Mentor 6: I still say it is too late. Sorry but it won’t happen. We already don’t teach music after core music so just like the poor physical education we have going in our schools. If you ask generalists to teach everything, nothing will be done well in the specialty areas. I think we need ot change our focus. Music, computers and physical education should be specialists in schools. Sorry but otherwise we will always be coming up short.

Mentor 1: Is there another method like platooning that will permit teachers in the elementary to teach their specialties while still keeping the consistency and relationships. I agree that generalists can’t be specialists in everything. Perhaps if we follow the walkabout concept, students could be grouped in family with several teachers that are specialists. The specialists would work with those that are following their passion. Again, we are looking at a paradigm shift. These kinds of changes are long term visions. A worthy discussion is what goals will direct us towards the vision where every subject is taught by specialists and still maintaining the key relationships of the school system.

Mentor 6: The key is teachers willing to learn and who are also passionate to see things integrated into their regular teaching. When it becomes a daily classroom activity and when we sing with our kids and do skits and when we use computers to enhance what we are already doing; only then will we truly be effective as educators.
Appendix F

Empirical Epilogue

WebLink or the Reincarnation of EdX (June 2001 to present)

Closure of EdX was contentious for the actors involved in modifying, debating and evaluating EdX as a knowledge contribution system—a success— or a knowledge disruption system—a failure. Closure of an artifact or prototype usually leads to a decrease of “interpretative flexibility” (Bijker, 1997, p. 25) —to one artifact becoming dominant and others ceasing to exist. In this case, EdX ceased to exist and the only other artifact to become dominant was the NETTL website, the home of the program’s philosophy and structured methods via its templates to document teachers’ personal and local knowledge. As I declared my resignation as the promoter/leader of EdX’s implementation in the field, EdX’s closure led to a decreased interpretation and decreased resistance by the key stakeholder actors, the mentors. Once I left the role, no one from the NETTL program was willing to take my place as facilitator or take ownership for the continuation of EdX. EdX concluded nine months after it began life as an innovative knowledge management portal for teachers.

Stabilization, the partner of closure, occurs inside one group’s communication about an artifact. Latour and Woolgar (1979) demonstrated that in the construction of scientific facts, ‘modalities’ are attached or withdrawn from statements about facts, thus connoting the degree of stabilization of the fact. In EdX, we began with the mission or story or inscribed narrative that the PKP professional development portals could make important, worthwhile knowledge accessible, and in the process of access, showcase these knowledge resources as usable contributions for teacher education. Our narrative and purpose then moved into a compromised position through implementation to a position of -there is utility and usable
contributions in EdX for some of the teacher-participants according to the researchers. And finally, our project arrived at the concluding modality that EdX faltered and failed to create a certain kind of epistemic community with a critical number of practitioners. Greater degrees of stabilization for the portal were achieved in the negative. EdX was not cared for enough in order to keep it alive by the central actors, the mentors, who had spent the most time debating and resisting its purposes, its story, its design.

My Resignation

After the mentors’ deliberation meeting on the future of EdX (January 2001), it was evident that there was no one or group of mentors ready to take on the role of advocating for EdX’s continuing presence, use, and integration into the NETTL course. One mentor, Deborah, was absent from the final deliberation meeting as she was not a mentor seeking university credit through the program while she mentored. Deborah communicated with me through email that she and her mentees were still staunch supporters of EdX. Deborah was herself unable to assume the role of EdX coordinator but she was able to identify two of her mentees willing to assume the responsibility with adequate support and training. We began a discussion of how I could train these mentees into the technical, infrastructural development of the portal as well as help facilitate the social connections with the project management team and the software developer. As I began to try to make this work explicit, I realized that the work would be difficult to scale down to a manageable level for these full-time teachers and students of NETTL. The commitment in terms of time and energy would be immense, probably unfair, and ultimately futile in comparison to usership results. I came to the conclusion that it was pointless to keep EdX alive for a community of users whose leadership
didn’t want it enough to own it, thus, I wrote a resignation letter that I sent to all members of
the research-design team and to every mentor.

**February 2001**

Dear EdX Colleagues,

As you know, I have been working with you in establishing and inservicing EdX as the NETTL knowledge-management tool since May 2000. My official commitment ended at the close of the Summer Institute. I have continued working to demonstrate the potential of EdX to both you the mentors and many mentees. I have donated enormous energy and time to this task as I believe educational knowledge-management portals are imperative for the future of teachers’ learning and professional development in technology.

I am now withdrawing officially from my role as facilitator and mentor of EdX and NETTL. I am still committed to this vision of teacher learning and teacher access to research regarding the integration of technology into curriculum. In fact, as you know, the experience with EdX will be the anchor of my doctoral research. This decision on my part means that I will no longer play any role in the communications among mentors, mentees or staff regarding the use and implementation of EdX. However, I may be contacting some of you to solicit your reactions with and evaluations of EdX.

The future of EdX is now firmly in your hands. I have been recently contacted by two mentees from Deborah’s group (Jaye and Joan). They were very concerned with the future access to and direction of EdX. More importantly, they were willing to commit time and energy to be EdX facilitators. I have conveyed to them, and, now I convey to you, that the future of EdX can be promising when some NETTL participants assume the role of EdX facilitator. I will no longer take the responsibility of participating in tasks such as finding my successor(s) or helping to train the successor(s). Many of you have the technical expertise to train the successor; therefore, I am not leaving EdX bereft of potential support for the next stage of implementation.

I have very much appreciated your participation in this valiant and innovative project in creating and implementing technological tools for teachers’ professional development.

Thank you for your time and consideration in this matter.

Sincerely,

Lisa Korteweg

Another Network in the Making

Before and during my time working on the EdX project, I was in contact with the Library and Information Technology Coordinator of my old school district, Salmon Island (where I was employed as a teacher for more than a decade). The IT Coordinator, Jennifer,
was keenly interested in collaborating with PKP on a portal of resources for her identified actor group, the teacher-librarians of the district. After the conclusion of EdX, I spoke to Jennifer about the future of EdX’s 500+ document repository. I knew there was an agreement with the EdX software developer, III, that the content would be exportable. PKP needed an educational home for its collected knowledge resources and Jennifer wanted to increase the resource base for both teacher-librarians and teachers in her district: we had a mutual need for equal exchange. In June 2001, the Salmon Island district Information Technology director agreed to write the software necessary for a First Class database, entitled WebLink, to house the EdX document repository. WebLink continues to the present and currently contains close to 1500 catalogued resources due to the sustained efforts of Jennifer and her department.

PKP was pleased to see the EdX effort become more “public” and more “scalable” as the Salmon Island District First Class server is an intranet of 3000 teachers and employees.

Thus, the empirical study ends with the experimental prototype, EdX, enrolling allies with a different group of teacher educators and technology developers in another school district. EdX becomes a reincarnated knowledge management portal in the process, renamed WebLink. WebLink becomes an artifact that solves many of the problems or disruptions of EdX as well as offers new ones to be considered (i.e., no assembled group of practitioners engaged in a course or project, therefore, no community of practice in the making). The combination of stabilization and closure processes makes it understandable that the socio-technical change of EdX, indeed the success and failure and transformation of EdX, is a continuous process. However, the evolving process of a prototype in educational technology is one that does not occur at equal rates or at distinct points in time; educational technology is
more like an interspersed evolution with periods involving successes and failures, starts and ends, and contributions and disruptions.